Analyses of urine were made nearly every day between the first and last of the above dates. The results showed, as indicated above, a steady diminution in the amount of uric acid and a corresponding increase in urea, which was so marked as to indicate an unmistakable influence from the oxygen enemata in bringing about the favorable results.

Case 5.—Mr. H., a diabetic patient. Came to the Sanitarium for treatment on April 1, 1888. A quantitative analysis of the urine made April 2 showed 256 grms. of sugar. In less than a week this was reduced by a diabetic diet consisting of milk, eggs, gluten, cream, and non-farinaceous vegetables, to 152 grms, the amount reported by his home physician while the patient was subsisting upon a diet of meat, eggs and bran bread. At this time, the oxygen enemata were begun, two litres being administered daily. On May 2, after three weeks' treatment, the amount of sugar had been reduced to 3.1 grms. The patient has had no medicinal treatment whatever, and his diet has never at any time since coming under my care been wholly free from starch. The following table of analyses for sugar shows the gradual diminution in the quantity of sugar after beginning the oxygen enemata:

April 5, 147.2 grms.; April 9, 80 grms.; April 15, 73.6 grms.; April 21, 44.8 grms.; April 27, 25.6 grms.; May 20, 3.2 grms.

Certainly the remarkable decrease in the daily amount of sugar passed in the urine must be attributed to some efficient cause, and the only one to which any such result could be reasonably attributed was the oxygen enemata, as the patient had previously been kept for months upon a strictly diabetic diet, without any favorable result. Future experience, however, must determine whether the results obtained are anything more than temporary.

Case 6.—A man of 28 years, suffering from Bright's disease of the kidneys—chronic parenchymatous nephritis—passing large quantities of albumen daily, and abundance of casts. Examination of urine made before beginning the treatment showed six grams of albumen, and smooth and granular casts, pus, uric acid, and urates. Quantity 1100 cc. sp. gr., 1015. Urea, 24 grms. After six weeks treatment with oxygen enemata, the amount of albumen present was found to be less, casts and pus less abundant. Quantity, 1490 cc., sp. gr. 1017. Urea, 37.25 grms., no urates nor uric acid.

Numerous other cases might be added to this list, but the above are sufficient to show what can be done in a variety of cases in which, upon theoretical grounds, we should expect benefit from the administration of oxygen in this manner, if it is a really efficient therapeutic agent. I trust the results shown are at any rate sufficiently striking to call the attention of the profession to

the value of oxygen as a remedial agent, when administered in the manner described in this paper.

Oxygen enemata may be administered by means of the apparatus used in administering sulphuretted hydrogen; but it may be much more accurately used by means of an apparatus described by the writer in a paper entitled "A New Form of Apparatus for Administering Gaseous Enemata," read before this Section one year ago. The treatment may also be given much more conveniently with this apparatus.

GRADUAL DILATATION OF ŒSOPHAGEAL STRICTURES.

Read in the Section on Surgery, at the Thirty-ninth Annual Meeting of the American Medical Association, May, 1888.

BY T. D. DAVIS, A.M., M.D.,

OF PITTSBURG, PA.; SURGEON TO MERCY HOSPITAL, SURGEON TO ST. FRANCIS HOSPITAL, FELLOW OF THE AMERICAN ACADEMY OF MEDICINE, ETC.

Obviously there is no more serious lesion than closure of the only passage leading to the stomach. Fortunately nature has guarded the œsophagus so that its freedom from disease is noteworthy, and its most frequent lesions are the result of external causes, neoplasms, or due to diseases of contiguous tissues. So rare and surely fatal have strictures of this passage been that until within recent years but little has been done in attempting permanent relief. The gravity and urgency of the symptoms have possibly prompted equally grave and heroic remedies, such as divulsion, cutting, gastrotomy, etc., until now it seems needful to call attention to more conservative methods of treatment. In striving for the brilliant, possibly the safer and more simple plans have been neglected.

Neoplasms of the passage itself, or of adjacent structures, may cause stenosis, but I wish now to consider only cicatricial strictures of the œsophagus. These are produced by any cause that will destroy its coats. When either its mucous or sub-mucous coat is destroyed, the resulting cicatrix is composed of smooth, hard, imperfectly organized tissue, that projects in ridges, or causes the adjacent mucous membrane to be puckered up into folds. If the continuity of the deeper tissues be also destroyed and the muscular coat invaded, the resulting cicatrix is very firm and callous, and the symmetry of the passage much contorted. Not only may the scar itself thus cause stenosis, but by its derangement of the circulation a secondary hypertrophy of the mucous membrane may result.

