the intestine which ensue as soon as the drug is absorbed.

It is difficult to follow accurately with the eye at one time the changes that take place in more than a single loop of intestine, but the camera records the progressive changes occurring in a number of loops, both above and below the one experimented upon.

The application of instantaneous photography may be further extended to the study of the contractions of the stomach, bladder, and diaphragm, and possibly to the study of the movements of the uterus in pregnant animals and the lungs in artificial respiration.

The method is so easy and so accurate that I trust it may prove of permanent value in enlarging our knowledge of the action of drugs upon the cardiac and intestinal viscera, and possibly other organs.—*Medical Record*.

AN IMPROVED APPLIANCE IN PHYSIOLOGICAL TREATMENT OF CLEFT PALATE.*

By HENRY A. BAKER, D.D.S., Lecturer on Oral Deformities, Boston Dental College.

It has usually been said that lesions of the palate arise from one of two causes, that is, they are either congenital or accidental.

Congenital cleft of the palate was as commonly

FIG. 1.

treated surgically as by mechanism. The former treatment has been nearly or quite abandoned in recent years, for two very good reasons: First, it is a very painful one for the patient, and difficult for the operator, and a failure of closure is largely in the majority. Second, it universally fails to improve the speech, even after a successful closure.

Notwithstanding the above facts, some physicians recommend staphyloraphy. They must certainly do so from want of knowledge of the anatomy and physiology of the vocal organs and their use in the mechanism of speech, which is the production of sound, and its direction through the nasal passage or the mouth at will, being controlled by certain organs whose modification and resonance enable us to form what we term articulate speech.

One of the most important aids in producing the above results is the soft palate. This organ is lifted up and comes in close contact with the pharyngeal wall, thus shutting off the nasal passage, which is absolutely essential in producing all excepting nasal sounds. After the operation of staphyloraphy such a closure is impossible, owing to the soft palate having been made too short and tense; hence defective speech invariably follows.

Accidental lesions of the palate, as the name suggests, are caused either by accident or disease. These cases may be successfully treated with a very simple appliance, while the same amount of skill exercised on a congenital cleft would have no beneficial result. This may be accounted for by the fact that in the former case the patient had learned to articulate distinctly, and use the organs of speech efficiently and correctly, while persons who are thus deformed from birth are obliged to learn the art and methods of articulation by slow and painful processes. The organs require the training which is necessary for one who acquires a new language. Hence the appliance for relief should not only fill up the gap in the defective palate, but should

FIG. 2.—The cleft, extending a little beyond the soft into the hard palate.

also be so constructed as to work on physiological principles in harmony with the natural movements; that is to say, it should be under perfect control of the surrounding muscles. It is manifest, therefore, that the success even of the most scientifically adjusted instrument depends largely upon the co-operation of the patient who uses it.

As the above malformations are classed as congenital

* Read by invitation before the Section for Clinical Medicine, Pathology, and Hygiene of the Suffolk District Medical Society.

† The accompanying cuts are kindly loaned by Dr. J. W. White, the editor of the *Dental Cosmos*.

and accidental, the appliances for their relief are classed as follows: obturators and artificial vela. Among the former Dr. William Suersen is the inventor of one which has created much interest. The most important and significant advance in this department of science, however, made itself manifest in attempts to form an artificial velum, and Dr. Stearns was probably the first to introduce its true principle. I speak of these two investigators, Suersen and Stearns, because I am led to think that they have brought before the profession the most scientific apparatus of each class, and it is from a consideration of both of their appliances that I have evolved the principle in explanation of which this paper has been prepared.

Suersen says: "In order to be able to pronounce all letters distinctly, it is accordingly necessary to separate the cavity of the mouth from the cavity of the nose by means of muscular motion. That separation is, under normal conditions, effected, on the one hand, by the velum palati, which strains itself (consequently by the levator and tensor palati), but, on the other hand, also by a muscle, which to my knowledge has not yet received a sufficient amount of attention in connection with these operations. I mean the constrictor pharyngeus superior. This muscle contracts itself during the utterance of every letter pronounced without a nasal sound, just as the levator palati does. The constrictor muscle contracts the cavum pharyngo-palatum, the pharyngeal wall bulging out, and it is chiefly on the action of this muscle that I base the system of my artificial palates."

