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THE
HYPODERMIC INJECTION
OF
MORPHIA.

ITS
HISTORY, ADVANTAGES AND DANGERS.

(BASED ON THE EXPERIENCE OF 360 PHYSICIANS.)

By H. H. KANE, M. D.,
NEW YORK.



NEW YORK:
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Entered according to Act of Congress, in the year 1880,

BY DR. H. H. KANE,

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To
DRS. WILLARD PARKER,
AND
DANIEL M. STIMSON,

*This book is respectfully dedicated, in attestation of their high
professional attainments, and their great
kindness to their former pupil.*

THE AUTHOR.

P R E F A C E.

A PHYSICIAN of the present day without a hypodermic syringe in his pocket or close at hand, would be looked upon as would have been a physician fifty years ago, did he not own and use a lancet.

There is no proceeding in medicine that has become so rapidly popular; no method of allaying pain so prompt in its action and permanent in its effect; no plan of medication that has been so carelessly used and thoroughly abused; and no therapeutic discovery that has been so great a blessing and so great a curse to mankind as the hypodermic injection of morphia.

Much has been written upon the advantages of administering the drug in this way—advantages that have been proved beyond question—and almost nothing upon the dangers, immediate and remote, thereon attendant. My attention was first called to the latter by the able and interesting article of Dr. E. Fletcher Ingals in the *Chicago Medical Journal and Examiner* for May, 1878. This article and the knowledge soon afterwards obtained, that many

honest, practical and well-educated physicians in various parts of the country had entirely abandoned the use of the instrument, led me to a careful study of the subject, the results of which are here given.

By personal inquiry, letters, and chiefly by means of six questions,* published, through the great kindness of the editors, in every prominent medical journal of Great Britain, France, Germany, and America, I have been enabled to gather much valuable and interesting material hitherto unpublished.

The inquiry thus started has gradually developed beyond my expectation, and I find that instead of sufficient material to make two or three interesting journal articles, as was my original intention, I

*Dr. H. H. Kane, of New York City, who has for some time past been collecting statistics on the hypodermic injection of morphia, would consider it a great favor if members of the profession who see this and have had experience with the instrument will answer the following questions :

1. What is your usual dose ?
2. Do you use it alone or with atropia ?
3. What is the largest amount you have ever administered ?
4. Have you had inflammation or abscess at the point of puncture ?
5. Have you had any deaths or accidents caused by this instrument ?
6. Do you know of any cases of opium habit thus contracted ?

Where there has been an autopsy (5) please state the fact and the results obtained therefrom. All communications will be considered strictly confidential, the writer's name being used only when he gives full consent thereto.

have enough to fill a small book. Indeed, between the letters, the results of personal inquiry, and the journal and other literature of the subject, I have found it difficult to maintain that just medium between undue meagreness and needless excess of detail. I have endeavored, however, to be as brief as was compatible with the vitality of the subject.

The question has been raised as to whether the term *hypodermic* is correct. To settle the matter as definitely as possible, I wrote Prof. Lewis R. Packard, of Yale College, whose clear and interesting reply I give in his own words:

“YALE COLLEGE, NEW HAVEN, CONN., Jan. 8, 1880.

“H. H. KANE, M. D.

“DEAR SIR: Your letter of 26th Dec. has been handed to me on my return home. I should say in answer that, according to the analogy of other formations in Greek and the actual usage in derivative words of this form, *hypodermatic* was the correct form. The syllable *mat* is a formative element making the word *derma*, in which the final *t* is regularly dropped, from the root *der*.

“I think there is no analogy by which one could justify, in such a case, the dropping of the two letters *a* and *t* and retaining of *m*, unless, possibly, there is one in the Greek word from which *patronymic* is taken. But in the majority of the English words, e. g., *dogmatic*, *rheumatic*, &c., we see the ordinary Greek usage, and I know of no case in Greek to justify *hypodermic*.

“Yours truly,

“LEWIS R. PACKARD.”

As I was not definitely informed of the incorrectness of the term *hypodermic* until the first half of the work was electrotyped, I have not changed it, and

continue its use throughout the work. The necessary change will be made in the succeeding edition or editions. The fact that the term "hypodermic" is now so firmly established in ordinary usage, is urged by Bartholow as a reason for continuing its use. I do not at all agree with him. The change can be readily made by any intelligent physician without confusion or misunderstanding.

I have to return my hearty thanks to those gentlemen of the medical press, both at home and abroad, who so courteously published my questions, thus allowing me to reach members of the profession everywhere in an effective manner. To their indulgence and kind coöperation is due much that is here presented.

I am also deeply indebted to the members of the profession who so promptly and fully answered my questions; especially to those gentlemen who unreservedly gave me the details of fatal cases.

I am, furthermore, under obligations to Prof. T. Gaillard Thomas for valuable advice and information, and to Drs. Willard Parker, Sr., and Willard Parker, Jr., for the loan of books and journals. Also to Dr. Campbell for assistance at the Library of the Academy of Medicine.

366 BLEECKER ST., JAN. 26th, 1880.

This is to certify that I have compared the letters in Dr. Kane's possession with the proof-sheets of the chapter on "Deaths," and find the cases there given fully in accordance with the subject matter in the letters.

T. GAILLARD THOMAS,

Jan. 26, 1880.

294 Fifth Avenue.

TO THE PROFESSION.

IN order that clearer light may be shed upon some important and still unsettled questions, and for the purpose of adding to the completeness of this work in subsequent editions, the author requests members of the profession *everywhere* to answer the following questions at once:

1. In how many cases of delirium-tremens, in what doses and with what result have you used morphia hypodermically?
2. Have you used the drug in this manner in acute inflammatory affections of the respiratory organs, and with what result?
3. Have you used it in acute or chronic renal disease, and with what result?

4. Do you know of any deaths due to the subcutaneous injection of morphia? If an autopsy was held, please state the result.
5. Have you had any serious cases of narcotism from the use of morphia in this manner? If so, please state the condition of the pupils, number of the respirations and pulsations, the amount of morphia used, whether there was any known organic disease, and whether there was any opium idiosyncrasy.
6. Have you had any cases where the drug was thrown directly into the blood? What were the symptoms and what the treatment?
7. In what diseases have you used this method of administering morphia, and with what results?

All communications will be considered strictly confidential, the reporter's name not being used when a request to that effect is made.

Editors of medical journals, to whom the author is already so deeply indebted, are especially requested to give insertion to the above questions.

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CHAPTER I.

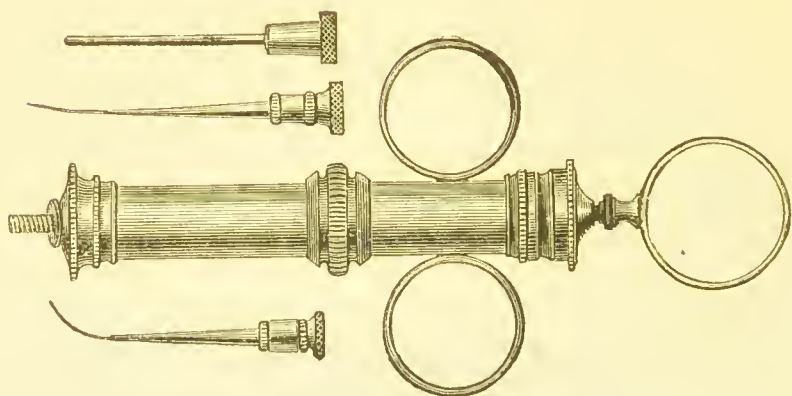
HISTORY OF THE DISCOVERY—THE INSTRUMENT— ADVANTAGES OF THE METHOD—THE DOCTRINE OF LOCALIZATION.

THE credit of being the discoverer of the subcutaneous method of administering drugs has always been awarded to Dr. Alexander Wood, of Edinburgh, who commenced the practice in 1843, and wrote upon it in 1855.¹ Dr. Wood's priority in this matter has been disputed by Rynd, of Dublin, and Kurzak, of Vienna. From a study of the facts in the case, it seems probable that two at least of these gentlemen, Rynd and Wood, made the discovery at about the same time, and that to neither is due the exclusive credit. Drs. Isaac E. Taylor and Washington claim² to have used practically the same method in dispensary practice in this city, in 1839. They made an incision into the skin and then injected the drug into the subcutaneous cellular tissue with an Anel's syringe, the nozzle of which was

¹ *Edinburgh Medical and Surgical Journal*, 1855.

² *N. Y. Medical Gazette*, 1870.

thrust into the cut. These gentlemen do not seem



ANEL'S SYRINGE.

to have fully appreciated the great advantages of this method, and Dr. Taylor was somewhat late in claiming the honors due to such a discovery. The claim made by Dr. Taylor is unquestionably a sound and just one, it being supported by the testimony of Prof. Lewis A. Sayre and others, who saw these gentlemen carrying out the practice daily. Drs. Taylor and Washington do not claim to be the first to use morphine in this way, their attention having been called to it by seeing an extract from some provincial French journal recommending it. The name and date of the journal has now escaped Dr. Taylor's memory, and Dr. Washington is dead.

It is interesting to study the successive steps

through which this matter passed before its truth and importance were fully recognized by the profession; and as we look back upon it now, we wonder that it was so long delayed, that it halted so long upon the threshold.

As early as 1809, in a little work entitled "Facts Establishing the Efficacy of the Opium Friction in Spasmodic and Febrile Disease," its author, Michael Ward, Surgeon to the Manchester (Eng.) Infirmary, &c., &c., called the attention of the profession to the fact that opium by the skin had quite a different action from opium by the mouth; that it produced a directly curative effect when thus exhibited, where opium by the mouth was of no apparent service. He claimed, in fact, the difference in action and the advantages that are now conceded to the hypodermic method by every educated physician. For instance, at pages 16 and 17 he says:¹ "*First.* That opium, when diligently applied externally, so as to be absorbed by the lymphatics, has powerful effects in allaying irritation, removing spasm and producing sleep. *Secondly.* That it is capable of producing these happy effects where the exhibition of it internally had not the same salutary operation. *Thirdly.* This mode of introducing it into the system may be resorted to with advantage, when it cannot be given internally or when it will

¹ T. Clifford Allbutt, *Practitioner*, 1861.

not stay on the stomach. Viewing the subject in this light, a wide field seems to lie open for investigation, which, if cultivated, may possibly lead to important improvements in the practice of medicine." Again, he says: "It may be urged that the *modus operandi* must be the same, whether opium be given internally, or applied externally by absorption; and, therefore, as it has not been efficacious when taken by the mouth, we cannot expect it to be so when applied externally. But experience, the only true test by which to try every hypothesis, seems at variance with this; at least, the facts contained in the cases above recited, militate, as far as their authority extends, against the idea of the *modus operandi* being the same; the effects produced being so different."

I do not wish it understood that I think Michael Ward can in any way dispute for the honors of discovering the subcutaneous method with Taylor, Washington, Wood or Rynd, but that, by a much less exact method, he demonstrated clearly to his own mind the important fact that opium possessed higher, more rapid, and more certain curative powers when absorbed by the skin, and possibly when applied directly to the diseased part. He was upon the very edge of the discovery; he stopped short of the more practical application of his knowledge. He rubbed the drug

into the skin, Wood incised the skin and then injected the drug; as also did Washington and Taylor. I only wish to show that his was the first step in the right direction, and an important one. In 1837, twenty-seven years later, Dr. Washington was in the habit of scarifying the skin of the lumbar region and rubbing in a solution of morphine in cases of painful labor.

In 1838, one year later, Dr. Richard Rolland¹ (*Treatise on Neuralgia*) relates the cure of a case of neuralgia by inserting $\frac{1}{16}$ gr. of morphia, in the form of a paste, into four punctures made over the deltoid of the affected arm. This was one step nearer the discovery. One year later (1839) Taylor and Washington incised the skin and inserted the drug with an Anel's syringe. In 1843, Wood and Rynd almost simultaneously commenced the practice of this method, using a syringe made for that special purpose. At first, Wood employed the little syringe then in use for injecting *nævi* with a solution of iron, the idea of injecting morphine having been suggested in this way. Dr. Wood's syringe-needle was not pointed, and had no lateral opening, it being necessary to incise the skin before introducing it. To Mr. Chas. Hunter, of London, is due, however, the highest praise of all. He at once recognized the great

¹ Wilson, "St. George's Hospital Reports," 1869.

importance of the discovery, improved the instrument, studied the therapeutic part of the subject with care and diligence, on both man and animal, and by dint of speaking at society meetings, and reading and publishing various papers¹ upon this subject, awakened the interest of the profession at home and abroad, in the matter, and placed the practice upon an established basis. Hunter's syringe was a decided improvement upon that of Wood. The latter was clumsy, inaccurate and without a needle point. Hunter added the needle point, lateral opening, and made many other small but important improvements. It is to be regretted that there should have been any hard feelings in this matter between these two distinguished gentlemen. Mr. Hunter seems to have endeavored to take away some of the credit attaching to Mr. Wood, by claiming that Wood's plan was only intended for the treatment of disease by localization, while his thought and experiment had developed the fact that localization was rarely necessary, and that other and more important diseases than those spoken of by Wood could be successfully treated by this instrument. Hunter's energy and zeal was certainly something wonderful. From England the practice spread into France and Germany, receiving

¹ *Medical Times and Gazette*, 1858 and 1859, and June 3, 1865; "On Speedy Relief of Pain," &c., London, 1865, &c., &c., &c.

favorable attention at the hands of Montpellier and Béhier, of Paris; Scanzoni, of Wurtzburg; Oppolzer, of Vienna; Graefe, of Berlin; and Eulenberg, Erlenmeyer and Lorent.¹

The first to use the hypodermic syringe proper in this country was Dr. Fordyce Barker, of this city, who received one from Prof. Simpson, while he was visiting in Edinburgh,² and used it here in May, 1856, on his return. Ruppanier did much both by journal articles³ and by the publication of a little work upon the subject,⁴ to popularize and extend the practice in this country. He used, chiefly, liq. opii seditavus (Squibb), 100 drops of which equaled 1 grain of morphia. Alexander Wood employed Battley's solution, a preparation double the strength of the tincture opii. To what extent the use of the syringe has become popular in this country we all know; that it is equally popular abroad is quite as certain.

The syringes at present in use in this country are all modifications of the instrument which Dr. Barker brought with him; Messrs. Geo. Tiemann & Co. having made the first from this model for Prof. Elliot, of this city, he preferring rubber to glass. Various

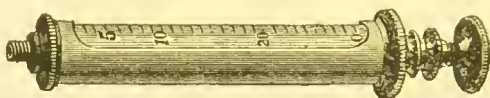
¹ Bartholow, "Hypodermic Method," Phila., 1879, pp. 16 and 19.

² *N. Y. Med. Gazette*, April 9, 1870.

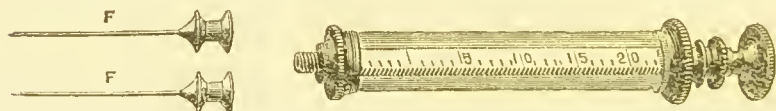
³ *Boston Medical and Surgical Journal*, April, 5th, 12th and 19th, and May 3, 1860.

⁴ "Hypodermic Injection," Boston, 1865.

kinds are made, some very excellent, some very poor. They are of silver, composition, hard rubber, and glass, or combinations of these. The glass

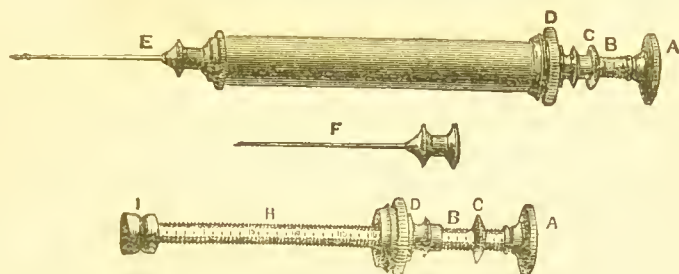


cylinder and metal cased instrument, when properly made, is probably the best, as it is strong, the fluid in the cylinder can be seen, bubbles of air detected, and any dirt or crystallized morphia can be seen and be readily removed. Furthermore, the purely metal

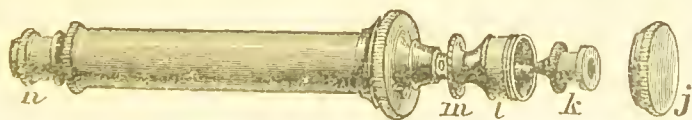


instruments are often dented accidentally, thus rendering the cylinder uneven and interfering with the proper working of the piston. In an instrument where the glass barrel is well made, the latter is always of exactly the same calibre throughout, and if properly protected by metal, will not be broken by a blow that would dent the metallic instrument. The instrument may be graduated on the glass or on the piston rod. I prefer the latter. Messrs. Codman & Shurtleff, of Boston, are making a most excellent instrument, all metal, so tempered and jointed as to

be perfectly accurate, air-tight, of even calibre, easily cleansed, and strong enough to withstand any ordinary blow without injury. The cuts here given are of the instruments made by this firm.



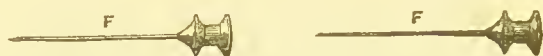
The leather packing should be of good material and be kept moist with a little carbolized oil. Drawing water into the syringe and retaining it by means of a metal cap screwed over the needle-end, is apt to rot the packing and defeat the very end which it is intended to accomplish. Some syringes have the packing protected on each surface by a thin metal plate, which preserves the leather, keeps it well com-



pressed, and allows of full expulsion of the last drop of fluid in the syringe.

The needles may be of plain steel, be gold-plated, or of pure gold. The steel needles, when well

made and properly cared for are, I think, the best. Through each needle a fine wire should be pushed and left *in situ* after each time of using.



Hard rubber syringes are usually poor and inaccurate. Most glass instruments are, as a rule, readily broken. An excellent instrument of this kind is made by Gemrig, of Philadelphia.

M. Damaschino presented to the Société Médicale des Hopitaux de Paris,¹ in the name of M. Gabriel Bay, medical student, the description of a new hypodermic syringe, which, it is claimed, will hold enough fluid for a number of injections, and thoroughly preserve it from contact with the air, and free from vegetable growths, decomposition, &c. It is provided with valves for determining the direction of the fluid, and it is quite a complicated piece of mechanism. If the solutions or the plain powder, as recommended in chapter II., are used, and reasonable care in keeping the instrument and needles clean is exercised, there will be no need of using such an apparatus, it having the disadvantage of getting out of order easily, and being hard to keep clean, in time defeating the very end which it claims to accomplish.

¹ *Gazette des Hopitaux*, Oct. 28, 1879.

After each time of using, the syringe, needle still on, should be washed out thoroughly by drawing into it and discharging from it several syringefuls of clean water. The needle should be removed and dried, the wire inserted, and the metal cap screwed on at the needle-end, thus preventing the entrance of dust or dirt.

THERAPEUTIC APPLICATION. *

It seems hardly necessary to say anything in favor of the view of a peculiar action of morphia when given in this way. Its advantages over morphine given by the stomach, as admitted by all writers on the subject are these:—

1st. Economy of the drug; less being necessary.

2d. Greater rapidity of absorption, and consequently greater rapidity of action, and greater permanence of effect.

3d. Possibility of giving, when the stomach cannot retain the drug, or when swallowing is impossible.

4th. Less tendency to constipate and none to disorder digestion.

5th. Greater local action.

6th. Peculiar curative action in certain diseases where morphia by the mouth is of no avail. Anstie, speaking of its advantages, says: ¹ “The advantages

¹ Anstie, *Practitioner*, July, 1868, vol. I., p. 33.

of the hypodermic over the gastric administration are these: 1. Economy of the drug. 2. Entire abolition of the depressing or irritant effects which are locally produced in the alimentary canal during the *digestion* of various remedies. 3. Far greater *permanence of effect* in many cases than can be produced by medicine swallowed. 4. Much greater rapidity of action—a quality which makes injected remedies of priceless value in certain emergencies. One most important conclusion from these facts is this: *that anodynes or hypnotics ought never to be administered by the mouth in acute diseases attended with anorexia.* The practical importance of this principle is immense. Regular and systematic nutrition is the great necessity and the great difficulty in these diseases, and the avoidance of any treatment tending to interfere with digestion of simple food is a cardinal necessity."

There is, undoubtedly, a very decided difference in action between equal amounts of a drug acting over a long and over a short period of time; in the one it is the gradual charging of the system with the drug; in the other the very rapid absorption and the sudden intense, almost shock-like action of the medicament. Herein lies the great danger attending the use of morphia in this way, in the case of patients who have an opium idiosyncrasy. Does any one

question the difference in effect of exposing a person suddenly to a heat of 210° F. in a close room, and of conducting him slowly through a series of rooms until finally one, the atmosphere of which is raised to 210° is reached? In the first instance the effects will be distressing, if not fatal; in the second agreeable and salutary. This point will be dwelt upon a little more fully when we come to consider those cases of death due to the hypodermic injection of morphine.

Great diversity of opinion still exists amongst medical men as to whether an injection of morphine is as effective when made at a distance from the seat of pain, as when made directly over it. The latter was the belief of Dr. Alexander Wood, and is shared by Eulenberg,¹ Béhier,² Mitchell, Keene and Morehouse³ in certain cases, and by many others.

Mitchell, Keene and Morehouse, after conducting a number of experiments on patients suffering from neuralgia, sum up their views as follows:

“As the opinion of many good observers is quite decided as to the fact that the injection gives the same relief, whether made near to or remote from the seat of pain, we may with reason be asked why we

¹ “Die Hypodermatische Injection der Arzneimittel,” Berlin, 1865.

² *Practitioner*, 1868, p. 35.

³ *Am. Journal Med. Sci.*, July, 1865.

used so many injections in the same limb or neighborhood. The answer lies in the fact that our patients very early, and we ourselves later and more reluctantly, reached the conclusion that the point at which the injection was to be employed was not a matter of indifference. In the milder instances of neuralgia a subdermal injection of morphia used anywhere in the body did give relief, but in cases of 'burning neuralgia,' such as we have described in our book on nerve wounds, p. 100, *et. seq.*, the nearer we could bring the agent to the place where the pain was felt the greater was the ease obtained. We are the more anxious to insist upon this matter, because we neglected to make the same comment when detailing our mode of treating these lesions in the volume above mentioned. The belief thus reached is not altogether unphysiological, as we very well know that morphia is capable of causing a local paralysis of sensory nerves with which it may come in contact."

Of the non-believers in the efficacy of "localization," Mr Charles Hunter¹ is the most prominent. His objections to continued localization are that, *First*, As good an effect can be obtained by distant subcutaneous injections; *Second*, The certainty to produce abscess and inflammation both of the skin, cel-

¹ *Med. Times and Gazette*, 1858-9.

lular tissue and nerve-sheaths, if injection into one spot is made often; and *Third*, That if localization was necessary in all cases, a large class of neuralgia could not be thus treated. Bartholow¹ is of the same opinion reserving as exceptions "cases of sciatica and zoster, and in all cases of long standing in which the trunk of the nerve has become altered. When neuralgic pain is purely local, produced by alterations of nerve trunks, as for example, many cases of sciatica, the injection of various irritants into the vicinity of the diseased nerve will often be followed by notable diminution of the pain and sometimes by cure. This important fact has been demonstrated by Luton,² Bertin³ and Ruppenner.⁴ It is probably in this way that local injections sometimes succeed when remote injections fail." Anstie⁵ believes that local injections are no more efficacious than distant ones, except in rheumatic troubles and chronic neuralgias where there is much inflammatory thickening and adhesion.

Chouppe,⁶ from one thousand experiments on himself, found morphia injected locally to produce anæ-

¹ "The Hypodermic Method," Phila., 1879, p. 74.

² Archives Gen.

³ *Ibid.*

⁴ "Hypodermic Injections," 2nd Edition.

⁵ *Practitioner*, July, 1868, p. 36.

⁶ *Gaz. Med. de Paris*, No. 35, 1874. *British Med. Journal*, April 10, 1875.

thetic effects from two to three minutes sooner than when injected at a distance from the seat of pain.

Eulenberg¹ declares in favor of "localization" on the ground that there is decided decrease of tactile sensibility, etc., at the point of injection.

Aside from its practical bearings in surgery, the following by Dr. Geo. A. Foote,² in his valedictory address as retiring President of the North Carolina Medical Society, is of interest in this connection: "In consulting with my esteemed friend, Dr. T. P. Jerman, I aided in the excision of a fibrous tumor weighing about one pound. The patient was a colored woman aged fifty years. The tumor was situated near the insertion of the deltoid muscle of the left arm. As an experiment, we injected into the fibrous growth half a grain of morphia and one thirty-sixth of a grain of atropia. After a few seconds, the tumor was extirpated without the slightest pain,—the patient remarking at the close of the operation, that had she not seen us cutting, she would not have known what was going on. The success was quite beyond our expectation. I have had but one opportunity of repeating the experiment. It was in the removal of a small wen under the right scapula. The result was equally satisfactory. In neither of these cases did sleep occur in

¹ "Die Hypodermatische Injection der Arzneimittel," Berlin, 1865.

² "Transactions of the Medical Society of North Carolina," 1877.

several hours. The reason is obvious. The atropia counteracted the cerebral effects of the opiate. It had long been a favorite problem with me to discover a method of rendering painless the minor operations of surgery without employing chloroform or any anæsthetic inhalent; and I am satisfied that the hypodermic injection of morphia and atropia into wens and fibrous growths meets the case and supersedes the necessity of employing so powerful and dangerous an agent as chloroform. I am not aware that the experiment has ever been tried before, and I earnestly invite your attention to the subject,—hoping that it may prove as satisfactory in your hands as it has been successful in mine.”¹

As opposed to the groundwork of Eulenberg’s belief we have the conclusions of Prof. De Renzi,² based upon many experiments: “*First*, The cutaneous sensibility, measured by Weber’s compasses, is generally increased rather than diminished, after subcutaneous injections. *Second*, Frequently repeating these injections

¹ An interesting question arises here. Was the local anæsthetic effect of the morphia and atropia independent of their constitutional action? and was the absence of pain due to the local narcotic effect produced on the nerves supplying the part, or was it the result of a constitutional impression manifested locally? Bartholow says both tactile sensibility and sensibility to pain are diminished at the site of injection.

² *La Nuova Liguria Medica*, Feb. 20, 1873; *N. Y. Med. Journal*, vol. 18, p. 214.

and each time measuring the sensibility, the latter is, after a few days, often found to be augmented in a considerable degree, and at the termination of the treatment is much greater than at the commencement." He therefore concludes "that morphia does not exert any direct and local narcotic effect."

Mitchell, Keene and Morehouse¹ noticed a like increase of sensibility in some of the cases under their care; the sensitiveness being very marked.

Dr. O. J. B. Wolff,² in cases of mental disease, prefers to make the injection in the anterior and lateral portions of the neck, so as to get close to the vaso-motor centre. He claims to get a better physical soothing effect than when the injection is made in other situations. This he determined by "actual experiment."

Those of my correspondents who have expressed themselves upon this point, are chiefly against "localization" as mischievous, and prone to produce inflammation if long continued.

From a consideration of the various arguments *pro* and *con*, it would seem that "localization" is only to be had recourse to for a single, or a few injections, and chiefly in the cases pointed out by Anstie, Mitchell, Keene and Morehouse, and Bartholow. The more

¹ *Am. Journ. Med. Sci.*, July, 1865, p. 68.

² "Archiv für Psychiatric," *Practitioner*, 1871, vol. VI., p. 374.

the complaint, especially neuralgia, has an acute or chronic inflammatory process as a factor, the more efficacious is a local injection. The cases of "Burning Neuralgia" which have been given by Mitchell, Keene, and Morehouse, as especially calling for localization of the injection, are traumatic, and essentially inflammatory. Where the disease seems dependent on a constitutional cause, the localization of the injection does not seem to be called for, distant injection being usually efficacious. This will, of course, not hold good in all cases. Further, I do not wish it understood that in many superficial or deep inflammations I advocate injection directly into the seat of the morbid process. When necessary, or desired, the injection should be made as close to the seat of this process as is reasonable. Dr. Foote's experiments are certainly worthy of being tried extensively.

A few words may be said with advantage as to where the injection had best be made, when local effect is not desired. Any part of the arm or leg may be selected, avoiding, of course, those situations where there is liability of wounding a vein. The parts over bony prominences should be avoided, as also parts where the tissues are tense or are rendered tense by the movement of the limb. Injections made over bony prominences are usually very painful. I am accustomed to select the anterior and outer as-

pect of the forearm. It is maintained by some, and I have verified the fact in many instances, that injections beneath the skin of the back, are more slowly absorbed than when given elsewhere. I have also found the same to be the case in some individuals, with injections made over the recti muscles of the abdomen. This rapidity of absorption varies in different persons, and by injecting plain water, as well as medicated solutions into myself and some of my patients, I have found absorption from the groin and inner side of arm to rank first in point of rapidity; forearm next, leg next, abdomen next, and the thick tissues of the back last. This is true both as regards the time required for the disappearance of the tumor formed by the fluid injected and the time when the agent employed (Potass. Iodid) made its appearance in the saliva. I am at present continuing these experiments, and hope by verifying in many what I have found in a few cases, to establish or destroy the correctness of the results already obtained. Limited space will not permit my giving these experiments in detail now.

Bartholow¹ says: "I have not been able to observe any difference in the rapidity of effect as influenced by the site of puncture. If, as sometimes happens, the patient prefer injection into the painful

¹ "The Hypodermic Method," etc., Phila., 1879, p. 33.

part, it will be well to yield to his prejudices, provided no contra-indication exists thereto. Eulenberg, on the contrary, found a less rapid effect from injections into the back than from those made elsewhere."

CHAPTER II.

INFLAMMATION AND ABSCESS—SOLUTIONS USED—
METHOD OF INJECTING—ERYSIPELAS—CYSTS—
TRANSMISSION OF SYPHILIS AND CARCINOMA—
CONCLUSIONS.

IT is surprising what a difference of experience there is amongst some physicians in the matter of abscess and inflammation following the puncture of the hypodermic needle. One gentleman reports that he has an abscess "in about one in every ten punctures," and another "in a practice of twenty years in which I have used the hypodermic syringe thousands of times, I have seldom had inflammation, and never abscess."

Of the 357 physicians answering my questions, 28 report abscess as common, 69 as rare, and 213 have had none. Thirty-four of the 213 have seen slight inflammation follow the puncture in a few cases. This yielded readily to cold water dressings or received no treatment at all. Thirteen of the 357 have found inflammation to follow very frequently.

These figures represent from twenty to thirty thou-

sand injections, at the least, many of the gentlemen having used the syringe for the past twenty years, none having used it less than two or three hundred times. The fact that out of this large number of injections there is so small a showing of abscess and inflammation, speaks well for the practice. I could not obtain the number of abscesses seen by each reporter, some reporting many (one in ten, &c.), some a few, and many saying nothing of the number. In this summary are not included those cases of abscess found in the habitués of the syringe, they being due in part to the multiple punctures, the low condition of the system, impure solutions, dirty syringes, and careless injecting. Cases of this kind are spoken of by many of my correspondents, and are mentioned by all the prominent writers on this subject. To include these in a table such as this, would be manifestly unjust. They will be spoken of more fully under the head of "The Morphia Habit."

Many of the gentlemen who have written me upon this subject ascribe the production of abscesses to various causes; as impure, decomposed or too acid solutions, dirty syringes, rusty or unclean needles, liability of the patient to cutaneous inflammation, and poor condition of the general health, all of which may thus act in different cases.

As to the solution, very few doubt that when it has

stood for some time, especially in warm weather, and has become filled with a minute vegetable growth, and decomposition, to a certain extent, has taken place, that it may lead to the formation of abscesses. To prevent the occurrence of this decomposition and growth of fungi, various agents have been employed. In a letter to the Cincinnati *Lancet and Clinic* for May 17, 1879, Dr. H. M. Keyes, Assistant Surgeon U. S. M. H. Service, writes as follows :

“Some years ago, while attached to the Roosevelt Hospital, in New York City, and after repeated experiments with various tests and anti-ferments, I became convinced of the practicability of making a solution of sulphate of morphia of the strength of ‘Magendie’s,’ without the aid of acid, except salicylic, and that not as a solvent but as a preventative of decomposition, making a solution that, when properly prepared, gave perfect satisfaction after years of use, never causing abscesses—as is frequently the case when the mineral acids are used—and when carried in the pocket for months, being in as perfect condition for use as when freshly prepared.

“I published the formula in *The Druggists’ Circular*, of New York, at the time, under my initials (H. M. K.); and, as I am satisfied that there are a great many physicians in Cincinnati to whom such a solution will be a welcome, I send you the formula to pub-

lish, should you so desire.

“The following directions, if followed, will give the desired result :

“ R. Sulphate of Morphia.....	256 grs.
Salicylic Acid.....	8 grs.
Distilled Water.....	16 fl. oz.

“Heat the water in a porcelain capsule, over a spirit lamp, until the boiling point is reached, add the powders, stir with a glass rod until the powders are dissolved, filter through coarse filtering-paper while hot, and keep in a glass-stoppered bottle of *green* glass.

“Druggists can make it up in this quantity or larger, as can apothecaries in hospitals, and be prepared to furnish it at a moment’s notice. The ‘liquor morphiæ sulphatis’ of the U. S. Dispensatory can be made from it by the proper dilution (f3ss. ad f3vijss. water), instead of keeping a large quantity of the latter on their shelves.

“Sulphate of atropia and other alkaloids may be added to it at the option of the physician.”

According to M. Damaschino,¹ abscess and inflammation may always be avoided by the use of a perfectly clean and pure solution, he asserting at the same time, however, that no solution can be kept free from vegetable growths and dirt, and undecomposed,

¹ *Gazette des Hopitaux*, Oct. 28. 1879.

unless in a phial, where it is perfectly protected from the air. To accomplish this, he recommends the combined phial and syringe of M. Gabriel Bay, to which reference has already been made.

Prof. Roberts Bartholow,¹ prefers the use of a simple solution of the sulphate in pure water, as follows:

℞ Morphiae Sulphat. gr. xvi.
 Aq. destil. $\bar{3}$ i.
 Dissolve and filter.

Dr. Jennie S. Elder, of Canastota, N. Y., writes:—
 “Solution prepared as follows:

“℞ Sol. Morph. Sulph. Magendie. $\bar{3}$ i.
 Atropiae Sulph. gr. i.
 Acid Benzoic } aa a trace.”
 Acid Salicylic }

With this she has never had either inflammation or abscess.

Dr. V. S. McNider, of Jackson, Northampton Co., N. C., uses:

℞ Morph. Acetat. gr. xii.
 Acid Acetic m. i.
 Glycerin. m. v.
 Aq. Pur $\bar{5}$ ss.

Dr. Thomas McAllister, of Amesbury, Mass.,

¹ “The Hypodermic Method,” Phila., 1879, pp. 42, 43.

writes; "I have used the following (Middlesex Hospital):

"R Morph. Acetatis..... gr. x.
 Acid Acetic,..... m. i vel. ss.
 Aq. Destillat..... 3 i.
 Misce et ad.
 Liq. Potassae,..... m. i vel. ss.

"Am not particular to have it freshly prepared every time. Carry it in pocket, and when one lot is gone I get another."

The English practice seems to be chiefly the use of solutions made with acids for solvents of the salts. Anstie¹ recommends the use of the acetate, so dissolved. Lawson² prefers the muriate. His solution is so strong that it requires to be heated, being solid when cold.

The committee of the Medico-Chirurgical Society used the acetate insisting, however, that the acid, necessary to dissolve it, should be carefully neutralized.³

Dr. Andrew M. T. Rattray, Portobello, Scotland, writes: "I adopt Dr. Tanner's formula—*i. e.*, in 3 i aq. destillat. I dissolve gr. x of morphia acetatis; to dissolve this salt thoroughly add a few drops of acetic acid, after which neutralize the fluid by the

¹ Anstie, *Practitioner*, 1868.

² *Med. Times and Gazette*, 1870.

³ "Trans. M.-C. Society," vol. L.

addition of liquor potassæ, till a cloud appears; finally, one or two drops of acetic acid are added to acidulate the solution." The dose of this is one or two drops, to which ten or twelve of water are added at the time of using.

John H. Wraith, M. R. C. S., Eng., L. S. A., Lond., &c., says, in this connection: "Yes, (inflammation and abscess), when I made the solution with the muriate of morphia, instead of the acetate, the muriate requiring more acid to dissolve it."

Edward T. Wilson, M. B., Oxon, F. R. C. P., Lond., who has made a thorough and exhaustive study of this subject, and whose paper in *St. George's Hospital Reports*¹ will repay careful study, writes me: "I always use atropia.

"℞ Morph. Acetat.....	gr. xii.
Atropiæ Sulph.....	gr. ss.
Aq. Destillat.	℥ ss.
Solve in Aq. Calent.	

"Abscess at point of puncture about twice or three times, perhaps, in many thousands of punctures. This immunity I attribute to the use of a simple watery solution, without the addition of acid; also in part to the weakness of the solution, rendering it less suitable."

Eulenberg,² who largely represents the German

¹ "St. George's Hospital Reports," for 1869.

² "Die Hypodermische Injection der Arzneimittel," Berlin, 1865.

practice in this matter prefers a solution of morphia hydrochlorat. made with a small quantity of hydrochloric acid.

Dr. Samuel G. Armor, Prof. Principles and Practice of Medicine, at the Long Island College Hospital, writes me that he usually dilutes Magendie's solution with an equal part of water, for the same purpose.

Dr. Charles E. Blake, of San Francisco, California, writes: "I have for the past year or two added about one grain of salicylic acid to the ounce of solution, for its preservative effect, as the growth of fungi is thereby prevented. Salicylic acid causes a little more smarting when the needle is used, but this quickly subsides."

Dr. O. J. Hallenbeck, of Canandaigua, N. Y., modifies the usual solution, as follows:

R.	Morph. Sulph.....	gr. lxiv.
	Atropiae Sulph.....	gr. ii ss.
	Acid Salicylic	gr. ii.
	Aq. Destillat.	$\frac{3}{4}$ iv.

Dr. G. E. Mecuen, 1,083 Tremont street, Boston, Mass., uses the following:

R.	Morph. Sulph.10 grms.
	Atropiae Sulph.009 "
	Acid Salicylic.....	q. s "
	Aq. Destil.....	6.00 "

M. Make a solution and filter.

Dr. J. T. Sledge, Middleburg, Warren Co., N. C., writes, "I use the following solution :

"℞ Morph. Sulph.	gr. xvi.
Atropiae Sulph.	gr. $\frac{1}{3}$.
Glycerin.	3 i.
Acid Carbolic	gtt. v.
Aquae	3 vii.
Misce et filter."	

Dr. J. B. Cooper, of Cales Station, Ill., writes : "Have had a few cases of abscess, but never when carbolic acid was added to the solution ; say one drop to the drachm."

Dr. M. A. Wilson, Clin. Asst. to Chair Dis. Child, Bellevue Coll., N. Y., writes : "I have tried the adding of a very slight amount of carbolic acid (gtt. ii. to sol. $\frac{3}{4}$ i.), chiefly with the view of preserving it, but see no advantages therefrom."

Dr. Crawcour, 194 Camp street, New Orleans, La., writes : "My solution is filtered, and to every ounce I add two drops of chloroform, which prevents the formation of fungi." Dr. Crawcour was one of the first to use the hypodermic syringe in this country, he using a Pravaz instrument as early as 1857.

Dr. C. C. Fite, President of the Board of Health, Shelbyville, Tenn., writes : "I dissolve the morphia in boiling water and then filter, and in summer add a little salicylic acid, which keeps it pure."

Dr. Jno. H. Lowman, Prof. Mat. Med., Wooster

University, Cleveland, Ohio, writes me: "I use Magendie's sol. of morphiae sulphas (gr. xvi. $\frac{3}{4}$ i.) Have used sol. bimeconate of morphia—this is more antiseptic, and fungi do not form in it as soon. It will remain clear longer than any other solution I have used."

Prof. John J. Reese, of Philadelphia, writes me: "I keep a solution of morphiae sulph. and atropiae sulph. on hand; It requires, however, (as you doubtless have found) to be occasionally filtered."

Dr. W. W. Vinnedge, of Lafayette, Indiana, writes: "Yes, recently I have had three abscesses appear at the point of puncture. The solution I used was too old. The fault was in the fluid, as shown by the microscope."

Dr. J. Hawtrey Benson, of Dublin, Ireland, has seen inflammation in about 1 or 2 per cent. of cases, but never abscess. He uses acetate of morphia, dissolved without the aid of acid.

James Donaldson, M. D., late of Madras Med. Staff, writes: "No, never, once only after injecting a solution of the acetate, which turned out to be very acid and acrid. There was, for a few seconds, sharp pain, and a small mark remained, looking as though the skin had been burned. No abscess occurred, the subject being quite healthy, but I believe that such would have occurred in an unhealthy per-

son. The skin looked, for days, as if scorched, and a brown mark long remained as if a sore had existed there. I threw the solution away, had another very carefully made, as nearly *neutral* as possible, and no such unpleasantness nor pain occurred."

Reginald E. Thompson, M. D., who was one of the committee, and who drew up the report on the subject of the hypodermic injection of morphia for the Medico-Chirurgical Society ¹ writes me as follows: "If the solution is not carefully made and neutral, irritation may readily be produced, and I have seen abscess occur."

Dr. J. Charles Adams, of Lake City, Minn., writes: "I have used this method since 1860 and have had abscess but once; then, too much acid was used in the solution."

Dr. Wm. W. Cable, of Pittsburgh, Pa., writes me: "I had both inflammation and abscess when I first commenced to use the instrument, but soon learned that it was caused either by the rust on the needle, or when, from age, some chemical change had taken place in the solution. Now, when I use only a fresh solution and take great care of the instrument, I have no trouble with the most sensitive skin. I never use a solution kept longer than 24 hours."

Dr. O. C. Tobey, of Westfield, Ill., in answer to

¹ "Transact. Med.-Chirug. Society," vol. L.

the fourth question says: "Yes. Several years ago fifteen abscesses followed as many punctures; thirteen in one man and two in another. I am perfectly satisfied that the fault lay in the morphia, for on procuring a new phial of the drug, the thing did not happen again, although I continued the use of it in the one case."

Dr. John S. Marshall, Physician to Cleveland Asylum for Insane, Newburgh, Ohio, writes: "In administering it about 1200 times slight inflammation has followed in a number of instances, and suppuration in about 25. All of these abscesses occurred in the course of a month. Doubtless the cause was owing to the adulteration of the morphia, atropia, or to the water. We afterward attributed it to the atropia, as we had no further trouble after purchasing a new lot of it."

Inability to keep the solution free from fungi, and the idea that there is less liability to abscess owing to the warmth of the preparation, has led many physicians to dissolve a powder of morphia of the requisite strength just before using.

Dr. John A. Ritchey, of Oil City, Penn., writes: "I have had scores of abscesses at the point of puncture, but never one when I dissolved the powders in water alone, immediately before using them."

Dr. R. Aberdein, of Syracuse, N. Y., says: "Only

had abscess form in two cases, and then think it was because I used Magendie's solution. I prefer to dissolve it when needed."

Dr. Madison Hammel, of Circleville, Ohio, writes: "I have always used the sulphate of morphia. To get a quick and good solution I put the dose in a teaspoon, add the water from the syringe, according to the quantity I intend to use. I warm this over a lamp, draw the fluid into the syringe and inject it anywhere without fear of abscess."

Dr. T. A. Mitchell, of Owensville, Ohio, writes: "Have had neither worth notice since I have been preparing solution at the time of use."

Prof. Samuel G. Armor writes: "I have always been accustomed to dissolve the morphia in a little hot water at the time of using, filling the syringe full. Or, if I use Magendie's solution, I dilute it in a syringe-full of warm water. I am under the impression that by thus diluting it there is less danger of abscess."