Direct violence has been known to cause such destruction of these tissues—such as injuries by sword juggling; swallowing foreign substances, as bones, coin, artificial teeth, or the too violent efforts to remove them. Syphilis, too, has in recent times been supposed to cause ulcers of the œsophagus, and it is not entirely free from the non-specific round ulcer. By far the most common

cause of such destruction of tissue and its resulting cicatricial stricture is the swallowing of caustic substances. The comparatively recent introduction of powerful caustics into domestic use has alarmingly increased the number of these cases. Dr. Campbell has reported to this Association¹ no less than twenty accidents from swallowing "concentrated lye," occurring in his immediate neighborhood, and from my own experience I should judge the number throughout our country, if known, would prove appalling. In the last ten years six deaths from swallowing concentrated lye have been reported to the Board of Health of Pittsburg. But these are only those who died from the immediate effect of the caustic, and by no means represent all who have perished from this substance, because those who died from the later effects would be reported, even if the primary cause was known, as dying from inanition, marasmus, etc.

It has been my fortune to meet a number of these accidents, and the success of my treatment has led me to present the subject for your consideration to-day. I can possibly best do so by presenting the cases in detail, for brevity omitting minor points.

Case 1.—In April, 1880, Henry C., aged 4 years, had been playing in the yard and came crying into the house with his mouth bleeding, leading the nurse to suppose that he had fallen out of his swing. He vomited and slavered thick saliva, tinged with blood, for several hours. On seeing him four hours after the accident he presented no appearance of shock nor any febrile reaction. His mouth was fiery red, leading a physician who had been called in before I could see him to suspect diphtheria. There was no sign of excoriations of tongue or fauces, but his mouth looked more as if he had been chewing nettles or some non-corrosive irritant. Oil and demulcents were freely given and by this time they were well retained. On the following day evidences of corrosive action were quite manifest, especially in the center of his tongue, but not at all in the fauces. From information afterward received, I have no doubt that he swallowed a solution of concentrated lye from an old empty can that had been carelessly thrown in the yard.

As his mouth rapidly healed, and he showed no further stomach trouble nor constitutional effects, I unfortunately concluded that he had escaped swallowing any of it, or if he had, that it was so weak as to do no harm. In five weeks I was called to see him again, when I was informed that he was having repeated attacks of vomiting, soon rejecting the small quantity of food he took, together with an immense quantity of slimy mucus. He had lost considerable flesh, and his face presented the haggard, anxious look of craving hunger. An Œsophageal stricture was immedi-

ately diagnosed, and, with the assistance of Dr. W. R. Hamilton, a No. 2 flexible catheter was with great difficulty passed through to the stomach. The difficulty was caused, first, by the great dilatation of the Œsophagus that had taken place above the stricture, making it extremely hard to find the natural passage and avoid making a false opening through the attenuated walls; and, secondly, the size of the stricture itself, which grasped firmly the small catheter. These difficulties, together with the struggles of the child, made the operation one of considerable delicacy and caution and rendered the prognosis, by every physician who saw him, extremely grave.

Immediately after passing the catheter, the child would be able to swallow a few spoonfuls of milk, but in a few hours the tenacious mucus would again accumulate and occlude the passage. In a short time the child realized the relief afforded by the dilatation and waited rather anxiously for the operation, often bringing me the tube to insert. In order not to hurt him, that I might retain his cooperation, I increased the size of the tubes very slowly, and thus stumbled almost on a very satisfactory plan of treatment—that of *very gradual dilatation*.

In six weeks, by thus carefully, regularly and surely dilating, without pain and with but little inconvenience, the opening had reached a size that I felt safe to allow the parents to use the bougies themselves. I increased them gradually, and by five months we were using a No. 2 rectal bougie, which I considered about the normal caliber of the Œsophagus of a child of that age, although the relative diameter and length of the Œsophagus of children I have nowhere found estimated or recorded.

This case has ever since been under my observation. For the first few years the bougies had to be inserted every few weeks. If he failed to masticate his food thoroughly it gave rise to retching. During the last year the tube has been inserted but a few times, and the marked symptoms of the stricture have disappeared.

Case 2.—In June, 1881, Bessie W., aged 30 months, drank some water out of a can half full of concentrated lye, which had been carelessly let stand in a neighbor's yard. I saw her a few moments after the accident, and immediately gave her half a tumbler of vinegar, which she drank eagerly, although it was at once rejected by the stomach. Her tongue, cheeks and fauces were completely whitened, and she was screaming with pain. She was bleeding freely from the mouth. Thickened mucus drivelled out in streams, and every few moments she would attempt to vomit. I followed the vinegar with table oil, and as it was rejected gave quantities of milk. She was pale and cold, and the manifestations of shock quite marked. She reacted speedily and in a few days the deeply burned portions of her mouth were

¹ "Journal of American Medical Association," October 27, 1883.

more clearly outlined. So deep was that in the center of her tongue that it was fully three weeks in healing.