It will be noticed that Suersen admits that the levator palati is an important organ of speech, yet he makes no provision for utilizing it as such, and only provides for the superior constrictor muscle coming in contact with the distal surface of his appliance to shut off the nasal passage. In my opinion, for the patient afflicted with congenital cleft to acquire perfect articulation with such an appliance (even if it be possible), years of application and training of this muscle would be necessary. A little reflection will show that this muscle, besides performing its own function, must be trained to fulfill those of the velum palati, levator palati, and tensor palati. But in an accidental lesion this may be all that is necessary, as the patient, having previously learned to articulate distinctly, and having this deformity come upon him afterward, the superior constrictor muscle would, no doubt, be sufficiently developed to perform that function.

Sir William Fergusson, in his report of dissection made by him of a cleft palate in 1844, states distinctly that the superior constrictor was very full, and he also claimed for that muscle very decided forward action in

FIG. 3.—Appliance in position: A, the plate; B, the stop, preventing any downward pressure when the muscles are in a relaxed condition; C, the artificial velum; D, D, muscle lying under it, the dotted lines showing the appliance resting on the muscles.

deglutition. It was in the years 1841 and 1842 that Dr. Stearns made his first artificial velum. In 1860 Dr. N. W. Kingsley came into the field, and took up Dr. Stearns' appliance. Finding it too complicated for the general practitioner to construct, and too expensive when completed for those in ordinary circumstances, he was led to serious thought in regard to modifying its production, but he still adhered to the same principle of utilizing the levator muscle.

Dr. Kingsley says respecting Dr. Stearns' appliance: "Two principles were vital to Dr. Stearns' instrument, namely, first, the artificial velum should embrace the levator muscles of the palate, so that it could be lifted by them; and, second, that it should bridge the upper pharynx behind the uvula, and cut off nasal communication at will."

Dr. Kingsley's modification of Stearns' instrument consisted chiefly in leaving off the triple form, and doing away with the central slit, the flap, and the springs. The simplified form consisted of two leaves of soft vulcanized rubber, connected in the median line, the palatal portion running down to the uvula, and then bridging across at that point, and the nasal portion reaching across the pharynx. Instead of the appliance being made in sections so as to slide across each other, as in the Stearns, the bifurcated uvula slides between the two leaves, and the levator muscles of the palate lift it up to meet the pharynx, thus shutting off the nasal passage. It will be noticed that in this simplified form the Stearns principles are fully carried out, and to Dr. Kingsley that credit is due. His claims to originality are in the simplifying of the Stearns instrument.

Dr. Kingsley says: "An important principle enunciated by Dr. Stearns as essential to the success of all artificial vela for congenital cleft was that the instrument filling the fissure in the natural palate must be of the nature of a valve under the control of the muscles surrounding it, and so arranged that it could be elevated by them, thus shutting off the nasal passage, as is absolutely essential in the production of certain sounds belonging to articulate language. This principle was carried out by him first in the character of the material

chosen, being of a yielding, elastic nature, and second in the form, being made to embrace the levator muscles, and subject to their control."

Dr. Kingsley in speaking of Suersen's appliance says: "First, that of all obturators this is the best form for a congenital fissure, but while the wearer is enabled to articulate with such an instrument, it is only after he has learned articulation with another apparatus. Second, that a soft, elastic, artificial velum is much better adapted to the acquirement of articulation than any unyielding, non-elastic substance, but when acquired an obturator may be substituted. Third, that in very rare cases articulation may be acquired with an obturator only, but it is the result of the extra activity of the pharyngeal muscles, while with the elastic velum the levators of the palate contribute largely."