Dr. D. H. Bliss, of Kansas City, Mo., carries powders of the sulphate of morphia of definite strength with him and dissolves them at the bedside. He has found carbolic acid and other "preservatives," when added in sufficient amount to be of service, to be very irritating to the tissues.

Dr. Wm. H. White, of Bloomfield, N. J., writing

on this point, says: "Often when administering the prepared Magendie's solution which had become a little stale. Never since adopting the course of preparing the solution at the patient's bedside by dissolving the sulphate of morphia in a silver spoon, or a homœopathic vial by means of heating it over a lamp."

Dr. J. H. Arton, of Hamilton, Bermuda, pursues the same plan.

Dr. W. W. Cady, of Logansport, Indiana, writes: "In reference to your fourth question I would further say that in order to avoid the possibility of abscesses and inflammation I do not use a prepared solution, but simply carry in my case a number of 1 grain powders. With the aid of a spoon and a syringe, and a few minims of water, the required quantity of morphia may be easily dissolved and given. You are, no doubt, aware how soon a prepared *acid* solution becomes filled with foreign growths, and how the morphine itself will manage to crystallize about the cork, thus not only rendering the solution unreliable but irritating also." A physician in the South, a slave to the habit, writes: "I have sometimes introduced morphia in the calf of my leg and in the abdominal muscles, but here it always produced considerable irritation and soreness. I have found morph. acetat. to give more pain than morph. sulph.

The points in which I prefer to introduce the needle on account of being less sensitive to the puncture and giving less pain and causing less soreness afterwards, are, just above the insertion of the deltoid, on the outer aspect of the arm and in the bend of the elbow, in the angle between the two veins. Near the shoulder, on the front of the arm, is another good point. I think one good reason why abscess has followed so seldom is because I always use the solution warm."

Some of the gentlemen from whom I have heard claim special advantages from their peculiar methods of making the injection, especially claiming immunity from abscess, thereby. The majority of the profession follow the usual plan of pinching up a fold of skin and passing the needle into the subcutaneous tissue; the gentlemen here spoken of vary somewhat in their manner of introducing the needle.

Ernest Aylward, L. R. C. P. E., etc., of Leeds, England, writes: "Neither abscess nor inflammation. I invariably inject deep into the gluteus muscle when I can get the patient to consent to it." Dr. G. Wm. Semple, of Hampton, Va., writes in this connection: "I had inflammation to occur at the point of puncture in a case where the insertion was made over the right kidney and probably into the fascia lumbalis. A small fibroid tumor resulted (1870), it has not in-

creased in size since six months after injection, and gives no inconvenience. I then added a minute quantity of carbolic acid to the injections and have since had no such accident, though for the last three years I have ceased to use carbolic acid and instead have plunged the needle deep into the muscular structure."

Andrew M. T. Rattray, M. D., of Portobello, Scotland, writes: "In this operation, with the left hand seize the fleshy part tightly and inject on the opposite side—*i. e.* say over the deltoid where the skin, is tight." Dr. S. R. Skillern, of Philadelphia, Pa., writes: "I would further state that in my experience the discomfort following immediately upon the use of the instrument and, too, the chances of an abscess are greater when the injection has been made directly under the skin than when it has been put deep among the tissues." Prof. Samuel Logan, of the University of La., writes: "I usually prefer to inject deeply into the muscular tissue over the shoulders." He used the loose cellular tissue in one case where it was necessary to inject a large quantity at one time. Dr. G. L. Dunlap, of Danville, Kentucky, has observed "that the deeper the needle is plunged into the muscular tissue the chances for these indurations to form are diminished."

Dr. A. Atkinson, of Baltimore, Prof. Mat. Medica

and Dermatology, Coll. Phys. and Surg., of that city, in answering the fourth question, says: "Had inflammation and small abscess but once, and then because the lady would not allow the instrument to go deeper than the skin. When I plunge the needle well into the muscular tissue I never see an abscess, induration or discoloration." Dr. George E. Jones, of Cincinnati,¹ believes that deep injections are preferable to subcutaneous ones, both as regards painlessness and freedom from abscess. Dr. Q. C. Smith, of Cloverdale, Cal., attributes freedom from abscess to injecting deep into muscle. Dr. W. O. Walker, of Winchester, Ky., believes in making the solution at the bed-side and in inserting the needle at about an angle of 45° , entering it from $\frac{1}{4}$ to 1 inch.

On the other hand, Dr. J. H. Thompson, of Goshen, N. Y., writes me in reference to abscess: "Yes, in my own case when the muscle was pierced by the needle, but not otherwise." And Dr. E. J. Bergen, of Trenton, N. J., writes upon the same subject: "I never have had but one abscess, and that when the injection was made deep in the deltoid muscle." Bartholow² does not seem to favor this method except for the use of strychnine in paralysis.

¹ *Lancet and Clinic*, August 10, 1878.

² "The Hypodermic Method," Philadelphia, 1879, p. 32.

He says: "It is claimed for this method that it is less painful and less liable to be followed by abscess, than by injection under the skin, but it is obviously improper if any considerable amount of fluid is to be injected."

Dr. Temuljee Bhicajee Nariman, of Bombay, writes that he does "not like the idea of pinching up a fold of skin and putting the needle under it, as we are advised by some. I always put my needle boldly in and let it pierce the subcutaneous tissue. I gently disperse the swelling produced by the injected fluid simply by pressing the surrounding parts."

Alfred C. Post, M. D., Prof. Emeritus of Clinical Surgery in the University Medical College, N. Y., writes me: "I attribute this immunity of my patients from local irritation to my manner of giving the injections. I raise a fold of skin, pierce it with the needle, inject a drop of the fluid, pass the instrument a short distance, inject another drop, and so on to the end. In this way, the liquid is diffused and much less violence is inflicted than when the fluid is injected in one mass."

Dr. Samuel Logan, of New Orleans, Prof. of Anatomy and Clin. Surgery in the University of Louisiana, follows nearly the same plan as that of Post. "To prevent the formation of abscesses," he

writes, "I am always careful to inject very slowly, and to scatter the fluid as I inject, and afterwards by a gentle kneading pressure on the parts assist its spreading and absorption."

Dr. C. A. White, of Danville, Ind., makes the following statement: "I am quite sure that the inflammations and abscesses are the result, generally, of the imperfect introduction of the needle. In some cases I think the skin is not even punctured through, but that the needle is so inclined as to 'split' the skin, as it were, and the solution is thus forced into a sort of *cul-de-sac*."

Dr. P. H. Thornton, of Lakeport, Cal., writes:—"I have had three abscesses, all in the same person, caused by injecting air, which I believe to be the cause of all abscesses, or nearly all. In fact this has been my experience in several thousand injections." It seems hardly possible that this could be the case, else why are not abscesses common in localized or general emphysema of the subcutaneous tissue?

Dr. Samuel P. Reed, of Scranton, Penn., says in reference to abscess: "I used to have abscesses frequently during the first two or three years experience, but have not had *one* for ten years. They can always be avoided with a little care (cleanliness and dipping the needle in carbolized oil.)"

Disease and lowered systemic tone are undoubted

predisposing causes of abscess following the use of the hypodermic needle. Dr. G. S. Dunlap, of Danville, Ky., had an abscess follow the injection in a case of rachitis. Dr. W. A. Neal, of Dayton, has never had abscess occur, save where "the blood was in bad condition."

Dr. Samuel E. Wills, of Earlville, Md., writes: "Abscess was the invariable attendant in several attacks for which hypodermic injections were used." He found in some cases, as did Prof. Logan, of New Orleans, in many, that the tendency to inflammation and abscess passed away after the first few injections.

Dr. Alfred Mercer, of Syracuse, N. Y., had an abscess form in the case of a drunkard, and Dr. A. B. Stuart, of Santa Barbara, Cal., had the same in a plethoric patient convalescent from delirium tremens; Dr. De Forrest Willard, of Philadelphia, Pa., has seen but one, and that in a feeble, nursing woman; Dr. J. W. Brome, of Mottville, N. Y., in the case of his father, who suffers from erysipelas.

Dr. G. Wm. Semple, of Hampton, Va., writes me: "As surgeon in charge of prisoners on Belle Isle, I had a good many cases of bad ulcers caused by it, in scorbutic prisoners, and many more afterwards, when in charge of Federal prisoners. Prisoners brought in wounded, from the field, in good general health, never suffered so. Since the war, I had an

abscess at the point of puncture in a lady who had been for some time suffering from a succession of abscesses."

Dr. A. L. Kilpatrick, of Navasota, Texas, had a large abscess form after an injection, in the case of a "large and extremely fat negress" who had congestion of the stomach, with vomiting and diarrhœa, "the abscess was disposed to spread, was phagadenic, and discharged very freely several days a most offensive matter." The sore healed in about a month. The doctor is inclined to blame the water used as a solvent. It was in the month of June. The same gentleman reports a case of abscess thus produced in a patient who had disease of the liver. The sore remained open about a week, the inflammatory action and the discharge seeming to do the patient good. Other cases are reported where the irritation of the abscess and the long continued discharge effected a permanent cure in obstinate neuralgia; the good results being attributed, of course, to the prolonged counter-irritation as of an issue.

Dr. R. W. Miller, of this city (N. Y.), relates two cases, one himself, where such abscesses were 4 and $4\frac{1}{2}$ months in healing. The last one ($4\frac{1}{2}$ months) was still discharging at the time of writing.

Dr. T. Gaillard Thomas, Prof. Diseases of Women and Children, College of Physicians and Surgeons,

New York City, writes: "In two of my cases, extensive phlegmonous inflammation has followed punctures, attended by dangerous sloughing of cutaneous and subcutaneous tissues."

The first case was that of a very fleshy lady, in the anterior aspect of whose thigh the doctor injected ten minims of Magendie's solution. In the afternoon she left the city and remained on the cars until she reached St. Louis, when she came under the care of Dr. Bell, of that city, who afterwards wrote Dr. Thomas that there was considerable inflammation at the point of puncture, that eventuated in a circular patch of gangrene a little larger than a large silver dollar. There was no tendency to lateral spreading, but the process went on until the muscular tissue was reached, when it stopped and the resulting excavation filled up rapidly with granulations. There remains a depressed cicatricial looking scar.

The second case was seen with Drs. J. J. O'Connell and T. C. Finnell, of this city. The patient was a young man very much broken in health owing to prolonged dissipation. His skin was covered with patches of psoriasis. He was then in a condition of delirium tremens. All remedies by the mouth had failed, and a hypodermic injection of ten drops of Magendie's solution was used as a *dernier ressort*, the patient's condition being truly deplorable. The result

was intense inflammation extending from the point of puncture, over the insertion of the deltoïd, to the tips of the fingers, resulting in a gangrene that laid the muscles and tendons bare. At one time it was feared that amputation would have to be performed, but the parts healed kindly, though very slowly. Cases of fatal pyæmia or septicæmia from inflammation and abscess at point of puncture are well known.

ERYSIPELAS.—Dr. Samuel Rapp, of Lake City, Colorado, reports the following interesting case: "Male. Aet 54. Gun-shot wound of *left* hand, bullet entering palm, passing upwards and outwards, making its exit at lower third of forearm, between radius and ulna. I gave a hypodermic injection of 10 drops of Magendie's solution in *right* forearm, which was followed by erysipelas at the point of puncture of needle, and patient succumbed in five days, as inflammation could not be controlled by tonics and antifebrifuges." Dr. Kilpatrick, above-mentioned, writes me of abscess and gangrene nearly requiring amputation of the arm of a white male child, aet. 5. The solution injected, however, was quinine in an acid solution.

Dr. F. W. Entrikin, of Findlay, Ohio, writes of a case where the needle passed through a vein, causing inflammation and suppuration, but with no bad re-

sults. The sore healed slowly. He has seen cases where there were slight evidences of erysipelas following puncture.

Mitchell, Keene and Morehouse¹ give the following: "The local annoyances resulting from injections so long continued and so numerous were sometimes very embarrassing, for though in some men they could be used in the same limb, week after week, in others the numerous punctures produced a very unpleasant increase of sensitiveness in the part. Such an instance may be found at page 151, case 31, of our treatise on wounds and other injuries of nerves. In other persons the injections gave rise to occasional abscesses, and in a soldier who was at one and the same time the subject of a very painful wound of the arm and of a cold abscess on the back, every injection gave rise to a large indolent abscess. One instance of erysipelas following the use of an injection was seen by us."

CYSTS.—Dr. Willard Parker, Jr., has kindly shown me his arm, beneath the skin of which are several small cyst-like tumors, the result of hypodermic injection some five years ago. Since they first appeared they have remained in the same condition and of the same size. The wall of the cyst seems to be fibrous, not very closely attached to the adjacent

¹ *American Journal Med. Sciences*, July, 1865.

tissues, and has a small opening upon the skin into which a probe can be readily thrust. They contain a small amount of white secretion or matter that does not exude unless the sac is probed or violently squeezed. They are perfectly painless. The doctor tells me that the mere introduction into the skin of a clean hypodermic needle would at that time produce considerable inflammation, and that the injections would cause circumscribed indurations that did not disappear for months. He was suffering from acute rheumatism at the time the injections were made, and was in a very low, anæmic condition.

I have since seen similar cystic tumors on the body of a prominent medical gentleman of this city. They were not open, however, and felt like small fibrous tumors. It is possible that the fibrous tumor spoken of by Dr. G. W. Semple, of Hampton, Va., was of this nature. A bistoury plunged into one of these bodies gave exit to a thick, whitish matter.

CARCINOMA.—Dr. Samuel W. Francis, of New York, writes, that after injecting morphia in the abdomen of a lady suffering from carcinoma of the ovary, he used the same needle on himself, and he says: "For several weeks I had a dark, round, lumpy mark on my leg." He recommends the keeping of a special needle for such cases. All needles should, at least, be cleaned in some disinfecting fluid after use on sy-

philitic and carcinomatous patients, and in all cases of infectious disease.

ACCIDENTS.—Dr. E. L. Partridge, of this city, tells me of a case where the following accident occurred to him: "The patient, a hysterical girl, was very violent, and as the doctor thrust the hypodermic needle into the cellular tissue, she suddenly pulled her arm away and the needle was broken off close to the syringe. He at once procured some ether, put her fully under it, and attempted to find the needle. This was impossible, and he finally gave it up. This was some three years ago, and the needle has not since been found." Dr. Temuljee Bhicajee Nariman, of Bombay, writes me of a like accident which occurred to him. The needle was, however, recovered.

From the foregoing facts I think we are justified in drawing the following conclusions:

1st. That "localization" of the injection is not necessary and sometimes mischievous, save in certain cases—*i. e.*, burning neuralgia;¹ cases of sciatica and zoster, and in all cases of long standing in which the sheath or trunk of the nerve has become altered;² rheumatic troubles and chronic neuralgias where there

¹ Mitchell, Keene & Morchouse, *Am. Jour. Med. Sci.*, July, 1865.

² Bartholow, "The Hypodermic Method," Phila., 1879, p. 74.

is much inflammatory thickening and adhesion,¹ and in mental diseases.²

2d. That rapidity of absorption varies in different individuals and in the same individual at different times, and with the place where the injection is made, that from the back being the slowest.

3d. That hypodermic injections blunt tactile and pain sensibility sufficiently to admit of the performance of minor surgical operations without the use of an anæsthetic.³

4th. That abscess and inflammation are *comparatively* rare occurrences.

5th. That too acid solutions, unclean syringes, rusty or dirty needles, Magendie's solution that has stood for some time, especially in warm weather, improper modes of injecting and unhealthy conditions of the system are liable to cause abscess or inflammation.

6th. That the sulphate of morphia is the best salt to use, being readily soluble in plain water.

7th. That no solution should be used that is not protected by salicylic acid, carbolic acid, or some such drug; the Keyes' solution being about the best.

8th. That carrying powders and dissolving at the bedside is an excellent plan.

9th. That "deep injections" are worthy of trial.

¹ Anstie, *Practitioner*, July, 1868, p. 36.

² Dr. Wolff, *Practitioner*, vol. 6, p. 374.

³ Foote, "Transactions North Carolina Med. Soc.," 1877.

10th. That serious inflammation, erysipelas, gangrene, and pyæmia may follow the puncture.

11th. That abscesses so formed are often very slow to heal.

12th. That needles should be *thoroughly* cleansed after using on syphilitic or carcinomatous patients, and patients ill with contagious or infectious disease.

13th. That small cystic and fibroid tumors may result from the inflammation.

CHAPTER III.

THE COMMENCING AND THE USUAL DOSE—IDIO- SYNCRASY—NARCOTISM—ELIMINATION OF MOR- PHIA BY THE KIDNEYS—EXPERIMENTS.

The usual dose or amount of morphia given hypodermically seems to vary greatly with different practitioners, and to be, to a certain extent, an index to their confidence in the safety of the method. The figures thus far obtained are as follows:—

Amount.	No. of Phys. Using.	Amount.	No. of Phys. Using.
$\frac{1}{16}$ gr.	2	$\frac{1}{8} - \frac{1}{10}$ gr.	1
$\frac{1}{8}$ "	13	$\frac{1}{8} - \frac{1}{6}$ "	17
$\frac{1}{7}$ "	1	$\frac{1}{8} - \frac{1}{4}$ "	26
$\frac{1}{6}$ "	28	$\frac{1}{8} - \frac{1}{3}$ "	4
$\frac{1}{5}$ "	12	$\frac{1}{8} - \frac{1}{2}$ "	12
$\frac{1}{4}$ "	49	$\frac{1}{8} - 1$ "	4
$\frac{1}{3}$ "	15	$\frac{1}{6} - \frac{1}{5}$ "	1
$\frac{1}{2}$ "	10	$\frac{1}{6} - \frac{1}{4}$ "	11
$\frac{2}{3}$ "	1	$\frac{1}{6} - \frac{1}{3}$ "	10
$\frac{3}{4}$ "	3	$\frac{1}{6} - \frac{1}{2}$ "	2
$\frac{1}{30} - \frac{1}{6}$ gr.	1	$\frac{1}{5} - \frac{1}{4}$ "	1
$\frac{1}{16} - 1$ "	1	$\frac{1}{4} - \frac{1}{3}$ "	4
$\frac{1}{12} - \frac{1}{6}$ "	2	$\frac{1}{4} - \frac{1}{2}$ "	5
$\frac{1}{10} - \frac{1}{8}$ "	1	$\frac{1}{3} - \frac{1}{2}$ "	4
$\frac{1}{10} - \frac{1}{4}$ "	1	$\frac{1}{2} - 2$ "	1
$\frac{1}{8} - \frac{1}{16}$ "	1	Guess at it from loose powder	3

The preceding table shows us that, both at home and abroad, the amount of morphia given as the "usual" dose is very diverse, and that many physicians, by administering such doses to strangers or to patients with whose idiosyncrasies they are not acquainted, are treading upon very unsafe ground. I shall endeavor to show in this chapter that the greatest care is necessary in the matter of giving the first injection, for dangerous narcotism and possibly death have been known to follow the subcutaneous exhibition of amounts of morphia less than those recorded by many physicians as their customary and commencing doses. The question of idiosyncrasy is one of great importance with reference to the exhibition of drugs by the stomach; much more so with regard to hypodermic medication, for rapidity of absorption is at its maximum, the narcotic action of the drug, when of this class, is trebled, and the systemic impression is, consequently, more sudden and shock-like. Examples of idiosyncrasies regarding both food and drugs are sufficiently numerous and well authenticated to deserve more attention at the hands of the physician than they at present receive, and a neglect to study them may possibly explain why so many physicians have so firm a belief in the *vis medicatrix naturæ*, and so little in the therapeutic action of drugs.

Certain drugs like certain diseases, while affecting the system generally, affect some one organ, system, or part of a system with marked intensity—other drugs like other diseases have no manifest action on the general system, but a decided action on some organ, system or part of a system. Let us suppose the drug to be equal to a certain amount of force, as the force necessary, for instance, to drive a sharp axe through an oaken stick having a diameter of four inches; given the same amount of force, the same degree of sharpness of the axe, and the same resistance by the wood, and the effect will always be the same. The effect will vary, however, with variations in the amount of force employed, the sharpness of the axe and the resistance offered by the stick. So with the use of drugs; effects will vary with the amount of the drug, its kind, and certain peculiarities, not yet understood, of the organ or system upon which it develops its maximum intensity. Given the same quantity of the same drug and the same organ, both as regards weight, function, nutrition, innervation, surroundings, &c., &c., and the effect will always be the same; let there be any variation, hereditary or acquired, in that organ, and the effect must of necessity vary.

In speaking of the difficulties besetting experiments for determining positively the question of an-

tagonism between opium and belladonna. Mitchell, Keene & Morehouse¹ say: "If it were clear that these two agents acted in some simple, direct way upon an economy equally as simple, the problem before us would indeed be like the case of acid and alkali; and present to us little that was confusing or difficult to comprehend. If, on the other hand, each of these drugs acted with equality of force but in opposite ways upon numerous organs of a complex being, the question would even then be simplified," &c.

I am firmly convinced that no drug known to us ever acts in precisely the same manner twice; although the main features of its action be alike. If there are lesser variations, surely there may be major ones, dependent in the main upon some hereditary peculiarity of the person. This is true of the nervous system and its parts in particular, and can be readily explained, I think, by a study of the nervous system and the nervous diseases of the present day, as compared with those of one or two centuries ago.

Dr. Geo. M. Beard,² than whom there is probably no man better able to speak upon this subject, says: "The organization of the average European and American of the cultured classes of the present day

¹ *American Journal Medical Sciences*, July, 1865.

² "Eating and Drinking," N. Y., 1877, p. 112, and again at p. 104.

is so much finer and so much more sensitive than it was one century, or even one quarter of a century, ago, that they cannot bear the same medicine, the same stimulants or narcotics, or the same ordinary food that they could then. What was then appropriate and necessary and right for their coarser organizations, is, for the finer organization that has developed with the intense brainwork of our time, suicidal or cruel.

“All the other conditions of race, climate, season, age, sex, being the same, or as nearly the same as possible, the food varies with the temperament in a manner at once striking and mysterious.

“In the chapter devoted to the description of the leading articles of food, some remarks were made on their palatability, digestibility and nutritive value. These remarks were of necessity general in their character; to all these are individual exceptions. There are idiosyncrasies in the matter of diet that defy explanation, and probably can be understood only when the mystery of life itself is solved. This applies not only to positive but to negative food, and to all our principal medicines.

“Even quinine has been known in a few instances to produce a peculiar and disagreeable eruption on the skin. Some cannot bear mutton, others are made ill by a pear, or watermelon, or cucumber.”

Henry Maudsley,¹ in the course of an article "On Opium in the Treatment of Insanity," says :

"There is hardly a disease in which opposite remedies may not be useful under the different circumstances which are denoted by such words as 'diathesis' and 'idiosyncrasy;' and there can be little doubt that future progress in therapeutics will lie in directing the means of treatment more definitely to the diathesis, and in less random attacks on the particular disease, which may have been engrafted on it.

* * * * *

"No statesman with a gleam of philosophy in his mind would dream of using the same measures for the radical cure of rebellion in differently constituted States, simply because it was rebellion; he would have regard to the fundamental causes of the disorder, to the evils in the political system whence it had sprung, and would in each case apply his measures differently, adapting them with special reference to the particular defects of each constitution. On the other hand, a foolish ruler, like an ignorant empiric in medicine, would immediately apply the same measures to rebellion, under whatever conditions it had arisen, because from time immemorial such measures had been thought good for rebel-

¹ *Practitioner*, Jan., 1869.

lion. So, he would do no good or would do great harm."

Many of us have seen or read of cases where the most minute doses of mercury caused salivation and produced other distressing symptoms; where inhalation of a minute quantity of dust arising from ipecac powder produced symptoms analagous to those of hay fever; where quinine caused a red eruption over the entire skin,¹ delirium, hæmaturia and sometimes syncope; syncope and depression, failing heart power, flushing of the surface, and swelling of the limbs from ergot;² and where there was a peculiar susceptibility to the deliriant, throat drying and rash producing power of belladonna or atropia. These are but few of the many instances that might be mentioned. It is a well-known fact, for instance, that a dose of cathartic medicine that will produce but a slight laxative effect in one person will produce hypercatharsis in another, that while tobacco agrees well with some persons, it is a decided poison³ to others; that alcohol has different effects on different constitutions in health and in disease, &c., &c., &c. Is it surprising then that idiosyncrasies exist with regard to opium and morphia, both extremely pow-

¹ F. D. Lente, *N. Y. Medical Record*, Nov. 16, 1878.

² *Med. and Surg. Reporter*, Phila., Nov. 29, 1879, p. 475.

³ Anstie, "Stimulants and Narcotics," Phila., 1865, p. 138.

erful drugs, and that such idiosyncrasy should be brought out more fully and more decidedly when its narcotic action is trebled and the rapidity of its entrance is quintupled ;—is sometimes almost instantaneous by the hypodermic method.

Anstie says¹: “ It must be allowed that opium is a drug, which, more than any other is liable to produce varying effects, according to the idiosyncrasy of the patient to whom it is administered.”

It can thus be readily understood why doses that, when given by the mouth, or to individuals who are not especially susceptible, when administered subcutaneously, will sometimes produce the most intense narcotism ; narcotism that may end in death unless the proper measures to combat the influence of the drug are resorted to at once. Death has been known to ensue, even in spite of these measures.

Anstie² devotes a chapter to the interesting subject of tolerance of large doses of some narcotics (notably alcohol and opium) in certain diseased conditions of the system.

The matter of idiosyncrasy is not confined to man alone. Prof. S. Weir Mitchell³ says :

“ A second series of experiments were directed

¹ “ Stimulants and Narcotics,” Phila., 1865, p. 116.

² *Ibid*, p. 210, &c.

³ *Am. Journal Med. Sciences*, Jan., 1870, p. 19.

towards discovering what amount of morphia might kill, when used hypodermically. As regards this point, I was surprised to find that wide differences were visible in different pigeons. This was partly due to various and easily seen causes, but in part also to reasons which probably rest on the idiosyncrasies of the birds employed. Thus, pigeons of two or three months old were commonly killed by injections into the groin of half a grain to one grain, but sometimes, though rarely, survived two grains. The same amounts used under the skin of the back were much less fatal. * * * *

The present series of observations, therefore, show a singular range of susceptibility, and indicate very distinctly that, as regards hypodermic injections, the pigeon enjoys no such complete immunity as seems to obtain with opium given by the mouth; while, as compared to morphia internally administered, the hypodermic method is vastly more fatal."

In this connection Dr. Corona¹ (*Giornale di Medicina Militaire*) says: "As regards the toxic dose, there was very great variation both as regards the age and the race of the animal."

Susceptibility to the narcotic action of morphia is somewhat more common, but no more peculiar than its tetanic, convulsive, nauseant, or deliriant action.

¹ *Edin. Med. Journ.*, Dec. 1876. *Practitioner*, 1877, p. 132.

These peculiarities¹ also are to be found in animals, but oftentimes are the chief action, the narcotic effect being reached only by immense doses. These matters will be more fully discussed under their proper headings.

An interesting point with reference to the effect of altitude on tolerance of drugs is brought out by Dr. Samuel Rapp, of Lake City, Colorado, who writes : "I have noticed in practice, in this altitude, which is 8,500 feet above the sea-level, that opiates are better borne here than at sea-level, and quinine cannot be given in such large doses on account of its producing headache, ringing in the ears and, at times, delirium."

NARCOTISM.—Were we able to distinguish by any peculiarity those persons who are especially susceptible to the narcotic action of opium, or its alkaloid, morphia, the hypodermic use of these drugs would be placed upon a more exact basis, and many physicians who are now much prejudiced against their use in this manner would regain their confidence, and the profession in general be more at ease. With this end in view, I have corresponded with many of our college professors and gentlemen who have had exceptional opportunities for the study of the subject, regarding the relative susceptibility of

¹ Mitchell, *American Journal Med. Sciences*, Jan., 1870, p. 32.

different temperaments, but regret to say that, thus far, I have been unable to obtain any reliable facts. Prof. S. Weir Mitchell, Roberts Bartholow, H. C. Wood and John J. Reese, of Philadelphia; J. C. Shaw, J. B. Mattison, and Alexander J. C. Skene, of Brooklyn; J. S. Jewell, Henry M. Lyman and James H. Etheridge, of Chicago; Richard McSherry and A. Atkinson, of Baltimore; and William A. Hammond, Geo. M. Beard, Alfred C. Post, Willard Parker and William H. Thompson, of New York, have found no one temperament in which there is special susceptibility to the narcotic action of opium. Definite conclusions have been reached by Prof. Roberts Bartholow¹ with regard to susceptibility to the effects of atropia. He says: "Children bear a much larger proportional amount than adults. Women are more susceptible than men. Persons having a light complexion are much more easily influenced by it than those having a dark complexion. A delicate female, having light-blue eyes and flaxen hair, possesses, according to my observation, the maximum susceptibility." If this is verified by other observers, its value to the profession will be great. Such exact observations of drug action on special constitutions or temperaments have a therapeutic as well as a toxicological bearing. If, as is now largely

¹ "The Hypodermic Method," Phila., 1879, p. 110.

believed, atropine is in many points a physiological antidote to opium, and if atropine is but poorly borne by persons of the configuration above described, opium and its alkaloid, morphia, ought to be well borne. This is, however, negatived by what little clinical evidence we now have on this point; children bear opium poorly, as also do women; and, according to Maudsley,¹ these drugs are borne best by persons of melancholic temperament. This is explained, possibly, on the hypothesis that a nervous system that is especially susceptible to the action of one powerful drug will be so to that of another. This is, at best, but a theory. Dr. Bartholow undoubtedly takes into consideration the question of idiosyncrasy with reference to the subcutaneous injection of morphine, for he says:² "The dose of morphia for hypodermic use varies from $\frac{1}{12}$ to $\frac{1}{2}$ of a grain. *In commencing, it should not exceed one-third of that ordinarily administered by the mouth.* It is prudent, in all cases, to test the physiological capabilities of the patient by a moderate dose, before resorting to the maximum amount. Patients vary in their susceptibility. Women are, as a rule, more easily affected than men. One twelfth of a grain is a sufficient dose for many of the conditions requiring an injection."

¹ *Practitioner*, Jan. 1878, p. 5.

² "The Hypodermic Method," Phila., 1879, p. 44.

Samuel G. Armor, Prof. Theory and Pract. Med., Long Island Coll. Hospital, Brooklyn, writes me: "It has been an impression with me that the sanguine and mixed temperaments bear opium better than the typically billious or melancholic. I have not studied my cases, however, with sufficient accuracy to be positive on this point."

J. H. Etheridge, Prof. Mat. Med. and Med. Jurisprudence in Rush Med. Coll., Chicago, writes me: "I have always noticed that persons affected with opiates in a manner *not* intended, are almost invariably *poor excreters*. The emunctories (one or more of them), were doing vicarious service—at least my observation has usually revealed some such physiological aberration." He further questions whether a defective nervous system, conjoined with the vices of civilization does not produce defectively acting excretory organs, and cause an intolerance of the drug in question.

The part that diseased, or hereditarily abnormal excretory organs play in producing temporary or permanent idiosyncrasy with reference to certain drugs is undoubtedly a large one, and would, in part at least, explain the action of caffeine in opium poisoning. Disease of the kidneys would suggest itself as being the most active factor in the matter, for the greater part of the morphia taken into the system

passes out in the urine. In its favor we certainly have the tradition of years; but against it the fact that morphia has been used with excellent results in chronic Bright's disease,¹ and in heart disease² where there was undoubted renal complications. Take also the use of morphia subcutaneously in puerperal convulsions, presumably uræmic, as advocated by Loomis,³ and successfully carried out by Fiset,⁴ Dain,⁵ and many others.

Dr. Samuel W. Francis, of Newport, R. I., writes me as follows: "I have brought a single lady, who was suffering from Bright's disease, out of five several convulsions, happening several hours apart, by injecting 10 minims of Magendie's solution of morphia, when her respirations became as low as three a minute; but she came out all right."

Whether the convulsions are due in these cases to uræmia or to reflex nerve troubles, it matters not, for the excreting power of the kidneys is, for the time being at least, markedly diminished or altogether abolished.

Take also, delirium tremens, where after an ex-

¹ Potter, *Practitioner*, vol. 15, p. 142. Roswell Park, *Practitioner*, vol. 15, p. 241.

² T. Clifford Allbutt, *Practitioner*, vol. 3, p. 342.

³ *New York Medical Record*, 1873.

⁴ *Ibid*, 1874.

⁵ *American Journal Medical Sciences*, July, 1874.

haustive study of many cases, Dr. Näcke,¹ of Dresden, found albumniuria in 82 per cent. True, in the majority of the cases this albumniuria passed away with the attack of mania, but during its continuance the excreting power of the kidneys was decidedly interfered with. Yet we find various authors² recommending the use of opium in this affection; some by the mouth, some hypodermically.

Dr. G. Bodington,³ apparently from clinical experience alone, advises in favor of opium and against the use of the "modern salts of the drug, they seeming to be the most dangerous."

When I come to speak of death from the subcutaneous injection of morphine, I shall be able to show several deaths, in this disease, the unusual effect of the morphia being due possibly to the hampered renal excretion.

In favor of the hypothesis that narcotism out of proportion to the dose of morphia, is due to defective renal excretion, stand the investigations of Chauvet.⁴ He has found that the kidneys, when diseased, have lost, to a certain extent, their power to eliminate

¹ *Philadelphia Med. and Surg. Reporter*, Sept. 27, 1879, p. 281.

² "Flint's Theory and Practice of Medicine," N. Y., 1873, p. 785.

³ "Holmes' System of Surgery," Lond., 1860, vol. I, p. 334; vol. 3, pp. 22 and 894. *Med. Times and Gazette*, 1859, p. 310, and many others.

⁴ *British Med. Journal*, June 9, 1861. *Amer. Jour. Med. Sciences*, Jan. 1862, p. 217.

⁵ *Klin. Wochenschrift*, Berlin, 1878.

drugs from the system. He found that in health, from one to two-thirds of the sulphate of quinine taken by the mouth is carried out through the kidneys, while in interstitial nephritis, only from one-tenth to one-fiftieth is thus removed. Two grains of potass. iodid. is, in health, eliminated in three days—in disease, in from five to twelve days; bromide of potassium, in health, by the twentieth day—in disease of the kidneys, not under thirty or thirty-five days; three grammes of sodæ salicylat. in from two to three days, in health—in from five to six days in disease. From these facts, the author considers himself justified in warning against the use of powerful drugs during renal disease, lest they prove fatal.

M. Tardieu¹ is of the opinion that special physiological conditions materially influence the elimination as well as the absorption of poisons in animals, and that variations will of necessity arise from certain individual organic conditions, which are by no means readily appreciated.

Anstie² believes that in dogs most of the morphine is eliminated rapidly by the kidneys; hence the unusually large doses they are able to take without causing any ill effects.

¹ *Annales d'Hygiène Publique*, Oct. 1864 and Jan. 1865.

² "Stimulants and Narcotics," Phila., 1865, p. 200.

To determine this point definitely, the following experiments were made :

1. To a healthy, well-fed dog, weighing fourteen pounds, 1 oz., $1\frac{1}{2}$ grain of the sulphate of morphia was given hypodermically. In thirty-five minutes the dog became comatose. But after some hours fully recovered.

2. The same animal being under the influence of chloroform, the abdomen was opened and both ureters were tied about two inches distant from their vesical insertion. The exposed parts were sponged off carefully and the edges of the wound brought accurately together. As soon as he had recovered fully from the ether, he was given $1\frac{1}{2}$ gr. of the sulphate of morphia subcutaneously. In exactly eighteen minutes after the injection, he became profoundly comatose and died in nine hours and thirty-nine minutes.

3. A black and tan slut, weighing eight pounds, was given 1 gr. of morphia, hypodermically, and soon became comatose. At the end of fifty-five minutes, thirty-five minims of Wyeth's fld. ext. coffee was injected subcutaneously. In ten minutes, thirty minims more; and in thirty minutes, twenty-five minims more. The stupor now began to pass off, and after resting quietly for some hours she fully recovered.

4. The same slut was put under the influence of chloroform several days later, and one kidney was removed, and two drachms tinct. cantharides was thrown into the remaining kidney with a veterinary hypodermic syringe. When recovered from the chloroform, 1 gr. of the sulphate of morphia was given hypodermically, and stupor was manifest in thirty-eight minutes. Fl. ext. of coffee was injected in the same manner and amount, but the dog succumbed rapidly to the morphine.

5. To a rabbit, weighing $3\frac{1}{2}$ lbs., six grains of the sulphate of morphia were given hypodermically. The animal recovered in four and a half hours.

6. The same animal died in three hours after giving the same amount of morphia, both ureters being tied.

Owing to my giving too large doses in several instances the animals died, or it was necessary to give antidotes, and thus rendered the results of experiments for this purpose useless or impossible.

These experiments, though few in number and not as carefully observed as I desired, seem to demonstrate the fact that in dogs and rabbits, at least, interference with the renal function renders doses of morphine fatal, that would otherwise cause only a stupor of some hours duration. These experiments would also tend to show that the beneficial action of coffee

in opium poisoning, in part at least, is due to its diuretic action. This action is now pretty well established.¹

These experiments need confirmation or contradiction at the hands of others.

With these facts before us, I think that we may safely decide that idiosyncrasies with regard to opium, do exist, and are of two kinds—hereditary and acquired. Of the latter I have spoken at some length, not because I have any power to settle the question, but simply to demonstrate the fact that our knowledge upon this point is very slight, and that, at best, we are greatly confused: That deficient or abolished renal function may lead to unusually forcible action of morphine is pretty well settled; that it has been given in disease where such renal conditions are present and without any perceptible evil effect, we also know. The explanation may lie in the fact that the evil effects of the drug that would otherwise be apparent are used up in combating certain symptoms of the general diseased condition, of which the renal trouble is but a part or the cause.

An interesting case bearing upon this question is reported to me by Prof. Wm. T. Lusk, of this city. It is that of a lady suffering with chronic parenchymatous nephritis. When first seen by Dr. Lusk and

¹ Prof. Gubler, *Le Progrès Médical*, June 15, 1879.

others she was supposed to be at the point of death. In using morphia hypodermically to relieve the pain of an attendant neuralgia, she contracted the morphia habit, and to the surprise of all lived for seven years. This is certainly a remarkable case.

That doses of this drug large enough to produce alarming narcotism and possibly death, in a healthy person, are entirely robbed of their narcotic effect when given to persons suffering intense pain, is well known. The same also of other drugs. To this, however, there are some exceptions, of which I shall speak more fully very soon.

Interesting observations on the different action of morphia, subcutaneously used, on the respiration in health and disease, have been made by M. Latil,¹ who has kindly written me, calling attention to articles by Renault,² Huchard,² Lévy,² Martin³ and Vibert.⁴ We also have the observations of Mitchell, Keene and Morehouse,⁵ Da Costa,⁶ Bartholow,⁷ and many others.

¹ "Des Injections Hypodermiques de Morphine dans les Dyspnées," *La France Médicale*, No. 11, 1879.

² *L'Union Médicale*, 1874.

³ "Société de Médecine de Paris," 1874.

⁴ *Journal de Thérapeutique*, 1875.

⁵ *Am. Jour. Med. Sciences*, July, 1865.

⁶ Quoted by the above.

⁷ "The Hypodermic Method," &c., p. 46.

CASES OF NARCOTISM.—Anstie¹ says, with reference to the commencing dose: "Three minims (or $\frac{1}{4}$ gr.) is an unsafe dose to commence with; dangerous and even fatal results have been known to follow its use. It should not be given till smaller doses have been tried."

Prof. H. C. Wood, of Philadelphia, in answer to my questions, kindly writes: "I saw once nearly fatal results from $\frac{1}{6}$ th of a grain. Respirations fell as low as two a minute. Six or eight hours' work was necessitated to save the patient." The same case is mentioned in his elaborate work on *Materia Medica*.²

Dr. William H. Ensign, of New York City (214 West 22d street), spoke to me of the case of a young lady whom he saw some years ago in consultation with Dr. Daniel Wisall (U. S. A.) in Washington, D. C. She was deeply narcotised by a hypodermic injection of $\frac{1}{6}$ th gr. of the sulphate of morphia, and some hours hard work with battery, artificial respiration and flagellation, and the administration of coffee and belladonna were necessary before she was out of danger. I wrote Dr. Wisall some time since for full particulars as to temperament, idiosyncrasy, disease, &c., but, as yet, have received no reply.

¹ *Practitioner*, July, 1868, p. 38.

² "Materia Medica and Therapeutics," Phila., 1879, p. 218.

Dr. Chas. T. Jewett, of this city, was called upon for assistance some years ago, in a case of narcotism following the subcutaneous use of the $\frac{1}{6}$ th of a grain of morphia, followed in an hour by $\frac{1}{6}$ th gr. more. The injections were given to relieve convulsions (presumably hysterical) in a young lady aged about 25. Artificial respiration, electricity and the hypodermic use of atropia were necessary before she fully recovered. She was of a decidedly nervous temperament. At the time of maximum narcotism the pupils were contracted to the size of pin's points and the respirations were as low as four per minute.

Dr. Temuljee Bhicajee Nariman, of Bombay, in answer to my fifth question, writes: "No deaths, but I have seen $\frac{1}{6}$ th of a grain of morphia injected hypodermically producing all the symptoms of opium poisoning. It was a case of renal colic in a Parsee lady, where, for the relief of pain, morphia was injected by her family doctor in my presence. The same day the doctor went out to some distant town, leaving the case in my hands. I told the relations not to disturb her for three or four hours. When that time was over, she could not be roused, and I was sent for, and with the greatest difficulty she was saved. She was perfectly unconscious; pupils were contracted to a pin-hole, and there was complete suppression of urine. There was no albu-

men in her urine either before or after the accident."

This is one of those cases that show very plainly that intense pain is not always a safe guage to the amount of morphia to be given. A somewhat similar case is related to me by Dr. F. D. Beane, of this city, where the narcotic action of morphia would manifest itself in spite of the most excruciating agony (ovarian neuralgia), the patient nearly dying, twice, from opium poisoning.

Dr. J. C. Adams, of Lake City, Minnesota, writes me the details of the following case: He was called at night to see a lady, aged 58, weighing about 200 pounds, and of the "lympa-choleric temperament." Her five grown children are all of the lymphatic temperament. Her previous illnesses were of the kind commonly known as "bilious." The doctor gave her, subcutaneously, $\frac{1}{3}$ gr. morphiæ sulphat. to relieve a severe pain to the right of the epigastrium, "due, in all probability, to the passage of a gall stone." Relief was obtained within half an hour. Four hours afterward the doctor was sent for, the messenger stating, "that she was very stupid and that her breathing was slow." The doctor ordered strong coffee, etc., and did not see her until the following morning at 8 o'clock, when he learned that she had "slept for short successive periods during the latter half of the night, being waked by nurse whenever the

breathing became oppressive." At the time the doctor saw her (8 A. M.), the pupils were contracted and the breathing abnormally slow. There were no indications of kidney disease in this case. She had a well-marked *arcus senilis* and occasional palpitation of the heart.

Dr. H. M. Smith, of Vincennes, Indiana, answers my fifth question as follows: "No deaths. In one case where the puncture was made in the temporal region for severe neuralgia of the eye and inflammation, the patient became much prostrated and nauseated, and under stimulation did not come out from under influence of drug for six hours. The eyes were entirely relieved by it." Dr. Smith does not say how much morphine was injected, but we may infer that it was less than $\frac{1}{4}$ gr., as in answer to question three he states that he has never exceeded this amount, and to question one, that his usual dose is from $\frac{1}{8}$ to $\frac{1}{10}$ th gr.

