removed, and vascular spasm is diminished. Albutt⁴ says, "In hyperpiesia, venesection is not only well borne, but its effects seem far reaching. It compasses some profounder alteration, lying beyond our direct appreciation."

How often it is safe to bleed a patient with hypertension has not been definitely established. It has been determined by Lyon⁵ that, after small losses of blood, the number of corpuscles reaches the normal again in from two to five days. In hemorrhages which amount to from three to five per cent. of the body weight, he found the period of regeneration to lie between five and fourteen days. The amount of blood withdrawn in chronic cases does not approach this limit, and it is seldom that venesection is indicated within a month after its last performance. There is, therefore, probably no reason why phlebotomy should not be repeated as often as the indication arises, within reason. The danger of permanently altering the blood by repeated blood letting does not seem, from the evidence at hand, to exist as a practical objection. Fox⁶ and Albutt⁴ both report cases in which venesection was practised repeatedly through a number of years without any ill effects. The results in the writer's cases agree with those of the authors cited. Fox⁶ has noticed, moreover, that such repeated venesections have permanently reduced excessive blood pressures, although the amounts of blood withdrawn were far too small to produce such effects in a direct manner. Mendel⁷ agrees with these conclusions, and believes that better results are obtained from blood-letting than from less vigorous measures. It seems fair to conclude that the measure is without danger in these cases of hypertension, and that the results, so far as they go, are favorable.

In conclusion, the following statements seem justified by the cases reported by the writer and others:

1. Venesection, performed under proper indications, is not a dangerous measure, especially since the "dose" can be accurately controlled.

2. In the presence of dilatation of the heart, renal toxemia, hypertension or a combination of these conditions, it may be expected to act more promptly and more surely than drugs.

3. It lowers blood pressure and at the same time produces a more efficient circulation when performed in cases of hypertension, but does not, in therapeutic "doses," lower normal arterial tension.

4. It should never be performed in the absence of definite indications, but should not be withheld until the hope of success for any measure is gone.

5. The amount of blood to be withdrawn is to be decided by the point at which relief is obtained. The error is generally on the side of too small an amount.

6. Repeated blood-letting, when indicated, does not seem to have any ill effects upon the composition of the blood.

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A BRIEF HISTORY OF GASTRIC INTUBATION.

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It has been stated, on good authority,¹ that Baron Larrey, Sr., preceded Kussmaul in the use of the stomach tube, having employed it with success in the nourishment of tetanus patients, and in the case of Marshal Murat, who had been badly wounded in the neck (1799). In these cases,² it appears that Larrey employed an œsophageal tube of gum elastic, which was introduced into the pharynx and passed a short distance down the œsophagus. It does not appear that the tube penetrated the stomach, for Larrey says that, at first, "we could not determine whether the tube was in the larynx or the pharynx, until a few drops of fluid had been introduced. If in the former, a suffocating cough was the result." To avoid this attack, Larrey himself directed the tube with his finger into the aperture of the œsophagus, but it does not seem that he ever went further than simple œsophageal intubation. In regard to Kussmaul's priority, it is well to note that the title of his monograph of 1869 is "Ueber die Behandlung der Magenerweiterung durch eine neue Methode mittelst der Magenpumpe." In other words, Kussmaul was the first to employ gastric lavage in dilatation of the stomach from pyloric obstruction. The fact that his memoir is printed as an academic festal "Programm" of the University of Freiburg, in celebration of the birthday of Grand Duke Friedrich, indicates the importance he attached to this therapeutic innovation. Glancing at the first pages of the Programm, we find that on September 19, 1867,³ he had already made a communication on the subject to the Deutsche Naturforscher und Aerzte at their Frankfurt meeting, and that on the authority of Bowditch, he attributes the invention of the stomach-pump to Dr. Wyman of America. But the stomach-pump has a much more ancient history, and the real point about Kussmaul's priority is that he was indubitably the first to wash out the stomach for a pathological condition other than poisoning.