A great many practitioners in treating a fissured palate simply separate the nasal and buccal cavities by a thin plate, thinking that the separation is all that is required. Some even make a great parade of this device, claiming it to be an improvement over any other appliance. A little reflection will show this to be impossible, as I shall endeavor to explain before closing this paper.

My own experience with soft vulcanized rubber for an artificial velum is that if it would resist the fluids of

FIG. 4.—The artificial palate thrown up by the muscles, E, E, as in all sounds requiring the closure of the nasal passage; F, the superior constrictor muscle, advanced to meet it; G, the tongue, raised, pressing hard against the appliance, as in pronouncing the letter k or g; A, the plate; B, the hinge joint and stop.

the mouth, and not go through a process of decay, and change its form, in short, if it could be made permanent, it would be all that could be desired. Since this is impossible, I do not hesitate to say that it is a very objectionable material, and I have been led to long and careful meditation regarding it.

I experimented for five years to provide an artificial appliance with hard rubber, carrying out the Stearns principle, whereby I could utilize the levator muscles to control the movement of the appliance, and with which articulation could be learned as well as with the soft rubber. My studies and experience induced me to settle upon the following device, which consists of a gold or hard-rubber plate (A, Fig. 1), covering the roof of the mouth down to the junction of the hard and soft palates. From this point the artificial velum, F, extends back and downward, restoring the symmetry of the palatal surface by bridging across and lying upon the muscles of each side. The distal surface, G, or that portion coming in contact with the pharyngeal wall, is quite broad, and so constructed as to articulate perfectly with this surface, while the constrictor muscle contracts and closes around it on a semicircle. This is the Suersen principle, and the main ideas I take from that appliance.

The velum is of polished hard rubber, gold, or platinum, and much resembles a chestnut in form.

It is attached to the plate with a hinge joint, B B, thus giving free movement at the junction of the hard and soft palate. At the junction of the hard and soft palate there is a stop, which prevents any downward pressure upon the muscles when in a relaxed condition.

The bulb-like form of the velum (see D, Fig. 4) necessitated a thickness which would naturally have made it quite heavy, and as the resultant weight would be a serious objection, I was desirous of overcoming the difficulty. A suggestion happily came to my relief in this way: While in a drug store I accidentally took up a hard rubber truss made by a Philadelphia firm. Discovering that the pad was made hollow, I thereupon wrote to the manufacturers, asking

FIG. 5.—The muscles relaxed, the appliance descended, thus giving a free passage for nasal sounds and respiration.

them if they would inform me how they prepared the rubber in that way. In their reply I found that the method was quite simple. It is as follows: Take the vulcanite rubber in the soft state and cut the sheets so that when joined together the desired form is given. Then a little water is dropped into the cavity (I found it better to add a little alcohol), the edges are sealed, and the piece vulcanized in the usual way. The steam produced by the water and alcohol inside creates sufficient pressure to keep the walls distended. By this method, the appliance that the cuts were taken from

which illustrate this article was made so light that it would not sink when put in water.

In treating a case by Kingsley's method, I was obliged to use a hinge-joint to bridge over a union by staphylophary. I found in that case that the appliance was much better controlled by the surrounding muscles, and saw a much more rapid progress in acquiring articulate speech. This led me to more fully provide for that muscular movement, and I will endeavor to give the reasons why this should be done. As we have before quoted from Suersen, in order to pronounce all letters distinctly it is necessary to separate the cavity of the mouth from that of the nose by muscular action, and to close the nasal passage in pronouncing every letter, except *m* and *n*. This can be demonstrated by holding the nose while endeavoring to pronounce all the letters as plainly as possible.

In studying the mechanism of speech, we learn that more than three-fourths of the sounds of articulate language depend upon the integrity of the soft palate for their perfect enunciation. This being the fact, articulation with a rigid obturator must be extremely difficult to acquire. If three-fourths of the sounds depend upon the free movement of the natural palate, it seems to me a sufficient reason why we should provide for that movement in an artificial one.