A gentleman from the south, whose name I am not at liberty to use, writes of two cases occurring in his practice, as follows: "Case 1. White. Mate of vessel. Wife on board. About 35 years old. Was suffering from the pain following a fall, to relieve which sulphate of morphia in powder, not more and possibly less than $\frac{1}{2}$ gr., (as much as I had frequently used,) was given hypodermically. The soporific

effects were developed slowly, in about 15 or 20 minutes, longer than usual. I then left, but was soon recalled, with the information that the mate was in an alarming condition, which I found verified on inspection. He was unconscious, respiration slow, corners of eyes upturned, with unmistakable symptoms of opium poisoning. He was at once removed from a close cabin to the upper deck where there was a good breeze blowing, cold water dashed repeatedly over body, strong coffee given to drink, flagellation with a flat roller used on legs, and he was walked about. No atropia was given as his wife objected on the ground that it might still further narcotise him. After vomiting, he gradually but slowly recovered. His wife stated that he had been nearly killed once by a dose of laudanum, of which she informed me after his recovery.

“Case 2. Maj.—, white man, about 30 years of age; a young man of intelligence and refinement, but unable to control an inordinate appetite for stimulants. Had had several attacks of “the horrors,” and it was in a threatened attack of one of these, and to avoid it, that his life was endangered by morphia used hypodermically. After the injection of $\frac{1}{2}$ gr., Magendie’s sol., (knowing from experience that large doses by the mouth were required), he went to his bed, and with arms crossed on breast, endeavored

to compose himself to sleep. But finding that he could not, in about half an hour after repeated calls by him for another injection, $\frac{1}{3}$ gr. more of same solution was injected. I soon perceived from his respiration that he was overpowered by the effects of the medicine, and that he was in danger. As he kept bachelor's hall, and there was no one with him, I summoned assistance, one physician and several unprofessional persons, who kindly rendered every assistance. Five drops fl. ex. belladonna was injected into muscles of arm, which quickly produced flushing of face, and which, with use of a rotary magnetic battery, were the principal agents in his recovery, the belladonna probably the more important one. After using them he recovered very soon, (in about two hours from time of the second injection,) his intellect perfectly restored upon his emergence from his dangerous condition. This gentleman not long afterward was found dead in bed one morning; it was supposed from the effects of an overdose of chloral taken over night."

Dr. E. K. Henschel, of New York City, reports the following interesting case, by letter: "Married lady, aged 26, weak, nervous and hysterical, to whom m. iv. (Magendie's solution) were given hypodermically. In three minutes she was fully narcotized; only by great effort could be wakened; even walking,

ice water, *pure* black coffee, etc., all had but slight effect. After $4\frac{1}{2}$ hours she was allowed to sleep one quarter of an hour; after six hours, allowed to sleep undisturbed. The amount given was rather less than four drops." The probability is that, in this case, the morphia entered a vein.

The committee of the Medico-Chirurgical Society reports¹ the case of a woman, aged 70, in whose infra-orbital region $\frac{1}{4}$ gr. of morphia was injected hypodermically with the result of producing narcotism, which was, however, fully recovered from.

Also the case of a woman, aged 45, in whom $\frac{1}{3}$ gr. of morphia in the left temporal region produced the same results.

Dr. Roswell Park, Assistant to Chair of Anatomy, Chicago Med. Coll., writes as follows: "A man of 52 years, who had been a hard drinker and a laborer, came into Mercy Hospital, in 1876, to be operated on for what was supposed by his physician (*sic*), to be cancer of both testicles, but which proved to be double hydrocele. The sacs were tapped and a seton put in each. This was followed by violent reaction, erysipelas, etc. Tr. ferri chlorid. was given in large doses and with benefit, until one afternoon he was seized with the most violent colic I ever saw, the intestines coiling up and relaxing again, so as to pre-

¹ "Medico-Chirurgical Transactions," vol. 50.

sent tumors of considerable size, visible under the abdominal walls. Morph. sulph., $\frac{1}{3}$ gr., was given hypodermically. He soon experienced relief, and not long after fell into a rather alarming condition of typical opium poisoning, from which he was aroused, however, in three or four hours."

"In another case, I produced still more alarming symptoms in a young woman seized with violent and uncontrollable mania. Repeated injections, at intervals of one hour were given. She had had a *total* of $\frac{2}{5}$ gr. of morphia sulph. and 14 grains of chloral hydrat. Three-quarters of an hour after the last injection, I was hurriedly summoned, to find her gasping for breath, face and lips livid, etc. Active treatment saved her, and she finally went to the insane asylum."

In the report¹ of the committee of the Medico-Chirurgical Society on morphia, a case of mania is related in which $\frac{1}{2}$ gr. of morphia hypodermically used, caused narcotism that lasted for four days, the patient finally recovering. Another case of the same disease is reported, where $\frac{1}{2}$ gr. thus given was followed by narcotism, ending in death. A case of mania is reported to me by letter by Robert Park, of Glasgow, Scotland, where he gave, hypodermically, 20 grains of morphia at a single and, I believe, the first

¹ "Medico-Chirurgical Transactions," vol. 50.

dose, without the production of any narcotism whatever. This gentleman is in the habit of giving very large doses, gauging the amount of the drug by the amount of the pain present. Although this practice has, thus far, proved perfectly safe in his hands, I should hardly care to try it.

The use of morphia by the mouth and subcutaneously, in mania, is highly spoken of by many authorities.¹

Dr. Reginald E. Thompson, of London, England,

¹ O. J. B. Wolff, "Archiv für Psychiatric," *Practitioner*, 1877, p. 374.
"Annales de la Société de Médecin de Gand," *Practitioner*, July, 1868, p. 322.

W. C. McIntosh, *Journal of Mental Sciences*, October, 1861.

Boyd, in 19th and 20th Annual Reports of the Somerset Asylum, England.

C. Lockhart Robertson, *Practitioner*, May, 1869.

Maudsley, *Practitioner*, Jan. 1878.

Bartholow, "The Hypodermic Method," *Phila.*, 1879, p. 56, quoting also :

Krafft-Ebing, *Bulletin Général de Thérapeutique*, Jan. 30, 1870, p. 474.

Maudsley, "Reynold's system of Medicine," vol. 2, p. 60.

Reissner, *Bulletin Général de Thérapeutique*, Jan. 30, 1870, p. 89.

Hunter, "On the Speedy Relief of Pain," &c., p. 16.

Lorent, "Die Hypodermatischen Injectionen nach Clinischen Erfahrungen," Leipzig, 1865, p. 16.

Erlenmeyer, "Die Subcutanen Injectionen der Arzneimittel" Neuwied und Leipzig, 1866. Dritte Auflage, p. 28.

Eulenberg, "Die Hypodermatische Injection der Arzneimittel," &c., Berlin, 1867, p. 154.

Thesc, to show the high authority advocating this form of treatment in mental disease, proving possibly that the narcotism was due to idiosyncrasy, hereditary or acquired, and having no direct connection with the disease itself.

who has been identified with this subject for years, having drawn up the report of the Medico-Chirurgical Society's committee on the hypodermic injection of morphine, writes me in answer to my 3d question: "One grain of morphiae acetat. is the largest dose I ever gave (in a case of severe delirium tremens which had resisted previous smaller doses). I don't think I should care to repeat the experiment as the effects were alarming, but the case rapidly recovered after these passed off."

In the report¹ of the committee of the Medico-Chirurgical Society, a case of delirium tremens is narrated where 1 grain of morphia subcutaneously (smaller doses, $\frac{1}{2}$ gr., having failed on the preceding night) produced profound narcotism, the respiration being greatly lowered. At one time death was momentarily expected.

Dr. L. D. Knott, of Bradfordsville, Ky., writes me: "I have had no deaths, but have seen alarming symptoms from it." I have written the doctor for fuller particulars, but have thus far received no reply.

Dr. M. E. Woodling, of North Branch, Minn., writes of two cases. The first was probably one of injection into a vein, and will be given under that heading. The other case is as follows: "A case of acute double pleuro-pneumonitis attended with much

¹ "Medico-Chirurgical Transactions," vol. 50.

pain. I twice attempted to relieve it by the hypodermic injection of $\frac{1}{6}$ gr. morphiae sulphat., but the pulsations and respirations would become feeble and irregular, necessitating its discontinuance before any impression was made on the pain." This case, with the next and some others that I shall give, seem to bear out the statements of Fothergill,¹ that morphia is a dangerous drug to use in cases of embarrassed breathing, due to organic lesion. Against his assertions, however, stand the observation of M. Latil² and others.

Dr. G. H. Lathrop has very kindly furnished me with the full details of the following interesting case: Some three years before the date of writing, he was called to see Mrs. M——, aged 40, of nervous temperament and usually in good general health. Occasionally suffers from neuralgic headache. The doctor found her with acute pleurisy, the pain being very severe. He gave a very small quantity (amount not stated) of morphia hypodermically. Patient complained of being faint and looked very pale. In five minutes she was free from pain and made a rapid recovery. Some two years after, morphia was given by the mouth in large doses, to relieve the pain of

¹ "Antagonism of Therapeutic Agents," Phila. 1878, pp. 55 11.

² "Des Injections Hypodermiques de Morphine dans les Dyspnées," *La France Médicale*, No. 11, 1879.

neuralgic headache, and without any ill effects. In 1878, the same lady had another severe attack of acute pleurisy. As the stomach was very irritable, the doctor again resorted to the use of morphia hypodermically. "Within one minute after injecting the morphia, the patient lost all color in face and lips and was completely prostrated. She was all the time conscious but unable to articulate. Breathing, slow and irregular. No pulse at the wrist for several minutes. Examination of the heart failed to discover the first sound, showing that it was affected in systole. With the appropriate remedies she rallied from this apparently dying condition and made a slow recovery. I am sure that if I had given this lady $\frac{1}{4}$ gr., or even any larger than $\frac{1}{8}$ of a grain, hypodermically, she would have died." The doctor explains the ill effects of the drug on the ground "that the relief from pain was so sudden, with probably an effect so instantaneous on the cardiac nerves proper, would produce the collapse of the patient."

I am inclined to believe that, in the last instance, at least, the injection was made directly into a vein, and that the case belongs more properly under the head of syncope.

It is possible that the symptoms may be explained on the ground that they were due to the operation of inserting the needle, the patient being evidently

very nervous. I give it here, however, to act as a companion to the last case and possibly add weight to the views of Fothergill. Brown-Sequard,¹ quoted by Dr. H. L. Harrington,² relates a case where a patient, who was to be bled, fainted at the first prick of the lancet. "The heart ceased to beat and the limbs seemed to be dead. The patient was called to life with the greatest difficulty. Death would have occurred if the most energetic means had not been employed immediately." Brown-Sequard's paper in the *Archives de Physiologie*³ will also repay careful study in this connection. The experience of most of my correspondents is in direct opposition to such views, as also are the observations of Dr. Edward Smith⁴ and others, already quoted.

J. C. Murphy, L. R. C. P. & S., E., &c., of Dublin, writes me: "I have found $\frac{1}{4}$ gr. the average dose. Some were very tolerant of the drug while others showed great susceptibility to its action. Two examples of the latter: Case 1.—An old lady who was suffering from acute (rheumatic) pain at insertion of the deltoid, I administered $\frac{1}{6}$ gr. *without atropine*. It was followed by headache, furred tongue, thirst and partial stupor. Case 2.—To re-

¹ *Chicago Med. Journal and Examiner*, May, 1878, p. 452.

² *Ibid*, July, 1878.

³ *Boston Med. and Surg. Journal*, Dec 30, 1869

⁴ *London Lancet*, Jan. 26, 1856.

lieve the pain of pleuritis. It was administered to keep the patient in hand, the agony being very great. I gave $\frac{1}{2}$ gr. on this occasion. It acted as an overdose and I had difficulty in arousing the patient. She subsequently died of double pleuro-pneumonia."

Dr. Murphy is of the opinion that atropine in small doses, with the morphine, modifies the more unpleasant effects of the latter, and lessens the danger of stupor. This is quite in accord with the conclusions of Bartholow¹ and of Mitchell, Keene, and Morehouse² so far, at least, as stupor is concerned. "Mèdical Student"³ in his strictures on a case of opium poisoning seems to misunderstand Dr. Bartholow in this connection.

Dr. Saml. W. Francis, knows of two cases of deep narcotism from the use of morphia hypodermically, but can give me no details, as the cases occurred in the practice of others.

Dr. B. H. Detwiler writes me: "No deaths. On one occasion I repeated the injection and came near narcotising the patient. Used aromatic spirits of ammonia hypodermically in half drachm doses with signal benefit." Dr. Detwiler does not say how much morphia was given at each injection, but states

¹ "Hypodermic Method," Phila., 1879, pp. 44, 129, 139, and 135.

² *American Journal Med. Sciences*, July, 1865.

³ *North Carolina Med. Journal*, Sept., 1879, p. 170.

in reply to my first question that his usual dose is from $\frac{1}{4}$ to $\frac{1}{2}$ gr. I have written to the doctor asking full particulars, but have, as yet, received no reply.

Dr. Geo. A. Foote, of Warrenton, N. C., late President of the Medical Society of that State, and who has an able and interesting article on the subject of hypodermic medication in the Society's Transactions for 1877, writes me in reply to question 5: "Never had any deaths or accidents. In one case I reduced the respirations to 4 per minute. The patient rallied kindly under the hypodermic use of whiskey and strong coffee."

Dr. Robert McNutt, of Rocheport, Mo., writes me: "I gave at one time a grain of the acetate in a case of intractable gastralgia from the long and excessive use of tobacco, and had some alarming symptoms which by the use of strong coffee passed off in eight hours."

Dr. C. S. Pixley, of Elkhart, Indiana, reports to me a case of intense narcotism in a robust farmer, aged 55, who was suffering excruciating pain due to the passing of a gall stone. The doctor gave $\frac{1}{2}$ gr. subcutaneously, followed in half an hour by the same amount. The patient was eased and had no unpleasant symptoms. This was in October. The following June, the patient had another attack, and Dr.

Pixley, knowing the amount the man had taken before, gave him 1 grain hypodermically. Very deep narcotism soon followed. Artificial respiration was kept up steadily from 1 A. M. to 7 A. M., other means being used also, and the patient was at last pronounced out of danger, he remaining unconscious for 24 hours. The doctor explains the narcotism here shown, in this way: "The reason of this conduct was, that during the past 10 months patient had had no attacks, (passage of gall stones) and consequently had no treatment and the tolerance of the drug, established when I last saw him, was gone." The patient had in former attacks been in the hands of an old physician, who had procured relief of pain only by giving very large doses of morphine, chloral, etc., by the mouth. The patient was permanently cured by the last injection; at least he has had no attacks since."

This case and that by Dr. McNutt illustrates forcibly the danger of using large doses. One grain, thus given, is a dangerous dose even when there is no idiosyncrasy.

At a meeting of the Suffolk District Med. Society of Boston,¹ Dr. Fifield said "that he had seen very nearly fatal results from $\frac{1}{8}$ gr. to $\frac{1}{4}$ gr. (of morphia used hypodermically), notably in one case at the City

¹ *Boston Med. and Surg. Journal*, Nov., 1876.

Hospital, where the battery had to be applied all night to keep the patient alive."

Dr. E. Fletcher Ingals, to whom belongs the credit of first making an effort to collect facts upon this subject and get at the truth in the matter, writes in the *Chicago Medical Journal and Examiner*,¹ giving the results of fifty-five replies to circulars containing questions as to death, syncope, usual dose, etc. That part of his article relating to death will be fully noticed hereafter. With reference to narcotism, one of his correspondents writes: "I am chary of the use of the syringe; using it when demanded—dose, $\frac{1}{8}$ gr. Largest dose ever ventured on was $\frac{1}{3}$ gr., in violent colic. The patient was asleep in one minute and did not awake for 16 hours. No bad results."

It would be interesting to learn whether this sudden effect was not due to the entrance of the drug directly into a vein.

Another writes him: "I have seen unexpectedly severe effects on several occasions. I do not give morphia in that way when I can give it by the stomach. The cases that I speak of were simply severe ordinary effects of the medicine."

And another: "In one case the patient slept 24 hours. The dose was only $\frac{1}{12}$ th of a grain."

Dr. Richard McSherry, Prof. Theory and Practice

¹ May, 1878.

of Med. in the University of Maryland, Baltimore, writes me: "Have seen narcotism, somewhat alarming, upon repetition of full doses ($\text{gr.}\frac{1}{3}$ — $\text{gr.}\frac{1}{2}$), but never a fatal result."

And again: "I send answers above to your questions, which are upon a matter of great importance. I certainly meet with subjects from time to time who bear opium very ill, or not at all. In some instances there is no means of knowing their susceptibilities before the *experimentum crucis*. Some subjects bear it very badly in some conditions, or at certain times; and the same people bear it well enough when changes occur with the progress of years, or under some altered conditions sometimes appreciable, at other times inappreciable."

Dr. E. Wenger,¹ of Gilman, Ill., vouches for the following case: "An old gentleman was suffering with rheumatism; he was attended by a promising young physician who had gained some notoriety by the use of the hypodermic syringe. He injected morphine on this occasion, and in a few minutes became alarmed at the condition of his patient. He at once sent for another physician, who, on his arrival, learned the conditions of things. Noble-hearted man that he was, to save the young man's reputation, he pronounced it a case of apoplexy. By prompt and

¹ *Chicago Medical Journal and Examiner*, Aug. 1877.

persevering treatment, he succeeded in saving the old man's life. He then advised the young man in a friendly way, to be a little cautious how he used the squirt in the future."

These cases of narcotism from doses of morphia that are not considered at all large by many of my correspondents and various writers upon this subject, are not all that are recorded, and certainly not all that have occurred. Their number is sufficient, however, to bear out the truth of the statement made in the early part of this chapter, that the commencing dose of this drug should be a very small one, thus testing the idiosyncrasy of the patient, and that the amount should be very gradually increased, if an increase is necessary. This caution has been urged by many authors, notably Anstie, Harley, Maudsley and Bartholow, and has been systematically disregarded by the bulk of the profession, to the end of throwing discredit upon, and creating distrust of a method, that in proper cases and properly used, has proved itself of the utmost value.

It is worthy of note that in these cases the morphia was used alone, in spite of the fact that atropia in small doses is thought by many authors to permit of larger doses of morphia being used with safety. (See chapter on Atropia and Morphia).

I consider it highly probable, furthermore, that the use of morphia, even in moderate doses, in certain diseases, to be spoken of more fully in the chapter on death, is extremely hazardous. These are delirium tremens, acute mania, that class of acute pulmonary affections where the tendency is to death by the lungs, and in some forms of acute and chronic nephritis.

CHAPTER IV.

INJECTION INTO A VEIN—ALARMING SYNCOPE— DEATH—RAPID ABSORPTION—TOURNIQUET.

ARTICLES have from time to time appeared in various medical journals, at home and abroad, detailing certain alarming symptoms following immediately upon the injection, subcutaneously, of moderate doses of morphia. Such accidents have been ascribed by most authors to the entrance of the needle into a vein, with the consequent sudden passage of the drug into the circulation; by some to the injection of a bubble of air into a vein; by others to fright attendant upon the dread of the operation and the prick of the needle; and by still others to the rapid absorption of the remedy when a vein is not punctured. Which of these hypotheses is the correct one it is at present difficult to decide; perhaps each may have proved a factor at certain times or in certain cases. The weight of opinion would seem to favor the idea of sudden entrance of the drug into the circulation by puncture of a vein. By a careful study of some of these cases we may be able to come to a definite conclusion.

Dr. M. E. Woodling, of North Branch, Minn., writes, in answer to my fifth query: "No deaths. My first case in which the hypodermic injection of morphia was tried resulted as follows: Patient large, strong and robust-looking man. Complained of pain in the course of the sciatic nerve, and of lumbago. Injection given back of the trochanter major, patient sitting; given slowly. I turned to lay the syringe on the table, when the patient appeared unsteady, straightened rather rapidly and persistently, and slipped from the chair, falling full length, supine, upon the floor, pale and with absent respiration. He was now perfectly limp. No response to shaking or questions. Spoke the word 'breathe' loudly in his ear. This he obeyed. Repeated this for about a minute, and in another he was able to sit up, but was very sleepy and unsteady, requiring assistance. In about five minutes he was able to stand, and I took him out on the street and walked around with him for an hour. I then took him home, still sleepy, but improving. The next morning he was all right, but the pain was only partially relieved. Other injections were given with no bad consequences."

Dr. A. Atkinson, Prof. Materia Medica, Coll. Physicians and Surgeons, Baltimore, in reply to my fifth query, writes: "Never had death to result, and but

one accident, and that was apparent suspension of animation for about fifteen minutes in a young lady, very anæmic, in whose case I injected $\frac{1}{8}$ th gr. of the sulphate of morphia (the regular Magendie's solution) into the rectus muscle of the abdomen, at the repeated and urgent entreaties of the patient, to relieve an obstinate uterine neuralgia. She recovered from the neuralgia and from the effects of the morphia in three-quarters of an hour. I had, a year before, injected $\frac{1}{4}$ gr. into the arm of this same patient for cardiac neuralgia, with complete relief of the pain in one hour, and with no bad effects."

Dr. Geo. E. Jones, of Cincinnati, has kindly written me and inclosed an article¹ of his, bearing directly upon this subject. In it he says: "Did the needle enter an abdominal vein? Several times. The first time I became somewhat alarmed; the patient at once threw up her arms, complained of suffocation, giddiness, excessive fatigue, a severe tingling sensation following the course of the circulation. The countenance was at first livid, then flushed; the eyes became unusually brilliant; slight muscular twitchings, profuse sweating, with cold extremities, and in a few moments complete relaxation was followed by

¹ "Some Observations on the Deep Injection of Morphia," *Cincinnati Lancet and Clinic*, Aug. 10, 1878.

deep sleep, which lasted only four hours, when she awakened, feeling, as she expressed it, 'ever so much better.' "

"The same accident occurred three times, the symptoms much milder, with the exception of a burning sensation of both eyelids of either eye and both lips, which at one time became painfully intense. The above symptoms were produced by an injection of five grains of sulphate of morphia into an abdominal vein.

"Being unable to see her for a day or two, I requested my friend, Dr. Geo. E. Walton, who had watched the case with a good deal of interest, to call and give her an injection of two grains, when she put both hands to her head and gave a cry of excruciating agony. A sharp pain darted through her head, which lasted ten or fifteen minutes; also complained of an intense itching of nose and lips, finally passing off, leaving no deleterious effects. The same accident occurred to myself, only in a less degree. These injections were also made in the abdomen."

The patient was a German woman, aged 37, and weighing about 135 lbs. The case was presumably one of fæcal accumulation in the colon, with severe abdominal pains.

Dr. W. A. Neal, of Dayton, Michigan, writes in this connection, as follows: "No deaths; the only

accidents were where a vein was punctured. This produced dyspnœa, great distress, and was usually followed by a chill and the reaction by fever; but in every instance there has been but one chill, and fever once lasting three or four hours."

Edward T. Wilson, M. B. Oxon, F. R. C. P., Lond., who has a valuable and interesting article on the subcutaneous injection of morphine in the St. George's Hospital Reports for 1869, writes me as follows: "Never either death or accident. Nothing beyond a temporary feeling of faintness, and on two occasions a temporary outburst of urticaria, which soon passed away." I hardly think these phenomena were due to injection into a vein, the writer not endeavoring to account for them on this ground. They partake more of the nature of rapid absorption with some idiosyncrasy. Dr. E. C. Seguin makes mention in the *New York Medical Record* of a lady thus affected (urticaria) by any preparation of opium taken by the mouth.

Arthur R. Graham, M. D., etc., of Weybridge, England, sends me the following interesting and conclusive case: "No deaths, but one alarming accident worth recording—I had injected a large dose (probably $\frac{3}{4}$ gr.) into the *right* forearm of a woman whom I was in the habit of injecting daily. Almost

immediately she started up, and holding up her *left* hand and looking at it, exclaimed 'Oh! how funny my fingers feel!' and fell back in a dead faint, with blanched lips. I immediately bound a tape tightly around the arm, above the puncture, and then gave brandy and asafoetida injections, but she remained unconscious, I think, for more than half an hour. After she was sufficiently recovered to talk rationally I loosened the tape, when she immediately fainted again. Of course I at once tightened the ligature and kept it so for some hours. The second swoon was less alarming than the first. In the first, no pulse could be felt, nor could the heart sounds be heard excepting with great difficulty. My impression at the time was that, had I not applied the ligature at once, I should have had a fatal result to chronicle. It was the impulse of the moment to tie on the tape, and had I had time to reason I should have rejected the idea as an entirely useless one; but in any similar emergency I should now recommend any one to try it."

Dr. E. Fletcher Ingals,¹ who has devoted much attention to the hypodermic injection of morphia, reports the following case: "I have often used hy-

¹ *Chicago Med. Journal and Examiner*, Aug., 1877.

podermic injections of morphia, and always with good results, until a few weeks since, when I obtained alarming results from the administration by this method of one-fourth of a grain of morphia.

“The patient, in consequence of continuous watching with sick children, had become debilitated, and, as a result, suffered at times from severe pains of a neuralgic character. I was called in the night to see her in one of these attacks. The pain had commenced about twelve hours previously, and with frequent exacerbations, had steadily increased in severity until it had become unbearable.

“I dissolved one-fourth of a grain of morphia in pure water, and administered it under the integuments on the outer side of the arm. Within a few seconds the breathing become stertorous, the pulse failed, the lips and countenance became livid, and the eyes were set; respiration ceased, the radial and cardiac pulsations were lost, and the heart sounds could not be distinguished. The woman was to all appearances dead. How long this condition continued I cannot tell; it seemed an age, but was probably only ten or fifteen seconds, for by prompt means I succeeded in resuscitating my patient.

“After a few minutes she expressed herself as much relieved. I remained with her some time, and then

left careful directions with the husband in case any other unfavorable symptoms should occur. During the next few hours the patient fainted twice, but she was restored by dashes of cold water in the face."

Dr. H. L. Harrington, of Little York, Ill., refers me to the report of a case¹ of his, which reads as follows: "Was called a short time since to treat W. S——, male, aged 62, for acute dyspepsia (bilious attack) accompanied by very severe pain. Administered hypodermically, in the hypogastric region, morphinæ sulph. .0.02 gram. Before the syringe was emptied alarming syncope supervened, and occurred twice, at intervals of ten or fifteen minutes. Stimulants administered freely, artificial respiration and the use of electricity were successful in reviving the patient. Neither narcotism nor coma were in any degree present. Is it possible to attribute the syncope to the effects of the drug? Not over fifteen seconds were occupied in the operation." I think this an excellent example of the puncture of a vein with entrance of the drug directly into the circulation.

Dr. Aug. M. Tupper, of Rockport, Mass., publishes the following interesting case:²

"On the morning of the 22d ult. I was called to

¹ *Chicago Med. Journal and Examiner*, April, 1879.

² *Boston Medical and Surgical Journal*, Oct. 30, 1879.

see Mr. G., who was stopping at one of our hotels. I found a healthy-looking young man, about thirty years old, suffering from lumbago, confined to his bed, and in considerable pain, aggravated very much by movement. Applications of mustard and an anodyne liniment were prescribed. In the evening I called again, and as the relief was slight, decided to inject some morphia directly over the seat of pain, a method I have found very efficacious in similar cases. Accordingly, I injected nine drops of a solution of sulphate of morphia, one grain to a drachm of water, into a spot midway between the spine and crest of the ilium. As is my custom, the solution contained one drop of carbolic acid, which I added in order to keep it. In five minutes he expressed himself as feeling relieved, and sat up in bed to show us the improvement. I told him to lie down and keep still awhile, and he did so. We chatted pleasantly for perhaps five minutes longer, when, turning towards his wife, he said, 'I think I am going to vomit,' and turned to the side of the bed. I noticed that he looked a little pale, and before Mrs. G. could get the basin he grew deadly pale, his eyes rolled up in his head so that only the whites were visible, the jaws were clenched, the head was drawn back, and the whole body stiffened, respiration ceasing also. I immediately went to him, dashed cold water in his face,

and took the wrist to feel his pulse, which, to my horror, was not to be felt. He was in this state for perhaps a minute. I then raised him up, and looking into his eyes, which were staring wide open, saw that the pupils were widely dilated. Very soon the color began to return to his face, he was drenched with perspiration, and recovered consciousness. I laid him back on the bed, and he looked up, smiled, and said, 'I'm all right now.' The pulse was quite full at sixty, but inclined to be irregular. I gave him brandy freely, and he had no further trouble, but the pulse remained at sixty for the next twenty-four hours; he said it was usually about eighty. I cannot verify that, for he left town the following day.

"That was certainly a very unusual effect from such a dose, a little over one-eighth of a grain. The question arose in my mind whether the acid could have had anything to do with it; but I have given the same mixture a great many times without the slightest trouble. I may add that the solution was prepared that morning, and I injected the same dose into the same part of the body, for neuralgia, in a female patient that very same day, previous to using it on this patient. I should not care to repeat this operation on Mr. G., and advised him never to have it done again. I would also state that it relieved his

lumbago, for the next afternoon he was dressed and down at his meals."

After seeing the report of this case I wrote Dr. Tupper, who has courteously furnished me with the following additional facts: "My patient, I should say, was of a phlegmatic temperament. He had taken no medicines by the mouth before I saw him, nor while under my care. He had never taken any narcotic in his life, he says. The pupils were natural very soon after the effects of the dose ceased. He writes me that his pulse remained at sixty for a week, but that he felt first rate. Pulse rate since then has been seventy-six. It seems to me that it must have been a peculiar susceptibility to the drug in his case, else it would not have had such a lasting effect upon the pulse. 'I do not think it was due to the mode of administration. He related to me afterwards that a cousin (I think that was the relation) had very peculiar and even dangerous symptoms from a dose of Dover's powder, some time ago, and that the physician in attendance was detained all night in consequence. This would go to show an idiosyncrasy in the family.'"

I think that the doctor is right with reference to idiosyncrasy, but I think, also, that the method of administering the drug had much to do with it. As I have said before, where an idiosyncrasy, be it to

narcotism or any other peculiar manifestation, exists, the sudden entrance of the drug into the system is certain to aggravate those symptoms; may, indeed, call forth an idiosyncrasy that the drug given by the stomach would, possibly, never have revealed. The fact that some ten minutes elapsed between the time of the injection and the first appearance of the alarming symptoms seems to preclude the idea of the needle having entered a vein. The symptoms are, however, exactly those that are seen when a vein is punctured. As will be seen from the results of experiments soon to be recorded, and from the conclusions arrived at by the Committee of the Medico-Chirurgical Society¹ of England, five minutes is abundant time for enough of the drug to be absorbed to produce its characteristic, and, therefore, its unusual effects, where idiosyncrasy exists.

Prof. H. C. Wood² states that he has seen deep coma produced in three minutes by a hypodermic injection of morphia. This may have been due to unusual rapidity of absorption from the cellular tissue, or to direct injection into a vein.

Here is a somewhat similar case:³ A lady, aged 24, who had been a sufferer from neuralgia every day for months, was given a hypodermic injection of $\frac{1}{4}$

¹ "Medico-Chirurg. Society Trans.," vol. L.

² "Materia Medica and Therapeutics," Phila., 1877, p. 205.

³ "Medico-Chirurgical Transactions," vol. 50.

gr. of the hydrochlorate of morphia in the subcutaneous tissue of the leg. Alarming syncope and extreme prostration came on within five minutes after the injection was made. The patient was not out of danger for four hours after, and was too ill to leave her bed for two weeks. The neuralgia did not return for some months."

Dr. Francis H. Miller, of East New York, formerly House Surgeon of St. Peter's Hospital, Brooklyn, writes me: "Several times, when, I suppose, my fluid entered some small vein, the patients complained of sudden weakness, faintness and dizziness, and almost syncope."

Dr. Samuel W. Francis, of Newport, 'R. I., writes me: "I have heard of two or three cases where extreme syncope set in, the patients being restored only with great difficulty."

Dr. J. S. Jewell, Professor of Nervous and Mental Diseases, Chicago Medical College, writes me: "I have never had any serious consequences follow morphia injection, but have seen temporary unpleasant symptoms (vaso-motor disturbances), vertigo, mental confusion, &c., a few times."

Dr. Geo. R. Fowler,¹ of Brooklyn, states that he has twice had alarming symptoms from puncturing a vein. He believes that this may be avoided by

¹ *N. Y. Medical Record*, Aug. 15th, 1874.

making the skin of the part to be punctured, tense, and introducing the needle at a right angle with the axis of the limb.

Prof. Nussbaum,¹ of Munich, has published an interesting account of an accident that happened to himself. He had made use of the hypodermic method of giving morphine to himself, as often as 2,000 times; using sometimes as much as 5 grains of morphia at an injection. One day he accidentally injected 2 gr. of the acetate of morphia into a vein and did not recover from the dangerous effects for two hours. He has seen the same symptoms, in a less degree, in two of his patients. He advises *slow* injecting, and withdrawal of the piston if a vein is punctured.

The following interesting remarks are clipped from an English journal² and bear directly on the question in hand :

“ ‘Observer’ remarks that ‘Spectator,’ in the *Journal* of April 12th, very accurately described what always happens when a vein has been pierced and morphia injected into it, although he might have added (as no doubt it occurred) that the person injected also experienced a strong taste of morphia; and probably, also, an unusually large quantity of

¹ *Med. Times and Gazette*, Sept. 23, 1865.

² *British Medical Journal*, May, 1879.

blood flowed from the puncture. It is a very serious accident to inject morphia into a vein, but it need never happen, if the operator, thrusting the instrument under the skin, will draw up the piston, when, if the point be in a vein, blood will be drawn into the syringe. 'Observer' knows a gentleman who for years has been in the habit of injecting himself with morphia three and four times a day, to whom the accident has frequently occurred, accompanied by the symptoms described by 'Spectator.' He is very alarmed at the time, and is afterwards careful to draw up his piston, but in three or four months he begins to be less cautious, until he gets another reminder. As to the necessity of drawing up the piston, there cannot be two opinions; for besides the symptoms certain to follow the introduction of morphia directly into a vein, there is the danger of air entering as well, should care not be taken to prevent it. 'Observer' has known an habitual morphia-taker by injection to contract albuminaria. The albumen would greatly diminish on the daily quantity of the injection being lessened, and entirely disappear in forty-eight hours when the morphia was wholly discontinued.

"'Injector' was, until very lately, for nearly two years, one of the victims of morphia, and during that time he five times thoroughly, and twice par-

tially, experienced more or less of the horrible symptoms sketched by 'Spectator' in the *Journal* of April 12th. The sensations were as follows: 1. A dull gnawing pain in some decayed teeth, accompanied by a metallic taste in the mouth; 2. A prickling and tingling of the forehead and cheeks, somewhat like prickly-heat; but this soon increased, spreading to the ears, neck, arms, and chest (but not below the waist, although the morphia was injected into the calf of the leg). This pain soon became almost unbearable, but it was entirely eclipsed by what 'Spectator' calls 'throbbing,' but which 'Injector' says would be better represented by imagining twenty blacksmiths confined in his head, with each an India-rubber-headed sledge-hammer, and each trying to make the best of his way out. Imagine, at the same time, that you are suffering from the first-mentioned broiled feeling; that your skin feels as if about to burst; your eyes as if already started from their sockets; your lips as if they did not belong to you—then you may have a faint idea of what 'Spectator' wishes to describe, and what I, who have five times felt it, yet feel powerless to lay before you as I ought." He had always thought that this condition was caused by, 1. Too rapid injection; 2. Too much at once; 3. The solution being too strong; and, 4. By its being in-

jected directly into a tolerably large vein. When the symptoms have occurred, he has always noticed that injection has taken place at one of two spots—probably into the same vein each time in each leg—one on each leg. Again, it only occurred when he had to inject a large quantity in a short time; and he always used a very strong solution of acetate of morphia (forty grains to the half-ounce of water). He advises that, when one feels any of the symptoms coming, he should walk about as rapidly as he can. He has relieved his worst attacks in this way, and has warded off others by violent exercise in his room as soon as he felt the pain in his teeth, or the metallic taste of the “prickly-heat.” He thinks that corroboration of his belief as to the cause of the symptoms is afforded by Dr. Pepper’s description of the results of injecting milk into the veins of anæmic patients.

The case referred to by “Observer” reads as follows:¹ “Scarcely has the fluid left the syringe when the most intense feeling of irritation and prickling is felt in the skin, spreading from the puncture rapidly all over the body. At the same time the skin becomes suffused with a bright blush. The heart’s action then becomes greatly quickened, and there is a throbbing, rushing feeling through the head. The

¹ *British Medical Journal*, April 12, 1879.

hands are somewhat swollen and the lips get a glazed appearance. In one case that I had, the patient became suddenly unconscious, as if knocked down by the sudden shock; and in all the cases where these symptoms have appeared the general disturbance has been very great and the attack of a severe character. The symptoms generally subside gradually, leaving behind great pain in the head."

This gentleman gives these as the main symptoms of several such accidents that have occurred in his practice, and characterizes their occurrence as something novel and important.

Dr. J. A. Houtz,¹ of Logansville, Penn., who is a staunch advocate of the hypodermic method, says: "The greatest danger is in injecting into a vein sufficiently large to carry the whole dose at once into the circulation. That can be avoided by selecting a place where the large veins are least numerous, and by injecting, say a third of a dose and then waiting eight or ten seconds, when, if in a vein, the symptoms will show themselves. The first symptoms are a feeling of great fullness of the head and intense flushing of the face, coming on within a few seconds after the operation. Such, at least, was the case in a patient of mine."

A case of syncope and prostration is reported by

¹ *Philadelphia Med. and Surg. Reporter*, Oct. 18, 1879.

Dr. E. Wenger, of Gilman, Ill. The amount of morphia used is not stated.

F. Woodhouse Braine, F. R. C. S., &c., publishes *the following case:¹ “Mrs. H. C., aged thirty-five, in good health otherwise, had been kept awake seventy-two hours by intense neuralgic pain on left side of head, face and neck, arising from a carious molar tooth on left side of lower jaw. She was injected with morph. acetat. $\frac{1}{3}$ gr. At 1 A. M. on June 28 last, the morphia, dissolved in about four drops of water, was introduced under the skin of the left arm, just over the insertion of the deltoid. No blood appeared at the puncture. In about fifteen seconds, tightness of the chest and difficulty in breathing was complained of, and the patient asked to be raised, saying she felt as if she was dying. Her face and lips now became pale; speech became indistinct (not inaudible); pulse irregular; some spasm of the facial muscles took place, and she fell, to all appearance, dead. Cold water was freely dashed over her face and chest, and as she was unable to swallow, her tongue was rubbed over with sal volatile, and ammonia applied to her nose, artificial respiration being kept up at the same time. During this time her face was blanched, pulse not to be felt, and respiration not to be perceived. Insensibility continued.

¹ *Med. Times and Gazette*, Jan. 4, 1868, p. 8.

for about three minutes; then, happily, one or two feeble beats of the pulse, and a shallow inspiration or two, showed returning animation. She then became conscious; pulse feeble but regular; respiration slow; fingers remained numbed, and both thumbs were firmly drawn into the palms of the hands. This passed off in about six minutes, leaving her feeling very ill, but free from the neuralgic pain, which did not return. There was no feeling of nausea, and no attempt at vomiting during any part of the time."

Mr. Arthur Roberts¹ publishes the following cases: "Sir:—The case described by Mr. Braine, in your last week's journal, of an unusual effect of subcutaneous injection is what I have seen in two instances, but nothing like to such an alarming extent. One was in a gentleman whom I had injected several times previously, the other in a lady. I have also partly noticed it when I have injected myself. In the first case, a few minutes after the operation, the face became intensely flushed; this was followed by vomiting, and then a dead faint and struggling for breath, the pulse scarcely perceptible. These cases, and the effect on myself, taught me, when injecting a patient for the first time, never to give more than the sixth of a grain—wait a quarter of an hour longer,

¹ *Medical Times and Gazette*, Jan. 11, 1868, p. 53.

and then give the remainder of the dose, after ascertaining how the first injection was taking effect. Women, I have found, are generally bad subjects for subcutaneous treatment; for they get frightened and nervous—in fact, one woman told me that though the morphia taken by the skin did her more good than by the mouth, yet she preferred the latter, for the instrument frightened her. I have used my needle over 300 times, and I have always noticed one fact—that if the wound bleeds after the operation the morphine enters the system much more powerfully and rapidly; and I always know when it is going to bleed, by the operation giving a good deal of pain. When this is the case I withdraw the instrument, to see if the puncture bleeds; if it does, I try a fresh place.”

Bartholow,¹ in his useful and able little work, calls attention to this danger in these words: “In practising the hypodermic injection it is important to avoid puncturing a vein. Serious depression of the powers of life, fainting and sudden and profound narcotism have been produced by injecting a solution of morphia directly into a vein. Fatal collapse might be induced by injecting air into a large vein, along with the solution.”

Syncope, &c., as we have seen, from this cause, is

¹ “The Hypodermic Method,” Phila., 1879, p. 32.

common; narcotism rare, the drug seeming to exhaust itself in its initial action, or to produce a condition of the system in which narcotism is wholly or partially impossible.

Dr. Corona¹ (*Giornale di Medicina Militaire*), summing up the results of his experiments on animals, says: "The injection of the two poisons (morphia and atropia) into the veins showed that a much smaller dose was sufficient to produce rapid and grave poisoning, but, even then, the morphia produced its action instantaneously, and its action always superseded that of atropia."

J. Pennock Sleightholme,² L. R. C. P., Lond., reports the following case: "A young man of sound constitution and good health, who had never before taken morphia hypodermically, partly as an experiment and partly with the hope of relieving some slight restlessness, injected himself at about 3 A. M. with $\frac{1}{6}$ gr. of morphia. Immediately after the injection he fell down on the floor in a state of syncope, and had slight convulsive movements on one side of the body; consciousness did not entirely leave him, and after lying still for about ten minutes he was sufficiently recovered to be able to go to the next room and help himself to a couple of glasses of

¹ (*Edin. Med. Journal*, Dec., 1876.) *Practitioner*, 1877, p. 132.

² *Practitioner*, July, 1871, p. 25.

sherry. After this the feeling of faintness gradually passed off, and he slept for about two hours, but on rising at eight o'clock in the morning the same feeling of faintness returned, accompanied with great pallor. These symptoms were relieved by a dose of brandy, but did not entirely cease until noon the same day."

A physician in the South, who is a slave to this habit, writes me: "Several times I have been unfortunate enough to puncture a vein, and to introduce some of the solution directly into it. Immediately I feel a peculiar tingling all over me from the tips of my fingers to the ends of my toes. The skin of my head feels as if a myriad of pins were penetrating it. This feeling passes off in from 3 to 5 seconds. Sometimes it has been followed by a turgescence of the vessels of the brain, causing a great fullness and throbbing, with slight headache following."

In a most interesting and instructive letter from Dr. Wm. W. Cable, of Pittsburgh, Pa., I find the following: "I have spoken of minor accidents which sometimes occurred. In all that I have seen they were caused by the injection of the morphia directly into a vein. A series of phenomena instantly take place. The patient describes the first sensations as the stinging of bees all over the body, with difficulty of respiration, and intense congestion and swelling of

the face and body. In one case that I saw the face was so swollen that in five minutes all traces of the natural features were lost. This condition of affairs calls for prompt action. If possible, the patient must be kept in motion, and applications of cold water be made to the face and spine. If the patient falls the limbs must be raised, and all methods used to keep the heart acting, for if you can *bridge over* 10 or 12 minutes, the patient is safe. To prevent being '*struck*,' as he calls it, one patient of mine carries a cord which he throws over the arm, and if an unfavorable symptom occurs, he uses it as a tourniquet, and in a moment the result is apparent in the extravasation of the blood and the morphia from the wounded vessel. This is a safe condition, as afterward no rapid absorption can occur."