Knowing beyond doubt that she had swallowed considerable of the liquid fire, at the end of the first week I introduced the largest size English flexible catheter to the stomach. It caused comparatively little distress, but was tinged with blood on its withdrawal. After a few days I introduced it again, and so every alternate day. But soon it caused too much pain and evident irritation, so I was forced gradually to decrease the size until in a month only the smallest sizes could be used with freedom from pain. At this time the child lived on milk alone and was well nourished. The œsophagus had two marked strictures, one opposite the cricoid cartilage, where it is normally constricted, and a still more tense one opposite the middle of the sternum. Neither of these were simple annular strictures, for on removing the bougie it always presented a spiral form, the result of its moulding in the passage. I had succeeded in again dilating the passage considerably, when the child unfortunately picked up a grape seed from the floor and swallowed it. The seed passed the first stricture, but became wedged in the lower one. It seemed impossible to move or pass it. Prof. James McCann saw the case with me at this critical stage, and succeeded in passing a small whalebone fillet, but joined with me in the gravest prognosis. I nourished the child by enemata for five days, when at last I succeeded in forcing the seed through.

For several weeks after, the progress of the case was quite satisfactory. During the third month I invited Dr. Hamilton, who had seen the first case, with me to visit this child. He readily passed a number eight catheter, but against my best judgment, also passed Nos. 9 and 10, insisting that it would do no harm and that I was going too slow. The largest bougie caused much pain and was slightly tinged with blood, the first I had seen since the original burn was healed. The next day she had greatly increased difficulty in swallowing, with some feverish symptoms. I was compelled to use a much smaller instrument, and on the fourth day found the catheter welling up full of pus. The too rapid dilatation had caused an abscess. For a number of days I passed no instrument, but nourished her entirely by enemata.

On resuming dilatation the progress of the case was slow but satisfactory up until a rectal bougie could be introduced easily, which was about six months from the beginning of treatment. This case is also under my observation and now, after seven years, is entirely free from any difficulty in swallowing, although the caliber of the passage is certainly less than normal. One cause of this perfect success, I believe to be, that the early treatment kept any dilatation from occurring or

any cul-de-sac being formed above the stricture.

Case 3.—Ethel R., aged 20 months, in June, 1885, drank a solution of concentrated lye, which had been prepared for scrubbing purposes. For five weeks she was under the care of a homeopathist. Her mouth was quite badly burned, but it healed in two weeks. When I first saw her she was the picture of distress, the emaciated body, hollow cheeks, gaunt, famished expression and sunken eyes, all told the unmistakable story of starvation, and yet her homeopathic physician had assured her parents that she was over all effects of the lye, but was now simply suffering from worms! On examination a stricture was found near the stomach. The dilatation of the œsophagus above the stricture was sufficient to hold a teacupful of food and retain it for an hour. With much patience and no little difficulty the opening was found, and day by day the gradual dilatation was kept up, as in the previous cases, and in six months resulted in complete recovery. This case differed from the others in presenting undoubted evidence of ulcers in the stomach, which however healed in due time, and now, after three years, she is enjoying good health, but like the first case is easily choked.

Beside these cases, I have attended two children whose mouths were badly burned with lye, but who fortunately did not swallow any. In addition, I have the names of four more who perished from the immediate effects, and two the results of which I do not know. This makes ten deaths, five recoveries and two unknown, or seventeen in all from concentrated lye in this city alone, beside the many unreported.*

In dilating these strictures I used the common English catheter straightened out, and mostly without their wires. Œsophageal bougies for children are not on the market, and, at any rate, increase too rapidly in size for gradual dilatation, beside the catheter, always easily attained, has the advantage of enabling you to introduce food into the stomach. On introducing these catheters the head is held as far back as it will go. The bougie is well oiled with butter, on account of its leaving no unpleasant taste. The instrument held lightly between the thumb and first two fingers is then slipped past the base of the tongue well against the posterior wall, in order to escape the epiglottis. With a slight rotary motion it is passed quickly to the stomach, where it is allowed to remain during two or three respirations. There is much less danger of exciting cough or retching if the finger or tongue depressor is kept out of the mouth. The lower two-thirds of the œsophagus being a very insensitive passage tolerates the instrument readily, and causes but little distress if held well back from the epiglottis.