Dr. Kingsley says that with a yielding appliance the levators of the palate contribute largely to correct speech. The surrounding muscles have control over my appliance in the following way: The artificial velum bridges across the opening and lies upon the muscles of either side. (See Fig. 3, D, D.) With all sounds requiring the closure of the nasal passage it is thrown up (D, Fig. 4) by the levator muscles, there being no resistance. The thickness of the velum brings its posterior surface in close apposition with the superior constrictor muscle, F, and thereby affords, in the pronunciation of the gutturals, a firmer resistance to the pressure of the tongue, G, than can be obtained with a thin obturator. By the presence of the hinge, B, the above movements are rendered so free and easy that there is no tendency to any displacement of the plate, such as occurs with a rigid appliance. If a nasal sound immediately follows a guttural, the descent of the velum is rendered certain by its own weight. (Fig. 5, D.) My first instruments show a spring bridging over the hinge, by which I intended to accelerate the movements of the velum. This I found later to be unnecessary.

To accomplish the above with a material that would be permanent was a problem very difficult of solution. Of course it is impossible to give to a piece of mechanism muscular power, but it should be made so easily movable as to be acted upon by, and be under perfect control of, the muscles surrounding it.

I claim the following advantages for my appliance:

First. That it is made of a permanent material.
Second. That articulation can be learned with it more readily than with any other appliance.

Third. That it is much easier to make.

Thus the unsatisfactory operation of the surgeon has been replaced by artificial organs of precision, working upon physiological principles. The ingenious appliances of our distinguished colleagues, Suersen, Stearns, and Kingsley, whose scientific attainments and researches have reflected such luster upon the art of dental prosthesis, have excited my admiration as I have studied their complex operations; and if I have been enabled to extend their usefulness and increase their value by substituting an imperishable material for the less excellent substances now in general use, I shall consider that the years of study I have given to this remote and rarely considered problem of science have not been altogether without their reward.

BOVINE OR HUMANIZED VIRUS?—A MODEL VACCINE FARM.

By ROBERTS BARTHOLOW, M.D., LL.D., Professor of Materia Medica, General Therapeutics and Hygiene in the Jefferson Medical College of Philadelphia, etc.

THE frequent occurrence of small-pox epidemics is significant of the need of more careful attention to the means of prophylaxis. Jennerian lymph has either degenerated in quality or vaccination is performed in so perfunctory a manner, often, as to be nearly useless. Owing to the sense of security or to the labors of those pestilent humanitarians of the Bergh school, vaccination is also, to a considerable extent, neglected, except in those countries provided with a compulsory law. Although the Jennerian lymph will preserve its original activity, under suitable conditions, it is plain that careless selection of the material for propagation and the utilization of improper subjects have combined to degrade the stock of humanized lymph. The chief objection urged by the opponents of vaccination is the transmission of animal poisons, especially syphilis, with the lymph stock. Although this danger is remote, it cannot be denied to exist. When such observers as Hutchinson and Viennois report examples of vaccinal syphilis, there can be no doubt of the reality of this combination and of its transmission by vaccination. That erysipelas and other contagious maladies may, also, be communicated by vaccine is alleged, but the proof is not so satisfactory. The opponents of vaccination have really no ground of contention than the danger of communicating other infections. The general question of the utility of vaccination has long been settled. If the one remaining objection which has real weight, and which still keeps the Bergh school of humanitarians in countenance, is finally disposed of, protection against variolous infection ought to be fully assured to the human race. The one mode to accomplish this desirable end is to establish the use of bovine or animal virus as the universal practice. This consummation is by no means remote, for Belgium, the German Empire, and very recently Austria, have established bureaus of animal vaccine, and are now issuing that virus exclusively for official purposes under the compulsory vaccination laws. Influenced more especially by the practice and writings of Warlomont, of Brussels, the English sanitary authorities are using the animal virus with increasing frequency. In this country very considerable extension has been given to the production and use of bovine virus.