This is a companion case to that reported by Graham, and the ligation of the limb proved to be of great practical importance.

An interesting series of experiments, bearing directly upon the use of the ligature in such cases, were made by Mr. Georges¹ at the Paris Society of Practical Medicine, some of which were conducted for this gentleman by M. Claude Bernard. These experiments consisted in "injecting poisonous substances into the cellular tissue, with the view of showing

¹ *Medical Times and Gazette*, June 14, 1865, p. 42.

the far greater safety and certainty of the hypodermic method as a means of administering, medicinally, highly-poisonous substances. He injected quantities of codeine, atropine, and especially strychnine, which would surely cause death in the absence of precautions for preventing the too rapid introduction of the poisons. These injections were practised without danger in the dog's paw, the passage of the poison into the veins being checked by the forcible application of a ligature around the paw. To render the experiment still more striking, he resolved to employ injections of the most dangerous of poisons—curare—and M. Claude Bernard conducted them for him. A solution containing about five centigrammes of curare, sufficient to kill more than fifty dogs of the size of the one operated upon, was injected into the paw, and in 20 minutes the animal fell on its side. The paw was now firmly tied, and at the end of about 20 minutes the animal arose. *Whenever the ligature was loosened he again fell down, sometimes at the end of ten minutes, and sometimes in a shorter period,*¹ and in this way it became possible to dose with complete certainty, according to the effect desired to be produced, the quantity of poison to be absorbed. The next day the dog was found on his three paws, only suffering from the swelling caused in the fourth

¹ Italics mine.

by the injections. The ligature was removed and he was soon all right."

"The same experiment performed on another dog was followed by the same results, the animal being caused to fall or rise at the end of five, ten, or fifteen minutes, accordingly as the paw was tied or untied. This dog, however, next morning, on the removal of the ligature, fell down again, all the poison not having had time to become eliminated by the urine, so that it was necessary to reapply the ligature. M. Georges points out the superiority of the endermic method, when we have to administer powerful substances, as we may apportion the dose with an exactitude, according to the tolerance of the disease, and idiosyncrasy of the patient, quite unattainable when administered internally."

Dr. Alonzo Clark, Professor of Theory and Practice of Medicine and Clinical Medicine in the College of Physicians and Surgeons, New York, kindly gives me the details of the following case: There was brought into Bellevue Hospital, some years ago, during his term of service, a young woman, aged about 25, suffering from trismus. The jaws were so firmly locked that it was necessary to break out a tooth in order to administer food and medicine. All ordinary medicine failing, on the evening of the second day, the house physician determined to treat the case with

hypodermic injections of morphia. He gave three injections of fifteen minims of Magendie's solution, with two hours' interval between the doses, and finding that no effects of the morphia were apparent at 2 A. M., he gave an injection of twenty minims. When he returned to the ward at 4 A. M. the patient was dead. The nurse on being questioned stated that the patient was "asleep" before the doctor left *the ward. The arm in which the puncture had been made was examined by Dr. Clark and others, and *over the point of the last puncture a little discoloration, as from extravasated blood, was apparent, and which, on careful dissection, was found to mark the track of the needle, which had opened directly into a vein.*

In this case the patient probably died almost immediately, the action of the morphia being shock-like, and its effect the more intense as $1\frac{1}{2}$ gr. had already entered the system by the skin.

Prof. Wm. T. Lusk, of this city, writes me of a case of syncope following immediately upon the injection. No blood appeared at the point of puncture.

Another case of death from injection into a vein is reported to me by Prof. Willard Parker. An injection of morphia, to relieve the severe pain of neuralgia, was made into the temporal region of an apparently healthy young man. Death was almost

immediate. The case was in the hands of a physician in Connecticut. I have repeatedly written, asking for full particulars, but cannot get them. It is a strange fact that all the cases where injection into the temporal or infra-orbital region is mentioned by correspondents and by some authors, it has been attended by either intense narcotism or death. (See p. 88.) This is, of course, not a uniform occurrence, but it has happened sufficiently often to call our attention to it, and urge caution in its use in this situation.

In this connection, and in point of history, the following quaintly worded extract from a diary, which appears in *Pepy's Journal*¹ of May 16, 1664, is of interest: "With Mr. Pierce, the surgeon, to see the experiment of killing a dog by letting opium into its hind leg. He and Dr. Clark did fail mightily in hitting the vein, and in effect did not do the business after many trials; but with the little they got in, the dog did presently fall asleep and so lay till we cut him up."

The different effects produced by the same accident on different persons seems to be due to some peculiarity of constitution with reference to morphine. The drug is thrown so rapidly into the circulation that it carries everything before it, seem-

¹ E. P. Wilson, "St. George's Hospital Reports," 1869.

ing to instantly overwhelm the vital powers. The brunt of its action seems to be exerted on the heart, and the key to proper treatment is thereby afforded. To whatever cause due, the effect is essentially the same, the difference being only one of degree. That syncope and vaso-motor disturbances are ever due to the injection of air into a vein with the solution, I very much doubt. In the first place, the morphia itself is quite sufficient to produce the symptoms, and in the second place, not more than a bubble of air is ever left, by carelessness, in a syringe, and this is not sufficient to produce these symptoms. To settle this matter, I purposely injected into the median cephalic vein of my own arm twice as much air as this with a solution of warm water, and without any bad effects; in fact, no effect whatever. My arm, above the point of puncture, was protected by a ligature that could have been drawn tight at a moment's notice had there been any untoward symptoms. The following day I injected the $\frac{1}{16}$ of a grain of the sulphate of morphia into another vein, with the effect of producing sudden dizziness, a feeling as if the head would burst, prickling and tingling of the nose, suffusion of the face and eyeballs, dilatation of the pupils, faintness and nausea. The pulse was first greatly accelerated, and then fell to about 65, and remained so all that day.

My pulse in health is 74. This was done at 10:30 A. M., and I did not fully recover until about 3 P. M. It may be well to state that morphia, either by the mouth or skin, always has a very unpleasant effect on me, while opium has not. Instead of causing sleep and soothing irritation, the former makes me nervous, "twitchy" and somewhat light-headed. In both cases the needle entered the vein, as it was made prominent by the ligature, and blood appeared at the point of puncture. As soon as the injection was made the ligature was loosened, I being ready to pull it tight at a moment's notice.

M. Calvet,¹ presents a physiological research of the action of morphine upon the various functions of the organism. A clinical study of morphine as a therapeutical agent, especially in the relations of acute to chronic morphinism. In the first, he observes that both intra-venous as well as subcutaneous injection of the hydrochlorate of morphine accelerates respiratory movements, succeeded by a period of retardation, and produces sometimes a momentary arrest or respiratory syncope. The same relative effects occur with the cardiac movements; at first accelerated, followed by retarded pulsations; sometimes even by cardiac syncope. During this time animal heat exhibits analogous phenomena, namely, the elevated is followed by lowered temperature. In

¹ "Thèse de Paris," *N. Y. Med. Journal*, Sept., 1877.

fact, the absorption of morphine, whether by intra-venous or subcutaneous injection, produces a very marked influence upon the reflex actions. In certain cases the period of exaltation does not occur, but the temperature becomes lowered, and the respiratory and cardiac movements are slower. Though he has not finally completed his researches, M. Calvet advances the opinion, "that the above phenomena are the dispnoea, dizziness, &c., sometimes seen during the operation of intra-venous injection of milk." A study of these cases ¹ (milk injections) shows us that these phenomena rarely, if ever, present themselves until a large bulk of fluid (from 2 to 6 oz.) has been added to the blood.

An interesting and novel series of careful experiments on man and animals, made by Dr. Gaspar Griswold,² then house physician in Bellevue Hospital, this city, although not made with that end in view, seem to demonstrate very clearly that a powerful and possibly irritant medicine (aq. ammonia dil.) when injected into a vein in quantity does not produce any untoward symptoms, but on the contrary were always found to have the happiest, and sometimes a most marvelous effect.

¹ Pepper, *N. Y. Med. Record*, Nov. 16, 1878. H. H. Smith, *Ibid.* Joseph. H. Howe, *Ibid.*, Dec. 7, 1878 and Jan. 4, 1879. J. S. Prout, *Ibid.*, May 11, 1878.

² "The Intra-venous Injection of Ammonia," *N. Y. Med. Record*, June, 1879.

Is it possible for such phenomena as have been ascribed to the injection of morphia into a vein to take place without such puncture? I think so. Some of the cases reported would seem to prove it; notably that by Dr. Tupper, where the symptoms did not appear until ten minutes after the injection was made. Every insertion of a hypodermic needle, of necessity, cuts across or opens a certain number of capillary vessels, to which is undoubtedly due, to a certain extent, the rapidity of absorption when drugs are given in this manner. The Committee of the Medico-Chirurgical Society¹ came to the conclusion, from experiments on men and animals, that absorption of a sufficient amount of the remedy to produce decided symptoms took place in from 4 to 10 minutes.

“Experiments on a healthy man, aged 32. Morph. acet. $\frac{1}{6}$ gr. was employed :

<i>Symptoms.</i>	<i>Skin.</i>	<i>Mouth.</i>
Absorption.....	5 min.	110 min.
Pulse increased.....	8 beats.	None.
Pulse lowered.....	12 “	10 beats.
Headache.....	36 hours.	10 hours.
Nausea.....	46 “	3 “
Pulse, its nat. standard.....	22 “	8 “
Incapacity to work.....	6 “	None.
Total duration of symptoms..	46 “	11 hours.”

¹ “Medico-Chirurg. Transactions.” vol. L., p. 570.

I have found that some drugs, notably jaborandi, when used hypodermically, manifest their peculiar symptoms in so short a time as one minute, no vein of any size being punctured. It is to be supposed that one drug is absorbed from the subcutaneous cellular tissue with about the same rapidity as another, but that each drug *manifests its presence* in the circulation with a difference in point of time according to its peculiar action, or to some idiosyncrasy of the patient. Thus, while morphia may be absorbed as rapidly as pilocarpine or jaborandi, it does not, save in certain persons or at certain times, give evidence of its presence by recognizable symptoms so early or so decidedly as the latter.

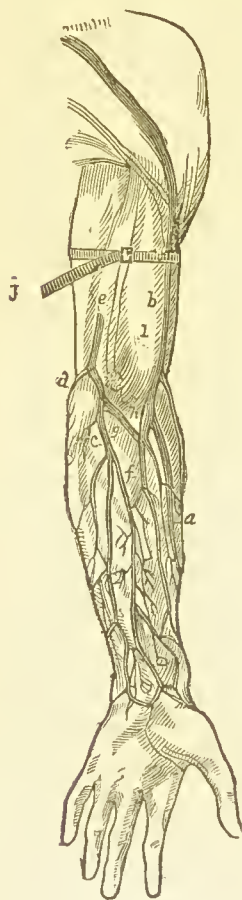
From this it would appear possible, in certain cases, for a very rapid absorption to take place, and sudden overwhelming of the heart by the drug to occur without the puncture of a vein. As the needle does not go deeper than the subcutaneous cellular tissues, in a large majority of the cases, the immediate treatment would be as effective in one case as in the other. At a recent meeting of the New York Pathological Society,¹ Dr. Amidon presented some microscopic specimens exemplifying the pathology of hypodermic medication. He said that although hypodermic medication had been in vogue twenty-five years, or,

¹ *New York Medical Gazette*, Jan. 10, 1880.

according to the claims of some, forty years, he was not aware of any accurate investigation of the relations between the hypodermically injected mass and the skin. He had injected Prussian blue (a weak solution) into the skin of moribund subjects, and a portion of skin was excised after death. The hypodermic injection was given in what he considered the best manner, namely, the pinching up a fold of skin and introducing the needle horizontally. The hypodermic injection was found to occupy a space three and a half centimetres in diameter and one millimetre in thickness, tapering in shape. The location of the hypodermic injection varied according to the amount of adipose tissues in the subject. In those who had but little adipose tissue the hypodermic injection remained immediately below the skin, while in those who had much, the injection diffused itself. It would be seen in the specimens presented that the hypodermically injected mass lay close to the arteries and veins: sometimes it completely surrounded an artery or vein. This, together with some other experiments, proved that it was by the blood-vessels and not by the lymphatics that absorption took place. In order still further to test the matter, he had injected muriatic of pilocarpine into the ankle and into the supraclavicular region, the physiological effects of the drug (diaphoresis, salivation, &c.,) were produced in both cases in

about the same time, varying in different subjects from one and a half to four minutes; there was no appreciable difference.

If the absorption had been by means of the lymphatics, the injection in the supraclavicular region would have produced its effects much more rapidly than that injected into the ankle. In one of the slides the section had fortunately been in the line of the puncture of the needle and showed that considerable injury had been done to the tissues. I am firmly convinced that no physician should be held free from blame in case of accident where he has not had a ligature or tape loosely encircling the arm above the point of puncture. At the first intimation of danger this should be pulled tight and kept so for several hours, being loosened gradually, thus permitting but a gradual entrance of the drug into the general circulation. With this precaution, it will be seldom necessary to treat



(Agnew.)

a, Commencement of the Cephalic Vein; *b*, Main Trunk of the Cephalic Vein; *c*, Anterior Branch of Basilic Vein; *d*, Posterior Branch of the Basilic Vein; *e*, Basilic Vein; *f*, Median Vein; *g*, Median Basilic Vein; *h*, Median Cephalic Vein; *i*, Biceps Muscle; *j*, Tourniquet.

such alarming symptoms as are here recorded. A tourniquet for this purpose is here shown. It consists of a

strap or heavy tape, at one end of which is sewed a "patent buckle" that will catch and hold at any point. In the absence of this or a skate strap with such a buckle, any cord or tape, so arranged as to be pulled tight at a moment's warning, may be used. The treatment of such condition when already established, is summed up in the one word—*stimulation*. Whiskey and ammonia hypodermically, cold affusion, electricity, when there is a battery at hand, and hot bottles to the precordia. The intra-venous injection of ammonia as successfully used by Dr. Griswold in several instances when the patient was moribund (phthisis, ascites, etc., etc.) might be tried with advantage. Regarding the strength of the solution, he says¹: "For this purpose I used the ordinary aqua ammonia (containing ten per cent. of ammonia gas), diluting it with an equal bulk of water." He thus describes his method: "Selecting a prominent superficial vein in the radial region, I exposed it by an incision through the skin. I then injected slowly into it a drachm of ammonia solution, taking care that the point of the hypodermic needle was free in the lumen of the vessel. This done, I placed my hand over the patient's heart and waited. In fifteen seconds I felt a marked increase in the force of the pulsations. In about two minutes there was a strong pulse of a hundred, which was

¹ *N. Y. Medical Record*, June 7, 1879.

plainly perceptible at the wrist. A minute later the patient sighed deeply; the color came back to her lips; her eyes moved and began to show signs of returning intelligence, etc." This patient fully recovered, and with no after-trouble from the injection. This was a case of syncope following thoracentesis; the woman failing to respond to 15 or 20 3ss. doses of whiskey given hypodermically.

In giving atropine with the morphine, hypodermically, care should be taken that no more atropine than is absolutely necessary be given, lest dangerous syncope result.¹

Dr. E. M. Nelson, of St. Louis, has kindly sent me the following history of a case illustrating this danger: The patient, a large, fleshy, apparently healthy woman, is one of those upon whom Dr. Thomas Wood, of Cincinnati, successfully performed ablation of the uterus. In spite of some years' absence of this organ, she was decidedly hysterical. The doctor was called to see her on account of a very severe pain, "most keen at a point below the border of the ribs on the left side and in the supra-pubic region." (In her case the lower part of the abdominal walls did not close after the operation, done 5 years before, and there is a hernia in the median line a short distance above the pubes. This is retained by an abdominal supporter when she is up.)

¹ Bartholow, "The Hypodermic Method," &c., pp. 110-117 inclusive.

At this visit the doctor gave her 10 gtt. of a solution of which this amount represented, morphia sulph. gr. $\frac{1}{6}$, atropia sulph. gr. $\frac{1}{96}$. "I had on the preceding days given injections of $\frac{1}{4}$ gr. morphia and $\frac{1}{64}$ of atropia, repeating the dose in half an hour, and had then gained only partial relief. This morning the patient demanded that I should give her a larger dose, so as to afford relief. I gave at the first injection 30 gtt., equal to morphia sulph. gr. ss., atropia sulph. gr. $\frac{1}{32}$. In half an hour there was no relief and no symptom of the action of the remedies, and I administered 20 gtt. more, equal in all to $\frac{5}{6}$ gr. morphia and $\frac{5}{96}$ gr. atropia. She experienced decided relief in a few minutes after the last injection, and I soon left. I returned about four hours later, and found that she had experienced quite alarming symptoms, commencing about half an hour after I left. She had fainted and seemed very much prostrated, thought she was going to die, &c. They sent for me, but I was out, and when I did see her all these symptoms had disappeared. I attributed the symptoms to hysteria, and in the evening, finding that she was suffering intense pain again, I gave her, in the course of an hour, about the same doses that I had given her in the morning. (I am not sure as to the exact quantity.) It seemed to have the desired effect in relieving pain, and I left her, expect-

ing that she would have a good night's rest. I gave the injection just as I had done in the morning: 30 gtt. first, and then, after waiting half an hour, and the pain continuing, giving a second dose somewhat less than the first. In less than an hour I was called back to see the patient again, the messenger reporting that she was dying. I found her in a condition that was sufficiently alarming. She would gasp for breath, call for the windows to be opened, and the pulse would fail, and sometimes entirely disappear, and respiration become very imperfect. Then, under the stimulus of ammonia to the nostrils and friction to the extremities, she would revive; the pulse regain its tone, and the respiration become normal. She would doze off, and I would begin to congratulate myself that the trouble was over, and that I might leave the patient, when the same symptoms would recur, and this again and again until daylight. The intervals of ease would become longer, and finally there was a cessation of the recurrence of syncope. The last article used in the way of treatment for this condition was iced champagne, and this seemed to be of advantage. I was convinced by the occurrence of similar phenomena that the symptoms of syncope were the effect of the atropinized solution, and afterwards, in treating that patient, when I desired to give large doses of mor-

phine, as was necessary at times, in order to relieve pain, I used a solution without the atropia. She took, last summer, within an hour and a half, by the mouth $\frac{1}{4}$ gr., and hypodermically $1\frac{5}{6}$ gr. of morphia, with no ill effects at all." Dr. Nelson mentions as a peculiarity of this patient that she has a very sensitive stomach; "more sensitive to the reflex influence of odors than any other I ever had to deal with."

Dr. E. Wenger, of Gilman, Ill., sends me the following: "A young man, aged 26, called to see a doctor, an old acquaintance, about 6 o'clock P. M., and while there complained of a pain in his side. The doctor told him he could relieve him in a few minutes by injecting a little morphia and atropia under the skin, to which he assented. After about ten minutes he left the office, feeling no change in the pain nor effect of the medicine. On reaching the pavement he became suddenly blind and fearfully sick. He was taken into a drug-store near by, and for three hours his life was almost despaired of. He says the prostration and sickness he suffered is indescribable. The pupils were very much dilated. What quantity was used I do not know."

Geo. Oliver,¹ M. B., believes that all danger of wounding a vein is done away with by inserting the needle perpendicular to the surface and passing it well in.

¹ *Practitioner*, vol. 4, p. 80.

CHAPTER V.

DEATHS FROM THE SUBCUTANEOUS INJECTION OF MORPHIA.

So widespread has the practice of giving morphia hypodermically become, and in so many serious conditions and diseases is it employed, that it is not surprising that the method has been charged with causing death, where a fatal result would as certainly have followed had the drug never been thus exhibited. Aside from such cases, however, there seem to be fair grounds for the belief that in some instances death was unquestionably due to the drug given in this way. The mere fact that such charges have been made against a proceeding at once so common and so valuable, demands a thorough and dispassionate analysis of the various cases of this kind, in order that, if possible, the question may be settled beyond a peradventure.

I shall first give the cases in their original fullness or meagreness of detail, and discuss them afterwards, premising their relation with the statement that no reasonable effort has been spared to obtain

information in every important particular; and that where such completeness is not found it is due either to carelessness or to unwillingness of the physician to answer.

CASE I.—Dr. Jno. H. Lowman, Prof. Mat. Medica in Wooster University, Cleveland, Ohio, writes me: "The case of death was as follows: Man, aged 40; health generally good; no known organic disease; I had often seen and examined the case; no idiosyncrasies in medicine. He was lame from a gun-shot wound of the knee. He became intemperate while living in Kansas, and had *mania-a-potu*. Returned to Cleveland and drank very little for twelve months; for past three months immoderately, though never known to be narcotized with alcohol. He was of a bilious (?) temperament. He occasionally bled freely on slight provocation, *e. g.*, pulling a tooth. Had had severe epistaxis three or four times. Perhaps he might be said to have hæmatophilia. On the occasion of last sickness he had severe epistaxis, stopped with ice and pressure on facial arteries. Reappeared next day; was stopped again. Reappeared the following night; stopped again; appeared next day, and bled profusely. Left post. and ant. nares plugged. Patient was weak, but picked up soon under milk. He obtained and drank considerable whiskey—amount not known.

Plugs removed at the end of forty-eight hours, and nares syringed with antiseptic and astringent lotions, and then mania appeared. It consisted mainly in visions and insomnia; no violence. Bromides, chloral and asafoetida were used, but without any decided effects. When consultant advised morphia sulph. hypodermically, I urged him to take the case, as I did not wish to assume the responsibility under morphine treatment; but he urged my remaining, and I unwisely did so, with the understanding that his was the directing treatment. After the second injection there was no change in the patient. After the third injection, $\frac{5}{8}$, possibly $\frac{6}{8}$ gr. in all, patient became a trifle more quiet. Pupils were unchanged. I left, with strict orders to call me if anything unusual appeared. Time, 11 P. M. Was called at 12:45, with the statement that the patient was dead. I questioned attendants, and found that the patient suddenly became very quiet, laid down and breathed hard, and died in from 30 to 45 minutes after lying down. Previously he had been constantly walking and talking. Pupils semi-contracted after death; skin pale. Could not get satisfactory information of details from attendants.

“I have observed other cases, where opium under above-described conditions acted adversely. One case of *mania-a-potu*, where in addition there was

bronchial catarrh; no excessive secretion. The symptoms followed a second hypodermic injection of the sulphate of morphia. I cannot recall the amount and have no record of it. The respirations diminished gradually and cyanosis developed. Artificial respiration and flagellation averted too profound coma. The bromide and chloral treatment was being used in this case also.

"I felt a little uncertain about the amount of morphia used in the case of death, but on referring to records I find: 1st injection, 7 P. M., $\frac{1}{5}$ gr.; 2d at 9 P. M., $\frac{1}{4}$ gr.; 3d at 11 P. M., $\frac{1}{8}$ gr."

CASE 2.—Dr. Lyman M. Willard sends me the particulars of the following case: "The man was of good build; about 25 years old; general health good, when himself. The latter months of his life were pretty well occupied in *drinking whiskey*, he being under the care of a medical friend of mine at the time of his death for delirium-tremens. After pretty thorough treatment with potass, bromide and chloral by my friend, I was called in, and found him very restless, sleepless, and much inclined to 'rat-catching,' and decidedly adverse to keeping his clothes on. Was perfectly docile, however, when spoken to sharply. Got him to take some good soup, and then gave him hypodermic injection of $\frac{1}{8}$ gr. of morphia, he not having had a dose of anything for some six hours

previously. Called again, with my friend, in four hours, I think, and found him in bed, as we left him ; a little quieter than when first seen, still not inclined to sleep. On consultation we concluded to repeat injection, which we did. Remained with him for $\frac{1}{2}$ hour, when, on his getting quieter, we left him in care of his brother, who slept in bed close to him, and who reported at inquest that his brother *turned several times in the night*, but seemed to sleep *quietly* most of the time, *snoring once in a while* when on his back, and seemed asleep when he arose in the morning to get the patient his breakfast. The brother, however, noticed the patient lying with his neck uncomfortably across his arm, but did not disturb him or touch him. In about one hour the brother came up again and noticed him lying as before, and on attempting to arouse him, found him dead.

“ At post-mortem the lungs were congested, brain not so ; stomach somewhat congested ; liver small and tawny in color, significant of cirrhosis. Kidneys somewhat enlarged, otherwise healthy.

“ As to ‘ pupils and pulse, &c., &c., &c.,’ they were not observed, of course, during the night. We last saw him at 8 P. M. He turned in bed at 3 A. M., and was dead at seven, sure, and probably at six, when his brother first arose. I remember that the pulsations were over 100 at 4 P. M. The respiration was not so

as to particularly attract attention when seen last by us. He evidently died from the excessive use of poor whiskey, as the coroner concluded on medical evidence. The man was of the nervous temperament."

CASE 3.—From a physician of prominence in London, England, I receive the following: "Largest dose, $\frac{1}{2}$ grain, repeated in about five hours, for delirium-tremens. Patient died of opium-poisoning. He was an old man."

CASE 4.—The following from a medical gentleman in this city, who does not wish his name used: "But one death, and that in a case of delirium-tremens, where $\frac{1}{6}$ gr. was employed hypodermically in combination with $\frac{1}{96}$ gr. atropine, and repeated in two hours' time, as the patient was still violent. He had already taken large doses of bromide of potassium and chloral. He died five hours after the last injection, of undoubted opium-poisoning. For two hours after the last injection 11:30 P. M., he was awake and restless, and twice threatened the attendant's life if he did not remove a dog (imaginary) from under the sofa. Suddenly the patient became quiet, turned upon his back, and the attendant believed that he was asleep, but failing to arouse him to administer some beef essence, became alarmed, and sent for me. When I arrived I found him deeply narcotized, pupils contracted to pin-holes, pulse slow (do not remember to

have counted it), and respirations at about 4 per minute. Gave $\frac{1}{50}$ grain atropiæ sulph. hypodermically, used the battery, cold affusions and coffee, but to no good end, the patient dying at about half-past four in the morning."

In answer to a series of questions addressed to him, the doctor replied: "There was no autopsy; the pupils just before death were contracted in spite of the atropia given—natural a few moments after death. He was 36 years old, and free from renal and cardiac disease."

CASE 5.—Dr. E. Fletcher Ingals,¹ amongst six other cases of death collected by him from physicians, reports this one: "I was called to see Mr. B., who lived seven miles away, at 8 P. M., and found him suffering from myalgia of the muscles of the back. I at once administered $\frac{1}{60}$ of a grain of the sulphate of atropia hypodermically. After waiting till dryness of the throat and other constitutional symptoms showed themselves, and finding no relief, I gave him $\frac{1}{4}$ of a gr. of morphia *by the mouth*.² In $\frac{3}{4}$ of an hour from the time I gave him the morphia the man was still groaning with pain, and then I gave $\frac{1}{4}$ gr. of morphia hypodermically, which soon quieted the patient. Not suspecting any unpleasant effects from

¹ *Chicago Med. Journal and Examiner*, May, 1878.

² Italics mine.

the medicine, I took my departure. In a couple of hours I was sent for to see the man, who, the messenger stated, 'was in a deep stupor.' Upon my arrival, I found Drs. L. and J., who lived only three miles distant. The patient's breathing was stertorous, and there was complete narcotism. Dr. J. stated that the pupils were not contracted when he arrived. He had given atropia hypodermically, and was using electricity. The latter was kept up, as well as artificial respiration, until the patient died, which was about 12 hours after the morphine was given. I have given morphia hypodermically a great many times, and repeated $\frac{1}{4}$ gr. doses as often as every 20 minutes, but never before saw any such effect as was produced in this case." In a letter to me, this gentleman writes: "My case referred to was a man of about 45 years of age, *very intemperate*,¹ and I fully believe that an intemperate man is more susceptible to the influence of morphia."

CASE 6.—A physician from the West writes: "I commenced the use of hypodermics in 1860, and have used them extensively since, with but one severe accident; in the case of an old Irish woman with asthma. I asked them particularly, before administering the medicine, whether she had taken anything or not. They said not. I gave her $\frac{1}{6}$

¹ Italics mine.

gr. morphine and $\frac{1}{40}$ atropine hypodermically, and shortly after discovered that they had given her 30 drops of tr. opii. by the mouth a few minutes before. She died on time."

CASE 7.—Another physician in one of our large Western cities writes: "In regard to the hypodermic use of morphia, I desire to supplement my former communication with this opinion—That I believe that *nearly*, if not *all*, fatal accidents from the hypodermic use of morphia are due to the fact that morphia has been previously administered by the mouth with no effect, and then a resort to the use of the syringe has so tranquilized the nerves that a cumulative action has been set up. I know of a case where a man was poisoned and died of just such treatment. Therefore I say, use only one method at a time." In reply to special inquiries from me, the same gentleman writes: "I had nothing to do with the case, and only know of it by *hearsay* and *circumstantial evidence*." The patient was a young man of about 22 years, tall, slim, and with a family history of insanity; of a nervous temperament. He was generally healthy, well-educated, and moved in the upper walks of life. Was of irreproachable habits. The patient was suffering from cholera-morbus. The quantity of the drug was guessed at when given by the mouth, three doses of morphia of $\frac{1}{8}$ gr. each,

at intervals of $\frac{1}{2}$ hour. There being no relief to symptoms, he then injected subcutaneously, $\frac{1}{12}$ gr., 2 doses, 20 minutes apart. He soon fell asleep never to awake, in spite of the best skill of several eminent physicians who were called in consultation. He lived about 18 hours after the time of the last injection. Previous to giving the morphine, the family entreated the doctor not to give it, *as none of the family could take it with safety*. "The general opinion is, that the doctor in the first place gave more than he says or thinks he did. That it remained dormant in the stomach, only to be absorbed as the nervous forces were quieted by morphine, hypodermically, and then a cumulative action on a patient morbidly sensitive to opium resulted."

CASE 8.—Alfred C. Post, Prof. Emeritus Clin. Surgery and Pres. of the Faculty of the University of the City of New York, Medical Department, writes me as follows: "According to my recollections, I have had but one case in which there was reason to believe that death resulted from the hypodermic injection. The patient was a gentleman about 70, suffering from a painful affection of the rectum. I injected 10 minims of morphia solution without relief of pain and without narcotism. Two hours after, I repeated the same dose. The pupils became contracted, the respirations very slow, and

full narcotism occurred, unrelieved by the antidotes which were employed, and terminating fatally within a few hours. There was reason to believe that the patient was uræmic."

CASE 9.—Dr. J. M. Snook, of Kalamazoo, has kindly written out the following case in full for me : "My patient was a man of fifty-two or fifty-four years of age, of Irish birth, bilious temperament, common school education, and engaged as baggage-master at the railroad depot. His health for several years had been poor, more particularly since five years previous, when he had an attack which his wife thought was very much like this last one, save the stupor, though he was inclined to sleep very heavily, and was attended at the time by five doctors. So far I have been unable to learn the precise nature of the attack, further than that they called it a bilious attack. He had at that time some urinary trouble, but what, I am unable to learn.

"For about three weeks previous to this last attack he had been feeling poorly, and had complained of pain in the bowels and had a poor appetite. At noon of the day that he was taken, he walked home with much effort, and back to the depot, but ate nothing. He continued to grow worse until about 5 P. M., when he was seized with a severe chill and pains in the stomach and bowels. I saw him at

about eight o'clock and found him suffering extremely from pains, and gave him the hypodermic injection ($\frac{1}{4}$ gr.), as stated, which quieted the pain within an half hour, when I left him feeling quite comfortable. About nine o'clock of the following morning they called me again, saying the pains were returning. I found him suffering not nearly so much as on the evening previous, but as it seemed to be increasing, gave him a small injection, I should judge about the one-sixth part of a grain, which soon commenced to produce its effect, and I left him, probably within fifteen minutes, after giving the injection. In about one hour they sent in haste to say that they could not rouse him, and he seemed to be sleeping too soundly. I saw him immediately, and found him breathing rather heavily—respirations sixteen to the minute, pulse about one hundred, pupil somewhat contracted. Upon raising him to a sitting position he would open his eyes and ask to be left alone. Six-drop doses of fluid extract of belladonna repeated twice within thirty minutes expanded the pupils to more than the ordinary size a trifle. There had been no urine passed since the night previous, so I attempted to use the catheter, but found the meatus so small that it had to be slit up before it could be done, and then obtained about two ounces of urine—non-albuminous. Gave strong enemas,

with no response from the bowels. The pupils continued dilated until after death. The respiration continued about sixteen until between three and four o'clock, when they were fourteen, and continued so until near death, which took place at half-past seven in the evening—a little over ten hours after giving the last injection. The face was not livid. I did not notice any discoloration of the body after death."

I think the consulting physician excluded opium narcosis from the general condition of the patient and the history of his case prior to this illness, as he concluded that his illness of five years previous, very likely, was the cause of the continued poor health and the prime cause of the present attack, though that, of course, was an opinion only, as the history of the first was not satisfactory, and nothing could be verified by autopsy.

CASE 10.—Dr. C. C. Lee, of this city, whose able article on the antagonism of opium and the mydriatics may be found in the *Am. Journal Med. Sciences*, Jan., 1862, writes me as follows: "I have seen one death following hypodermic injection—in a case of broncho-pneumonia in an old man, who died within a few hours, comatose, with symptoms of pulmonary hyperæmia."

CASE 11.—Dr. A. P. Brown, of Jefferson, Texas,

writes: "Probably one death." To a request for full particulars, the doctor writes that he took no notes of the case, and the particulars have slipped his mind.

CASES 12, 13, 14, 15.—A physician in Indiana writes, in his second letter: "I did not intend to convey to your mind the impression that I knew of four deaths, beyond a doubt, due to morphia used hypodermically, but that other medical men shared with me that belief. I cannot go to Dr. X., and say to him, 'I think you did so and so with your hypodermic syringe.' All I can testify to is this: I am credibly informed that three of the four, after the use of an unknown quantity, (they made up the solution at the bed-side, guessing at the amount of morphia), hypodermically; the patients went to sleep, and were never aroused. In two of the cases the remedy was used in what is known as 'bilious colic;' in one, in diarrhœa. In the other, I have been unable to form an opinion. No post-mortem, except in one, wherein were found biliary calculi. *No consultations* were had, and, as I said before, I felt delicate about quizzing the attendant, especially as we were not on good terms. Please do not think I came to this opinion on that account. The fourth one happened to a good friend of mine, and still I did not like to approach him on the subject. Death occurred in

from three to eight hours in three cases. Cannot say as regards the second one. I am well aware that this information is valueless for statistics, because death from the syringe cannot be proven beyond a doubt. But I shall always think that in this vicinity four deaths have arisen from the careless use of the syringe."

CASES 16, 17.—Dr. E. Wenger, of Gilman, Ill., who is much opposed to the use of the instrument, reports, through Dr. E. F. Ingals,¹ the following cases: "Case 1.—I was called to see a woman in her fifth confinement. On my arrival, found her in convulsions. Another physician had been called, who arrived in a few moments. I at once suggested bleeding. The doctor had just bought a hypodermic syringe (the first I had ever seen), and suggested the injection of morphine, to which I assented. The effects of the convulsion, or the injected morphine, brought on a heavy stupor, with slow, stertorous breathing, from which she could not be aroused. I delivered her with the forceps. She slept on until she breathed her last. Case 3.—Mrs. W., aged about 56, had pain in one of her shoulders; in the morning she called the family physician, a man of knowledge and experience. He injected morphine into the arm, and relieved her in a few minutes; in the evening he

¹ *Chicago Med. Journal and Examiner*, Aug., 1877,

called again, and found his patient well, but thought, to secure a good night's rest, it would be well to inject a little more morphine, which he did, and in thirty minutes his patient was a corpse. The feelings of the doctor can be better imagined than expressed."

I give here Dr. Wenger's reply to my letter, asking for further details of these cases :

"I am sorry that I cannot give you some more useful information concerning the cases referred to. There was no autopsy held in Cases 1 and 3. The general physical condition of these persons was good; both stout and healthy women, living on farms in the country. There was no examination of the urine of either. In Case 1 there was as much as one grain morphia used, though not all given at once (dissolved in water). I never learned what quantity was given in the other cases. I was present at the death of Case 1. The symptoms were similar to apoplexy—unconsciousness—slow, heavy breathing, and full pulse; rate per minute I do not recollect; died about ten hours after the injection; was not present with the other cases, but, from what I could learn, were similar; do not know the condition of pupil at and just after death; no examination of urine after death. I wish to say here that country physicians have very limited means indeed for chem-

ical analysis, and what is more, it is rarely possible to get the consent of families to post-mortem examinations."

The doctor says, further: "I met Dr. Alexander, of Broadway, Rockingham Co., Virginia, in Washington, D. C., last summer, and asked him if he had ever seen or heard of any accidents from the hypodermic injection of morphia. He told me that there had been two deaths in his vicinity." I wrote Dr. Alexander, at Dr. Wenger's suggestion, and received the answer that Dr. Wenger was mistaken, he (Dr. A.) having never seen or heard of a case of death from morphia used hypodermically, but had spoken of some deaths caused by chloral.

CASES 18, 19, 20, 21, 22 and 23.—Dr. E. Fletcher Ingals,¹ of Chicago, to whose article I have already referred several times, sent out some eighty circulars to prominent medical men of the Northwest, embodying a series of questions relative to the occurrence of death, accident, etc., from the use of morphia, hypodermically. He received fifty-five replies, that yielded seven cases of death, one of which is already given on page 148 of this chapter. Of the other cases, he says: "In two of the seven fatal cases reported, the amount of morphia administered was

¹ "*Chicago Med. Jour. and Examiner*," May, 1878.

not ascertained, though it was believed not to have exceeded the ordinary dose. In other cases the doses and the condition of patient were given, but I am not at liberty to report the cases fully. However, as my information was derived from men of large experience and recognized ability, I can vouch for its accuracy. The names of my correspondents are withheld for obvious reasons.

“ One reports two deaths, one of which was caused by the subcutaneous injection of $\frac{1}{5}$ of a grain of morphia, combined with $\frac{1}{75}$ of a grain of atropia.

“ Another reports two deaths; one from two doses of morphia, $\frac{1}{3}$ of a grain each, with an interval of four hours between the first and second doses. In this instance the morphine was given to relieve intense pain attending invagination of the intestines. Death from narcotism ensued six hours after the second dose. The other death reported by the physician resulted from $\frac{1}{4}$ of a grain given in a case of sciatica. The patient died comatose within five hours.

“ Another reports death caused by two doses of $\frac{1}{4}$ grain each; *the first given internally.*¹

“ The sixth case was that of a patient upon whom ovariectomy had been performed. Shortly after the operation this patient was given, subcutaneously, 10

¹ Italics mine.

minims of a saturated solution of morphia, which amount was repeated five hours later, on account of pain. In fifteen or twenty minutes the latter dose was followed by profound narcotism, and within two hours death ensued, notwithstanding persistent use of the most approved treatment. In this case the exact dose was not known, but considering the ready solubility of morphia, it probably equalled, and may have exceeded, $1\frac{1}{2}$ grains. The physician who gave me the notes of this case found that 10 minims of water at 60° Fahrenheit would dissolve $6\frac{1}{2}$ grains."

CASE 24.—"In Washington City a death has recently occurred from an apparently small dose of morphine, hypodermically given. Patient had pneumonia and his cough became distressing. His physician had given him during the day, Dover's powders without effect. At 9 o'clock in the evening he gave a third of a grain of morphia hypodermically. He had attended the patient frequently before, and had never discovered that opiates by the mouth or under the skin had any unusual effect upon him. After the physician left, the family of the patient became alarmed at the symptoms and sent for him to return. Not finding him, another physician was summoned, and discovering opium poisoning, applied electricity, etc. The regular medical attendant reached the bedside of his patient

only to see him die a short time afterwards. The patient and physicians were among the best people of Washington, and the affair caused much distress. The newspaper reports show very manly conduct on the part of the physician who administered the fatal dose. He did not attempt in the slightest to shirk writing in the certificate that the immediate cause of death was an overdose of opium.

“The opiate treatment of pneumonia is the one perhaps most in vogue, having the high sanction of Flint. Hypodermic medication also has a host of followers, and among many careful men in the profession, although it is somewhat singular that a fatal issue should have been reached in the case narrated. One-third of a grain of morphine under the skin is a full dose, but one far from being considered a dangerous one, especially when administered in a case where it was known from previous experience that no idiosyncrasy against opiates existed, and where the distressing symptoms demanded quick relief. The second physician called, when interviewed by a newspaper reporter, said that one-eighth to one-fourth of a grain of morphine were the ordinary hypodermic doses, and that in the present instance death was no doubt due to the over-powerful action of the narcotic on nervous centers already weakened by lack of aerated blood.

Possibly in the present case the cumulative effect of the previous doses of the Dover powder may have lent its aid to the result."¹

The seventh case I have given at p. 148.

CASE 25.—Dr. J. G. Stokes, of Grayville, Ill., writes me: "I had one patient with syphilitic laryngitis. I was called to see him in his last hours, and he begged for ease and sleep, and I gave him $\frac{1}{2}$ grain of morphia over the deltoid muscle. He fell asleep in from 5 to 8 minutes, and died in three or four hours, never having been aroused. Hence I concluded that he would have lived 12 to 24 hours longer without the morphia. This is the only case that I have met where I thought life was shortened by its use."

CASE 26.—Dr. N. S. Read, of Chandlerville, Ill., sends me the following: "The case I mentioned as being narcotized with $\frac{1}{6}$ gr. of morphia was a man who had been intemperate for years; age 35, height, 5 feet 8 inches. He had, for the last three or four years, drank, on an average, $1\frac{1}{2}$ pints of whiskey per day; eat but little, and was very much emaciated, weighing about 92 pounds. He had been confined to his bed for some three or four weeks, and was suffering from pain in the stomach and lungs. There was very little, if any elimination from the kidneys.

¹ *Louisville Med. News*, Feb. 23, 1878.

The urine had a specific gravity of 1.003. I concentrated a portion, over one-half, but found no crystals of urea upon adding nitric acid. He was expectorating a white, tenacious matter, which I think was excrementitious. The pulse was 110 and small. I was called in to give relief from pain in the stomach and lungs. I gave him $\frac{1}{6}$ gr. of the sulphate of morphia at 10 P. M. Called the next morning to see him. He had slept all night; was breathing regularly, pulse 110; temperature 100° ; pupil contracted. Continued in that condition 36 hours, when the respiration became slower (14), and gradually sank until he died, 48 hours after taking the morphine. How much the morphine had to do with his death I am unable to say. The friends had been looking for him to die a week before."

In answer to another letter, the Doctor writes me: "There was hepatization of one lung. No softening or ulceration. No albumen in the urine. Very little urine secreted."

CASE 27.—A physician of this city reports the following case: "I was called to see a married gentleman, aged about 38, fair build and nervous temperament. He was suffering from violent pain over upper part of abdomen, coming on in spasms every two or three minutes, and apparently accompanied by contraction

of the diaphragm. His wife stated that he had been subject to these attacks for the past 10 years, different physicians ascribing the seizure to different causes, but all treating it alike—with morphine. He had, she said, been given as high as 20 minims of Magendie's solution every half hour until relieved; relief being usually obtained in about $1\frac{1}{2}$ or 2 hours, at the most. The man was apparently suffering intense agony, and begged for a hypodermic injection of morphia, as he could retain nothing on the stomach. At 8 P. M. I gave him 10 minims of Magendie's solution subcutaneously, and repeated this at 9 and 11 P. M., as he was still suffering seemingly as intensely as when I first saw him. Returning at 1 A. M., and finding him still in great pain, I gave a final injection of five minims. He soon expressed himself as feeling easier, and after a time fell into an easy sleep. I then went home, thankful that I had relieved such intense suffering. At 6:30 A. M. I was hurriedly summoned to the patient's house by the intelligence that he was dead. On arriving I found him so, having been dead probably a half or three quarters of an hour. The pupils were natural.