* Since presenting this paper the daily press of this city has recorded the deaths of four more victims from swallowing concentrated lye, and there is still a fifth case now under treatment in my immediate neighborhood.

From a study of these cases I am well satisfied that: 1. Too much weight has been given to spasmodic stricture of the œsophagus by Michel, Campbell, Smith and others; that involuntary muscles can even have tonic spasms at all is a question, but to hold with Campbell that such a spasm can continue for eight days, calls for a stretch of the imagination beyond my power. At no time did I have any evidence of spasmodic stricture in these cases. Any difficulty in introducing the dilators was due solely to causes mentioned. The relief given by passing the bougie is readily explained, not by its overcoming spasm, but by its removing the tenacious mucus or some article of food that had clogged the passage or lodged on the shelf of the stricture.

2. The advantage of the early introduction of the bougie to prevent dilatation of the œsophagus above the stricture is clearly manifested by the history of these cases.

3. The second case certainly contrasts the rapid and gradual plans of treatment, to the great if not vital advantage of the latter. To "make haste slowly" is the only safe rule. The gradual being almost painless and giving great relief secures the co-operation of the patient. It avoids too great irritation and danger of inflammation or rupture, all of which are likely to follow rapid dilatation.

4. Are not these seventeen accidents enough to second Dr. Campbell's proposition, that some legal restriction should be placed upon the sale of this intensely dangerous substance.

5. Finally, I shall watch with interest to see if any of these cicatrices shall develop malignant disease.

DR. WM. H. PANCOAST, of Philadelphia, asked what form of bougie Dr. Davis had used and whether he had ever tried the olive-pointed or the rat-tail bougie.

DR. DAVIS replied that he used only the common English catheter, which he considered the best adapted to the treatment of children, in whom this accident was most common.

DR. I. N. QUIMBY, of New Jersey: I can endorse what Dr. Davis has said in regard to gradual dilatation of œsophageal strictures. I accept the principle also, as it applies to the dilatation of urethral and other strictures. I have seen very much harm done by too rapid dilatation, which seems to lacerate, and instead of overcoming seems to rather retard and perhaps make the stricture more firm. This probably indicates that we should go slowly. In a case which came under my observation, I took a little rubber bougie, or rather rubber tube, introduced it and then inflated it with a small syringe, thus producing a gradual dilatation, until a little discomfort was complained of by the patient, but never enough to cause pain.

DR. PANCOAST: There are one or two additional important features of the paper, one of which is

that just referred to by Dr. Quimby, and which, I am happy to say, expressed most happily my views on this subject. I refer to the fact that all mucus passages of the body should be treated by slow and very gradual dilatation. It is the most efficacious method of treatment. In this connection I have a manœuvre which I might mention to you. I have a spontaneous dilatation, by hydraulic pressure, it is true, which I secure in each case by directing the patient every time he passes urine to catch the urethra and hold it until the stricture is dilated to a slight degree by the urine in its effort to escape. I do not use the urethrotome until it is settled that no further dilatation can be carried on by other means.

The "rat-tail" and filiform bougies of French make are of great service. I have also used the hydraulic dilatation spoken of by Dr. Quimby, with success.

The worst cases of œsophageal stricture that I have ever had were, one from lye, one from cancer, and one from sulphuric acid. The patients recognize very promptly the benefit which is derived from this gradual method of dilatation. I heartily endorse the suggestion that the members of the American Medical Association be requested to report, at the next annual meeting, all the cases they have observed of stricture of the œsophagus from concentrated lye.

Another point to which I desire to refer is the fact that muscular spasmodic stricture of the œsophagus does unquestionably occur. We can easily understand how this is likely to occur if we refer to the anatomical relations of the œsophagus as it passes through the diaphragm. In the diaphragm there are three openings, the first of them for the passage of the aorta, and the most posterior and right behind that of the œsophagus, is an osseo-aponeurotic opening. The second opening is for the vena cava, and is a tendinous opening, as it is right at the junction of the central and middle leaflets of the central tendon. It is surrounded on all sides by tendinous structure. The third opening, however, is right through the muscular substance of the diaphragm. It is elliptical in form and is intended to transmit the œsophagus. It is intended to act like a sphincter upon the œsophagus. Too sudden swallowing, as we have doubtless all learned from our own experience, is followed by a closure of this portion of the œsophagus and momentary retention of the food in that passage.

DR. DAVIS: I merely want to call attention to the fact that all the cases reported in my paper were under 5 years of age, and that for this reason no complicated apparatus could be employed.