Unfortunately, there is in this country no official bureau—no central authority—intrusted with the production of animal lymph, and heretofore no establish-

ment for its propagation under scientific control and supervision. This important work is surrendered to private enterprise, and is conducted merely as a business with which the public has no concern, except the purchase of the vaccine matter offered to them. There are numerous "vaccine farms," conducted according to the notions of their respective owners, and well or ill managed as their knowledge permits. In consequence of this state of affairs, there is a general feeling that the medical profession is not yet as well provided with sources of supply as is desirable. The Messrs. Wyeth, of Philadelphia, in deference to the recognized need, have inaugurated an establishment in which all of the scientific skill necessary has been combined with the indispensable business tact and enterprise; for a vaccine propagating establishment which is not at the same time adequately equipped from the scientific side, and successful as a business venture, has no justification for its existence. The vaccine propagating establishment of John Wyeth & Brother is on the estate of "Rokeby," the country seat of the senior partner. This estate is beautifully situated near Westtown, a station on the Westchester Railroad, in Chester County, and about forty miles from Philadelphia. The land is undulating, fertile, well watered, and admirably adapted to grazing and the care of cattle. Fortunately, there are no great herds, and no epidemics among the usual small herds of farmers common to this region. The buildings of the vaccine propagating establishment consist of two stables, an operating and storage house. The stables have each a capacity for forty heifers. Special attention has been given to heating, lighting, and ventilation—to all the elements of a correct hygiene in respect to bovine sanitation. The air space is ample, the windows large, admitting an abundance of light, the stalls roomy enough to permit free motion of the limbs. The temperature is kept uniform by a special heating apparatus, and at the same time the air is freed from excess of moisture and foulness. The walls of the stable and operating rooms are lined with hard wood and the floors are made of asphalt. The drains for the removal of liquid matters are so constructed as to secure immediate results, and the solid excreta are promptly disposed of. The operating room is similarly equipped, and in respect to all the necessary conveniences for carrying on the work of procuring vaccine lymph, is unsurpassed. Skilled assistants are in charge of every part of the work, and the selection and examination of the heifers to be used as vaccinifers, and the direction of the inoculations, are under the immediate management of Dr. Zuill, Professor of Veterinary Medicine in the University of Pennsylvania. The care of the lymph and its preparation for distribution and transport are conducted in the laboratory of the Messrs. Wyeth, where there is every facility for the purpose, especially that kind of facility combined with accuracy of detail which is the chief endowment of an accomplished pharmacist.

The Wyeth vaccine propagating establishment has, thus, a capacity for the production of an immense supply of lymph, and its resources are capable of indefinite extension; consequently, no future epidemics will find the country unprovided with the means of prophylaxis. That the distrust of vaccine lymph which now exists shall no longer be a justification for neglecting vaccination, the Messrs. Wyeth have insured, by procuring for perpetuation, a stock of animal lymph of the highest excellence. Looking over the world's sources of supply, they decided that the vaccine of the Belgium Bureau, originated and propagated under the direction of Dr. Warlomont, and his successor, Dr. E. Janssens, President of the Board of Supervisors of the State Vaccine Bureau and Inspector in Chief of the Hygiene Service of the City of Brussels, is the best now available—that can, indeed, be produced under existing conditions. To obtain this virus and transport it from Belgium, they secured the services of Dr. Sajous, a distinguished physician of Philadelphia, who is, also, the Consul of Belgium in that city. Observing every sanitary precaution, Dr. Sajous successfully transported the lymph, and it is now being propagated at a rate, the only limit of which is the demand. We have thus a vaccine bureau which compares favorably in its appointments and in its product with the best of the official establishments. In some respects a private enterprise of this kind has distinct advantages. As the success of the enterprise as a business venture must be based on the quality of the product, it is obvious that the proprietors must exert their best efforts to maintain the excellence of their establishment. The work of an official bureau, on the other hand, is performed rather perfunctorily, and the officials are not intimately concerned to keep up its reputation.

It is a remarkable fact that, in many instances, persons supposed to be fully protected by repeated insertions of humanized lymph disclose a new susceptibility on inoculation with genuine bovine virus. This result is confirmatory of that view which maintains the decadence of Jennerian lymph, and is a strong argument for the use of the bovine. If there were a final reason necessary to establish the superiority of the bovine lymph, this would, surely, supply it.