“Autopsy revealed deep congestion of the lungs. All the other organs normal. Brain not examined.”

Here is the death of an apparently healthy man from the hypodermic injection of $1\frac{1}{6}$ gr. of morphia

given in $\frac{1}{3}$ gr. doses, at intervals of one and two hours; pain unabated in severity, and the time covered by injections, five hours. There was no history of idiosyncrasy; on the contrary, a history of tolerance for large doses.

The wife, who should have sat up with the patient, having seen him in these attacks before and having seen more morphia used, went to bed and to sleep in the full belief that on rising she would find her husband in his usual health. Owing to the frequency of these attacks, once in every two or three weeks, he had become something of an invalid.

CASE 28.—Dr. W. H. Haynes, of this city, writes me as follows: "I have given as much as fifteen minims to start with in severe, painful and uræmic cases, and in a hospital case of abdominal aneurism which had ruptured, where the bone was gone and the aneurism pressed directly on the membranes of the cord and the nerves, causing intense agony. I gave as much as twenty-five minims in less than a half hour, to his relief, though he died with symptoms of opium-poisoning 4 hours after, yet the autopsy showed that he was doomed any hour."¹

CASE 29.—Dr. Garland² recited the case of a

¹ Full report in *Hospital Gazette*, Aug., 1877.

² "Meeting of Suffolk District Medical Society," *Boston Med. and Surg. Journal*, 1871, p. 150.

married lady, 40 years old, healthy, but delicate and sensitive, and the mother of two children. In July she was taken sick with vomiting and purging. From the onset she had a small quick pulse, restlessness and constant nausea. Dr. Garland gave her $\frac{1}{4}$ gr. subcutaneously. She died 15 hours after the injection, in spite of all measures employed."

CASES 30 and 31.—In the Report¹ of the Committee of the Medico-Chirurgical Society two deaths (one in a case of mania) from the subcutaneous injection of morphia are given.

CASES 32 and 33.—The case reported by Dr. Alonzo Clark and that reported by Willard Parker in the chapter on Syncope, &c.

CASES 34 and 35.—A gentleman of excellent attainments and sound judgment reports to me the following cases, which he saw only in consultation. He does not wish his name to appear in connection with them, lest it should cause hard feeling between the physician who had the cases and himself. Both cases, strangely enough, occurred in the practice of the same man.

The first was that of a man aged 40, who was suffering from severe abdominal pain. The physician in attendance claims to have given two $\frac{1}{2}$ gr. doses of morphia subcutaneously, with an interval of about

¹ "Medico-Chirurgical Transactions," vol. 50.

two hours between the doses. The consultant says: "The patient was moribund when I was called to him some hours afterward, but I know nothing more of the history of the case, and can only surmise that he must have had either larger or more frequent doses than was stated." The doctor does not place much reliance on the statements of the gentleman in attendance.

The second case was that of an old lady, aged about 70, much enfeebled by an attack of dysentery. For some days she had been treated by opium by the mouth and by rectal suppositories of the same, without apparent toxic effect. The physician in attendance finding that the tenesmus was very severe, decided to give morphia hypodermically. He says that he gave $\frac{1}{2}$ gr. in this way. No opium had been taken otherwise that day. When seen by the consultant the patient was deeply comatose, with pin-hole pupils, infrequent breathing, &c., &c. "I injected $\frac{1}{24}$ gr. of atropine and repeated the dose after fifteen minutes, using, meanwhile, mild flagellation and other customary means.

"After the second dose the pupils slightly relaxed and the patient seemed to be rallying; so, having another important case on hand, I departed, leaving the atropine solution for my colleague to use again if needed, and urging him to see that the patient

was kept awake and supplied with strong coffee. As I learned afterward, however, he left the matter to the family attendants and went home; the patient relapsed into coma and died about six the following morning.

“As you see, I have really no scientific data about either of the cases. In the latter I used small tentative doses of atropine to correspond with the alleged smallness of the dose of morphia; but if the usual antidotal rule be correct, the fact that the pupils only began to relax after $1\frac{1}{2}$ gr., and subsequently retracted, would indicate that she must in some way have had over a grain of morphia, at the least computation.”

CASE 36.—Dr. J. J. Henna, of this city, writes me of one case of death, from morphia thus used, but gives no particulars, as the case occurred in the practice of another physician, and Dr. Henna did not see the patient until after death. Such a case, of course, cannot be used for statistical purposes.

A prominent specialist of this city has told me of several cases of patients who had left this city, where they were under his care, and in good general health, and soon after reaching home died, having been a few hours before injected with morphine. The cases were always reported to this gentleman as death

from some acute disease. In one instance in particular the death was attributed to *acute diabetes*!

Here, then, are the records of 36 cases of death, all of which are ascribed with more or less justness to the hypodermic injection of morphia. How many of these patients were really thus killed, or rather in how many of these cases we have sufficient evidence to warrant us in ascribing death to this cause, it is not easy to say. Let us see. In case No. 1, reported by Prof. Jno. H. Lowman, of Cleveland, death was undoubtedly due to the injection, I heartily endorse Dr. Lowman's opinion that the use of the hypodermic syringe in that case was uncalled for and extremely hazardous. It is possible that death might have occurred had the morphia not been used, for the man was in a very low condition from the loss of blood and other causes, but everything seems to point to the conclusion that the hypodermic injections were weighty factors in its causation, and teaches us most certainly that the use of the drug in this manner in such cases is extremely hazardous. Dr. Lowman, from a large experience with patients suffering from alcoholic excesses, had learned that such cases do not bear the subcutaneous injection of morphia well. It is to be regretted that an autopsy was not held, as then, probably, the question would have been settled beyond a peradventure.

Maudsley,¹ quoted by Bartholow,² very justly says : “ In former times—indeed a very few years since—the notion universally prevailed that the delirious symptoms were owing to the exhaustion which was chiefly kept up by want of sleep ; and consequently, that the production of continuous sleep for several hours was the sole and all-important means of cure. It was therefore the custom to ply the patients with larger and larger successive doses of opium, with the view of drowning the delirium in narcotic stupor. Great mischief arose from this widespread belief and practice. In the first place, it has often happened that the patient, without sleeping at all, has passed first into a condition of coma-vigil, next of stertorous breathing, and at last sunk, fairly poisoned with opium.

Bartholow³ then says : “ I quote these strong but just expressions to warn my readers against the abuse of the hypodermic injection of morphia in the treatment of delirium-tremens.

“ The following are the indications for the use of this method in this disease :

“ The condition of ‘ horrors ’ or wakefulness preceding delirium.

¹ “ Reynolds’ System of Medicine,” vol. 2, pp. 88, 89.

² “ The Hypodermic Method,” &c., p. 59.

³ *Op. cit.*, pp. 59, 60.

“Excessive and uncontrollable vomiting of food, drink and medicine.

“Mild cases in which there is little tendency to depression of the vital forces, in which the assimilation of food proceeds satisfactorily.

“It is contra-indicated in severe and protracted cases, with great depression of the vital forces, and non-assimilation of food.

“In cases where serious organic lesions of liver or kidneys have occurred.

“In cases in which the delirium-tremens is consecutive to traumatic or other serious lesion of brain.”

Anstie says : “It has happened to me, as I doubt not it has to others, to see patients suffering from delirium-tremens who had been injudiciously pressed with large doses of opium, because smaller doses failed to produce sleep, die from collapse almost as suddenly as if they had been shot, or had swallowed a large dose of prussic acid, most obviously from the effects of the medicine.”¹

Dr. Geo. Johnson expressed a like opinion to Dr. Anstie.

I have already referred to some apparently conflicting testimony on this point. I then gave the opinion of Bodington in favor of opium, rather than “the modern salts of the drug, they seeming to be the most

¹ “Stimulants and Narcotics,” London, 1865, p. 158.

dangerous ;” of Näcke, who found temporary albuminuria in 82 per cent. of the cases of delirium-tremens observed by him.

Austin Flint¹ says: “Opium given in large and enormous doses, as was formerly the practice, was conclusively shown by Ware to be pernicious. Sleep is the desired object, but narcosis is not a substitute therefor. It is hazardous to induce the latter. But an opiate, in small or moderate doses, is often useful. A quarter of a grain of the sulphate of morphia every five or six hours, or an equivalent of codeia or some other preparation, is the safe limitation as regards dose and intervals.”

Victims of the alcoholic habit must sooner or later become afflicted with hepatic and renal cirrhosis, in which condition there is of necessity imperfect nutrition and defective elimination of both food and tissue detritus. The nervous system is shattered by both mal-nutrition and chronic alcoholic poisoning. Is it surprising, then, that such a system is especially susceptible to the sudden shock-like action of a drug so powerful as morphia; rendered trebly so by its exhibition by the hypodermic method? It would seem that the tolerance established by one poison (alcohol) may be sufficient to withstand the initial dose of mor-

¹ “Clinical Medicine,” 1879.

phia, but that point being reached, or the limit of renal elimination being found, morphia exerts its baneful influence, and in a manner somewhat different from the narcotism of the average case. In this connection the cases of narcotism in alcoholic subjects, found at pages 88 and 91 are of interest, especially that of nearly fatal narcotism recorded by the Medico-Chirurgical Society's committee.

Case 2, by Dr. Lyman M. Willard, is of a like character, although here there is possibly more room for doubt that death was thus caused than in Case 1. The verdict of the coroner's jury seems to have been based on the supposition that a man who turns in bed several times in the night, who seems to sleep quietly, snoring once in a while when on his back, and where there was found *no congestion of the brain*, but congestion of the stomach and liver, and a tawny color and diminution in size of the latter, significant of cirrhosis, with kidneys somewhat enlarged, could not have died of morphia narcosis. No mention is made of the condition of the lungs, a very important point in this connection, I think. It seems hardly possible to my mind that a young man of good build and fair general health could, as drinking goes, produce cirrhosis of the liver and diffuse nephritis in a few months of debauchery. The doctor states that the kidneys were somewhat enlarged;

otherwise healthy. In case of palpable enlargement, a careful microscopical examination of these organs would be necessary to decide their freedom from disease. The man does not seem to have died of starvation. The fact that no congestion of the brain was found at the autopsy is the strongest argument against the idea that the man's death was caused by the morphia, for if enough of the drug was given to cause death by respiratory failure, there should have been congestion of the brain and its membranes, marked retardation of breathing, mechanically¹ congesting the cerebrum and its membranes. There is but one idea to be advanced in explanation, and that is the fact that death may have been caused by *gradual* failure of respiration and death by the heart, as has been known to occur in these cases.

Anstie says:² "If these (small stimulant doses) failed, however, larger doses of the same remedies were tried, but rarely, I believe, with beneficial result. The narcotism thus induced was unnecessary, and not unfrequently fatal; its depressing influence being excited, not gradually and by slow degrees, but suddenly and powerfully, depressing the heart's power in so rapid a manner as to cause collapse and death."

¹ Hammond, "Sleep and its Derangements," Phila., 1869.

² "Stimulants and Narcotics," Phila., 1865.

If death occurred in this case in this way there would be no trouble in understanding why there was no congestion of the brain and its membranes, and why the prominent symptoms of opium-poisoning were not present. As the case stands, I think there is reasonable doubt as to whether the death was caused by morphia. The brother's testimony should not, however, be taken without question. It would be natural for him to excuse any supposed neglect on his part by such a statement as he there made.

An interesting question, suggested by the history of this and the other cases of delirium-tremens here reported, is as to how far the effect of depresso-motors (the bromide of potassium and chloral), previously or simultaneously given in large doses, may render the exhibition of opium or morphine dangerous in certain conditions of the system. These drugs have a direct depressant action on the heart,¹ and the latter (chloral) on the respiratory centres.² So,

¹ In speaking of the treatment of strychnia-poisoning, Wood says (page 292): "It is obvious that the use of aconite or tobacco, in large doses, is accompanied with grave danger, on account of their influence upon the heart, and we have in bromide of potassium a substance devoid of any such objection," etc. This is a somewhat strange assertion in connection with the records of experiments at page 309, where it is said: "It is well established that large toxic doses of the bromide exert a direct paralyzing action on the heart, lessening both the force and frequency of the beat, and finally causing diastolic arrest."—"Materia-Medica and Therapeutics."

² Wood, "Materia-Medica and Therapeutics," Phila., 1877, pp. 309, 320.

also, has morphine in large doses. According to general experience in the use of drugs of one class, smaller doses of each, in combination, act fully as well and with as much power as larger doses of any one of them. Hence, it may be possible that the depressant action of morphia in these cases (mania and delirium-tremens) is due to the previous or simultaneous exhibition of chloral and the bromides in large quantity. Moreover, in both of these affections there has been little or no food taken, and that irregularly, and in delirium-tremens there is usually some organic disease of the liver or kidneys, and sometimes of the brain, heart or lungs.

There must, however, be present the condition of system that obtains in these diseases, for if we may judge from the few cases recorded, morphia in more than the ordinary amount, hypodermically, acts in an antagonistic manner to at least one drug that in large doses is a profound depressor of the action of the heart and lungs, death taking place in the majority of instances from failure of respiration.¹ I refer to aconite. The following case by Dr. F. H. O'Brien,² of this city, will illustrate what I mean:

"The patient, Miss M——, aged twenty-four, un-

¹ Fothergill, "Antagonism of Therapeutic Agents," &c., p. 43; Wood, *op. cit.*, p. 170.

² *N. Y. Medical Record*, Feb. 8, 1878.

married, took through mistake half a drachm of the tinct. aconiti rad., which was followed in twenty or thirty minutes by a sense of warmth in the stomach, nausea, and oppression of breathing. Shortly after this, followed numbness, tingling, and slight muscular weakness. She did not attribute her feelings to the drug, and in one hour from the time it was taken (4.30 P. M.) the dose was repeated. She started soon afterwards to walk a distance of two miles, and did not complain until about half way. On reaching her destination she began to stagger, and was soon completely prostrated. Her voice became very weak, and she complained of cephalalgia and lancinating pain in different portions of the body, but particularly in the joints. I was sent for, and arrived at 6.40 P. M. Learning that the patient had taken a poisonous dose of aconite, I administered the usual emetic, which was swallowed with great difficulty. I sent for Dr. Wm. H. Studley, who quickly arrived. I found the patient in the following condition: Axillary T. $97\frac{1}{2}^{\circ}$, P. 32, R. 10. Pupils dilated, extremities cold, loss of consciousness, extreme pallor of face with expression of great suffering, and there was a twitching of the mouth and eyelids. Emesis was produced. The stomach contained a considerable amount of fluid, which had an odor of alcohol. The retching continued, and

her condition each moment grew worse, the pulse becoming frequent and irregular, and respiration more difficult. By consent of Dr. S., I injected, hypodermically, fifteen minims Magendie's sol., just after which (not exceeding one minute) the symptoms became more alarming still, she having a slight convulsion. There was a spasmodic contraction of the laryngeal muscles, respiration ceased, and the pulse was imperceptible. Dr. S. did not observe me inject the morphia, and remarked that if I had not already done so it was useless to inject it.

"She was a dying woman; respiration had ceased, the feeblest pulsation could not be detected, the body was cold to the touch, and we had every evidence of impending dissolution. We had lost all hope in the case, but were endeavoring to detect a feeble impulse of the heart, when suddenly and to our surprise the pulse sprang up about the rate of forty per minute. The laryngeal muscles were relaxed and respiration began. Very soon the cheeks were flushed, and heat returned gradually to the extremities.

"The thermometer was again placed in the axilla, and registered $98\frac{1}{2}^{\circ}$. The retching continued, and in half an hour the pallor returned, there was general muscular tremor, and the pulse became frequent and irregular, as before. Ten minims Ma-

gendie's sol. was injected, and an enema containing twenty grains carbonate of ammonia and one ounce of brandy. She soon rallied as before, this time recovering consciousness, and complained of cephalalgia, burning sensation in the stomach, and severe pain in different parts of the body. At ten o'clock P. M. I injected ten minims more Magendie's sol., which seemed to quiet her, and at twelve o'clock she was asleep. The bladder had been evacuated four times since eight o'clock. 15th, 6 A. M.—T. 99°, P. 80. Has vomited only after the enemata, which were repeated at intervals of two hours. She complains of great muscular soreness, and movement of the body is painful. She is very weak, her grasp being scarcely perceptible. Champagne and mucilaginous drinks were given, and the enemata continued, but at longer intervals."

This patient fully recovered. A similar case is reported¹ by Prof. Alonzo Clark, of this city, in which the direct stimulant action of morphia was quite as decided and much more rapid.

Dr. Wm. H. Haynes, of this city, writes me of a similar case, where morphia hypodermically used acted with celerity and marked benefit.

The fact that one decided respiratory depressant

¹ *N. Y. Medical Record*, Jan. 3, 1880.

should, in large doses, act as a cardiac and respiratory stimulant, in cases of poisoning from a drug that kills by paralyzing the respiratory centres, is very hard to understand in the light of our present knowledge, and teaches us the importance of placing more dependence upon clinical than upon theoretical medicine.

Of Case 3 I have no particulars, but the reporter seems to entertain no doubts as to the cause of death. The dose, $\frac{1}{2}$ gr., seems rather large (the more so as the man was old, and as it was repeated in five hours' time). Anstie, in his paper on alcoholism,¹ gives $\frac{1}{2}$ gr. as the *maximum* dose, and $\frac{1}{10}$ to $\frac{1}{4}$ as the usual amount.

Case 4, reported by a physician of this city, who does not wish his name to appear, is one of the same nature as Case 2. There is no doubt but that this man died of morphia-poisoning, an autopsy only being needed to settle the matter beyond question. Here the doses were small, $\frac{1}{6}$ gr., repeated in two hours' time, and it is interesting to notice that the patient remained awake and talkative for two hours after the last injection; that he had previously had large doses of chloral and the bromide of potassium, and that his last sleep was not marked by stertorous breathing, although the respirations were as low as four per min-

¹ "Reynolds' System of Med.," vol. 2.

ute; that just after death the pupils were of natural size, and that the man who was young (36) was free from cardiac or renal disease.

With reference to this condition of the pupils it is worthy of notice that Wood states¹ that the pupils in opium narcosis are contracted, or, as death approaches, are widely dilated, and that inequality of the pupils may sometimes occur.

In Case 5, there seems a reasonable probability that death was thus caused, although it seems strange that such a result should ensue from $\frac{1}{4}$ gr. morphia by the mouth, and $\frac{1}{4}$ gr. subcutaneously, when the patient had, previous to the injection, received $\frac{1}{60}$ of a grain of the sulphate of atropia, and further injections of the same by another physician, after narcotism appeared. I think the case must be thrown out of our list, as it is not known how much atropia was given in all,² and as no autopsy was held; the more

¹ "Mat. Med. and Therapeutics," Phila., 1877, pp. 205, 214.

² In the *North Carolina Medical Journal* for April, 1879, a case appears where a woman was deeply narcotized by $\frac{1}{2}$ gr. morph. sulph., given hypodermically, for the relief of epileptiform convulsions occurring about the time of the menstrual flow. Atropia sulph. was used hypodermically, as follows:—3 P. M., $\frac{1}{20}$ gr.; 4 P. M., $\frac{1}{12}$ gr.; 5 P. M., $\frac{1}{8}$ gr.; at 6 P. M., $\frac{1}{4}$ gr.— $\frac{1}{2}$ gr. in all, in a period of 3 hours, According to the best knowledge on the subject, 1 gr. of morphia is antidoted by $\frac{1}{24}$ gr. of atropia (Bartholow and others). Here enough atropia was given to antidote 12 grains of morphia, and the symptoms point plainly to death from atropine-poisoning. An interesting article relative to this case may be found in the same journal, for September, 1879.

so as the man had been very intemperate for some time. The possibility of erroneously ascribing death to morphia is shown by the following cases :

Dr. Fifield,¹ after narrating some cases of nearly fatal narcotism resulting from the subcutaneous use of from $\frac{1}{8}$ to $\frac{1}{4}$ gr. of morphia, told of a case of labor where death was attributed to the hypodermic injection of $\frac{1}{4}$ gr. of the sulphate of morphia. The autopsy revealed rupture of a branch of the cœliac artery. Had no autopsy been held in this instance, death would undoubtedly have been laid at the door of the hypodermic injection, and with a show of reason.

A case of like nature is that occurring in the practice of Prof. Roberts Bartholow, where death from $\frac{1}{6}$ gr. of morphia was claimed, when in reality it was due to œdema of the glottis.

Case 7, may be taken as an example of that class of cases where the drug by the mouth alone would kill, if given in fair doses, there being decided idiosyncrasy in all members of the family. The case further illustrates the danger, pointed out by several of my correspondents, of giving morphia hypodermically after it has been given by the mouth. The same danger is illustrated in Case 5. If the

¹ "Proceedings of Suffolk District Medical Society," *Boston Medical and Surgical Journal*, Nov., 1876.

physician who attended the case is believed, the patient died of morphia-poisoning, and from small doses. If the reporter, the consulting physicians, and the father are believed, morphia was given by the mouth in inexact doses, the amount of which was guessed at, and will consequently never be known. With this conflicting testimony, and in the absence of an autopsy, I think the case should be classed as doubtful so far as the statistics of death from small doses, with reasonable intervals, are concerned. By it, however, the lesson of the existence of such a thing as idiosyncrasy and the danger attending the exhibition of this drug in these cases, and the danger of morphia by the skin after morphia by the mouth, is forcibly illustrated.

Case 6, further shows the danger of the subcutaneous use of morphia after giving opium by the mouth.

In Case 8, reported by Prof. Alfred C. Post, of this city, there is a reasonable probability that death was due to the morphia, the renal trouble, if present, undoubtedly predisposing to narcotism by reason of imperfect elimination. Cases of renal disease where this method of using morphia has been attended only by excellent results are detailed at page 74, as also some experiments performed by myself with the view of throwing some light upon this subject.

In Case 9, reported by Dr. Snook, of Kalamazoo, Mich., there seems a reasonable probability that death was caused by morphia; but without an autopsy one could not be *certain* of it. Take the following case as a further illustration of the error it is easy to fall into in this matter :

Dr. R. H. Sabin, of West Troy, N. Y., has very kindly written out this case for me in full: "Capt. R. R—, the patient spoken of in my previous communication, was a very active business man. Two years previous to his death he complained to me of a distress after eating. I gave him some medicine which relieved him. Something like a year after, he complained to me that after eating he would have a pain in the stomach, would have to stop for a few moments, and then the pain would pass off. He could not, during the last year, walk up a hill without stopping to rest. He often left his house in the evening to call on me, with the intention of consulting me in regard to it; would sit all evening talking of everything else, and go away without saying anything about it. The day of his death he went to church in the morning, where he was taken with pain about the heart, so severe that he left the house, went home, applied mustard to the chest, and sent for me. When I saw him he was suffering severely. I used chloroform by inhalation, and the pain soon changed

to the left shoulder, and was described by him as being most excruciating. Fearing that irritation in the stomach might be causing the pain, I gave an emetic of mustard and ipecac. He soon vomited, but the pain was not relieved. I then gave $\frac{1}{8}$ gr. morphia, and continued external applications. As this did not relieve the pain, I got my syringe and gave $\frac{1}{4}$ gr. morphia under the skin over the shoulder, where he complained of the severe pain. About two hours from the time he was first taken he began to get easier, though he was not entirely relieved, but so much better that he dropped into a quiet sleep. In ten or fifteen minutes he awoke and said he was much better, though in some pain. He slept again, and I left him in the care of his wife and neighbors. About three-quarters of an hour passed, his wife speaking to him every few minutes, he showing by his answers that he was perfectly rational. About 4 P. M. his wife noticed a change in him. I was sent for—arrived soon after, but found him dead.”

“Post-Mortem.—Body well nourished ; right lung slightly congested, and with adhesions between pleural surfaces. The coronary arteries were ossified, the one going to the left side being entirely obliterated. The walls of the left ventricle were very thin and softened. The autopsy was made by

Drs. Hun and Hails, of Albany, and Dr. McLean, of Troy, in the presence of several other medical gentlemen. These gentlemen considered the death due to angina pectoris, and believed that the morphia had nothing to do with it. There was nothing abnormal about the kidneys or stomach."

In Case 10, reported by Dr. C. Carroll Lee, of this city, death from morphia seems to be unquestioned, and the doctor is an excellent observer, whose opinion is worthy of full credit. This case, like those reported at page 92, would seem to be in accordance with the views of Fothergill, stated at the same page.

Of Case 11, we have no particulars.

Of Cases 12, 13, 14, and 15, the evidence is not sufficient to warrant us in saying that death was due to morphia, hypodermically used. It is probable, however, that one at least of these four deaths was thus caused.

Cases 16 and 17, reported by Dr. E. Wenger, of Gilman, Ill., are hardly worthy of a place here, owing to the fact that the details are very meagre; there was no autopsy; and in case 16, the disease itself seems to have been sufficient to cause death. Had this patient died and no morphine been given, I think no question would have been raised as to the cause of death. Such cases are dying every day, in precisely the same manner, and without the use of

morphine; indeed, many cases of cure are reported by this very plan of medication in this disease. In Case 17, reported by the same gentleman, the death was almost too rapid (30 minutes) for it to be caused by morphia. The meagre detail points as much to disease of the heart as to death from opium narcosis. I think there is no question as to the honesty of the belief entertained by Dr. Wenger as to the cause of death, but I think he comes to this conclusion on rather meagre grounds. The case may have appeared sufficiently conclusive to the doctor who saw it, but it seems as though so important a matter would have sufficiently impressed itself upon his mind to enable him to state the grounds of his belief; the more so, as the subject of death from the hypodermic injection of morphia was a new and startling thing at that time. Furthermore, in Case 1, as much as one grain of morphia was used, a fact not stated in the *Journal* article, and in his, Case 3, the amount of morphia used is not known, and as the patient died within 30 minutes, something unusual (as puncturing a vein) must have occurred, if the fatal result was due to the morphia.

Cases 18, 19, 20, 21, 22 and 23, reported by Dr. E. F. Ingals, are worthy of consideration only from the fact that Dr. Ingals vouches for the truth of the reports. The reports themselves are anything but

satisfactory. The doctor might have given some important part of the case histories, and certainly the doses used, without in any way compromising the gentlemen who reported the cases. The opinions of any one man, though he be honest and thoroughly educated, as is Dr. Ingals, are of necessity warped by a certain amount of bias, and error in reasoning upon such cases will oftentimes creep in.

Hence, the opinions of one man upon so important a question as this are by no means conclusive, and only of value inasmuch as they awaken other men to a study of the subject and excite discussion in which truth may at last be reached. It is heartily to be wished that the doctor had given fuller information than he has done. One of the cases, in this gentleman's interesting article, illustrates the danger of giving morphia hypodermically after giving it by the mouth.

In the case of the patient upon whom ovariectomy was performed, the amount of morphia was excessive and it is not surprising that death ensued.

In Case 25, death was probably due to the morphia, and was, perhaps, a mercy to the patient.

In Case 26, it is probable that the morphia had little, if anything, to do with the patient's death; although in such a condition of kidneys (probably renal

cirrhosis) the elimination of morphia would be very slow and narcotism very likely to result from a small dose.

In Case 24, there is reason to believe that death was due to the injection of morphia, and very forcibly illustrates the possible danger (borne out by other cases) of giving morphia hypodermically after administering opium or morphia by the mouth, and of using it in those diseases where the tendency is to death by the lungs, the blood being already in a poorly ærated condition.

In Case 27, we can say as positively as anything can be said in medicine, that death was due to the morphia, although given in but small doses (the patient being accustomed to larger amounts, if the wife's statements are to be believed), and at reasonable intervals.

It has often been asserted that narcotics are harmless so long as intense pain is present, their whole force being expended in relieving the pain. This may be true in the majority of instances, but in some cases it is not so. Witness this case and some others reported under the heads of narcotism and of death.

In Case 28, the dose was excessive. The case was one, however, where euthanasia was possibly justifiable.

In Case 29, there is reasonable grounds for believing that death was due to the morphia injected, although in small amount.

Although Cases 30 and 31 are lacking in detail, it is to be supposed that the eminent gentlemen composing the Committee of the Medico-Chirurgical Society would fully assure themselves of the truth of the matter before announcing these facts.

In Case 32, death was in all likelihood due to the injection, and to the fact that it was made directly into a vein. It is quite supposable that a patient suffering from trismus should die in a hospital ward without attracting the particular attention of the nurse. This and the one reported by Dr. Parker are the only cases of death that I know of from injection of this drug into a vein. The demonstration of the fact was made with Dr. Clark's usual accuracy.

The treatment of tetanus and trismus by large doses of morphia bears the stamp of authority. This is one of the diseases where large doses of the drug are sometimes used with marked benefit, narcotism rarely showing itself.

In Cases 33 and 34, there is no absolute proof of death from morphia, as the reporter himself admits. In Case 34, the woman's age, her great prostration, and the fact that the pupils did not respond to the atropia, would throw much doubt upon the matter. The

question here arises as to whether it is a safe proceeding to give as much atropia as was here given when the action of the heart must have been very weak.

The other cases are, of course, doubtful, but the probability is that in at least one of them death was due to the morphia used. Acute diabetes is a somewhat novel affection.

CHAPTER VI.

TREATMENT OF OPIUM NARCOSIS — ATROPIA —
STRYCHNIA — AMMONIA — COFFEE — ELECTRI-
CITY — ARTIFICIAL RESPIRATION — OXYGEN —
COLD DOUCHE — FLAGELLATION — WALKING.

SO much has been done in the matter of experiment upon both men and animals, to determine the antagonism of atropia and morphia (opium and belladonna), and so many cases have been given in its support, that the treatment of opium or morphine narcosis seems to many a very simple matter. However numerous and complete these experiments may have been, and however many cases have responded to this form of treatment, the fact still stands that not a few victims of opium-poisoning die in spite of the careful and conscientious carrying out of the treatment in every detail. Such cases, though possibly proving themselves the exception to the rule, teach us that full reliance cannot be placed on one measure alone. A person who has taken a fatal dose of morphia may have had the effects of that drug

thoroughly antidoted by the action of atropine, and yet die from some cause other than the immediate effects of the drug. Indeed, there is reason to believe that in some cases the patient is actually killed by the antidote.¹ It will be well, then, to consider atropine as a valuable agent in saving life jeopardized by poisonous doses of morphine, and to study all those agents the sum of whose actions combat as nearly as possible the fatal tendencies of opium or morphia. The tendency to death in poisoning by opium or its alkaloid, morphia, is by failure of respiration. Hence those means that combat this tendency are the most valuable. We may arrange all the agents necessary to use as follows :

<i>To Aid or Establish Respiration,</i>	{	Atropia,	{	Sylvester's method (modified),
		Strychnia,		
		Ammonia.		
		Artificial respiration,		Electricity.
		Oxygen.		
<i>To Stimulate the Heart,</i>	{	Subcutaneous injection,	{	Ammonia,
				Whiskey,
				Caffeine or coffee.
		Intravenous injection,		Ammonia.
		Enemas,		Hot water,
				Whiskey,
				Ammonia.

¹ *North Carolina Medical Journal*, April, 1879.

To Produce General Stimulation, { Cold douche and warm douche, alternately,
Hot irons to epigastrium,
Flagellation,
Walking.

To Counteract Soporific Effects, { Caffeine,
Ammonia,
Cold douche.

To Produce Diuresis.—Caffeine. (?)

Only those measures that are of service in poisoning by morphia hypodermically will be discussed here. In reality, the only difference in treatment of narcosis, resulting from morphine by the skin and opium or morphine by the mouth, is, that, in the latter case, the stomach-pump or emetics are to be used in addition to the other means, of which I shall now speak.

ATROPIA—BELLADONNA.—The question as to whether belladonna is a physiological antidote to opium has long been a debated point, the discussion extensive and the writings voluminous. The feeling at the present day, amongst those who review the history of the question fully, fairly and dispassionately, seems to be that these two drugs are mutually antidotal in certain particulars only, and that the benefits to be derived from the employment of belladonna in opium-poisoning are confined to the

very limited area of direct stimulant effect on the respiratory centres. As favoring the view that these two drugs and their alkaloids are mutually antidotal in man, we have the experiments and conclusions of Mitchell, Keene and Morehouse,¹ Bennet,² Bartholow,³ Fothergill,⁴ the statistical and other papers of Norris,⁵ Lee,⁶ Oliver,⁷ and Smith,⁸ and many cases⁹ of poisoning where such antidotal action is fairly well proven.

¹ *American Journal Med. Sciences*, July, 1865.

² *British Medical Journal*, 1874, p. 547.

³ "The Hypodermic Method," &c., Philadelphia, 1878.

⁴ *Am. Journ. Med. Sci.*, October, 1862.

⁵ *Ibid.*, Jan., 1862.

⁶ Thesis, *Ibid.*, July, 1876.

⁷ *Phila. Med. and Surg. Reporter*, Nov., 1874.

⁸ "Antagonism of Therapeutic Agents," Phila., 1878.

⁹ S. Wordsworth Poole, *Practitioner*, vol. 13, p. 251. D. B. Wilson, *Philadelphia Med. and Surg. Reporter*, Nov. 17, 1878. H. Wardner, *Medical Examiner*, Feb. 15, 1874. Antonio di Bernardo, *Gazette Hebdomadaire*, No. 8. J. F. Prentiss, *Chicago. Med. Journal*, Dec. 1866. Motherwell, (*Australian Med. Journal*, Oct. 1861), *Med. Times and Gazette*, Jan., 1862. Thos. Anderson, (*Monthly Journal Medical Sciences*, April, 1854), *Am. Journal Med. Sciences*, July, 1854. Johnson, *London Med. Record*, April 9, 1873; 300 cases in China treated with atropia with success, the best results being obtained in the severer cases; also quoted in "Ringers' Handbook," N. Y., 1875, p. 50. M. S. Buttles, *N. Y. Medical Record*, Aug., 1868. H. S. Downs (11 cases), quoted by J. P. McGee, *Am. Journal Med. Sciences*, July, 1869. D. S. Bucklin, *N. Y. Medical Journal*, vol. 20, p. 165. Radcliffe (*London Lancet*), *Practitioner*, July, 1868, p. 247. *Practitioner*, vol. 4, p. 59. Ulrich, *Medical Summary*, Nov., 1879. C. H. Lewis, *Detroit Lancet*, Nov., 1879. Greenway, *British Medical Journal*, Oct. 5, 1878. Black, *Canada Medical Record*, Dec., 1879; and many others.

Dr. Alfred Ludlow Carroll, of New Brighton, Staten Island, writes me as follows :

“ As to the antidotal action of atropia—still disputed by Harley and some others—I have quite recently had another instance, in the person of a gentleman who took nearly an ounce of laudanum with suicidal intent. I saw him about an hour afterwards, when, of course, most of the drug must have been absorbed ; and narcosis was already commencing. I gave him an emetic of turpeth mineral, followed by warm mustard-water, as a preliminary measure ; and, as soon as I could procure the solution, injected $\frac{1}{12}$ grain of atropia, the effect of which upon the pupils was marked within ten minutes. With constant exercise and a repetition of the atropia two hours later, he made an excellent recovery.”

Prof. John J. Reese thinks that the weight of evidence is in favor of the mutually antidotal powers of these two drugs, as concluded from a study of clinical cases. He seems to think the results of experiments on animals far from satisfactory in establishing the question of antagonism. In a recent letter the doctor tells me that he has since seen no reasons for changing his opinions as thus stated.

¹ *American Journal Medical Sciences*, April, 1871, p. 380.

Dr. John Harley¹ does not believe that there is sufficient antagonism between these drugs to be of material service in cases of poisoning. He furthermore believes that, when given together, the atropia intensifies the hypnotic action of opium, he having proved this to his own satisfaction on the human subject. This seems to be in accordance with the views of Bartholow² and Miller,³ and the facts presented by some of the cases reported to me.

Anstie does not believe that these two drugs are mutually antidotal. He says: "It may be possible that in poisoning with one narcotic, a different narcotic, in doses so small as to have only a stimulant action, might prove beneficial, as is clearly the case with small doses of tea or coffee in poisoning with alcohol. But, that the general poisonous action of one narcotic can remedy the general poisonous action of another, appears extremely improbable, and should be rejected until there is some better evidence of it than we at present possess."

Dr. A. Falck, a reference to whose article is to be found in *Schmidt's Jahrbücher*, calls attention to the fact that the so-called antagonism of opium and

¹ "Gulstonian Lect.," *British Medical Journal*, April, 1878, and "The Old Vegetable Neurotics."

² "Materia Medica," pp. 368-9.

³ *British Medical Journal*, Nov. 17, 1877.

⁴ "Stimulants and Narcotics," Phila., 1865, p. 207.

belladonna was noticed by Albinus and others, as early as 1570. He (Falck) does not believe that these drugs are antidotal in the true sense of the term, as will be seen from the following: "Atropin and physostigmin; strychnin and chloral hydrate; chloral hydrate and atropin; morphine and atropin, are all respectively antidotal in a pharmacological sense, but not in a physiological one. That is, the one will diminish the symptoms caused by the other, but will not produce contrary physiological effects."¹

Dr. Corona,² from a series of very full, careful and varied experiments on animals, comes to the following conclusions: "That a partial physiological antagonism between atropia and morphia may be recognized, but that the theory of a mutual therapeutic antagonism cannot be accepted. Morphia is available as an antidote in poisoning by atropia, but poisoning by the former drug may not be combated by the latter."

Brown Sequard³ affirms his disbelief in their mutual antagonism, basing his opinions upon experiments made on animals.

With reference to the value of experiments on animals with the view of obtaining reliable facts relating

¹ *Philadelphia Medical and Surgical Reporter*, Dec. 13, 1879.

² (*Giornale di Medicina Militaire*) *Practitioner*, vol. 18, p. 132.

³ *Journal de la Physiol.*, Oct. 1860, p. 726.

to the use of these drugs in man, the protest of Mitchell, Keene, and Morehouse¹ is of interest :

“ And here it is not unfit that we should criticise the loose way in which therapeutic inferences have been drawn from experiments on animals, where, of necessity, poisonous doses have been used and their effects studied. Most of the symptoms which ensue when a dose of any ordinary narcotic has been taken are so completely subjective that we can learn their existence only by the statements of the person who feels them. Even when these drugs are given in poisonous doses to animals, it does not follow that the resultant symptoms will, either in degree or in kind, correspond accurately to those which occur under like circumstances in man. Dr. Anstie, in his recent work on Stimulants and Narcotics, has very well illustrated this proposition. We ourselves have seen a dog recover after the subcuticular injection of *twenty-five grains* of atropia thrown, in divided doses, into various parts within a few minutes.

“ The temptation to study poisons in cold-blooded creatures is always very great, because in these animals certain facilities for toxicological study are presented which do not elsewhere exist. But, as might be expected, analogies fail us more and more as we

¹ *Am. Journal Med. Sciences*, July, 1865.

pursue our researches upon creatures remote from man. No more striking example of this is to be met with than one of us, Dr. Mitchell, has recorded in the *Journal de la Physiologie*, for Jan., 1862, where the author details at length a series of experiments upon snapping-turtles which he attempted to poison with woorara.

“In this paper it is shown that while only $\frac{1}{96}$ of a grain is required per pound of the animal to destroy a rabbit within a few minutes, the snapping-turtle is poisoned with difficulty, and not surely, by $\frac{1}{7}$ of a grain for each pound of its weight.

“It would be easy to extend these examples and to show, not that we should cease to use animals for the study of poisons, but that in order to appreciate properly any toxic agent, we must follow its effects through a wide range of created existence from vegetable to man, and that its therapeutic uses are to be learned only from its influence upon the being to whom, finally, it is to be of medicinal value.”

Prof. H. C. Wood, of Philadelphia, whose powers of observation and analysis are of the highest order, says: “When the subject in hand is looked at from its clinical aspect, the conclusions of Dr. Bennet are confirmed. To tabulate and discuss the cases of opium or belladonna poisoning, in which the counter-narcotic had been used, would require very many

pages, and I, therefore, can only state my opinion that these records establish the therapeutic value of atropia in opium-poisoning; but this does not indicate, much less prove, complete antagonism between the two drugs. No one would question the value of alcohol in certain stages or conditions of opium-poisoning, and yet no one would claim that opium and alcohol are in any sense antagonistic. In opium-poisoning death occurs chiefly through failure of the respiration. Atropia is the only known drug which exerts a decidedly stimulating effect upon the respiratory centres. It is evident that in advanced stages of opium-poisoning this property renders atropia an invaluable remedy. In protracted opium narcosis the cardiac and vaso-motor actions of atropia are of service; but it should never be forgotten that the main influence for good is upon the respiratory centres. The first improvement from atropia in these cases is, usually, increased frequency of respiration; and as the breathing becomes less embarrassed the other symptoms ameliorate, largely because of the increased æration of the blood.”¹

Fothergill² adds two drugs to the list of direct respiratory stimulants: “There can exist no longer any doubt that we possess in atropia, in strychnia

¹ “*Materia-Medica and Therapeutics*,” Phila., 1877, pp. 250-1.

² “*Antagonism of Therapeutic Agents*,” Phila., 1878, p. 109.

and in ammonia most powerful means for acting upon the respiratory centres when these are being paralyzed by toxic agents."

A strong point in favor of the hypothesis of the mutual antagonism of these two remedies is the fact, if it can be well proven, that atropia exercises a directly controlling and curative effect on some of the unusual manifestations of morphia (convulsions, tetanus, etc.) where its beneficial effect could in no way be referred to its stimulant action on the respiratory centres (see p. 231). I think that we must conclude from what we at present know that we are not justified in simply giving atropia in every case of opium narcosis to which we are called, with the expectation that atropia *alone* will do the entire work without aid, even if they are mutually antagonistic. There are other measures nearly, if not quite, as important, and should a patient die without their use, the physician must, of necessity, feel that there are fair grounds for the belief that death was due to his culpable neglect.

It has been experimentally and clinically demonstrated that about $\frac{1}{23}$ gr. of atropia should be exhibited for every grain of morphia taken, and *vice versa*. This is, of course, not exact, the amount necessary in each case being decidedly modified by special idiosyncrasy and diseased condition, both as regards opium and

belladonna. The physician must decide alone from the condition of the pulse and respiration.

If the respirations, after one or two repetitions of fractions of a proportionate dose, increase in frequency and the pupils commence to dilate, the hand should be stayed and other measures employed to still further better the patient's condition. Too much atropia may prove decidedly injurious, and, as a rule, the physician who puts implicit confidence in the antagonizing power of atropia, in the excitement of the hour, is very apt to overstep the bounds of safety. One such case has already been cited.

On this point Bartholow¹ says: "It cannot be too strongly insisted on, in this connection, that belladonna in too large quantity, or too long in action, exhausts the irritability of the unstriped muscular fibre, and thus induces the very state which its administration was intended to relieve. The state of the pupil, the action of the heart, and the condition of the reflex movements are the guides to the administration of belladonna in cases of opium narcosis. The smallest quantity of belladonna which will dilate the pupil, raise the tension of the arterial system, deepen the respiration, and re-establish the reflex excitability, should be used. The author has a strong conviction, arising from some painful personal expe-

¹ "Materia-Medica," pp. 368-9.

rience, that it is a fatal error to attempt to restore a patient in opium narcosis to complete consciousness by repeated doses of belladonna. The action of these agents, combined, is to produce profound sopor, and this is not a condition of danger so long as the pulse, respiration, and reflex movements, are in good condition. To substitute belladonna narcosis for opium narcosis is only increasing the hazard under which the patient is already struggling."