In the Galenic treatise on "The Physician," we find the brief sentence that "to empty a full

bladder, an instrument shaped like a Roman S is employed, which Erasistratus calls a catheter."⁴ But even before the time of Erasistratus (300 B.C.), it seems likely that the simple idea of introducing a hollow tube into the rectum or urethra, if not into the œsophagus or larynx, must have occurred to more than one ingenious person. In the well-known section on "Medicinal Remedies which have been borrowed from Animals" in Pliny's Natural History,⁵ occurs the familiar instance of the ibis which "by means of its hooked beak, laves the body through that part by which it is especially necessary for health that the residuous food should be discharged." Any hollow tube in nature, such as bamboo or the flexible stalks of water-lilies or other aquatic or semi-aquatic plants, perhaps tipped with bamboo, might well have been adapted for this purpose, in the first instance. The Thakore Saheb of Gondal, in his "History of Aryan Medical Science" (1896), mentions twenty varieties of Nadis or "tubular instruments like catheters" used by the ancient Hindus (p. 182), and states that, in their surgical teaching, dummy catheterization was practised on "an unbaked earthen vessel filled with water" (p. 185). The large number of cases in which elongated objects have been found in the male or female bladder will suggest that the idea of catheterizing the bladder per urethram did not require any great stress of mind, and that the notion of the simple siphonage of the stomach's contents may have occurred to primitive man, even if he found it difficult or impossible of accomplishment. Indeed, it will be found that the crude idea of nearly every therapeutic procedure of permanent value came from primitive or semi-cultured people, and the history of each has "a long foreground." In the textual history of medicine, however, the "law of priority" is that credit, in each case, shall be given preferably to the author of the first published record of the discovery or invention.

In the case of intubation of the stomach, we find such a record in the graduating dissertation of Alexander Monro III (1773-1859) of Edinburgh (the "evergreen *tertius*"), which deals with the subject of difficult deglutition (*De Dysphagia*). In contesting John Hunter's priority in the matter of passing food into the stomach by means of a tube (1790), Monro *tertius* states that thirty years before the publication of his own graduating thesis of 1797, his father, Monro *secundus*, had employed a flexible tube with bellows and speculum oris, for removing dangerously fermenting fluids and gases from the stomachs of cattle. The son gives a full description of this apparatus, which is figured on plate xiv of his dissertation, and which, if we may credit his statement, dates back to 1767. From a newspaper of the period, he gives the following description of the instrument by Monro *secundus*:

"This tube is to be composed of an iron wire, much larger than a common stocking wire, or about 1/10th part of an inch in diameter. In order to give it the cylindrical form, it is to be twisted around a thick rod of iron; and, after taking it off the rod around which it was turned, it is to be covered with smooth leather.

"To the end of the tube, which is intended to be passed into the stomach, a brazen pipe, two inches long, of the same size as the tube, and pierced with a number of holes, is to be firmly connected.

"To prevent the tube from bending too much within the mouth or gullet, in time of passing it down into the stomach, an iron wire, 1/8th of an inch in diameter, and of the same length as the tube, is put within it, which is to be withdrawn when the tube has entered the stomach.

"The space from the foreteeth to the bottom of the first stomach of the largest ox, measures about six feet; the tube, therefore, ought to be six feet long, that we may be sure of its answering the largest oxen.

"And, to prevent the tube from being injured while it is introducing, a speculum oris, of a large size, the under plate of which is one foot long, and three inches broad, and the screw which separates the two plates about six inches in length, should be previously put into the ox's mouth, that his tongue may not come in the way, and that he may not crush or break the tube with his teeth.

"After the tube is passed into the stomach, it may be allowed to remain within it for any given length of time, as, when it is pressed to one side of the throat, it does not interrupt the breathing of the animal.

"The greater part of the elastic and compressed fixed air will pass through the tube, and, if it be thought necessary, the remainder of it, or the superfluous drink, may be sucked out by bellows fixed at the upper end of the tube, with a couple of valves, one at its muzzle, and the other in the side of it, so disposed as to allow the air to pass in the direction outwards."⁶

On September 21, 1790, John Hunter read to the Society for the Improvement of Medical and Chirurgical Knowledge a "case of paralysis of the muscles of deglutition, cured by an artificial mode of conveying food and medicines into the stomach." He describes his apparatus as follows:

"The instrument made use of was a fresh eel-skin, of rather a small size, drawn over a probang, and tied up at the end, where it covered the sponge, and tied again close to the sponge, where it is fastened to the whalebone, and a small longitudinal slit was made into it just above this upper ligature. To the other end of the eel-skin was fixed a bladder and wooden pipe, similar to what is used in giving a clyster, only the pipe was large enough to let the end of the probang pass into the bladder without filling up the passage. The probang, thus covered, was

introduced into the stomach, and the food and medicines were put into the bladder, and squeezed down through the eel-skin.