Second, with regard to the olive pointed bougie: My idea in the treatment of these cases was continued pressure. The olive point dilates while passing through, but you do not keep up the pressure by it. Having the same diameter through-

out, the catheter makes constant and even pressure, no matter to what extent it is inserted. Again, in speaking of spasm of the œsophagus, I said "tonic" spasm. I claim there is no such thing as a tonic spasm, like that lasting eight days. Of course I recognize spasmodic constriction.

DR. PANCOAST: I think that the Doctor will recollect that the great value of the filliform bougie, the great value of the bougie with olive tip, that the great value of the rat-tailed bougie is the fineness of the tip and the fact that the largest calibre of the instrument being higher up, keeps the fine point of the instrument more directly in the centre of the passage—and that is the chief value of it. My friend should also remember the difficulty experienced by many in swallowing pills, as is so often expressed by the patients.

DR. I. N. QUIMBY supported Dr. Davis' view in regard to tonic spasm of the œsophagus. He did not see how such constriction could be possible.

ELECTROLYSIS IN THE REMOVAL OF NASAL AND PHARYNGEAL NEOPLASMS.

Read in the Section on Surgery at the Thirty-ninth Annual Meeting of the American Medical Association, May, 1888.

BY D. S. CAMPBELL, M.D.,
OF DETROIT, MICHIGAN.

The therapeutic value of the galvanic current in urethral hypertrophic catarrh, fibromata and mucoid growths of the uterus, etc., has been presented with considerable force of late by various writers, but more notably by Apostoli, of Paris.

He has clearly demonstrated from clinical evidence that this "not strictly surgical nor strictly medical" form of treatment has special advantages over others in the treatment of fibroid and mucous growths of uterus. In his narrations he claims to have suppressed the miseries constituting the fibroidal symptomatology to the enormous per cent. of 95, by either a sensible reduction or complete absorption of the growths. And though his remarkable successes—aided, perhaps, by the subtle manifestations of its properties—may have given color to his reports, I am fully persuaded, after a careful manipulation of this particular form of chemical force in a large number of cases suffering principally from nasal and pharyngeal neoplasms, that its therapeutic value is worthy of consideration.

But, in dealing with this apparently hidden form of treatment, I regret exceedingly that I can on this occasion but briefly allude to the manner in which material changes take place in tumor structures, as the question of greatest interest to practitioners is centred in the purely clinical and practical results of its use.

Practical experience has shown that the con-

ductivity of tissues offers a fair transmission of electrical fluid, and that the material changes which this fluid produces at the polar points of attraction is simply an electrolytical decomposition. The principle of this metabolism is based on the theory that, as the proteid is the essential material substratum of all animal organisms; and being first made active in the vegetable compound, before its conversion into animal tissues, by the action of heat and light—the source of all energy—on elementary substances, this same constructive organic property can be set free, though now a storehouse of active regenerative energy, by the agency of the same elements which gave it birth in the organic kingdom.

But a more definite chain of analytical evidence is necessary, before a rational conception of the destructive materialistic changes is made easy.

As energy (latent) is the product of activity, and whether in this instance it is stored up by vital or chemical influence, or both, its latent power can be set free by the action of these same potent elements. But this action is purely a source of heat, which is constantly expended, both in the transformation of lifeless pabulum in the construction of living tissues, and in their natural destruction. But that which we call organized pabulum is the material deposit which had its birth and growth, and after it spent its usefulness, goes on to the period of decay. The energy displayed in its organization is principally dependent on vital force; but in its decomposition it is entirely dependent on chemical action.

Viewed in that light, chemical action—the principal force in nature—is the direct opponent of vital force, and consequently the chief physical annoyance organized bodies encounter; for no sooner has cell life begun, whether it has reached the period of its existence or not, than it is acted upon by this indomitable foe. Manifestations of this are discernible in various diseases, but more notably in diabetes, where a laxity of nervous energy is plainly observed.

From this process of reasoning we are entitled to assume that any interference with the process of regular vital motion interrupts cell proliferation; and that unless its functional activity is protected and prolonged by a continuous stimuli of nervous energy, or vital force, its existence is cut off by the execution of chemical laws.

Now, as electrolytical action is the result of chemical decomposition—in a galvanic cell—its influence must necessarily be destructive to cell life; that is, if applied to any prominent degree of stimulation, negatively speaking; for practical experience has shown that the negative electrode induces a transportation of watery fluid toward it, which must eventually disturb the conditions favorable to the process of segmentation. Recognizing this fact in the normally robust segmentation and cell proliferation, can we not discern the