Prof. H. C. Wood¹ likewise deems this a matter of considerable moment, as is here shown: "It is a matter of the gravest practical importance to decide when, how, and in what quantities, the mydriatic should be employed. The exhibition of belladonna should, I think, commence as soon as there is decided failure of the respiration. The stomach is so paralyzed in the narcosis that it is uncertain how fast absorption will take place in the viscus; and the drug should always be given hypodermically, in the form of the alkaloid, if possible. The first injection of atropia should be of such size that it could not possibly do harm, and $\frac{1}{40}$ of a grain is, in most instances, a fair commencing dose. Very generally several repetitions of this are necessary, and the delicate practical point is to decide how often these repetitions shall be indulged in.

¹ "Materia Medica and Therapeutics," &c., p. 251.

“I think that very frequently too much atropia is given, and believe that often a great deal of firmness is required in these cases not to use it too freely, especially since reliance is generally placed upon the pupils as a guide. They are, however, a very unsafe guide, as is apparent when it is remembered that whilst opium contracts them by influencing the nerve centres, atropia probably dilates them by acting on the peripheral nerves. It must not be forgotten that in doses of sufficient magnitude atropia paralyzes the nerve trunks, and may thus increase the danger. A cardinal principle should, therefore, be to give no more of the mydriatic than is absolutely necessary. One-fortieth or one-sixtieth of a grain may be injected every fifteen, twenty, or thirty minutes, as the urgency of the symptoms may demand. The judgment should be formed from a bird's-eye view of the whole case, fresh atropia not being given so long as the respiration and other symptoms are undergoing amelioration, but the dose being renewed so soon as any tendency to relapse is manifested. Thus, if, under the influence of atropia, in a case the respirations had risen from four to eight per minute, I would not use the counter-poison again until there was manifested a tendency for the respirations to grow less frequent or unless, for a long period, there had been no improvement.” I quote Dr. Wood at this length

because he so aptly expresses in a manner that cannot be improved upon what I deem safe and sensible practice.

STRYCHNIA.—Fothergill¹ asserts that strychnia has a decided power over respiration, acting here, as elsewhere in the body, as a tonic. If this be true, and there seems very little reason to doubt it, then, in opium poisoning where there is decided embarrassment of respiration, we have in strychnia a valuable respiratory stimulant. Dr. Geo. A. Foote² gives the following testimony in support of this view: "The antagonism of opium to strychnia is worthy of special attention. Dr. A. S. Jones, an intelligent physician of Warren County, administered, by mistake, three grains of strychnia to a valuable pointer dog. Soon its characteristic effects, pain and convulsions, followed. In order to relieve the suffering and, if possible, to save the life of the animal, he injected six grains of morphia within two hours after discovering his mistake. The recovery was perfect, and the dog enjoyed forty-eight hours of profound and delightful repose. Being desirous of testing, for myself, this antagonism, I made two similar experiments—giving one and three-fourth grains of strychnia to one dog, and two and a half to another.

¹ "Antagonism of Therapeutic Agents," *Phila.*, 1878, pp. 107, 117.

² "Transactions of the Med. Society of the State of North Carolina," 1877, p. 69.

The toxical effects were soon manifested, both animals exhibiting signs of extreme suffering. I then injected one grain of morphia every half hour into each of my canine patients, until four grains had been used to counteract the smaller dose of strychnia, and six grains to counteract the larger dose. The spasms yielded readily, the pain abated, and both dogs recovered, after having slept about two days. I related the above experiments to my friend Dr. L. J. Picot, a member of this Society, who soon had an opportunity to test the treatment in the case of a gentleman who, with supposed suicidal intent, had taken strychnia in quantity sufficient to produce appalling convulsions. He successfully met the emergencies of the occasion by the hypodermic use of five grains of morphia in divided doses at short intervals. The case was reported to this Society (see *Proceedings*, 1875). Prof. John J. Reese denies the antagonism of these agents (see *American Journal of Medical Sciences*, 1871, April number). He administered to a dog hypodermically *one grain* of sulphate of morphia, and after waiting *ten minutes* he *injected half a grain of strychnia*. The animal *died* in twenty-one minutes. Now I think that Dr. Reese's failure was due to the small quantity of morphia used. Strychnia has acquired a reputation as a poison scarcely inferior to that of prussic acid ;

and yet, if I do not greatly err, we have in the hypodermic use of morphia a potent instrumentality for counteracting its fatal effects.

“And here let me mention a case reported by Dr. Charles Duffy, of Newburn, N. C. He says: ‘I have recently had a brilliant recovery from poisoning. The patient had taken three grains of morphia and one hundred and sixty of chloral. I injected hypodermically, *one-twelfth of a grain of strychnia*. In less than fifteen minutes a slight tonic spasm ensued. The patient, who but a few moments before could not be aroused by shaking, flagellating, &c., now, as if by magic, became semi-conscious—the dusky hue giving place to the natural color—like a cloud to a ray of sunshine.’ ”

It would be well to use it and atropia together, keeping them in solution, or, what is much more convenient for carrying in small compass, in powder. The following formula would give the required strength in a few drops ready for subcutaneous injection.

R. Strychniæ Sulphatis.....gr. i.
 Atropiæ Sulphatis.....gr. ii.
 Aquæ Destil.....℥ ii.

M. Ten minims gives $\frac{9}{16}$ gr. strychnia and $\frac{4}{13}$ gr. atropia.

Or with caffeine :

R. Strychniæ Sulphatisgr. i.
 Atropiæ Sulphatis.....gr. ii.
 Caffeinæ Citratisgr. 96.
 Aquæ Destillat..... $\frac{3}{4}$ ii.

M. The same strength as the above with the addition of 1 grain of caffein to every 10 minims of solution.

Or when in powders :

R. Strychniæ Sulphatis.....gr. $\frac{1}{2}$.
 Atropiæ Sulphatis.....gr. i.
 Caffeinæ Citratisgr. 48.

M. Fiat chart, no. 48.

Each powder contains $\frac{1}{16}$ gr. strychnia, $\frac{1}{4}$ gr. atropia, and 1 gr. caffein.

It would not be advisable to commence with more than $\frac{1}{90}$ gr. of strychnia hypodermically, nor should the total amount employed exceed $\frac{1}{20}$ gr., although more than this has been used. If this fails to give relief, by assisting respiration, it will be both useless and hazardous to venture upon larger doses. Toxic doses of this drug would still further embarrass respiration and increase the patient's danger. The minimum fatal dose recorded is "something under half a grain."¹

¹ H. C. Wood, *op. cit.*, p. 292.

ARTIFICIAL RESPIRATION.—The methods of producing artificial respiration may be divided into mechanical and electrical. Of the former there are several excellent plans now in use, the best of which, probably, is a modification of the Sylvester method. It is the more advantageous as it can be performed with the patient in the sitting posture. It has been employed with success by Dr. H. P. Campbell¹ in a case of this kind, and is described as follows:—

“ The patient was supported in the sitting posture, by an assistant kneeling on the bed at his back and holding his head erect between his hands; two other assistants, standing on each side of the patient, now took charge of an arm each, holding the limb firmly at the elbow and upper part of the forearm; the tongue was now pressed down by the handle of a spoon, or the fingers introduced into the mouth; the assistants having charge of the arms were now directed to elevate these limbs simultaneously, carrying them above the head at an angle of about forty-five degrees, and dragging upon them so as to slightly lift the patient; the arms were then depressed and brought down close against the sides of the thorax so as to compress the chest.

“ The effect of these movements was the following:

¹ Monograph, “Caffein as an Antidote in the Poisonous Narcotism of Opium,” Augusta, Ga., 1860.

At each attempt at lifting the body by the arms in this way, forcible *traction outwards* was made on the walls of the chest, through the pectorales major and minor muscles, the serrati and parts of the two latissimi dorsi muscles—giving rise to expansion of the walls of the thorax; the air was thus caused to enter forcibly into the lungs, and thus *inspiration* was completed. The arms were then brought steadily down and pressed against the sides of the thorax and abdomen—compressing them and expelling the air forcibly from the lungs and effecting *expiration*.

“Under the use of the artificial respiration, the appearance of the patient was much improved. The color was restored to the face, the lips became redder, and the countenance more natural, though the relaxation of the muscular system was by no means lessened; if the head was left unsupported for an instant, it fell forward as suddenly and forcibly as that of a dead man. The artificial movements were continued for more than an hour, and though the color of the patient was improved and the heart’s action became normal, still, when they were omitted, there was found no improvement in the natural respirations, these being still *but four in a minute*, as before artificial respiration was applied.”

A little atropia given hypodermically would probably have made the effects of artificial respiration

more apparent and permanent. Even without it this patient, after a time, began occasionally to take a natural inspiration, until, finally, breathing was normal. As in cases of asphyxia from drowning, artificial respiration should be kept up for a long time. It is an interesting fact in this case that as soon as the patient was allowed to resume the prone position all efforts at natural respiration ceased.

ELECTRICITY is another important measure at our command with which to establish or assist respiration. In the *Annales d'Electricité*¹ are recorded four cases of opium-poisoning, in which, after all other means had failed, electricity proved successful. No mention is made of belladonna in these cases. One pole was placed at the back of the neck and the other at the perineum.

In Dr. Trask's case,² already referred to, where five grains of morphia were taken by the mouth by mistake, and where $\frac{7}{16}$ gr. atropia sulph. was used hypodermically, electricity was also employed, and with signal benefit. An electrode over the phrenics on each side of the neck gave the best results.

In the case reported by Dr. C. T. Jewett, of this city, excellent results were had from one pole at the back of the neck and the other over the pit of

¹ *Boston Med. and Surgical Journal*, 1868, p. 208.

² *New York Med. Journal*, vol. 20, p. 165.

the stomach; breaking the current as often as was necessary.

Dr. Geo. M. Schweig¹ relates a case of poisoning from seven grains of morphia (Magendie's solution). He first injected $\frac{1}{24}$ and then $\frac{1}{60}$ gr. sulphate of atropia hypodermically. Slight dilatation of pupils; no effect on opium narcosis. Electricity was then tried. The poles were placed over the phrenic nerves, causing inspiration; diaphragm was allowed to relax by breaking current as soon as inspiration was complete. None of the other respiratory muscles would respond to a very strong current. The patient finally recovered.

More atropia might have been used in this case with advantage. It is not surprising that the small amount employed did not materially affect the narcosis. About $\frac{1}{3}$ of a grain should have been used.

Care should be taken not to use too strong a current, or to use it too long. As the breathing improves, gradually diminish the force of the battery.

So familiar is the profession with the use of the battery in these cases that it does not seem necessary to go into details.

INHALATION OF OXYGEN.—Prof. H. C. Wood,² from whose very able work I have already so largely

¹ *N. Y. Med. Journal*, vol. 19, p. 278.

² *Op. cit.*, p. 251.

quoted, writes as follows: "The double nature of profound opium narcosis must not be lost sight of: the blood is saturated with carbonic acid almost to the dead-line, and much of the unconsciousness, much of the failing circulation, much even of the embarrassed respiration, is due to the presence of this gas. As soon as the system is in a measure relieved of this load it begins to rebound; emetics act, consciousness returns to some extent, the circulation frees itself, and the road leading towards health is entered upon."

Improvement of the respiratory function by medical and mechanical means, tends to better this condition, which may, however, be further relieved by the inhalation of oxygen. Not only is the patient suffering from an excess of carbonic acid, but also from a lack of oxygen.

John Ellis Blake¹ used inhalation of oxygen with excellent success in a case of poisoning by aconite, other measures being also employed. This treatment was suggested by Dr. T. G. Thomas, who had employed it successfully in the cyanosis of croup, pneumonia, etc. Dr. Blake's method is as follows: "A small rubber tube being connected directly with the copper reservoir, the other end, terminated by a small nozzle, was inserted in one nostril, leaving the

¹ *N. Y. Med. Journal*, vol. 21, p. 361.

other free to admit common air. A small jet of gas being now permitted to escape, on closing the galvanic circuit the lungs were filled with this highly oxygenated air. Keeping up artificial respiration, with this new, powerful agent to help, good effects were soon seen in the lessening of the lividity of the face and lips, and a less corpse-like look generally. The amount of oxygen used in this case was four hundred gallons." The patient's condition just previous to the use of the oxygen was as follows: "The body was becoming quite cold, no higher temperature being observed at this time in the mouth than 95°-96° F.; cyanosis marked, not only the face being darkly blue, but the same color being observable under the nails. The following interesting article¹ by Dr. Charles B. Ball, Surgeon to the Blaenavon Iron Works, Pontypool, bears directly upon this matter:

"On January 16th, 1877, I attended a family who were found insensible in bed that morning. I found a man aged 55, his wife aged 48, and daughter aged 16, in one bed, in a very small room, quite insensible. There were the remains of a large fire in the grate, the chimney of which was imperfect. Upon admitting plenty of air and using the usual restoratives, the

¹ (*British Med. Journal*, April 20, 1878, p. 562) *Braithwaite's Retrospect*, Jan. 1879, p. 218.

woman became sufficiently conscious to say that she remembered being up at 2 A. M., when she experienced considerable difficulty in breathing, and a severe headache; after which she remembered nothing further till she was restored to consciousness. The man became semi-conscious, but the girl remained perfectly insensible. I had her, therefore, removed to another and well-ventilated room, where artificial respiration was resorted to. She now had violent tetanoid convulsions, at intervals of a few minutes. The muscles of the face were, however, exempt from the general spasm. The pupils of the eyes were of average diameter, but dilated in bright light and contracted when the light was removed. This phenomenon was also noted in the man's case.

"During the day, the man and woman progressed favorably, but the girl became much worse, the convulsions appearing at longer intervals and the intervening coma being more profound. The treatment now adopted in her case was the application of a blister to the back of the neck, stimulating enemata, and the hypodermic injection of pure ether. None of these measures had the desired effect, and at ten o'clock that night she ^{was} apparently dying. The convulsions had entirely subsided. The pulse at the wrist could not be felt, and the respirations were few and shallow. Through the kindness of

Mr. P. C. Gilchrist, F. C. S., I now obtained a large supply of pure oxygen, which, by a little arrangement of an ether-inhaler, I was enabled to give her to breathe in any degree of dilution required. At first equal parts of air and oxygen were given, but afterwards the proportion of oxygen was increased. It produced a rapid and most marked effect ; the pulse soon became perceptible and quickly increased in force. After the inhalation of about four gallons of gas, it was discontinued, respiration and circulation having been well revived. During the inhalation the convulsions recurred, having been absent for several hours. Although not sensible during the night, she was decidedly better, being able to swallow fluid nourishment, and the convulsions gradually subsiding. She did not recover consciousness till the morning of the 18th, being forty-eight hours from the time I first saw her.

“The different degrees in which the persons suffered, although exposed to the same poison, appear to be worthy of note. The intensity of the girl's symptoms is, I think, accounted for by the fact that she suffers from phthisis, and has therefore a smaller available lung surface. As the woman got up to walk about the room during the night, she for the time respired a higher, and therefore purer, atmosphere ; and this may account for the fact that

her symptoms were the lightest of the three. The action of the pupils with regard to light, noticed in two of the cases, was remarkable and very apparent. Although the inhalation of oxygen has been recognized in medicine since the time of Sir H. Davy, yet its use among the generality of practitioners is not frequent, and the above case was the first time I have ever used it. Its action impressed me greatly; for I have never witnessed a life so certainly saved by any other therapeutic agent. One great objection to its more general use has been the difficulty of obtaining the gas readily in a state of purity and in a portable form. This has now been obviated; and I have here a copper flask, into which fifteen gallons of pure oxygen have been compressed. I obtained it from Messrs. Barth, of 26 Duke street, Bloomsbury, and it appears to be very convenient for medical purposes, being easily carried about, as its weight is only five pounds three ounces when full; the diminution in weight will tell, roughly, the amount of gas used."

It would be an excellent idea if some of the instrument or large retail drug houses in the various cities would keep fifteen or twenty gallon reservoirs of this gas on hand. Indeed, as poisoning by opium is so common, it would be a good plan for at least one drug-store in every town to keep one of these reservoirs in stock.

THE HEART.—It is often necessary to support the action of the heart during opium narcosis. This is best done by hypodermic injections of whiskey and ammonia. Of the latter the aromatic spirits may be used or the aq. ammonia diluted with equal parts of water. About half a drachm of each should be used, and repeated as often as is necessary, the pulse being the guide. Hot enemata of whiskey may also be tried. If the heart fails to respond to these, the intra-venous injection of ammonia after the Griswold plan (see p. 132) should be resorted to.

Ammonia, aside from its stimulant action upon the heart and arteries, is a powerful respiratory stimulant, acting probably directly upon the respiratory centres in the medulla.¹

Caffeine may be used, also, with a view to stimulating the heart's action. It will be spoken of more fully in the next section.

Flagellation, walking the patient about, the cold douche and hot applications to the epigastrium are too familiar to need explanation.

SUBCUTANEOUS INJECTION OF CAFFEINE.—The experiments of Dr. J. Hughes Bennet² have proved caffeine to be, within certain limits, antagonistic to opium or morphia. This action is probably a double

¹ H. C. Wood, *Op. cit.*, pp. 109, 110.

² *British Med. Journal*, 1874.

one—as a cerebral stimulant and as a cardiac stimulant. I say within certain limits, for Dr. Hughes found that the lives of the animals experimented on were saved by caffeine when a certain amount of morphia had been given, and that when that amount was exceeded caffeine was powerless to save.

The question was raised not long since by Prof. Montrose A. Pallen,¹ of this city, his views being based on the treatment of cases of opium-poisoning by the fluid ext. of coffee, whether the beneficial results obtained in such cases were not due to the diuretic powers of coffee or caffeine. The fluid ext. of coffee which the doctor employed was had of Wyeth & Co.,² of Philadelphia, and was for the purpose of acting as an eliminator of the urates in gout. He says: “It certainly possesses valuable properties in the treatment of chronic gout as a renal depurant. Can it act thus to remove the poison of opium and the tissue detritus caused therefrom?”

Prof. Gubler³ asserts that caffeine, theine, men-

¹ *N. Y. Med. Record*, Dec. 21, 1878.

² This firm has kindly furnished me with a sample of the same, which is a powerful and elegant preparation, and worthy of trial, as much of the caffeine of the shops is said to be adulterated, and consequently unreliable. It is of the strength of a grain to the drop.

³ *Le Progrès Médical*, June 15, 1879.

theine, &c., are excellent diuretics and well worthy of trial. I give here his formula :

Caffeine.....gr. vii. ss.
 Syr. Menthæ..... $\frac{3}{4}$ i.
 Aq..... $\frac{3}{4}$ ii ss.
 M. Dose $\frac{3}{4}$ ss. to $\frac{3}{4}$ i., repeated if necessary.

“ Prof. Sewell, of Quebec (*British Med. Journal*),¹ reports the case of a lady who had taken, for the relief of pain, three drachms of Battley’s liquor opii. sedativus every three hours till sleep was produced —altogether she had taken about three ounces and a half of the solution. When seen by Dr. Sewell, at 11 P. M., she was totally unconscious, with pin-hole pupils, an imperceptible pulse, and, what seems almost incredible, only three respirations in two minutes. A strong infusion of green tea was prepared without delay, and half a pint of it was injected into the rectum, where it was retained for half an hour. This was repeated at intervals till 4 A. M., when the patient had so far recovered as to be able to speak, and at 8 A. M. she was pronounced out of danger. Even then, however, her sight had not recovered ; she asked the attendant to light the gas, although the sun was shining brightly into the room.”

Dr. Lewis Shapter ² reports four cases of the suc-

¹ *N. Y. Med. Record*, July 20, 1878.

² (*Boston Med. and Surg. Journal*) *Monthly Review*, &c., Oct. 1879.

cessful use of this remedy in the dropsy of advanced cardiac disease, when in some instances digitalis had failed to give relief. The amount of urine was trebled. We can readily explain this on the knowledge that caffeine is a decided cardiac stimulant.

Clinical experience confirms what experiments on animals have taught us with reference to the beneficial action of coffee or caffeine in opium-poisoning. Dr. W. W. Cochrane, of Atchison, Kansas, reports two cases as follows:

"Mrs. R——, aged 25 had taken three powders, each supposed to contain $\frac{1}{4}$ grain morphia, for colic. Had taken the last powder three hours previous to my arrival, and had been insensible for two hours; the most strenuous efforts failed to arouse her. Breathing almost imperceptible, pulse feeble, intermittent, pupils contracted, insensible to light. Gave her hypodermically thirty drops of strong coffee, repeated in fifteen minutes, and again in fifteen minutes, when she soon opened her eyes and was sensible. Directed her to drink coffee and be kept warm; she begged hard to be permitted to sleep. Recovered kindly.

"2. C. H. S., aged 55, had taken opium for several years, until the habit had increased up to twelve grains a day. Had taken in the last month four drachms of morphia and four ounces of chloral for

rheumatism. He was found on the floor and supposed to be dead. He had taken within four hours five grains of morphia and one hundred and fifty grains chloral hyd. No efforts aroused him. Head and extremities cold, pulse feeble and irregular, pupils contracted, insensible to light; breathing would cease for seconds, when artificial respiration restored it. Gave him, per forearm, twenty drops strong coffee, repeated in ten minutes, and again in fifteen, when in twenty minutes more he became sensible and recovered.”¹

Dr. Seneker² reports a case of rapid recovery in morphine-poisoning, after injecting 3 grains of caffeine subcutaneously within ten minutes.

Dr. H. F. Campbell³ relates an interesting case of opium-poisoning, where over half an ounce of laudanum was taken. The patient recovered, treated only by artificial respiration and large doses of coffee and caffeine by the mouth and rectum—twenty grains by the latter. As a result, there was extreme restlessness, as soon as stupor had passed off, and great nervous excitement, some of the symptoms being somewhat analagous to those of an over-dose of strychnia. The same gentleman reports another

¹ *Michigan Med. News*, 1879, p. 249.

² *St. Louis Med. Journal*.

³ Monograph, “Caffeine as an Antidote in the Poisonous Narcotism of Opium,” Augusta, Ga., 1860.

case¹ where the patient had taken 3 oz. of laudanum 15 hours before being seen. Caffeine was used as in case just reported, but the patient died from a "collection of mucus in the lungs."

Probably the best way in which to give coffee in these cases is by the hypodermic method, caffeine or Wyeth's fluid extract of Java coffee being used, the former in 1 gr. doses, every half hour, until some change in the strength of the pulse and consciousness somewhat returns; the latter in 30 drop doses in the same manner. The drug should not be pushed too far, as it may then act as a depressant. The indications just given will be the best guide.

VERATRUM VIRIDE.—Attention has been called to the supposed antidotal action of veratrum viride over opium, by a writer whose name and the name of the journal in which he wrote have now escaped my mind, also by Dr. James C. Gardner, of Mitchell, Indiana, who writes as follows:

"My attention was first called to the antagonism between opium and veratrum viride when treating a case of peritonitis. I gave opium and veratrum combined; the opium was intended to relieve the pain and restlessness; the veratrum to reduce the action of the heart and arteries. My prescription was pulv. opium, gr. ii to gr. iij, Norwood's tincture veratrum

¹ *Southern Med. and Surg. Journal*, August, 1860.

viride, gtts. v. My patient was relieved, but did not sleep. I next treated a case of typho-malarial fever in which delirium and restlessness were prominent symptoms. I gave sul. morphine, followed by the happiest effect in procuring sleep, rest and quietude for four or five hours, when my patient awoke, having a very dry mouth ; pulse full and numbered about eighty-five. Patient restive, I concluded to add five gtts. of Norwood's tincture to the next dose of sul. morphine, and give every fourth hour until the patient rested and slept well. After the third dose was given I found my patient resting well, but had not slept since commencing the use of the veratrum viride. I then directed the veratrum to be omitted and the morphine to be continued. One dose of the morphine was sufficient to procure a good, refreshing sleep. In a few days after I had noticed this effect, I thought this must certainly be attributed to the veratrum viride. I was called to see a child, aged 15 months, who had swallowed about a half grain of sul. morphine left by a physician for a lady who had been in the habit of taking morphine. She had mixed the morphine in a little water and left it standing in a glass on a chair, to step into an adjoining room, when the child drank the poison. I saw the child in about an hour and a half after it had drank the solution. The little fellow was comatose ; I could hardly arouse him enough to

get him to swallow the medicine. I gave him gtts. x. of Norwood's tincture of veratrum viride. In about thirty minutes he vomited, his eyes opened, he looked around, then looked up in my face and smiled. His improvement continued from this, so that he required no further aid."¹

Further testimony and experiments are needed to settle this question. It is worthy of attention from the fact that veratrum is of the same class as aconite, and morphia has been found to act almost magically in aconite-poisoning, as pointed out by Prof. Alonzo Clark² and Drs. O'Brien³ and Haynes (see p 176).

¹ *St. Louis Med. and Surgical Journal*, Dec., 1879.

² *N. Y. Medical Record*, Jan. 3, 1880.

³ *N. Y. Med. Record*, Feb. 8, 1879.

CHAPTER VII.

CONVULSIVE AND TETANIZING ACTION OF MORPHIA ON MAN,—IDIOPATHIC TETANUS.—CASES OF TRAUMATIC TETANUS FROM RUSTY AND UNCLEAN NEEDLES.

THERE are some peculiar effects of morphia on the human system that are of interest by reason of their variety and the possible light that they shed upon the antagonistic action of morphia and atropia. They are few in number, but well authenticated, and are in strict accordance with our knowledge of the action of the drugs on the lower animals. Such facts might, with some show of justice, be urged in favor of a belief in the doctrine of evolution, showing as they do how closely and inseparably man and animal are linked, and how a certain trait or idiosyncrasy that marks *all* the members of one class is perpetuated in an occasional member of another class.

A word here with reference to the antagonistic action of morphia and atropia, in the light of these peculiar manifestations. If it can be proven

conclusively that atropia has specific power to control the convulsive and other unusual actions of morphia *in man*, then we must admit that its beneficial action in opium and morphia poisoning is due to direct antidotal power, and not to its stimulant action on respiration only.

Dr. S. Weir Mitchell makes the following statement:¹ "Pigeons, and probably other birds, seem to possess the same peculiarity which causes certain men to exhibit, under opiates, only excitement of the motor ganglia, emesis and a restlessness which, with fuller doses, might possibly eventuate in convulsions—a rare incident of opium-poisoning, which, however, occurred early in a case which I have elsewhere reported." Not finding a record of this case in any works or journals to which I had access, I wrote Dr. Mitchell upon the subject, and received the following reply: "I am, unfortunately, unable to recall the name of the journal in which it was published, but I send you, briefly, my recollections of the case: A gentleman had taken an overdose of morphia some four hours before I was called to see him. He exhibited marked symptoms of opium-poisoning, and during my visit had several convulsions, from mild to severe. In one hour I administered $\frac{2}{3}$ gr. atropia

¹ *Amer. Journal Med. Sciences*, Jan. 1870.

and was fortunately able, soon after, to see him gradually recover."

It is a well-known fact that as we descend in the scale of animal life, we get very different effects from the same drug. The more simple or imperfect the structure of the brain, the more certain is morphia to excite reflex irritability. In the frog we have distinct tetanic spasms. Upon this may be explained the fact that in children convulsions are not uncommon in opium-poisoning; also that in persons of "nervous temperament" opium and its alkaloid, morphia, are prone to produce excitement, nervousness, sometimes delirium, and occasionally tetanic spasm. Such effects have been known to occur in the adult,¹ though more common in children after poisonous doses of this drug. It has been found that morphia is more apt to produce these results than is opium.²

Charvet,³ quoted by Pareira,⁴ made a very extensive series of experiments with reference to the effects of opium on different animals, by which the conclusion is reached that "the effects of opium on the animal kingdom have a relation to the degree of development and influence of the nervous system.

¹ "Christison on Poison," &c., p. 707.

² Christison, *op. cit.*, 725; "Taylor, on Poisons," &c., p. 615.

³ "De l'Action Comp. de l'Opium," Paris, 1826.

⁴ "Materia-Medica," Lond., 1853, p. 2108.

A glance at this interesting series of phenomena, called forth by opium in different classes of animals, gives us all its usual and unusual effects on man. Convulsions in fishes, amphials and reptiles, stupor in birds, tetanus in frogs, &c., &c. Different effects are produced also on different races of men,¹ varying with their mental and moral peculiarities.

M. Waldemar Baxt,² of St. Petersburg, after a series of extended experiments with the various opium alkaloids, comes to the conclusion, amongst many others, that: "1. The whole group of opium alkaloids taken together constitute a series of agents with two specially characteristic actions—*narcotic* and *tetanically convulsive*. 2. Each individual alkaloid possesses one or the other of these characteristic effects exclusively, or else a blending of the two opposed actions, in consequence of which the one or the other becomes prominent, while the other is more feebly pronounced. 3. The first place, as a pure *narcotic*, must be given to papaverine. It is followed by morphia narceia, codeia, &c., with constant diminution of the narcotic character of the influence and continually increasing convulsive ten-

¹ Pareira, *op. cit.*, p. 2109. Editorial, *London Med. Examiner*, July 5, 1877.

²("Archiv für Anat. und Physiol., Reichert und Dubois-Reymond," No. 2, 1869; *Practitioner*, Sept., 1869) *Am. Journal Med. Sciences*, October, 1869.

dencies, which in the bain reach the level of complete tetanus, indistinguishable from that produced by strychnia, except by the size of the dose required.

Dr. Samuel P. Reed, to whose interesting letter I have referred several times, relates the following case, which was probably one of those rare and peculiar manifestations of morphia: "Two hours after I had used this injection in a case of torticollis in a young lady, alarming symptoms of strychnia-poisoning showed themselves, lasting about $\frac{1}{2}$ hour. I could never account for them." Dr. Reed's solution and method of making the injection will be referred to a few pages further on (p. 250).

Dr. Courtenay,¹ of Jamaica, relates the following interesting case:

"A male coolie, under treatment for lumbago, in the Lucea Parochial Hospital, Jamaica, was ordered a hypodermic injection of one-sixth of a grain of morphia, the injection to be repeated every night. This treatment was continued for three nights, and on the morning following the third use of the injection the patient complained of feeling unwell at breakfast, and retired to bed at 9.10 A. M., where he was seized with convulsions of a tetanic nature. His symptoms were the following: he was quite in-

¹ (*British Med. Journal*, Oct., 1879) *Boston Med. and Surg. Journal*, Nov. 13, 1879, p. 711.

sensible, his eyes were widely opened and staring, the pupils slightly contracted, teeth clenched, face flushed, nostrils dilated, and breathing hurried. There was spasmodic contraction of the muscles of the upper extremity; the temperature was increased; the heart's action regular, though weak. This attack lasted for ten minutes, when consciousness returned; but on attempting to speak he was seized again, and the convulsions returned at gradually increasing intervals, until they finally left him at twelve, noon.

"The treatment immediately adopted in this case was the administration of doses of ten drops of the tincture of belladonna every hour, with coffee and brandy, and the application of the extract of belladonna down the course of the spine. This treatment was continued for a few hours, and, all urgent symptoms having yielded to it, the belladonna was given in diminished doses of five drops every four hours, and continued for the two following days. At the end of that time, no recurrence of the convulsions having taken place, the ordinary treatment for lumbago was recommended, of course with the omission of the morphia injection."

Phillips,¹ speaking of the action of opium in poisonous doses, gives the following: "The course of events differs considerably in young children, especially in

¹ "Materia-Medica and Therapeutics," N. Y., 1879, p. 65.

young infants. Here there is a more rapid passage into profound stupor ; but what is especially characteristic is the much greater frequency with which convulsions occur. The convulsive movements vary from mere twichings of the facial muscles to rhythmical startings of the limbs ; to severe clonic convulsions, which may be hemiplegic or may affect both sides of the body alike, and even to tetanic spasms. I have seen three adults thrown into a state of apparently complete tetanic rigidity of the whole body, the mouth open and squared, all the facial muscles highly tetanized, the spine strongly curved, resembling the shape of a well-drawn bow ; and this state of opisthotonos continue in each case, without any abatement, from twelve to forty-five hours, and then only become relaxed to become rigid again for a longer or shorter time, according as the effect of the opium was kept up."

Anstie¹ refers to a case of poisoning by 3 grains of morphia injected into the rectum, where the pupils were strongly contracted, the breathing was rapid² at first, and *delirium and incomplete coma*³ were present.

TRAUMATIC TETANUS FROM PUNCTURE OF THE

¹ *Op. cit.*, p. 208.

² A not uncommon occurrence in men and in animals, according to Anstie, when the drug enters the system rapidly.

³ Italics mine.

HYPONDERMIC NEEDLE.—Tetanus, due to the puncture of the hypodermic needle, is not a common occurrence, in which event the records of the following cases may prove of interest:

“At Southsea, recently, an inquest was held upon the body of Mrs. Frampton, wife of a lieutenant and adjutant in the Royal Marine Light Infantry.

“Deceased s husband deposed that his wife was 25 years old, and that in 1871, previous to giving birth to a child, she suffered greatly from sickness. A surgeon, to alleviate this, used morphia by the hypodermic method, always injecting the solution himself. Some time since, deceased assured him she had entirely given up the use of morphia.

“On the previous Thursday he found the deceased suffering from convulsions. She grew worse and died the following morning. Since her death several bottles had been found in her wardrobe, tied up in a parcel and secreted, together with five or six small cases, each containing a hypodermic syringe.

“Mr. Cruise, pharmaceutical chemist, said that at first he refused to serve the solution, but on reference to his junior assistant he was informed that Mrs. Frampton had been frequently supplied with the solution. In August, September, and October, he supplied nine bottles each month, the last being on the 30th ult.

“Dr. Norman described the state he found deceased in, and stated that when Mr. Norman and Dr. Jackson were called in they discovered on the upper part of both arms a large number of old scars, which they were informed were the result of hypodermic injections five years ago. There were no recent marks about the arms, but upon both thighs there were a large number of similar marks, and also several marks of recent punctures. Around some of these latter there was a redness of the skin in different stages, and one particularly had the appearance of having been made within twenty-four hours. He was of opinion that Mrs. Frampton died from tetanus, caused by the punctures made in the thighs for the purpose of injecting solution of morphia. He had been shown three syringes, all of which were in a dirty condition, apparently not having been wiped dry after using. The steel needles were in a very rusty state, which would be likely to set up inflammation.

“The jury returned a verdict to the effect, ‘That the deceased died from tetanus, or lock-jaw, caused by inflammation arising from punctures made by the deceased herself, for the purpose of subcutaneous injection of solution of morphia.’ ”¹

In this connection the following from Bartholow,²

¹ *Medical Press and Circular*, Nov. 29, 1876.

² “The Hypodermic Method,” etc., pp. 96, 97,

who refers to cases of abscess, traumatic fever, etc., by Calvet, and death by Dujardin-Beaumetz, following the puncture, is of interest: "One of the most inveterate subjects I have ever encountered was a man living in the wilds of Texas, who used a glass hypodermic syringe that had been broken many times, and mended with successive deposits of sealing-wax, until only the rusty old needle remained in view." And yet no tetanus!

The newspaper report of the following case has been kindly sent me by F. W. Barkitt, L. R. C. P., &c., Dublin, Ireland. The extract is from the *Irish Times* newspaper, Oct. 23, 1879, giving an account of the coroner's inquest:

The patient was a governess, single, aged 56, and addicted to the morphine habit, using the drug hypodermically.

"Dr. Austin Meldon deposed he was called to see the deceased on the morning of the 16th instant. He found her in the spasm of lock-jaw. She was actually in the spasm when he entered the room, her body being bent forward. Witness was of opinion the disease commenced late on Sunday night. From examination and inquiry, witness had made up his mind that the disease was caused by a slight wound, inflicted by the needle of a subcutaneous injection syringe. There were numbers of marks over her

body, where she had been in the habit of making these injections. The slight wound to which he had referred was made on the previous Friday. He found she had been in the habit of using these injections for years. That morning she told him she had used twelve grains of morphia in one injection, and showed him the papers which had contained the four powders. That was an enormous quantity, a quarter grain being a full dose. The immense quantity she used that morning showed she had been using it for years. She told him that she was in the habit of using, when affected with neuralgia, twenty grains in twenty-four hours. There was no case on record of so much being used.¹ Witness asked her why she had adopted that mode of taking morphia. She said, in order to avoid the temptation of taking more of the drug. There was a case of poisoning from morphia in the same way in London last year, but the quantity was considerably smaller—the dose taken being only one grain four times a day. After witness saw her he continued the injections during her spasms, and they relieved her pain, but of course the doses he gave were very small, and as the suffering became less so did the quantity in the injection he administered. He would account for the lock-jaw

¹ In my chapter on "The Morphia-Habit" I shall show that much larger amounts have been used and for long periods.

which caused her death by the particular puncture in the skin, as a nerve might have been injured by the entrance of the needle. It was a very hazardous thing for an unprofessional person to use one of those needles. He knew of two cases of lock-jaw caused by it. In one of these cases the patient was very nearly poisoned, for he used, when he had no pain, a dose which had been ordered him by a medical man when he was in great pain. Witness made a careful post-mortem examination. He had never seen a lady of that age whose organs were in a more healthy condition. The reason she used it, I may say, was to relieve facial neuralgia in the first instance, and the habit grew on her. I found the surface of the body punctured in innumerable places with the needle. She seemed as if she had been tatoored.

“Coroner: Is there anything else you think it well to tell us? Are you certain she died from traumatic tetanus? ‘I am clearly of that opinion both from the history and condition of the case.’

“Coroner: There is one point which I would wish to have cleared up. Several medical men have mentioned to me that it is quite possible she might have obtained, either by mistake or otherwise, strychnine in place of morphia. You are satisfied that is not the case? ‘I am perfectly satisfied. I should say that

the symptoms of tetanus and strychnine are the same while the spasms are on. After the spasms pass away the patient becomes quite well in strychnine, but the muscles remain contracted in lock-jaw.'”

I have written Dr. Meldon, asking for histories of the two cases of tetanus referred to, but as yet have not had a reply. The *British Med. Journal*,¹ in commenting on this case, says that it has no knowledge of the case referred to by Dr. Meldon as occurring in London, but refers to three cases of death from traumatic tetanus after the hypodermic injection of the sulphate of quinine (*Lancet*, July 6, 1867), and a case² of tetanus after the use of morphia, due probably to the use of rusty needles (*Lancet*, Dec., 1876, p. 873).

Referring to this case, Dr. J. O’Flanagan, of Durham, writing to the *Medical Press and Circular*, which also contained a report of this case, says:

“Sir:—I think the above title of the case reported in your last issue does not accurately express the nature and cause of the malady from which the patient died. I am of opinion that the neuralgia caused the tetanus, and that the morphia injections, so largely used, ‘staved off’ for a considerable time the ‘evil day’ from the poor patient, who finally

¹ *Hospital Gazette*, Dec. 6, 1879.

² See page 234.

gave in to the blood disorder, and the tetanus therefrom. I am led to believe this from my remembrance of a case of trismus in a young woman (rheumatic) which I treated successfully, five years ago, with ^{*}hydrate of chloral, Fleming's tincture of aconite and bromide of potassium, and with chloroform inhalations. At the time I did not deem the case of sufficient importance to publish; but, having very recently succeeded in saving a bad case of traumatic tetanus in an interesting little girl of nine years old by the same means, I intend shortly to collect my notes of the first case, and to publish both cases together, with your permission, in the columns of the *Medical Press*." ¹

I think that very few will agree with Dr. O'Flanagan in his view of the case.

Dr. A. Ady, of West Liberty, Iowa, reports the following case: "On the 19th of this month I injected fifteen grains of bromide of quinia, dissolved in thirty minims of dilute alcohol, into the cellular tissue above the crest of the left ilium of a man aged sixty-two years, for an intractable periodic neuralgia in that position. The neuralgia was relieved, but there was more than ordinary inflammation at the site of injection, followed by a forming slough. It gave him considerable pain on the 21st and 22d,

¹ *Hospital Gazette*, Dec. 6, 1879.

when morphia was ordered sufficient to relieve him. During the 23d and 24th he was reasonably comfortable, and sat up most of the afternoon, Sunday, entertaining company. Upon retiring, at 10 P. M., he was seized with tetanus, and died in twenty-three hours. I have been intimate with him for twenty-six years, and, with the exception of occasional attacks of this neuralgia, he has enjoyed uninterrupted health." ¹

Prof. A. Liautard, of the American Veterinary College, this city, writes me the details of the following case of tetanus in a horse :

"DEAR DOCTOR :—I enclose the history of the case of traumatic tetanus I wrote to you about, as I see it printed in the *American Veterinary Review*. Tetanus is not an uncommon disease amongst horses, and, of course, is more commonly traumatic.

"Gray gelding, 7 years old, which suffered one night with spasmodic colic and was treated by hypodermic injections of morphine and atropine in three places on one side of the neck ; these were followed by small abscesses, which, being opened, healed rapidly. Four days after he was found with his jaws closed tight, the membrana nictitans protruding over the eye, the muscles of the body contracted ; in a word, presented all the symptoms of tetanus. The

¹ *N. Y. Med. Record*, Dec. 14, 1878:

treatment consisted in the administration of bromide of potassium every four hours in 4 ounce doses with chloral hydrat. per rectum. He was destroyed four days later."

Dr. Ross¹ reports a case of traumatic tetanus following lancet-puncture for vaccination in a child:

"Edward K., three and a half years old, of healthy German parentage, never sick since a mild attack of scarlatina in early infancy, was visited at 8 o'clock P. M., June 5th, 1879, and found to be suffering with tetanus, from which he died before 8 A. M. the following morning. He had no evidence of having, either recently or remotely, received an injury of any sort—no wound by puncture, laceration, or incision at any time since birth, with the exception to be mentioned. It was only during the early part of the day that his family noticed a peculiar expression about his face, and an occasional elevation of his arms and shoulders, which culminated at dinner in such a pronounced convulsion that he fell from his chair to the floor. Quickly following this fall he had two spasms of such severity as to necessitate the calling of a physician. When I reached the house the 'sardonic grin' was pronounced, and jaws tightly locked, several spasms occurring during my brief visit. As the night advanced they recurred

¹ (*Southern Clinic*) *Nashville Journ. Med. and Surg.*, Dec., 1879.

with rapidly increasing frequency, and only ended with his death. Three weeks previous to his attack, he had been *vaccinated* by a German midwife, the virus inserted in two points on the left arm. Upon one of these sites, a normal looking, almost dry crust appeared, and at the other a *highly inflamed ulcer*, from which the crust had evidently been forcibly torn. To my mind, this furnished a satisfying cause for the disease."

I give this case only for its rarity and its bearing on the subject of tetanus from the inflammation following slight puncture.

The lesson to be learned from these cases is that the syringe and needles should be kept scrupulously clean, being cleansed both *before* and *after* each time of using, by drawing warm water into the syringe and forcing it through the needle. If the water be slightly carbolized it will be an advantage. The "rimmers" figured by Dr. Bartholow in the frontispiece of his little work¹ are not necessary unless the needle is left uncleaned, in which case it is better to throw it away and use a new one.

¹ "The Hypodermic Method," &c.

CHAPTER VIII.

MORPHIA AND ATROPIA.

Is there any decided advantage in using the sulphate of atropia with the sulphate of morphia for purposes of subcutaneous injection? Some authors and some of my correspondents seem to believe that there is, and assign to atropia various important modifying actions which it will be well to study in detail. I shall here give a table showing how many of those answering my second question do and do not use atropia :

<i>With Atropia</i>	{	Always.....	46	{	Asthma, Neuralgia, Idiosyncrasy.		
		Occasionally	48				
		In special cases..	16				
			110				
<i>Without Atropia</i>			210				
			320				

It will be seen from these figures that but a few over one-sixth of the entire number answering this question use atropia invariably; about the same

proportion use it occasionally; about one-nineteenth of the number use it only in special cases; and over two-thirds do not use it at all. Some of those who never use it have not done so simply because they were used to and satisfied with the plain morphia solution, while others, after trying it, gave it up, either finding the atropia of no particular advantage or the morphia alone more satisfactory.