"The instrument did not produce irritation in the fauces or œsophagus; in such cases, the parts losing their natural sensibility, allow greater liberties to be taken with them. An eel-skin seems very well adapted for this purpose, being smooth, pliable, and readily passed into the stomach; but as cases of this kind may occur where eels cannot be procured, a portion of the gut of any small animal, as a cat or lamb, will make a very good substitute."

Thus it appears that, in the eighteenth century, *Monro secundus* (1763), John Hunter (1790), *Monro tertius* (1797) and *Larrey senior* (1799) employed or recommended each a flexible tube for artificial feeding or for withdrawal of the contents of the stomach.

The next record in point of time is that of the Philadelphia surgeon, Philip Syng Physick who, in the *Eclectic Repertory and Analytical Review* of October, 1812, gives an "Account of a New Mode of Extracting Poisonous Substances from the Stomach" (pp. 111-113). The case was one of laudanum poisoning in two male twin infants, three months old, both of whom were in a state of profound coma when Physick saw them. He says:

"Under these circumstances it clearly appeared no time was to be lost, and therefore, as they could not swallow anything I determined to inject an emetic into their stomachs. For this purpose a large flexible catheter was passed through the mouth down the œsophagus into the stomach, and through this, one drachm of ipecacuanha mixed with water was quickly injected by means of a common pewter syringe."⁸

After several trials, in which the different fluids ingested were withdrawn by applying a syringe to the projecting end of the catheter, good breathing and heart action was brought about in the little patients, only one of whom, however, recovered. In a footnote on p. 112, Physick says:

"The idea of washing out the stomach with a syringe and tube, in cases where large quantities of laudanum or other poisons had been swallowed, occurred to me at least twelve years ago, and I have constantly, for many years, recommended it in my lectures. In the year 1809, Dr. Dorsey performed the operation of washing out the stomach in such a case, but the patient had taken the poison twelve hours before he was called, so that he did not succeed."

In a subsequent note in the same journal (pp. 380-381), Physick adds:

"I have the pleasure of announcing to you and to your readers, that in several instances which have recently occurred in this city, the practice has been completely successful.—In two cases treated by Dr. Dorsey, in which large quantities

of laudanum had been taken, there is great reason to believe that no other mode of treatment would have succeeded in preventing the fatal event. Both patients were saved by injecting warm water into their stomachs, and extracting it again, together with the laudanum, by means of a syringe.

"I therefore am happy in having called the attention of the profession to a mode of treatment not before used in this country, at least within my knowledge; but I have now an act of justice to perform in ascribing the merit of the invention to Dr. Alexander Monro, junior, of Edinburgh, who published it in his inaugural thesis, in A.D. 1797. Of this circumstance I was entirely ignorant when I sent you my paper, and probably should still have remained so, had it not been mentioned in his book of *Morbid Anatomy*, a work which has but very lately come into my hands."

Thus, while Physick was the first to pump out the stomach in a case of poisoning, he very modestly renounces his claims to the invention of the instrument in favor of the Monros. In Ludwig Darmstaedter's valuable "*Handbuch zur Geschichte der Naturwissenschaften und der Technik*" (1908), it is stated (p. 1822) that "the English surgeon F. Bush first emptied the contents of the stomach in a case of opium poisoning by means of a suction pump provided with a gastric sound." But Physick's priority in the matter apart from his papers of 1812, is attested by the following affidavits, published in the *Medical Recorder* (Philadelphia) of October, 1826 (pp. 325-326):

No. 1.

I do hereby certify, that in the years 1802, 3, and 4, I attended Dr. Physick's lectures upon surgery, and heard him recommend the introduction of a tube into the stomach, in cases where poisonous substances had been taken, through which tube, fluid might be injected by a syringe and extracted again; thereby enabling the practitioner to remove such noxious substances from the organ.

(Signed) ISAAC CLEAVER.

Philadelphia, June, 1820.

No. 2.

I do hereby certify, that I attended Dr. P. S. Physick's lectures on surgery in the years 1805, 6 and 7, that, in these lectures, the doctor exhibited a tube coated with elastic gum brought by Dr. Dorsey from Paris, and made there by Dr. Physick's order, long enough to reach from the mouth into the stomach. With such a tube, Dr. Physick advised to inject water or other fluids into the stomach, and draw them back again by the aid of a syringe, in cases where laudanum or other poisons had been swallowed, and thereby to work them out of the stomach and introduce counter agents.