That the effects of these two drugs when used together are different from the effects of either used alone, is clearly demonstrated by Bartholow,¹ who has studied their physiological action, alone and together, upon the human adult.

He found that the effect of the morphia was modified, as follows :

On the Nervous System—

1. Atropia in small doses increases the hypnotic power of morphia.

2. Atropia in sufficiently large doses counteracts the hypnotic properties of morphia, and if in excess causes phantasms, illusions, &c.

3. It increases the pain-quelling power of morphia.

4. It does not affect the disorders of motility and vertigo, sometimes produced by morphia.

5. In cases of poisoning these drugs are mutually antidotal.

¹ "The Hypodermic Method," &c., pp. 130, 131, 132, &c.

6. It dilates or holds normal the pupil, which would otherwise contract under morphia.

7. It prevents or modifies the arterial tension produced by morphia.

Circulation and Respiration—

8. It prevents depression of heart-power produced by morphia.

9. It counteracts the fall of temperature produced by full doses of morphia.

10. In small doses, it adds to the power of morphia to reduce the number of respirations.

11. It prevents that fall in the number of pulsations which has been found to result from a moderate dose of morphia.

The Digestive Apparatus—

12. It increases the dryness of the larynx, mouth, &c., produced by morphia.

13. The constipation from morphia is prevented, and relaxation of the bowels often occurs. This seems to be due to increased peristaltic action.

14. The dyspeptic troubles sometimes occasioned by morphia are abated, but not prevented.

15. Nausea and prostration from morphia are often lessened or prevented by it.

Genito-Urinary Organs—

16. Atropia upholds the functional activity of the kidneys, which is decidedly lessened by morphia.

17. Atropia prevents the diaphoretic action of morphia.

18. The dysuria of morphia is not relieved by atropia, both having the same effect on the bladder, though in a different way.

From a study of these results of Dr. Bartholow's careful and painstaking experiments and observations, of which this summary is a necessarily imperfect representation, we are naturally led to conclude that atropia should be of much service, when given with morphia, both in health and disease. It requires, however, careful discrimination as to when to give it and when to withhold it.

For example, where it is necessary to give morphia in large doses in cardiac disease, or in diseases where the tendency is to death by failure of heart-power, it will always be advisable to use the two drugs together, using just enough of the atropia to combat the action of morphia on the heart, and slightly stimulate it. It is well settled, however, by numerous observations that in shock and various conditions where there is decided failure of heart-power, morphia in small doses is a special cardiac stimulant.

In case we wish to increase the pain-quelling power of morphia, and at the same time get an hypnotic effect, a small amount of atropia — say

$\frac{1}{120}$ gr.—should be added to each dose of morphia. If it is desired to obtain relief from pain, and yet have no soporific effect, the amount of atropia should be increased, so that its action on the cerebrum shall slightly outbalance that of the morphia.

Dr. Bartholow's statement that atropia and morphia decrease the number of respirations more than morphia alone, he modifies by offering the following as an explanation: "When Dr. De Courcey received the morphia alone, he experienced much less soporific effect than when both agents were injected together; and to this quiescent state of the cerebral functions is to be attributed the slower respiratory movements." I think that this is the true explanation, and it is borne out by the mass of evidence showing that atropia exercises a direct stimulant power over the respiratory centres. Were this not so, it would be extremely hazardous to use these two drugs in that class of diseases where the tendency is to death from failure of respiration.

The cases of narcotism, syncope and death, already related, where morphine was given hypodermically in acute pulmonary disease, offer a fair probability that the use of this drug in this class of diseases is of itself dangerous, the drug acting in the same direction as the disease. If this is not merely coincidence, and it is certainly borne out by a study

of the physiological action of morphia, then where, from great pain, it is absolutely necessary to resort to its use, sufficient atropia should be given at the same time to overbalance its soporific and respiratory depressant action and to directly stimulate the respiratory centres.

Of course, in diseases such as acute pleurisy, with but little effusion and agonizing pain, to which the existing dyspnoea may be referred, a sufficient amount of morphia to banish the pain will lessen the frequency and increase the depth of the respirations.

It must be borne in mind in this connection that individuals vary greatly in their susceptibility to atropia, and that one or two injections must be made before an exact knowledge of the case can be had. A patient of mine, a lady suffering from the passage of a gall-stone, was twice troubled with illusions and phantasms from the use of $\frac{1}{80}$ gr. of atropia in combination with $\frac{1}{2}$ gr. morphia. According to the experience derived from the average case, this lady should have borne a much larger amount of atropia, and its unpleasant effects on the cerebrum have been counteracted by the morphia. For this reason I should advise that the two drugs be kept in separate bottles or powders, so that the dose of either may be varied at pleasure.

With reference to the increased power of morphia

and atropia over morphia alone, to relieve pain, there is some diversity of opinion. The combination of the two drugs has been highly lauded in all forms of pelvic pain, notably that of a neuralgic character. Prof. T. Gaillard Thomas, of this city, in conversation with the author, a few days since, said that he had never found atropia to add to the pain-relieving power of morphia either in pelvic or other pains. To this he made the exception in favor of dysmenorrhœa, but held that atropia was of service then only by virtue of its being a drug that was itself capable of giving great relief in that affection. He had formerly used the two drugs together in all cases, but had of late years employed morphia alone, finding it to act quite as well as when atropia was combined with it. The opinion of Dr. Thomas, especially with reference to pelvic pains, is of unusual interest, as his opportunities for observing and treating this class of affections have probably been greater than those of any other man in this country.

Dr. Samuel P. Reed, of Scranton, Pa., writes: "The advantages of combining the atropia with the morphia are that it increases the anodyne and relaxing influence and lessens its narcotic effect. I have had old rheumatic cases send for me to give them 'a shot' (as they called it), and said 'that mine was stronger than anybody else's.'" The doctor's

manner of making his solution is somewhat peculiar and the solution is so strong that it would be hardly safe to trust it in the hands of any but a very careful man.

He says: "I keep on hand, in a glass-stoppered phial, a solution of atropia sulph., gr. $\frac{1}{4}$ to aq. destillat, ʒi . Of the latter, I pour into a teaspoon about 9 minims, (the quantity my syringe is marked for), and saturate it with morphia sulph. (at least gr. i.) I then inject into the areolar or muscular tissue one or two minims, wait a minute or two, and continue to inject 1 minim at a time every two or three minutes, without removing the syringe, until the desired effect is produced." This solution, so far as the morphia is concerned, is a very strong one, and, in the light of the facts presented in the chapter on narcotism and death, I should not advise its trial.

It seems hardly possible that the efficacy of the doctor's injection can depend on the presence of atropia in the solution, for by his own showing there would be but the $\frac{1}{320}$ gr. of this drug used if the whole of the 9 minims was injected; and that would represent gr. i. of morphia, a very heavy dose. Furthermore, in using so little of the atropia the doctor loses the power with which atropia is credited by some (Bartholow, Fothergill; see p. 259) of rendering large doses of morphia safer.

Dr. Julio J. Lamadrid, of Brooklyn, N. Y., writes me: "Another reason why I prefer to use these two agents together is that the pain-relieving power of morphia is greatly increased by atropia."

Dr. J. Howard Morgan, of New York City, writes as follows: "I very frequently use it with atropia sulph., especially where I wish to prolong the pain-quelling effects of the remedy, and also where I wish to avoid nausea or other unpleasant effects of the drug in susceptible patients. This last object is often not attained fully, but the prolongation of the pain-controlling influence has often been quite noteworthy. I remember a case of a man who suffered much from acute rheumatism who was relieved by a hypodermic injection of atropia alone for about three hours, and then by one of morphia alone for four or five hours, but on combining morphia and atropia in one injection (the dose of each being a little less than when given alone), the pain was relieved nearly twenty-four hours. This observation was several times repeated on him, and uniformly with the same result."

Dr. A. B. Stuart, of Santa Barbara, California, writes: "Use it alone when the pain is the result of or accompanied by inflammation; in other cases, such as neuralgia, with atropia."

Anstie¹ is of the opinion that atropia itself possesses the power to relieve the pain of neuralgia and sometimes cure the disease, the cure, when resulting, being usually permanent. He admits, however, that its pain-relieving power is much inferior to that of morphia, except in all pelvic neuralgias. He has also found it of the greatest service in neuralgia of the eye, when there is inflammatory trouble, with the danger of destruction of this organ. If it acts so well alone in these cases, it should have some beneficial effects when combined with morphia.

Mitchell,² on the contrary, found that atropia, even in large doses, utterly failed to give any relief to neuralgic pain. He recommends the combination of the morphia and atropia for the purpose of having the atropia combat the propensity to sleep caused by the morphia. It was found to do this very satisfactorily. This conclusion is based on the large series of experiments made on the human subject by this gentleman and Drs. Keene and Morehouse.³ Of course these gentlemen say nothing regarding the use of atropine alone, or the two drugs together, in the pelvic troubles of females, as their experiments were carried on exclusively upon men—soldiers wounded in war.

¹ "Neuralgia and its Counterfeits," London, 1871, p. 189.

² "Injuries of Nerves," Phila., 1872, p. 271.

³ *Am. Journal Med. Sciences*, July, 1865.

Bartholow¹ says: "Whenever the hypodermic injection of morphia is proper and necessary, atropia should be combined with it, unless contra-indicated;" and again:² "The pain-relieving power of morphia is increased by atropia."

Dr. Samuel Logan, Prof. Anatomy and Clin. Surgery in University of Louisiana, New Orleans, writes me that he prefers the combination of morphia and atropia for severe neuralgia.

AS A PREVENTER OF NAUSEA AND PROSTRATION.—Here, as upon the preceding questions, opinions are decidedly at variance. Mitchell, Keene and Morehouse³ say: "Like others, we have met with other inconveniences attendant upon this mode of employing morphia. In rare cases it always caused distressing sick-stomach, but as the pain for which we used it was oftentimes agonizing, the patient usually preferred to endure the sick-stomach rather than fail of the delightful relief he obtained from the injection. In these instances it was commonly observed that the morphia ceased, after a time, to produce either nausea or emesis." And again:

"Morphia was very apt to cause nausea when

¹ "The Hypodermic Method," &c., p. 134.

² "*Ibid*," p. 130.

³ *Am. Journal Med. Sciences*, July, 1865, p. 68.

injected subcutaneously. In some men it never failed thus to affect them, when to such persons we gave the two drugs in equivalent doses—that is to say, doses which controlled the pupil, and perhaps after a time dilated it—we still found that nausea occurred as when only morphia had been employed. Here again the antagonism fails.”

Ringer¹ is of the opinion that these unpleasant manifestations of morphia are often counteracted by adding belladonna to the morphia, in the proportion of one of the former to twenty of the latter.

Dr. J. C. Lyman, of San Rafael, Cal., writes upon this point as follows: “I find the addition of atropia a preventive of nausea, and do not recall ever having a patient who was nauseated by an injection of morphia and atropia, whereas, before I used the atropia, nausea was quite common.” Dr. Julio J. Lamadrid, of Brooklyn, N. Y., believes that atropia prevents or modifies the nauseant effect of morphia hypodermically used. Dr. G. Wm. Semple, of Hampton, Va., formerly used atropia for this purpose, but now finds that from 3 ss. to 3 i of diluted hydrobromic acid, by the mouth, “is a certain preventive of that very grave inconvenience.”

The observations of Dr. J. M. Dacosta² are of in-

¹ “Handbook of Therapeutics,” N. Y., 1875, p. 520.

² *Am. Journal of the Med. Sciences.* April, 1870, and April, 1871.

terest in this connection. He speaks very highly of the use of the bromide of potassium to prevent the nausea and vomiting following the use of morphia, and to which some persons are peculiarly liable. He found that the nausea of opium was more readily controlled than that of morphia.

Dr. J. Y. Dale gives a case in practice where the bromide acted with remarkable effect—the nausea having been great and persistent. According to Anstie,¹ the nausea and vomiting resulting from narcotic drugs is due to “narcotic depression” of the nervous centres. In cases where atropine acts so well in preventing or allaying this difficulty he believes it to be by stimulation of these depressed centres and by reason of its power to check excessive gastric secretion, a property possessed by most narcotics when given in small doses.

That this nausea and prostration may be so severe as to cause alarm is shown by the following case, reported to me by Dr. H. M. Smith, of Vincennes, Indiana: “In one case, where the puncture was made in the temporal region for severe neuralgia and inflammation of the eye, the patient became much prostrated and nauseated, and under stimulation did not come out from under influence for six hours.”

¹ “Stimulants and Narcotics,” Lond., 1865, p 225.

These cases are as much to be referred to idiosyncrasy as is narcotism, &c., the brain being the organ most readily affected in one case, the stomach in another, the muscular system in another, and so on, according to hereditary or acquired peculiarity.

Dr. J. Charles Adams, of Lake City, Minn., expresses himself as follows: "I incline to the opinion, based on my own observation, that when *very severe pain* is instantly relieved there is more nausea than when the pain is gradually mitigated."

Dr. Samuel W. Francis, of Newport, writes: "I do think that atropia aids in preventing nausea, &c., but have not felt the need of it in my practice."

Professor Jno. W. Lowman, of Wooster University, Cleveland, Ohio, says: "Usually alone; with atropia when morphia is not tolerated or when too great physical depression results. Also, in asthma and diseases of like nature. I always give morphia alone when the patient exhibits great force or power."

Dr. P. H. Thornton, of Lakeport, Cal., writes: "If an idiosyncrasy for morphia exists, I combine it with atropia; if not, I use it alone."

Bartholow¹ says, in this connection: "The sickness and nausea, and the not uncommon great depression of the vital powers, caused by morphia

¹ "The Hypodermic Method," &c., p. 133.

are opposed by atropia. The after-stomachal effects of morphia—indigestion, loss of appetite, a pasty tongue—are much diminished by atropia, but not absolutely prevented.” As atropia produces the same digestive troubles as morphia, he recommends its use in small doses,—as morphia $\frac{1}{4}$ gr., atropia $\frac{1}{20}$ gr.

Dr. Montrose A. Pallen,¹ of this city, has found atropia to mitigate the nausea and vomiting of morphia. He recites a case, however, where it failed to do this, though given in large amount ($\frac{1}{50}$ gr.).

Dr. E. T. Wilson² found that in some patients who were nauseated by morphia given by the skin, if the first few drops were injected *slowly*, no such trouble occurred, but if injected rapidly, nausea showed itself at once. Indeed, he found that where the first few drops were slowly introduced, the remainder of the fluid could be rapidly injected without causing any disturbance.

William T. Lusk, Prof. Obstetrics, Diseases of Women and Children, &c., Bellevue Hosp. Med. Coll., writes as follows: “I use it without atropia. (Morphia makes me very sick always. I was advised to take it once for a cold, and combined it with atropia. The combination made me feel worse than usual).”

¹ *N. Y. Medical Record*, Dec. 21, 1878.

² “St. George’s Hospital Reports,” 1869.

LESSENS TENDENCY TO PRODUCE HEADACHE AND DIGESTIVE TROUBLES.—As we have already seen, morphia given subcutaneously is less apt to disorder digestion than when given by the stomach.¹ There are some cases, however, where morphia, hypodermically, does produce these troubles, and in which atropia lessens this tendency. A number of my correspondents testify to its efficacy in this respect.

RENDERING LARGE SUBCUTANEOUS DOSES OF MORPHIA SAFER.—Dr. Alfred Ludlow Carroll, of New Brighton, Staten Island, writes me: "I have the fullest faith in the efficacy of morphine in diminishing the narcotic and augmenting the anodyne influence of morphia. In a tolerably wide experience I have invariably found that a much smaller dose of morphia would relieve neuralgia when combined with atropia than when given alone, and for some years past I have always employed the combination."

J. C. Murphy, L. R. C. P. & S., E., etc., of Dublin, writes me: "I have used the solution with atropine, which seems, (along with counteracting its unpleasant effects), to moderate its soporific power." He relates a case where the lady was most intolerant of even the smallest doses by the mouth, and where he was able to give it, in combination with atropia,

¹ Anstie, *Practitioner*, July, 1868, p. 33.

in large doses by the skin, without any unpleasant effects whatever.

Dr. Julio J. Lamadrid, of Brooklyn, believes that by combining atropia with morphia much larger doses of the latter can be given than would be safe otherwise. Bartholow¹ says, speaking of the hypodermic use of morphia in asthma: "Ordinarily I combine atropia with the morphia, in order to give large doses with safety; for in this disease, as in many other neuroses, the maximum doses are often required to accomplish relief." And again:² "Atropia in small doses— $\frac{1}{96}$ of a grain—increases the hypnotic power of morphia; but if the quantity of atropia be sufficient, it overpowers the effects of morphia on the cerebrum, causing wakefulness or disturbed sleep, phantasms and illusions." This is quite in accord with the conclusions of Mitchell, Keene and Morehouse,³ but opposed to those of Corona.⁴

Fothergill⁵ is of the same mind, for he says: "There seems every reason to believe that belladonna may be usefully combined with opium or mor-

¹ "The Hypodermic Method," etc., p. 76.

² *Ibid*, p. 130.

³ *Am. Journal Med. Sciences*, July, 1865.

⁴ (*Giornale di Medicina Militaire*, quoted by *Edinburgh Med. Journal*, Dec. 1876.) *Practitioner*, 1877, p. 132.

⁵ "Antagonism of Therapeutic Agents," Phila., 1878, p. 62.

phia in those cases where it becomes imperative to give very large doses of these agents, such doses indeed as may threaten the respiration or circulation. Belladonna will maintain the action of the centres under huge doses of morphia, without interfering materially with the effect upon the cerebro-spinal centres."

The following case seems somewhat strange in the light of these facts; illustrating, however, the advantages of giving atropia for the purpose of getting increased power.

"A lady suffering from cancer of the womb had had as much as 2 grs. and $\frac{2}{5}$ of morphia injected hypodermically at once to relieve the paroxysms of pain. This dose did not produce sleep for an hour or more, and then only of a dozing character and easily interrupted. As the disease had not advanced far, I was anxious to husband the morphia as much as possible. Believing that belladonna or atropia increases the effect of opium, I gave $\frac{1}{60}$ of a gr. of atropia with morphia, with such good results that after a few trials I found that $\frac{4}{5}$ of a gr. of morphia, when combined with $\frac{1}{40}$ of a gr. of a atropia, was enough to relieve the pain as effectually as the 2 grs. and $\frac{2}{5}$ of morphia had done alone, and produced sound sleep at once.

"On one occasion, a dose of $\frac{1}{30}$ gr. of atropia and

$\frac{4}{5}$ of a gr. of morphia had failed to relieve an unusually severe attack of pain. After 4 hours, the patient's son, who had previously given the injection under my direction, on his own responsibility repeated the dose, not unnaturally supposing that as $2\frac{3}{5}$ grs. of morphia had been given at once, several times before, $\frac{4}{5}$ of a gr. might be repeated after an interval of 4 hours. On visiting her soon afterwards, I was cautioned not to disturb her; but, being anxious to see the effects of the second dose, I examined her a little more attentively than usual, and found the supposed sleep was really profound coma. The pupils, moderately dilated, were insensible to light. The respirations were shallow, and continually interrupted by an alarming pause. The eye-lids when opened remained so. No shaking or pinching produced any effect. Although vomiting was a prominent symptom with her, neither finger nor feather, tickling the fauces produced any movement. The sole reflex action that I could excite was a slight quiver of the right eyelid when cold water was thrown on the face and chest, but the respiration was not altered by it. Ammonia to the nostrils also failed to cause movement. The pulse was soft, regular and 116. Frequent cold affusion to the face and chest, with mustard poultices to the calves of the legs and the nape of the neck, were applied at intervals for an hour

before the patient could be roused. As far as this one case goes, nothing can be more conclusive, I think, than that atropia intensifies rather than counteracts the sedative effects of morphia."¹

The Case (No. 5, Chap. v) where death resulted from morphine in spite of the exhibition of atropia before the latter was given, and during the narcosis also, seems to be inexplicable.

If it can be settled beyond question that atropia possesses this power, then we have in it a most important safeguard; one that will permit of the giving with safety not only the ordinary dose, which, as has been shown, may often produce serious and even fatal narcotism, but of giving very large doses, such as are sometimes required. As these large doses are, however, usually exhibited during intense pain, we should expect the pain itself to use up much of the evil effects of the drug, and lessen its danger; and as the gentlemen who claim increased safety from the addition of atropia also claim increased pain-relieving power, by the same measures, smaller rather than larger doses would consequently meet the indications, and not call for the safety action of atropia.

Indeed this matter is still far from being proved, the chief argument in its favor being obtained from

¹ J. N. Miller, *British Medical Journal*, Nov. 17, 1877.

a priori reasoning from the physiological antagonism of the two drugs. A careful series of experiments should be made upon both man and animals for the purpose of determining this point definitely. Until such experiments, carried on with the utmost care and for this purpose alone, are made, a positive opinion on this point should not be given, much less acted upon. Those experiments already made are not sufficiently conclusive to warrant a final opinion, the more so as they have been chiefly done upon animals.

We are to conclude, then :

(1). That atropia is considered of service by some in increasing the pain-quelling powers of morphia; by others that it exercises no influence whatever in this direction.

(2). That by some it is considered a perfect and by others a partial preventer of the nausea and prostration sometimes following the use of morphia hypodermically; by still others as of no value whatever.

(3). That the nausea and prostration of morphia subcutaneously is best controlled by the simultaneous exhibition of the bromides or hydro-bromic acid by the mouth.

(4). That atropia in small amount increases the hypnotic power of morphia.

(5). That atropia is considered by some to render

doses of morphia, that would otherwise be dangerous, safe.

(6). That the constipation resulting from the use of morphia hypodermically may be combated by small doses of atropia.

(7). That atropia is considered by some to prolong as well as increase the pain-relieving power of morphia.

A study of these final conclusions and others, given a few pages back, teaches us that there is considerable room for exact clinical inquiry as to the advantages of combining the two drugs for hypodermic use; that if the propositions offered by the gentlemen who have studied the action of these drugs separately, and when given together, are correct that such combination is of use *therapeutically* only, for the purpose of combating pain, and in some few special diseases, for as regards the majority of bodily functions, these agents antagonize each other and render any other than their anodyne action *nil*.

In painful affections of the abdominal organs, where it is desired to relieve this pain by a remedy or remedies that do not constipate, then atropia and morphia are invaluable. Also in those cases of enuresis where an irritable condition of the bladder predominates; in fact in all forms of incontinence of

urine of the hyperæsthetic type.¹ In such cases, however, the drugs given by the rectum are quite as effective, if not more so, than when given subcutaneously. This is especially true in the nocturnal enuresis of children; the use of morphia in any way being dangerous, and the puncture of the hypodermic needle producing sufficient fright to cause syncope and convulsions. Painful personal experience has taught me this, I having had a case where I used this instrument, the child nearly dying of fright.

I think upon the whole that the double solution (morphia and atropia) is being used too much, and with but little sensible discrimination. Even though atropia may do no harm when thus used, still it is foolish to employ it when there is no necessity for it. Every physician should study his cases carefully, and where the one or the other solution is called for give it, but he should not, as a mere matter of routine, give atropia every time that he gives morphia (by the skin). Certainly not until the safeguard action of atropia is settled. As the evidence stands now, the atropia and morphia solution is safer to use because the atropia adds to the anodyne powers of the morphia, and hence it is necessary to use less of the latter drug.

¹ Skene, "Disease of the Bladder and Urethra in Women," N. V., 1878, p. 80.

CHAPTER IX.

THE MORPHIA HABIT—ITS DANGERS—PECULIARITIES AND TREATMENT.

IT is not my intention to go at all extensively into the subject of the morphia habit ; first, because I do not consider myself at liberty to devote to it the space necessary for its full and comprehensive discussion ; and second, because those better qualified to do so have already expressed their views upon the subject. Edward Levenstein,¹ Medical Director of the Maison de Santé, Schoreberg, Berlin, has studied this subject at great length, supplementing the results of his observations on a large number of the slaves of habit, by numerous experiments on animals.

His work, an English translation of which has just been published, will well repay perusal. Calvet² has also studied the subject upon animals.

The dangers of contracting this habit from the hypodermic use of morphia was recognized³ in the very infancy of the practice, but was scoffed at or

¹ "Die Morphiumsucht," Berlin, 1877.

² ("Thèse de Paris"), *N. Y. Medical Journal*, Sept. 1877.

³ Anstie, *Practitioner*, 1860.

disregarded until a few years ago, when the profession in Germany, England and America awoke, almost simultaneously, to a knowledge of the fact that the habit had become alarmingly common, and that it had been contracted, in the majority of instances, through the carelessness of the physician, who had taught either the patient or his friends how to use the instrument.

Some of my correspondents, men of ability and in large practice, express themselves as very skeptical of the truth of the statement that the morphia habit has ever been formed by the use of the drug hypodermically. Testimony from all parts of the civilized world settles this matter beyond question. Bartholow, from whose excellent little work I have so often quoted, says :¹

“The introduction of the hypodermic syringe has placed in the hands of man a means of intoxication more seductive than any which has heretofore contributed to his craving for narcotic stimulation. So common now are the instances of its habitual use, and so enslaving is the habit when indulged in by this mode, that a lover of his kind must regard the future of society with no little apprehension. It may well be questioned whether the world has been the gainer or the loser by the discovery of subcu-

¹ “The Hypodermic Method,” &c., p. 90.

taneous medication. For, every remote village has its slave, and not unfrequently several, to the hypodermic syringe, and in the larger cities men in business and in the professions, women condemned to a life of constant invalidism, and ladies immersed in the gayeties of social life, are alike bound to a habit which they loathe, but whose bonds they are powerless to break. Lamentable examples are daily encountered, of men and women, regardful only of the morphia intoxication, and indifferent to all the duties and obligations of life, reduced to a state of mental and moral weakness most pitiful to behold.

“Usually the habit is formed in consequence of the legitimate use of the hypodermic syringe in the treatment of disease. Employed in chronic painful maladies for a long period, it is discovered, when an attempt is made to discontinue the injections, that the patient cannot or will not bear the disagreeable, even painful, sensations which now occur. More frequently, when the injections are to be used for a long time, the patient is unwisely intrusted with the instrument, and taught all the mysteries of the solutions and the mode of administration.”

In reply to my 6th question, Prof. T. Gaillard Thomas, of this city, unreservedly expresses himself as follows: “Yes, of a large number of such, several of whom are now under observation. Indeed, I look

upon the frequency of these cases as a great and growing evil. I never, now, under any circumstances, teach the patient to use the syringe upon him or herself. In my own experience, two deaths have occurred from the prolonged and excessive use of this method of administering morphine, it being continued as a vice for years."

The same opinions are expressed in an editorial in the *London Medical Examiner*, July 5, 1877,¹ the writer instancing many cases where morphia is given unnecessarily, thus leading to the habit, when other drugs fully able to accomplish the desired therapeutic end are neglected.

Levenstein² recognizes the dangers of thus contracting this terrible habit and forcibly depicts its horrors.

Anstie³ thinks that there is "far less tendency with hypodermic than with gastric medication to rapid and large increase of the dose, when morphia is used for a long time," and that there is less mental, muscular, nervous and gastric derangement, less interference with the powers of life, when the habit is thus contracted and carried out, it being thus a smaller

¹ *N.Y. Medical Journal*, Sept, 1877.

² Review of "Die Morphiumsucht," Berlin, 1877, *Edinburgh Med. Journal*, August, 1878, p. 160.

³ *Practitioner*, July, 1868.

evil than the old form of excess by the mouth.¹ That this may be the case in certain individuals there is no doubt, but that it is so in the majority of instances is decidedly negatived by the reports which I have received from all parts of the country, and from gentlemen who devote their attention exclusively to this subject.

Dr. Joseph Parrish, so well known in this connection, writes me that there are exceptional instances where not only does morphia, thus taken several times daily for years, not lessen the vital powers, but seems to be positively beneficial.

Dr. Golding Bird² relates the case of a lady, probably hysterical, who, for the relief of acute paroxysmal pain in the loins, took morphine. She had been taking it for seven years. For the past two years had increased the dose to 10 grs. t.i.d. There were no obvious ill effects; functions were properly carried on, appetite good, and there was no known organic disease.

The morphia was taken by the mouth. This case is given simply to illustrate the fact stated that morphia taken for a long period seems to be of positive benefit, or to do no apparent injury in certain cases, which are, however, but rarely met with.

¹ *Practitioner*, vol. 6, p. 149.

² *Boston Medical and Surgical Journal*, 1842, p. 355.

Dr. J. B. Mattison,¹ of Brooklyn, a well known specialist in this line, has had a number of cases of this kind under his care, and is of the opinion that persons of the decidedly nervous temperament are those most likely, indeed almost certain, to drift into this habit if the injections are continued for a month or more by the physician, especially if it is necessary to use the drug in large doses.

In support of this is the careful research of Dr. Geo. M. Beard,² of this city, who shows how readily persons suffering from neurasthenia take to the use of stimulants and narcotics and push them to excess.

These facts, taken in connection with like views expressed by many of my correspondents, teach us to be specially guarded in the continued use of this drug in persons of this class. It seems to be more dangerous in those instances where full narcotic doses are required in order to relieve the pain of neuralgia, &c., to which this class of persons are especially liable. Persons addicted to the excessive use of alcohol sometimes replace it with opium or morphine, and carry the latter to the same excess as the former.

From those of my correspondents answering the 6th question I have gathered the following:

¹ Interview.

² *Quarterly Journal of Inebriety*, Sept., 1879.

131 physicians report 184 cases of the opium-habit thus contracted, and,

197 physicians have never seen or heard of a case of this kind.

All of those gentlemen reporting indefinitely as "many cases," "have often seen it," "a not uncommon sequel," "know of a number," etc., I have credited with three cases, and I have thus, in all likelihood, reported less than have been actually seen.

Charlatans in various parts of the country are reaping a rich harvest from the victims of this habit. From correspondence with several of these I find that the majority of their victims formed the habit through the use of this instrument for disease, chiefly neuralgia. These quacks are utterly without conscience, without a jot or tittle of honesty or honor, and go on bleeding their patients pecuniarily from day to day, while deluding them with lying assertions and holding out false hopes. An analysis of their so-called perfect substitutes for morphia, by Dr. J. B. Mattison, of Brooklyn, showed them to consist of morphia in large amount; sometimes, morphia and atropia.

Anstie¹ is of the opinion that there is a decided difference, dependent on the manner in which the drug is given. Witness the following:

¹ *Practitioner*, vol. 6, p. 149.

“ That there is a special state of chronic narcotism induced by the continued repetition of *large* hypodermic doses of morphia is a fact familiar to many physicians. It differs strikingly from that which results from the persistent abuse of opium or morphia taken by the mouth, in the slighter effects which it produces on consciousness, and especially in the fact that it usually scarcely impairs, if indeed it does not decidedly increase, the activity of appetite and digestion; hence it is far more consistent with the active performance of the duties of life, and with the maintenance of general bodily nutrition; and, so far, it must be considered as a much smaller evil than the constitutional habit induced by the old-fashioned forms of opium excess. But it is quite as fatally effective as the latter in weaving a chain of habit from which the patient can either not escape at all or can do so only by great efforts, involving the prolonged endurance of great distress. It is certain, then, that the physician can only be justified by very special circumstances in allowing such a condition to be set up in any patient under his charge.”

This is not at all in accordance with the experience of Bartholow, Mattison and Levenstein. At the time in which Dr. Anstie wrote the habit was not so common and much smaller doses were used then, than are employed by the slaves of the habit at the pres-

ent day. The amount of the drug at present used in this way is positively astonishing.

In the case of the governess who died of tetanus following the puncture of a hypodermic needle (see p. 237), the statement is made by Dr. Meldon, that on some days the patient used as high as 20 grs. subcutaneously in the 24 hours; and that this is the largest amount on record. The doctor is mistaken in this. Dr. Bartholow¹ knows of cases where 20, 40 and 60 grains were used daily by habitués; and Dr. Robert Park, of Glasgow, Scotland, writes me of a case of acute mania in a woman, where *one scruple* of morphia was given, hypodermically, at a single dose, she being a non-habitué.

Dr. J. C. How writes me that he has seen patients who were in the habit of taking (hypodermically) from 2 to 18 grains in the course of the day.

Dr. Samuel Logan, Prof. Anatomy and Clin. Surgery in the University of Louisiana, writes me of the following case, which is of interest both from the large amount employed and the ease with which the morphia was diminished in amount and finally stopped altogether:

"The largest amount I have ever reached was in a case of excessive and prolonged suffering from an hepatic abscess, in which, after giving it daily in gradually

¹ "The Hypodermic Method," &c., p. 91.

increasing doses for eighteen months, the amount of twenty-five grains morning and night was reached and continued for ten months. At the end of this time, I began to decrease the dose very gradually without the knowledge of the patient; and at the end of another year I had ceased giving anything but water. For three months I continued to give her water alone, for the purpose of deceiving her. During all this time the hepatic abscess was discharging through the right lung; and it continues to do so, at intervals, still. My first visit was paid Feb. 4, 1875. In this case the morphine seemed to act as a substitute for food, for the stomach was in such an irritable condition that it would retain nothing for weeks at a time. She was sustained also—perhaps chiefly—by nutritive enemata. The latter are even now continued, the stomach being still unable to retain but a very small amount of anything whatever, leading me to believe that it must be bound down by adhesions. To me the chief interest of this case centers around the fact that it demonstrates the possibility of relieving the patient from the ‘opium habit’ by the gradual method. This can be better done when the agent is given, at each dose, by the physician himself. I never teach my patients how to use the instrument, except in necessarily fatal cases. Nor can you trust the relatives or the nurses in this matter. They *will* yield

to the importunities of the patient. I adopted the plan of surreptitiously adding a syringe-full of water to the phial containing the morphine mixture, as I was washing out my instrument after using it each time. Not even the mother of the party discovered what I was doing till I informed her some six months after I had begun the reduction of the dose."

This case and those to follow demonstrate very clearly that with a reasonable amount of care on the part of the physician, there is but little fear that this habit will be contracted. It is in those cases where the physician lets the control of the instrument go out of his hands or where he needlessly uses it, or uses it in unnecessarily large doses, that there is danger of contracting the habit.

Dr. Richard J. Noble, of Selma, N. C., writes me : "On one patient I have used the hypodermic syringe between 2,500 and 3,000 times in a period of eighteen months, and so far see no signs of the opium habit."

Dr. A. W. Carson, writing me, refers to a case where 60 grains of morphia were used, hypodermically, in the 24 hours. No details are given, and I have, as yet, received no answer to a letter requesting full information.

Prof. H. C. Wood, of Phila., writes me of two cases, in one of which the habit was readily broken off. In

the other, it was doubtful whether the habit was contracted by taking morphia by the syringe, or by the mouth.

Dr. Wm. H. Vail, of Cornwall-on-Hudson, N. Y., sends me the history of the following case :

"In August, 1874, I was called to see a stranger—a lady—who said she was suffering from one of her usual severe attacks of neuralgia, and that her physician always used large doses of morphia hypodermically, so I gave her $\frac{1}{2}$ a grain in that way (I then carried the grain powders). In the evening, as she said she was no better, I gave her $\frac{3}{4}$ of a grain. Next morning, I gave her a grain at her solicitation for a larger dose. To make a long story short, I saw her twice a day for some time—every visit she wanted a larger dose. I soon decided she was an opium-eater. But in order to see how much she could bear, I increased the dose more or less every visit (generally $\frac{1}{2}$ a grain) till I reached the dose of 8 grains of morphia hypodermically at one time."

Dr. E. W. Drake, of Middleboro, Mass., writes me of two cases of the habit thus formed, both parties committing suicide because they were unable to break their terrible bonds.

Dr. P. C. Remondino, Health Officer of San Diego, Cal., writes me of a case of morphia habit

from the use of the syringe. The patient used from 8 to 10 gr. per day, increasing to 24 gr. during a severe fit of illness. There is no hope of recovery, as the man is thoroughly broken down. This patient has but seldom had abscess. He plunges the needle directly into the muscular tissue of the arm or leg.

Dr. W. McKenna, of Carrickmacross, Ireland, writes me that in a case of aneurism, in which there was great pain, he used morphia and atropia twice a day for twenty-one weeks, and found that he "did not have to increase the dose even to the end." It may be possible that when atropia is used, increase in the amount of morphia necessary to control pain is not required. If there is any probability of this, it is certainly worthy of extended trial to determine the point positively, for then not only would the danger of contracting the morphia habit be less, but a clue to its proper treatment be reached.

T. Carter Wigg, M. D., L. R. C. P., M. R. C. S., L. S. A., of Derby, England, writes me as follows: "I am of opinion that for all practical purposes $1\frac{1}{2}$ to 2 grains is the dose which gives the full therapeutic value. I have not found larger doses (in cases where the use of morphia has been continued for some time) produce greater or more lasting effect. I have generally found the effect of a dose of morphia, hypodermically administered, to last not more than

from 18 to 20 hours, however large the dose may have been. I have been enabled in one case, where I used it for nine consecutive months, in doses of $1\frac{1}{2}$ grains, by occasionally reducing the dose when the pain was less severe, to thoroughly relieve the patient with the full dose of $1\frac{1}{2}$ grains. I have found one grain every 12 hours produce better results than even as much as 3 or 4 grains once in 24 hours. I will never permit or advise a patient to administer morphia to himself."

Dr. W. F. McAllister, of the Quarantine Office, San Francisco, sends me the details of the following case, where an extraordinary amount of morphine was taken at the dose, and in the 24 hours :

"A physician who resided in this city contracted dysentery while in Shanghai, China, in the summer of 1873. Morphia was used hypodermically, and he drifted into the habit of using the drug in this way himself; the habit resulting in his death in 1878. I was called to see him professionally in Feb., 1875. He was at that time residing at Hong Kong, China. He was consuming each day seventy-two grains of the sulphate of morphia, taken in three doses, 24 gr. to the dose. This he continued to do until the day of his death.

"In another case, equally as interesting, a surgeon in the United States navy contracted the habit while

in Tokio, Japan. He used the drug by hypodermic injection. He was suffering at the time with secondary syphilis. There was hardly a portion of his body free from puncture-points and hundreds of abscesses had followed at the point of puncture. He subsequently returned to California and died in the insane asylum. This patient used twelve grains at a dose."

The first case is certainly a very remarkable one. The second less so, for scarring of the entire body in these patients is common, and the dose is not very large.

In this connection I am reminded of the fact that physicians themselves are often slaves to this habit. I know of two such instances myself and have heard of many others from my correspondents in various parts of this country; none from abroad.

Dr. Wm. W. Cable, of Pittsburgh, writes me: "Yes, a great many of these cases. All these persons who use opium hypodermically, contracted the habit by using the drug for relief of pain caused by accident or disease. Among the diseases for which it had been used in these cases I can enumerate, facial neuralgia, acute rheumatism, sciatica, dissection wounds, simple cholera, ileo-colitis, and diarrhœa. Many of these patients having provided themselves with a syringe take it as regularly as the drinker does

his 'nip,' and in quantities that would astound the uninitiated; one professional man taking 32 grains a day without apparent injury. The only *fatal* cases that have come under my observation were persons who administered the fatal doses themselves (two of the four fatal cases were doctors). In all, the deaths were sudden and unseen by medical men, and in none was any analysis made of the solution used, nor any post-mortem examination of the bodies held."

The two fatal cases spoken of by Prof. T. G. Thomas, of this city, were both in young persons, and the death was due to extreme exhaustion, dependent on imperfect nutrition and a gradual depression of the nervous and circulatory systems.

Dr. William Commons, of Union City, Indiana, answers my sixth question as follows: "Yes; one case—a married woman of good condition in life, twenty-six years old, and when in good health weighing from ninety-five to one hundred pounds. Had not menstruated for four months, and had been treated for obstinate vomiting, which for two months had been controlled by hypodermic injections of morphia. When I saw her she was receiving injections of twenty minims of Magendie's solution of morphia four to eight times in the twenty-four hours. Did not interfere with injections, and gave nourishment per rectum. At the post-mortem, ten days

later, the body was emaciated, weight about fifty pounds; complexion like a mixture of Java coffee and milk; stomach a bag of gas, with the mucous coat peeling off under the finger; liver atrophied; uterus containing a two months' fœtus, which, with all the internal organs, had a color like a mixture of black coffee and cream."

The doctor is inclined to the opinion that death was due to the morphia habit, but the amount used was so small and the time so short that I think it more likely that the vomiting produced extreme exhaustion, with, possibly, some gastritis, and that the patient died more from innutrition and exhaustion than from the morphia habit.

Dr. J. C. Howe, of Haverhill, Mass., writes me: "It has been my fortune, since my return from the army in 1866, to be brought in contact with numerous slaves to the 'opium habit.' I think the use of the syringe is much preferred by habitues to its administration by the mouth; in quite a number of cases it had never been used save by injection. I have no doubt that the quickness of effect and, it may, be the slight stimulus of the prick is the cause of this preference.

"I have had under my care patients using from 2 to 18 grs. daily, in from 1 to 4 injections.

"In two cases—one male, one female—small super-

ficial abscesses followed about one-fourth of the injections. In both these cases the point of insertion was the arm, mostly the upper arm.

"In three cases, all males, who inserted the point in the thigh and buttock, there have been seven deep-seated abscesses, slow in their course, with extremely offensive contents. I think I have found the habit more easily broken up by those who have used the syringe, though I have not usually found the cure difficult in either case where I could get entire control of the patient. Except in victims of the habit, I now rarely use the syringe unless the exigencies of the case seem especially to require it."

The infrequency of abscess amongst some of those who use the syringe for years is a matter of surprise, they making from 2 to 35 punctures a day. Thus, one gentleman, a physician of ability, who has been a slave to the habit for the past six years, writes me that in all that time he has had but two abscesses, and attributes these to the employment of an impure solution. This freedom from abscess must be attributed to cleanliness of the instrument, dissolving the powder at the moment of use, and injecting it while warm. As a rule, the more concentrated the solution the more liability there is to abscess. The majority of these habitués, according to my correspondents, make the injection deep into the muscular

tissue, and to that attribute immunity from pain, inflammation and abscess. Those persons, of whom instances have already been given, who seem to maintain an excellent physical condition, although using morphia in this way several times daily, rarely have abscess. Those, on the contrary, whose health is broken, either from the practice or from some chronic disease, are prone to have abscess follow nearly every puncture. This is especially true of syphilitics.

In some of these persons the condition of the body is terrible. Abscesses are to be seen in every stage, from those just forming to those just healing or healed; large and small cicatrices, reddened, bluish, hardened or doughy lumps; ecchymoses; patches of gangrene of various sizes cover the body everywhere, "leaving" as some of my correspondents express it, "hardly a spot of healthy skin, large enough to be covered by a dime."

The cut at p. 287 represents one of the male nurses at Bellevue Hospital, who contracted the habit by stealing the house physician's syringe to give himself an occasional injection. The effect was so pleasing that he continued the practice and finally died. The wood cut here given represents the condition of his body a short time before death.

Abscesses thus produced are usually deep and

continue to discharge for months, thus further depressing the system. In some persons abscesses are common at first, the skin being very irritable, but after a time they cease to occur, until the systemic tone is severely depressed, and the tissues are suffering from innutrition, when they are very frequent and often accompanied by circumscribed patches of gangrene.

In all these cases constitutional is much more important than local treatment, although the latter should not be neglected. Nitrate of silver, when the granulations are exuberant, and Balsam Peru when sluggish, also strapping, are of service.

Prof. Willard Parker has seen peculiar conditions of the skin result from the habitual use of the syringe. In one case keloid prominences showed themselves, and in the other there was a condition of the leg closely resembling elephantiasis.

Dujardin-Beaumetz¹ relates a case of death, and Calvel,² (both quoted by Bartholow³) "has collected many cases of abscess, traumatic fever and other accidents produced by hypodermic injection of morphia, but, rightly enough, refers them to the causes above mentioned—the state of the needle, improperly

¹ *Bulletin Générale de Thérapeutique*, Jan., 1879.

² "Thèse de Paris."

³ *Op. cit.*, p. 96.



prepared solutions, and to the cachexia induced by the morphia habit."

I have already referred to two cases of death from traumatic tetanus, produced by the use of rusty or unclean hypodermic needles. That tetanus may result from a severe local inflammation, vaccination pustule, and from the hypodermic use of quinia, has also been shown.

TREATMENT.—The treatment of the morphia habit is of three kinds: sudden deprivation, gradual deprivation, and substitution. The former is the plan of Levenstein,¹ who has treated many cases in this way and with excellent success, so far as accomplishing a cure is concerned. It is necessary, however, that the patient be fully under the physician's control, the best place being an asylum. This plan has two decided objections: if the patients have been using the drug for a long time or in large quantities, their sufferings are agonizing, and there is decided danger of serious and even fatal collapse. This has been pointed out by Bartholow,² who has had a very unpleasant experience of the kind, and also by Levinstein; but the latter claims that it can always be obviated by careful watching and prompt treatment, which consists in the injection of a small

¹ "Die Morphiumsucht," Berlin, 1877.

² "The Hypodermic Method," &c., p. 90.

quantity of morphia, say $\frac{1}{2}$ gr. repeated, within a few minutes, if the pulse and general condition do not improve. He remarks that the morphia given for this purpose does not prolong the time of the severe symptoms of abstinence. In addition to this, other means are to be used. "At the same time the patient is to be kept awake by counter-irritation, smelling-salts, cold compression on the head, dropping ether on the skull, by talking loud to him and shaking him; and such stimulants as liquor ammonia, champagne, port-wine, brandy, hot coffee or tea with rum, are to be given internally."

The same author graphically describes the symptoms of total abstinence from morphia, as follows: "Only a few hours have passed since using the last injection of morphia, and already the feeling of comfort brought on by the action of the drug is passing off. The patient is overcome by a feeling of uneasiness and listlessness; the feeling of self-consciousness and self-possession is gone, and is replaced by extreme despondency; a slight cough gradually brings on dyspnoea, which is increased by want of sleep and by hallucinations. The vaso-motor system shows its weakness by abundant perspiration, by the dark color of the face, which replaces the pale condition apparent during the first few days. Flow of blood to the head and palpitation of the

heart, with a hard pulse, soon show themselves. The latter symptom often disappears suddenly, and is replaced by a slow, regular, thread-like pulse, which is the sign of the beginning of a severe collapse. The reflex irritability increases; the patients begin to sneeze, and have paroxysms of yawning; they start if any one approaches them; touching their skin causes cramping movements or convulsions; the trembling of the hands, if not already evident, now becomes distinctly perceptible. The power of speech is disordered; lisping and stammering take place. Diplopia and disorders of the power of accommodation, frequently accompanied by increased secretion of the lachrymal glands, show themselves. The patients are overcome by a feeling of weakness and total want of energy, and are thus compelled to lie in bed. Neuralgic affections of various parts of the body, pain in the front and back of the head, cardialgia, abnormal sensations in the legs, associated with salivation, coryza, nausea, vomiting, and diarrhoea, tend to bring them into a desperate condition. Some persons will bear up with fortitude under all these trials; they will quietly remain in bed and endure the unavoidable suffering, hardly uttering a complaint. Of the others, although the great minority of them sleep and doze during this trying time, some can find rest nowhere; they

jump out of bed, run about the room in a state of fear, crying and shrieking; gradually they become calmer, although occasionally their excitement increases. A state of frenzy, brought on by hallucinations and illusions of all the senses, at last causes a morbid condition to which I have given the name of delirium-tremens, resulting from morbid craving for morphia, it being similar to that caused by alcohol. Some of the patients, however, will be found walking about in deep despair, hoping to find an opportunity of freeing themselves from their wretched condition." Many cases illustrating the different phases of this state are then given by this author.

Here is further evidence in favor of the plan of treatment by sudden deprivation of the drug:—
"Dr. Osgood (*Quart. Jour. Inebriety*, June, 1879) has, in a hospital, during the past two years, treated 800 cases of opium inebriety. His plan, in general, is: (1) The absolute and total discontinuance of the use of opium from the beginning of treatment. (2) A trusty attendant to be with the patient day and night for the first three days. (3) Chloral hydrate for the first three nights if required. (4) Good food, milk, raw eggs, brandy (in some cases), chicken broth. (The above to be taken in small quantities). (5) In diarrhœa, give two-drachm doses of a mixture of equal parts of

tincture catechu and tincture of ginger. (6) Vomiting will frequently yield to bismuth in fifteen-grain doses; and in some cases a single dose of calomel has acted like a charm. Ice is of advantage in some cases. (7) Throughout the entire treatment it should be remembered that the patient is below par, and requires tonics. Quinine and tincture of iron have a prominent place in our list. (8) The patient should expect to suffer more or less for the first three days, and should make himself a prisoner for that time. By the fourth day there is usually marked improvement. (9) Usually by the sixth day all desire for opium is gone. The patient then requires a change of air and surroundings, and tonics for a few weeks. Out of one hundred cases thus treated there was but one death, and that from apoplexy." ¹

Dr. Bartholow ² recommends gradual diminution of the morphia and gradual increase of atropia in the solution used, at the same time paying marked attention to the condition of the general system, using general and special tonics, good food, nutritive enemata when necessary, compelling exercise, and procuring sleep when absent or disturbed, by means of appropriate measures.

¹ (*Detroit Lancet*) *Canada Lancet*, Dec. 1, 1877.

² *Op. cit.*, p. 102, et. seq.

Dr. J. B. Mattison,¹ of Brooklyn, who has done some excellent work in this special field, quotes Dr. Parrish² as a firm believer in the plan of cure by gradual diminution, and gives the following amongst other deductions:

“ ‘To relieve the symptoms it is desirable to avoid the shock, as it is desirable to avoid it in surgical operations.

“ ‘For this purpose, the practitioner should immediately reduce the accustomed supply to the minimum dose, which will meet this condition.

“ ‘When the minimum is reached, the suffering of the patient begins, and then the practice should be to give tone to the nervous system, as the opium stimulus is withdrawn. The reduction should be in minute quantities and the tonic doses full and persistent.

“ ‘The moral sentiment, the confidence and courage of the patient, should at all times be kept up to the attainable degree.

“ ‘Such a course will almost always secure the desired result.’

“The above we believe to be the plan of treatment best adapted to a large majority of cases. True, we cannot support it from personal experience, by refer-

¹ *Southern Med. Record*, Dec., 1874.

² *Med. and Surg. Reporter*, Nov. 15 and 22, 1873.

ence to a single case so managed ; but it appeals itself (in our judgment) most strongly to 'common sense,' which is better than any theory, and, besides, has the indorsement of those whose *successful* experience entitles them to the very highest respect and belief.

"From a superficial view, a plan of treatment directly the reverse of what we advocate answered a perfect purpose in the case under consideration, and, seemingly, our practice was rather inconsistent with our precept. Granted ; but there were some unusual circumstances in this instance, which, fully explained, will make it far from inexplicable why we succeeded so well, notwithstanding a complete and immediate withdrawal of the accustomed stimulus."

The plan which Dr. Mattison is now pursuing seems to possess all the advantages of the several plans heretofore in use, and but few of their disadvantages. The patients being under his immediate supervision, he puts them at once upon full doses of the bromides, sixty grains three times a day, and rapidly increases the amount of these as he lessens the amount of morphia, timing it so that when reflex irritability from deprivation of morphia is present in maximum intensity, the bromides are being given in doses sufficiently large to control it. With this he also uses other means, as tonics,

baths, &c. The doctor's views may be found expressed in his own excellent manner in the *Quarterly Journal of Inebriety*.

Dr. S. F. McFarland,¹ of Oxford, N. Y., believes that these cases are best relieved by "*large reductions at rather long intervals*, allowing time for the system to rally between each, and the patient to retain his self-control."

In connection with the possibility of entirely substituting water for morphia when there is danger of the habit being formed, the following cases, which Dr. R. J. Kinkead, Prof. of Obstet. Med., Queens College, Galway, sends me, are of interest: "Fearing that the habit might be contracted by a patient to whom I had constantly to administer morphia hypodermically, I determined to substitute water in its place—I had never heard of this being done at the time—and I was greatly surprised to find that, whereas, when the morphia was injected, I had time to wash out the syringe and put it up in the case and bid my patient good night, when the water was injected, she fell asleep almost immediately. It never failed to have this effect, and it did not cause a sensation of cutaneous irritation, which usually followed next day when the morphia had been injected.

"But more marked than all was the effect produced

¹ "Trans. N. Y. State Med. Society," 1877.

on another case. Having to accompany a patient on a long railway journey, and finding that the jolting of the train occasioned great agony, I injected $\frac{1}{4}$ grain of morphia. In a short time it produced its effect, but all through the stupor, the motion of the train was felt, and occasionally the patient would spring up into a sitting posture. The eyes would open, pupils enormously dilating, consciousness would return, pupils contract, and, with a groan of pain, the patient would sink down to doze off and go through the same performance again in a short time. In about 2 hours this effect of the morphia wore off, and pain being severe, I was entreated to give another injection. This time I injected water. The patient immediately fell into a sound sleep. Slept without disturbance for the remainder of the journey, did not perfectly wake up when moved from train to a carriage, and slept quietly in it whilst being driven to the house. On other occasions, I have found the same effect follow."

Dr. E. L. Betterly, of Wilkesbarre, writes me that he has succeeded in deceiving his patient in like manner.

There are advertising charlatans in various parts of the country who pretend to break up this habit in from 8 to 20 days by means of the hypodermic use of a perfect substitute for morphia. Some of these solutions have been analyzed and found to contain morphia—some morphia and atropia.

Dr. W. C. Blalock¹ recommends hydrocyanic acid as an efficient substitute for opium and morphia, in the treatment of the opium habit. He has found "no patient who could not quit morphia while under the influence of the acid." It acts pleasantly, without depressing after-effects. His formula reads :

R. Acidi hydrocyanici dil..... gtt. xlviii;
 Syrup. Simp..... ℥ij;
 Aquæ..... ℥j.
 M. Sig: a teaspoonful at 7 A. M., 12 M., and 8 P. M.

Dr. William F. Hutchinson relates the following interesting case² of cure by electricity: "About the first of January of the present year, I was requested by Dr. O. C. Wiggin, of this city, to see with him a lady supposed to be suffering with cerebral congestion in an advanced stage.

A visit to Mrs. S. revealed the following history: "Age 39; married; one child, aged six; and has had one miscarriage. Weight, about 150 pounds; and general appearance of contour and skin good. Patient kept up a low moaning, answering most of my questions intelligently, then relapsing into a semi-unconscious condition. Pulse 100, compressible. Temperature 99°; no loss of control of evacuations; conjunctivæ congested and pupils contracted

¹ (*Atlantic Med. Journal*) *Physicians' Monitor*, 1878, vol. 4, No. 8.

² (*N. Y. Med. Record*,) *Southern Med. Record*, Sept. 20, 1879.

closely; perspiration starts upon the smallest exertion, which also causes pain in abdomen and excites vomiting, which has lately become persistent, accompanied with intense thirst. Hands and feet cold, with shrivelled palms and plantar surfaces. No difference in temperature of head and axilla.

“Ophtalmoscopic examination gave retinal and choroidal congestion, with venous enlargement, slight optic neuritis, and choked disk.

“There was constant pain, and sense of fullness in frontal region.

“The only family history that could be obtained bearing upon the case was the death of one sister, a year ago, from acute brain inflammation, the remainder of the immediate family being still living and in good health; and the present condition appeared to be the culmination of six years of almost constant pain and general nerve exhaustion, following the birth of the child, aggravated by a subsequent miscarriage.

“At this visit no suspicion was entertained by me of any opium habit, and the case was diagnosed as passive cerebral congestion, dependent upon general neurasthenia.

“The next day Dr. Wiggin called and gave me the following additional items, which at once placed the case in its proper light and gave the key to

many of the symptoms before cited. After her confinement, which was a long and painful one, she suffered severely from wandering pains in back and hips, for which her attending physician at the time ordered tincture of opium applied externally, giving at the same time ten drops by the mouth, and the ground was broken for the building of the habit. The dose steadily increased until she came under the charge of Dr. Wiggin, some six months previous to my seeing her, when she was taking four ounces of laudanum daily, internally, besides continuing external applications as before. Attempts were made to stop the pernicious habit, but it was too late for wise counsel to avail, and the usual cunning of opium-eaters procured for her the drug in spite of every effort of both husband and physician.

"All forms of concurrent medication had been faithfully tried, but nothing was of use except the opium, to which it became absolutely necessary to resort occasionally, as, without it, the poor lady would arouse the neighborhood with agonizing screams and cries.

"At this juncture, as a forlorn hope, it was decided to essay galvanism, hoping that its great vitalizing power might aid in restoring tone to the exhausted nerve-centres. At my suggestion, Collis Brown's chlorodyne was given in place of laudanum,

and produced the same effect with an ounce per diem that the four ounces of the former had done.

“Central galvanism was applied with a twenty-four cell Bartlett battery, using six cells from the cilio-spinal centre to the forehead with a downward current; then from the cervical vertebræ to the solar plexus with an ascending current, each lasting six minutes, or until the skin was thoroughly reddened under the negative carbon point. For the first few days applications were made morning and night. In a week the vomiting had ceased and consciousness returned, and the evening sitting was omitted. After a month the dose of anodyne was gradually decreased, but with every diminution the nausea returned, and nothing but a return to the old dose would avail. But her condition was very much improved. She slept better, the eyes were normal as to color, and the palms were no longer dry. At the close of the second month she was able to sit up, and the dose of anodyne was steadily cut down without the patient's knowledge, by adding to the chlorodyne a sufficient quantity of flavored treacle to replace each dose taken, until at that time an ounce would last three days.

“Her general condition was greatly improved, and she began to take interest in her surroundings. In two months more she commenced to go out, and

came to my office for treatment when I changed the current to the Siemens and Halske cabinet cell, which, with its low tension and perfect capability of control, I regard as the ideal battery for central galvanism. There was no further trouble, and to-day, June 21st, the lady is quite well, attending to all her household duties, not having tasted opium in any form for seven weeks, and expressing unbounded delight at being free from the terrible habit which had so long been her master.

“The *rationale* of the action of galvanism in this case is difficult to understand. When the circuit was closed over the superior cervical sympathetic ganglion, Dr. Wiggin and myself distinctly observed a sudden wavelike contraction of the distended retinal veins, which resumed their size in a few moments after the stimulus was removed. But, after some weeks' treatment, these veins became normal, and the intraocular congestion had disappeared *pari passu* with the cerebral symptom, and having repeatedly witnessed the same phenomenon in other cases, I am led to believe that the galvanic current has a direct tonic influence upon the vaso-motor system, which accounts for the occasional surprising results obtained in cases of cerebral congestion. With the advent of increased nerve circulation, came an absolute horror for the drug, and it is not easy to

know to what to attribute the increase of strength of will up to the point of totally dispensing with it of her own accord, unless it be to some change in mental power, due to increased nerve tone, the direct result of what I have before termed the vitalizing power of the galvanic current. Faradism was not at any time employed.

“Dr. Wiggin gives full credit to the special treatment for the cure of the case.”

The most important point for the physician to keep in mind is that, in the majority of cases, formation of the habit from the use of the hypodermic syringe is his own fault. When care and discretion are exercised the rule will be for the patient to recover without any desire to continue the use of the drug. To attain this end the following precautions are necessary.

1. The drug in any form or in any manner should never be used in cases where the patients are of decidedly nervous temperament or when they are in a condition of neurasthenia, *so long as some other drug can be found to accomplish the same end, even though relief be a little less rapid.*

2. In any case the drug should be used only in quantity just sufficient to obtain relief. It is surprising in how many cases decided relief from pain will result from the subcutaneous injection of morphia in

very small doses ($\frac{1}{16}$ to $\frac{1}{6}$ gr.), especially if the puncture be made deep into the muscular structure of the part.

3. The earliest opportunity for decreasing the amount of the drug should be carefully watched for and the necessary gradual decrease in the strength of the solution be made.

4. Where morphia is to be used for any length of time, atropia should be combined with each dose of it, in small amount (from $\frac{1}{90}$ to $\frac{1}{120}$ gr.), as Bartholow is of the opinion that the danger of contracting the habit is thus lessened.

5. The patient should be kept in utter ignorance of what the solution contains, and of its strength. Under *no conditions whatever should the patient, his friends or attendants be instructed in the use of the syringe.*

If these rules are followed, the matter will be entirely in the hands of the physician, and the number of the slaves to this habit will be materially diminished, for in the majority of cases there will be no desire to have the injections continued.

Some patients, tasting the sweets of full doses of morphia, will undoubtedly keep the matter in mind, however careful the physician may be, and, unknown to her most intimate friends, procure a syringe and use it, as is instanced by the following from Dr.

William Edward Vermilye, of Pittsfield, Mass.: "Yes; have heard of several, and have had one instance in my own practice. Three years ago I attended a lady with acute rheumatism and gave her several ($\frac{1}{4}$ gr.) injections at bed-time. Unknown to her husband or to any one else she procured a syringe, morphia in $\frac{1}{4}$ grain powders, and is now a confirmed opium-user."

The cases reported by Dr. Samuel Logan and many others, and those that I give here, evidence the fact that so long as the instrument is in the hands of the physician, the amount, even though large, may be gradually lessened, and the patient be brought to a favorable close of the illness with no morphia desire remaining.

Dr. J. Northrop Smith, of Hickory Grove, Ga., writes me as follows in answer to my sixth question: "I know of but one case, and that of only two years' standing. He was so completely under the influence of the morphia that I have known him to take 6 or 8 grains every twenty-four hours. He has been under my treatment now for some time, and I have gradually reduced the quantity to 1 grain in the twenty-four hours."

Dr. William Judkins, of Cincinnati, gives me the brief notes of a somewhat similar case:

"The patient was a confirmed opium-eater. When

she first came under treatment, gr. $1\frac{1}{4}$ had no more effect than half that dose ; so the syringe was full of water, she was satisfied. Gradually reduced amount without her knowledge, giving internally tonics, &c. Marked improvement took place, and after three months' treatment, the last of which water alone was used hypodermically, discharged her cured.

Prof. William A. Hammond, who, by the way, has never known of a case of morphia habit contracted from the use of the syringe, writes me of a case of chronic spasm of the sterno-mastoid muscle, where he "carried the quantity of morphia up to twelve grains, with the result of curing the disease." There seems to have been no difficulty in reducing the amount and finally discontinuing its use.

CHAPTER X.

THE SUBCUTANEOUS INJECTION OF MORPHIA — CONCLUSIONS.

A STUDY of the opinions and cases that I have collected and presented in the preceding chapters, furnishes abundant food for thought; the more so, as nearly every physician in the world is using a hypodermic syringe with more or less frequency. Many are unquestionably using this instrument too often; are using it in cases where the same, or other remedies, by the mouth, would be equally efficacious, and certainly safer. Far be it from me to condemn the use of an instrument the employment of which has brought both temporary and permanent relief, sometimes cure, to thousands suffering the most intense agony. Its value in cases especially suited to it cannot be over-estimated; its use in cases unsuited to it, or where other means would answer as well, cannot be too strongly and heartily condemned. Death, syncope, alarming narcotism and, perhaps more important than all, that living death—the morphia habit

—bids us choose our cases well, and continue its use for only so long a time as is absolutely necessary.

It would seem from a study of the cases related under the latter head, and from many of the interesting letters for which I cannot find space, and therefore give at second-hand, that so long as the drug is used carefully, and with discrimination, by the physician, the morphia habit is little apt to result, and that it may be broken off when once formed, although the amount of morphia used is large. But nevertheless, even when these results are attained, persons, especially those of the neurasthenic type, will often procure a hypodermic syringe surreptitiously and continue, commence or re-commence the practice anew. For this the physician is certainly not to blame, but the fact still stands, and the question arises whether relief by other means, though less prompt and less permanent, would not have been preferable to the deplorable mental, moral and physical condition that almost uniformly obtains when the habit is once established.

When Wood first gave his idea to the world, and when that idea was practically developed and extended in point of applicability by Hunter and others, it was thought to be glory enough to have found a weapon sufficiently powerful to cope with severe and obstinate neuralgia and diseases that

would not yield to other treatment. To-day, as seen from its journal literature, the subcutaneous method of giving morphine has become almost universal, and it is employed for complaints of the most trivial character. Aside from the immediate and remote danger of thus needlessly extending this practice, there is another reason why this instrument should not be so commonly employed—there is apt to be slurring of diagnosis and a blind treatment of the most prominent symptom. This is especially the case with the younger members of the profession. Having relieved the pain, they fail to study the minor symptoms, to look at patient's family and personal history, to be observing of skin and tongue and pulse. It may be urged that the patient often recovers without any other treatment. True! But many do not, and the lack of study of every point in the successful cases bears its fruit of slovenly diagnosis and unscientific treatment in many succeeding cases.

I have not thought proper to devote space, in the present edition of this work, to a special discussion of the affections in which the hypodermic injection of morphia has proved especially advantageous.

I shall simply content myself at present with giving a list of these diseases, some of which have been spoken of in the preceding chapters, and with the

statement that the most marked curative effects have followed, especially in epilepsy, idiopathic tetanus and neuralgia. These diseases are :

ANÆMIA, CEREBRAL.

ANGINA PECTORIS.

ASTHMA. [The morphia cigarettes of Reginald Thompson are better.]

BLEPHAROSPASM.

BRONCHITIS. [With hacking cough and with excessive secretion.]

CHOLERA. [Dr. T. Y. Johnston, of Sarnia, Ontario, Canada, relates the following: "1 grain by actual weight in 3ss. tepid H_2O —in collapse of 'Canadian cholera' constant vomiting—involuntary discharges every 10 minutes—extreme case—caused by drinking impure water in haying-field, in large quantity—hot day—happiest results."]

CHOLERA MORBUS. [Many of my correspondents testify to its very rapid and powerful curative action in this affection.]

CHOLERA INFANTUM. [In minute doses.]

CARCINOMA.

CYSTITIS. [Morphia by suppository is preferable.]

CONTINUED FEVERS. [Small stimulant doses, and with small doses of antimony to control delirium.]

CONVULSIONS, HYSTERICAL. [Lauded highly also by some in infantile convulsions, when given in small doses.]

CARDIAC DISEASES. [Small stimulant doses; also for the troublesome cough of attendant bronchitis.]

CHOREA. [Rarely curative. Produces much-needed sleep and modifies severity of symptoms. One case of cure reported from injections of $\frac{1}{10}$ gr. morphia and $\frac{1}{12}$ zinci sulph.]

DELIRIUM-TREMENS. (Vigilans.) [A dangerous remedy.]

DYSPŒA. [Of great service oftentimes, whether the affection is due to mechanical or other causes.]

DISLOCATIONS. [Often removes pain and relaxes muscles, thus allowing easy replacement.]

DIABETES. [Sometimes, though rarely, curative.]

DYSPEPSIA, NERVOUS. [Often a marked benefit, but should be used with the greatest care lest morphia habit be formed.]

DIARRHŒA. [Other means quite as effective and less dangerous.]

EMPHYSEMA.

EPILEPSY. [Often curative. Best in non-traumatic and minor cases.

Dr. J. A. Gamage reports the following, Feb. 28, 1873: "Mrs. H. 2371 Tulip St. Age 66 years. Widow for 24 years. Blonde. Above the average height; weight 136 lbs.; always enjoyed good health with exception of the frequent epileptic attacks. Catamenia regular and normal; no dysmenorrhœa or uterine trouble. One child, female, aged 30 years. Troubled since 1853; first attack occurring without any apparent cause; always suddenly, with but one manifestation of its approach—*i.e.*, copious and frequent micturition, occurring shortly before an attack. No giddiness, deafness, dimness of sight, sounds in the ears, sparks of light before the eyes; but marked distention of the veins of the head and neck, trembling of the extremities, wandering, confused state of the mind, with entire loss of the power of distinct articulation, occur immediately before the epileptic attack.

"The most severe seizures are preceded by painful sensations, particularly spasmodic pains in the stomach. The convulsive action of the muscles was not confined to any particular part, but more active about the face. Always of the clonic kind; the thumbs always firmly pressed in upon the palms of the hands. The face always livid, with a turgid state of the veins of the head and neck; respiration laborious and always sonorous, varying with the severity of the attack.

"These spasmodic symptoms always abate abruptly.

"In no attack has either urine or faeces passed off involuntarily.

"The shortest duration of the paroxysms, twenty minutes; the longest, nine hours.

"Never more than one paroxysm has occurred at one time or on the same day; but occur regularly—monthly in winter, semi-monthly in summer.

"The mental powers have gradually been failing, till (at this time, 1873) almost total imbecility now exists.

"I am indebted to her daughter for the greater part of this history of her mother's case; also, the fact that she has been under medical treatment for years, here and there, hospitals, dispensaries, and private physicians, regular and others, embracing all pathics.

"Concluded (as an experiment) to attempt the prevention of future occurrences, by administering hypodermically $\frac{1}{8}$ gr. morphia sulph. thrice daily for one month; daily for three months;

thrice weekly for three months ; weekly for one year, and semi-monthly for one year—then discontinued treatment. During this time no other medicine was given for the malady under consideration, and no attack has ever occurred from that day to this time of writing.”

Dr. Charles Bain, of Murphysborough, Ill., another, as follows : “ The case in which I used such a large dose of morphia and atropia was one of epilepsy, which had resisted all treatment for seven years. At the time that I began the treatment of the case the spasms had become so severe that they had paralyzed one side of the patient, and the interval between the spasms was only five minutes, and the patient had not been able to eat or drink for forty-eight hours. I began the treatment by using one grain of morphia and one-fiftieth of a grain of atropia every 6 hours, and in five days the spasms had ceased entirely. Now, for the first time in the history of the case, neuralgic pains set up, of the severest grade, all over her system. I had then to increase the atropia and use the syringe three times a day to keep the patient quiet, and finally I had to increase the atropia to one-sixteenth of a grain, and use it only twice a day. I used the above dose of morphia and atropia twice a day for some two months, and the pains began to subside, and I would only use it at night or bed-time, to give rest for the night. I used it at night only for some thirty or forty days, and then only every other night, as the pains kept gradually giving away and finally not more than one time in a week. I treated the case from first to last, about six months, with the hypodermic syringe and nothing else. At the end of this time all pains ceased. It has been now three years since the patient has had any symptoms of epilepsy or any pain.”]

GASTRIC CATARRH.

GASTRIC ULCER.

HEPATIC COLIC (Gall-stones).

HEPATIC CANCER.

HEPATIC ABSCESS.

INSOMNIA. [Often succeeds where opium or morphia by the mouth fail.]

INCONTINENCE OF URINE.

ITCHING (Pruritus Vulvæ).

LARYNGISMUS STRIDULUS. [Bartholow.—But a minute quantity of morphia to be used.]

LEAD COLIC.

LUMBAGO. [Inject directly into the muscle; $\frac{1}{12}$ gr. a sufficient amount.]

MALARIA and MALARIAL NEUROSES. [Spoken of in the highest terms by some of my correspondents.]

MANIA and INSANITY.

MENINGITIS, CEREBRO-SPINAL.

MUSCULAR SPASM. [See Hammond's case, p. 305.]

NEURALGIA. [Over one half the slaves to the habit contracted it in being treated for this disease. Under no circumstances let the patient buy or use the syringe himself.]

NYMPHOMANIA.

OVARIAN NEURALGIA.

PLEURITIS.

PNEUMONITIS. [See pp. 91, 92.]

PERICARDITIS.

PERITONITIS.

POLYURIA. [Other remedies act quite as well.]

RENAL COLIC. [Often the only manner in which morphia can be given with relief to the intense pain. The injection should be made directly into the lumbar muscles.]

RHEUMATISM.

SHOCK. [In small stimulant doses, frequently repeated.]

SPINAL IRRITATION.

SPRAINS.

TETANUS. [Acts better in idiopathic than in traumatic form.]

URÆMIA.

VAGINISMUS. [Rectal or vaginal suppositories better.]

VOMITING OF PREGNANCY. [Often of great service.]

As already shown (in Chapter I), morphia, when given hypodermically, acts differently, in some respects, from morphia when given by the mouth. These differences are not so important, however, as to warrant us in the indiscriminate use of the drug in this manner. It is only fitted for cases where it is desired to obtain :

- (a.) Rapidity of action.
- (b.) Increased force of action.
- (c.) Direct benefit from localization.
- (d.) A minimum effect on the functions of the alimentary canal.

These four propositions really cover the whole field of the usefulness of morphia in certain diseases, and explain the difference in action. The action of a drug when given by any way other than the stomach is no way different save in rapidity of action, increase of force, absence of local action on the stomach and presence of local action on the absorbing surface. Such difference is, of course, very important in certain diseases, and as such is worthy of careful consideration, but the attempt, made by some, to ascribe the curative effects of the drug thus given to a mysterious something, in no way explainable, is foolish. Difference of effect from varying degrees of force is aptly illustrated by the difference between an easy blow upon a "rice-grain tumor" of the wrist joint, and a forcible blow—the one makes little or no impression, the other ruptures the sack and cures the disease—of difference in rapidity, by the example of the hot air bath given at pp. 24, 25.

The same knowledge that leads us to a proper understanding of the therapeutic action of the drug thus given, also points out very forcibly the danger

of using it hypodermically in certain persons and in certain diseases.

Those cases where death has been attributed to this method of exhibiting morphine furnish a very instructive chapter. In some instances the fatal result was undoubtedly wrongly, although honestly attributed to this cause. So complex a piece of mechanism is this body of ours; so many diseases, so many taints and impressions, hereditary and acquired, are working in us from year to year; so much have our physical and social surroundings to do with the state of our health; so many processes are going on within us, of which we have but the faintest inkling of their how or why, that it becomes us ill to say positively, especially in the absence of a knowledge of all the facts in the case, and frequently without the light shed by an autopsy, that death was due to this or that cause alone. The same facts admonish us that routine practice and favorite prescriptions are a snare and a delusion; that we need more exact knowledge and less taking things for granted; that patients must be treated individually and not as a class, and that shouldering a disease with a name and then smothering its outcry—pain—under a heavy dose of morphine, is not the chief aim and end of all medicine, and is but superficial and unscientific practice. The patient's physical and mental peculiarities must

oftentimes be understood, or a cure, unless by a happy accident, is not possible.

I do not forget that in many cases diseased action may be set up and continued by the pain of some other diseased action, or the disease itself be aggravated by the continuance of this its most apparent and most distressing symptom. In such cases morphia or its like are of great benefit, and should be given by the skin when they cannot be taken by the mouth or rectum, and *not otherwise*. In any case the patient should not know what he is taking, and the drug should only be continued as long as is *absolutely necessary*. If necessary the drug should be called by some other name.

Many of these cases of death, however, are as well established as it is possible to establish anything of this kind. Furthermore, it must be borne in mind that the cases thus recorded are but a percentage, possibly a small one of the cases where death has actually occurred from the use of the drug in this way. There is a natural delicacy about exposing one's blunders to the world, especially blunders that have compromised the life or caused the death of a human being. Crimes these will be considered, however much the physician may offer in their extenuation, and however great a part may have been played by the idiosyncrasy of the patient. The dose

may have been small, the patient apparently in a precarious condition of health, and death occur. Thinking men would not blame, yet moral cowardice on the part of the physician far outbalances the honor attaching to the sacrifice of personal feelings for the good of the profession or the public.

In support of this, I may say that I know of cases other than those here reported, where death was attributed to the hypodermic use of morphia, and yet the physicians will not even allow the histories or the main facts of the cases to be used anonymously.

Still, with this knowledge of the possibility of death from small doses, and the fact that death has occurred in many instances, it must be remembered that the practice yielding this number covers a very extensive ground both as regards time and the number of injections—forty years and fully thirty thousand injections, at the lowest estimate (the latter applying only to the practice of my 360 correspondents). If the practice, when legitimately pursued, can be made, by a little care and the study of idiosyncrasy, to yield few or no deaths and accidents, and but few cases of the morphine habit, such care and study will have been well repaid. Meantime a physician, who from a neglect of these precautions loses the life of one or more of his patients, should be held responsible, provided it has been in

his power to acquaint himself with the facts in the case.

Three very plain lessons are taught us, I think, by the cases here recorded : First, that the use of morphia in large doses by the mouth, and especially in small or large amounts by the skin, is a very hazardous proceeding in delirium-tremens and, possibly, in acute mania. Second, that the use of the drug in this way, if given at all, should be given with the greatest care in those diseases in which there is a tendency to death by the lungs, and where the blood is but poorly aerated. Third, that the hypodermic injection of morphia in chronic organic disease of the kidneys, especially that form known as "cirrhotic" or "granular contracting" kidney, may be followed by fatal results.

At the same time, it must be remembered that in these very diseases morphia, in large doses ($\frac{1}{2}$ to 3 grains), has been repeatedly given by the hypodermic method and not only without producing fatal or serious but, on the contrary, very beneficial results.

Robert Park, Med. Officer for 3d and 4th Districts of City Parish, Glasgow, Scotland, writes me of the following case : "Mrs. Sarah Walker, prostitute, aged 36, admitted into Chatham Workhouse, Oct. 8, 1869, under my care. Insane ; suffering from gay delirium, and very violent. Usual narcotism ob-

served after morphia given *per orem*, did not follow. Sleep not obtained for many hours, but delirium moderated and controlled. Seen on the day following the injection (*one scruple having been given*), by Dr. Hutchins, F. R. C. S., of Chatham. Solution used contained 1 gr. in 12 minims and 3ii were injected. She was sent to Baring Lunatic Asylum, Kent."

Dr. Wm. M. Baird, of Washington, N. J., writes as follows: "15 minims at 9 A. M.; 30 minims at 9.30 A. M.; 30 minims at 10 A. M.; and 3i at 10.30 A. M., and failed to get effects then, and ceased. This was in a case of sleeplessness from excessive drink." Others of my correspondents report like cases. Here $4\frac{1}{2}$ grains was administered subcutaneously within a period of one hour and a half. Hardly a safe proceeding in the light of cases already recorded and the fact that Ware found that more persons died under the opiate than under any other treatment.

There necessarily enters into this, as into every problem of like nature, the element of possible error, due in part to coincidence, in part to our inability to judge fully, from lack of knowledge or opportunity. For instance, Dr. B. may be firmly convinced that Mr. C. died from the effects of a hypodermic injection of morphia, given to him while he was suffering an attack of delirium-tremens. An

autopsy is not made, either from objections offered by the man's friends or from carelessness, perhaps fear, on the part of the physician. Dr. B. will consequently always believe that death was due to the drug, when, *possibly*, if an autopsy had been held, sufficient cause might have been found to utterly refute the idea.

If ours was a profession the members of which were prone to vent petty spites and secretly cast discredit upon one another, Dr. B. might, perhaps, in the absence of a post-mortem examination, be still more firmly convinced of the truth of his opinion, if the death occurred in the practice of his rival, Dr. S. This, however, is merely a supposition, and a very unchristian-like one at that.

Further observation and clinical experience may prove that I am in error on these points, but until such evidence is presented we have sufficient grounds for avoiding the use of the drug by this method, or using it with the utmost care and in minute doses, in these complaints.

An important point, in treating any person with whose peculiarities we are not acquainted, is to ascertain whether any idiosyncrasy with reference to opium or morphia exists, and to use a *very small* commencing dose, increasing it afterwards as the exigencies of the case may require.

Many physicians are daily using quantities of morphine, at a single dose, that have been known to kill in some cases. Others are using amounts that are not only much larger than this, but extremely dangerous and, in my opinion, uncalled for save in very rare cases, much smaller doses accomplishing all that is to be desired. These gentlemen urge that they have been giving the drug in these amounts for years past and have had neither accident nor death. This is no proof that such doses are not dangerous. Many men can say the same with regard to chloroform; still no one doubts that death has been produced by that agent in cases when a fatal result was least expected and in the hands of gentlemen who had taken every precaution and were fully competent to administer it.

Take the following extracts from a letter that I received from a prominent medical man in Scotland, as an example: "Usual dose varies much, as *e. g.*, from $\frac{1}{8}$ to 1 *grain* at *first* injection, and from $\frac{1}{4}$ to 3 *grains* for subsequent injections. Physiological and therapeutical effects relied upon as guides. I never predetermine my dose now, but *inject slowly* a dose as nearly as possible proportionate to intensity and quantity of pain to be relieved; or, otherwise, relatively to constitution or idiosyncrasy of individual." Again he says: "From 2 to 3 grains a very frequent

dose, and perhaps (roughly speaking) $1\frac{1}{2}$ grains might be set as an average in my practice." Still this gentleman has never seen death or accident result. *He has been very fortunate.*

Every blessing of the extent that this method of administering morphine has been to suffering humanity must needs have its draw-backs, and consequently he who avails himself of its advantages should be prepared, at a moment's notice, to combat its evil effects and successfully treat the accidents that may occur.

I venture to say that many of the deaths here recorded would not have occurred if the agents necessary to use and the knowledge of just how to use them had been in readiness. To this end every physician should carry with him, in the same case with the morphine (so that when he takes the one he is obliged to take the others) the proper drugs to use in case syncope or narcotism result. It has, I think, been demonstrated with sufficient fullness, that atropia alone should not be fully depended upon in combating the narcotic effects of opium or morphine.

By having these drugs, the names and amounts of which should be plainly *printed* upon each paper, in the form of powders, they can be carried in small compass—in the case containing the syringe. They are as follows:

6 $\frac{1}{30}$ gr. Atropine powders.

3 $\frac{1}{30}$ gr. Strychnine powders.

6 2 gr. Citrate of Caffeine powders.

6 1 gr. Carbonate of Ammonia powders.

Or in solutions :

Magendie's solution of Morphia — 3 ii.

Solution Atropiæ Sulph. (gr. $\frac{1}{4}$ to 3 i) — 3 ii. (m. v.
= $\frac{1}{48}$ gr.)

Solution Strychniæ Sulph. (gr. $\frac{1}{2}$ to 3 i) — 3 ii. (m.
v. = $\frac{1}{24}$ gr.)

Solution Caffeinæ Citrat. (gr. xii to 3 i) — 3 ii. (m. v.
= gr. i.)

Aq. Ammonia (10 per cent. gas) to be diluted with
equal parts of water — 3 ii. vel. $\frac{2}{3}$ ss.

or, if preferred, the compound powders or solutions given at p. 209 may be used.

Where the physician does not object to carrying a little larger case, the solutions may be carried in $\frac{2}{3}$ ss. bottles, which will need refilling less frequently, and not necessitate the use of such concentrated solutions. Indeed, all the drugs used by the hypodermic method can be packed in a small compass.

By this arrangement the physician has at hand the means for combating any dangers that may arise. This is of especial importance in country practice, where it is often several miles to the nearest drug-store. These remedies are needed at once; the battery and oxygen can be sent for. Cold water for

douching purposes, and wet towels for flagellation are always to be had.

The tourniquet (described at p. 136) for ligature of the limb in case of syncope, should be in the case or in the physician's pocket. In its absence any strong piece of cord or linen will answer the purpose. I must again insist that it is never safe to give a hypodermic injection of morphine or of any other powerful drug without a cord or tourniquet hanging loosely on the limb, ready for immediate use, in case of necessity. It will, probably, not be necessary to tighten it in one out of a thousand injections, but that once may prove fatal if the appliance is not at hand.

The method of injecting is a matter of no small importance, both as regards the frequency of inflammation and abscess and the liability to wound a vein, with the resulting unpleasant and sometimes dangerous symptoms. Many of my correspondents favor the deep injection, while some few believe it improper. In this connection I give an extract from the letter of Dr. Stephen B. Hamlett, of Waco, Texas, it having reached me too late for insertion in its proper place :

"Morphia to have its full effect and to act promptly when injected under the skin, should be *thoroughly* dissolved, and the solution made warm before using.

"I have frequently observed that when persons, es-

pecially those unaccustomed to resorting to this means of relief, *roughly punch* the needle into the tissues, they not only cause great pain to the patient, but, by the imperfect manner in which the medicine is applied, they greatly modify the good that would otherwise result from its use. My opinion is that the medicine acts much more promptly when placed well into the subcutaneous cellular tissue, after having been prepared as above suggested, for I have frequently observed that when placed into the *muscular tissue*, as is often the case, its effects are quite slowly developed and altogether unsatisfactory.

“Caution should at all times be observed in giving morphia in this manner, when it has been recently administered *per os* without relief. For I have noticed, at times, the prompt relief apparently given to all the functions by the use of a hypodermic injection of morphia, and have been led to believe that absorption even, under certain circumstances, may be materially aided. In this manner we are liable to get the cumulative effect of the drug, and narcotism results.

“I would advise caution, also, in the use of any anodyne or anesthetic *immediately* before resorting to the hypodermic use of morphia.”

Slowness of effect, in many cases, is to be desired, and if injection into muscle gives this result, then it

should be followed in all cases save those where a sudden and shock-like or very rapid action is required. Deep injections, are, I believe, worthy of a more extended trial than they have thus far had.

Prof. Wm. H. Draper, of this city, in conversation with the author a few days since, dwelt forcibly upon the relation existing between rough and careless injecting and the occurrence of inflammation and abscess. He *never* makes the puncture in the forearm, but selects the parts on the front of the arm, about the shoulder, and the abdomen, owing to the small number of veins and the abundance and depth of the cellular tissue, permitting free movement of the skin. His method is as follows: He pinches up a longitudinal fold of skin, and inclining the syringe at about an angle of 45° , enters the needle *at a right angle to the long axis of the limb*; the danger of puncturing a vein being, therefore, at a minimum. The needle working freely in the subcutaneous cellular tissue, he injects *slowly*. Although having used the syringe for many years and in a large number of cases, he has never entered a vein or had an accident. In support of his views, he cited the case of a young lady, suffering intensely from spinal irritation, where he gave an injection twice or three times a day for over two years without the occurrence of a single abscess. As the case improved he gradually diminished the num-

ber of injections, and finally ceased to give them. To-day, her skin does not bear a mark to show the place where the injections were made, and there is no thickening of the subcutaneous cellular tissue.

The doctor is firmly of the opinion that had this young lady been allowed to use the syringe, she would have become a slave to the habit. He never permits a patient or his friends to use the instrument.

I give here the following from Dr. A. G. Emory, of Opelika, Alabama, which was unfortunately overlooked. It belongs in the chapter on INJECTION INTO A VEIN :

“I remember three cases in which there were very distressing symptoms, chiefly nausea and vomiting, which continued for several hours ; in one case at least 10 hours. The first time I had the trouble was in an unmarried lady of about 25 years and hysterical. Morphine was used to prevent, if possible, the return of certain nervous symptoms which came on every forenoon. The dose was small—exact amount not remembered—and was injected under skin of arm. I remember that the puncture bled, and my opinion is the needle entered a vein, for she complained almost instantly of a dizziness and nausea, and very soon she began to perspire quite freely and was very restless and pale. I never repeated morphine in her

case. In one of the other two cases there is an idiosyncrasy, as opium in all methods of administration produces nausea and vomiting."

Finally, let it be distinctly understood that I consider the hypodermic use of morphia a very decided therapeutic advance, and of incalculable benefit in allaying pain, and curing disease in cases where other modes of treatment utterly fail. In calling attention to the dangers sometimes attending the use of the drug in this way, I do it not from a one-sided view of the question, not with a desire to condemn it, simply to point out what *may* occur, endeavor to show how best to avoid it, and, if possible, restrict its use to those cases in which it is proper.

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*Who have kindly favored the author with their opinions
upon the hypodermic injection of morphia.*

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