(Signed) JOHN D. THOMAS.

Philadelphia, June, 1820.

No. 3.

I remember that, in the winter of 1808-9, Dr. Physick informed me that he had an elastic tube,

brought from Europe by Dr. Dorsey, for the purpose of injecting fluid into the stomach, and drawing it out again, in order to wash out poisonous substances, such as opium, etc.

(Signed) BENJAMIN S. JENNY.
Philadelphia, June, 1820.

"In the year 1803, Dr. Dorsey was in Paris, and had made, by Dr. Physick's order, a tube of the kind now generally used, constituted of the same materials as the French catheter, and resembling it, except in size. That the use for which it was designed was unknown in Paris previous to that period, is evident from a letter from Dr. Dorsey to Dr. Physick, dated 1803, and now in the possession of the latter, in which he states that the makers were curious to know what was the intention of so large a catheter. It was not long before they ascertained the point, and tubes have been since regularly imported from there, for the supply of physicians in the United States."

In the *London Medical and Physical Journal* of September and November, 1822, respectively, we find two articles on the removal of opium and other poisons from the stomach by means of a flexible tube, by Francis Bush of Frome (Somerset)⁹ and Edward Jukes of Westminster,¹⁰ England. Jukes, however, claims to establish priority over Bush by a citation from an unnamed periodical, dated May 29, 1822. Both papers refer to cases of opium poisoning. Bush calls his instrument a "gastric exhauster" and describes it as follows:—

"The instrument consists of a common syringe, with a flexible tube fitted to it, of length sufficient to allow one end to enter the stomach; it may be formed of leather, or of the same materials as the elastic flexible bougie (the same syringe should have these tubes of different sizes, to suit the various subjects who might require their use); the ordinary circumference of it would be from an inch to an inch and a half; the point destined to enter the stomach should be smooth and furnished with holes, like the catheter; these holes should be four, or six in number, and as large as the tube will admit of. By attention to this part of its construction, even the more solid, as well as the fluid, contents of the stomach will be brought from it, when the piston is made to act. The syringe and the tube should not be permanently fixed, but so constructed that they can be put together and separated instantaneously; and a flexible rod of whalebone should accompany the tube, to give firmness to it in entering the stomach, but should be withdrawn before the syringe is fixed."

Jukes's instrument is of similar character, with the exception that he employs an elastic bottle instead of a syringe for pumping. With this apparatus, he made a number of successful experiments on dogs purposely poisoned with opium, and even went the length of performing similar experiments upon himself. In 1823, an

improved stomach pump, invented by Mr. Reed, of Hosmonden Lane, Kent, was introduced with success in the wards of Guy's Hospital, through the good offices of Sir Astley Cooper. In lecturing on opium poisoning and upon the use of Reed's instrument at Guy's, Sir Astley said:

"We are indebted for it to Mr. Jukes, a Surgeon at Pimlico, who published an account of it in the *Medical and Physical Journal* for November, 1822, p. 285; and a further account in the same Journal for June, 1823. Mr. Jukes originally employed a gum elastic bottle to be applied to the tube; but the improvement of a syringe was suggested by Mr. Bush, of Frome."¹¹

With this lecture, the stomach pump was permanently introduced into English practice, and improvements in its construction were only a matter of time. In the same period were published the pioneer English works on toxicology by Addison and Morgan (1829) and Sir Robert Christison (1829), which followed Orfila's great treatise of 1813-15.

In Maupassant's "Mont Oriol" there is a satirical description of the passage of a stomach tube, in which the patient "with staring eyes, purple cheeks, lips covered with foam, panted for breath, gasped as if he were suffocating, and had agonizing fits of coughing; and clutching the arms of the chair, made desperate efforts to get rid of this beastly tube which was piercing his body"—the doctor all the while exhorting him to "Cough! cough! in order to facilitate the descent!" This grotesque and very flippant caricature of a simple procedure—a good example of "how not to do it"—may at least serve to remind us that the idea of a stomach-pump or tube must have occurred to many in the past, but the difficulty of passing the instrument without much practice probably retarded its earlier introduction. The tube itself was nothing; the mastery of the technic of passing it everything.

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