While admitting the necessity for a return to the original sources of supply, there are those who deprecate this necessity, because of the trouble which they experience in "getting the virus to take." It has been proved, over and over again, that the bovine virus is as readily inoculated as the humanized, if certain very obvious precautions are taken. As regards the necessity for using fresh and unchanged lymph, the same is true of both kinds. Lymph, the microbes of which have ceased to be active, or that has commenced to decompose, is not only without power, but may be hurtful, by setting up a septicæmia. Bovine, or animal, lymph is more readily obtained now than the humanized, and with the improved methods of storage and transportation there is no part of the world to which it may not be sent in good condition. The chief objection to the bovine lymph has been the apparent uncertainty of its development after inoculation. This uncertainty, experience has shown, is due to the faulty methods of insertion. When quills or ivory or bone points are used, the first step consists in moistening the lymph coating the exterior. Some patience is required for this, and sufficient time must be given to it, until the lymph is soft enough to be entirely wiped off on the scarifications. A little dexterity is required in making proper scarifications. The knife or needle must penetrate to the *rete mucosum* of the derma, and not go beneath the true skin. The layer of cells underlying

the epidermis is the true soil for the growth of the virus, and in this must it be planted. Only a little blood should be drawn. It is usual to make a number of transverse scratches, until the soft tissue is reached and a little blood appears; but it is quite possible to reach the necessary depth without inflicting any pain or drawing blood. By carefully scraping off the epidermis over the necessary space, the proper absorbing surface is presently reached, and into this the virus can be rubbed with the certainty of being absorbed, since all of the matter on the quill or ivory point is utilized by being confined to the exposed part of the true skin. Although the scarifications may be made very closely, much of the virus is merely rubbed on the epidermis. To insure success, it cannot be too strongly insisted on that the virus on the quill or ivory point must be softened by water before attempting to rub it in, and that the rubbing in of the virus be done patiently and thoroughly. It is to neglect of these requisites to success that failure is to be attributed.—*N. E. Med. Monthly.*

THE FORMS AND HEIGHTS OF CLOUDS.

ONE of the weak features of contemporaneous meteorology is the almost entire absence of positive and well co-ordinated data in regard to clouds. It may be said that our knowledge concerning this interesting class of phenomena amounts almost to nothing. Aside from a few isolated tentatives, we have limited ourselves up to the present to noting the various varieties of clouds, according to a classification which is twenty-four years old, and which is entirely insufficient, that of Howard. How many researches on the form of clouds, on the height at which they float in the air, and on their nature, can be cited? Very few in truth, and yet the study of these meteors is of an importance that no meteorologist will deny, since, if conducted systematically and rationally, it would cause weather science to take an enormous stride. What would be necessary would be a possibility of submitting the clouds to as complete an observation, or rather to as uninterrupted a one, as we submit the barometer and thermometer nowadays.

Their many aspects should be observed and sketched; their altitude at different times of the day, or under certain peculiar atmospheric conditions, should be measured; while repeated balloon ascensions might make known to us their thickness, composition, and temperature. These are all the questions that obtrude themselves upon modern meteorology, and that it will be necessary for the latter to take up in a near future if it wishes to make progress.

We are happy to be able to make known, in the line of researches just mentioned, an important series of measurements and observations upon the heights and movements of clouds made at Upsal by Messrs. Ekholm and Hagstrom.

These observations were pursued during the summer of 1884, from the 25th of June to the 6th of September. The total number of them was 344, but it became necessary to reject 13 per cent. The varieties of clouds observed were the nimbus, the cumulus, the cumulostratus, the alto-cumulus, the cirro-cumulus, and the cirrus, and, on two isolated occasions, the stratus and the strato-cumulus. The observations on the cirrostratus were not utilized.

THE FORMS OF CLOUDS.

We give herewith illustrations of the principal varieties of clouds.

The *Nimbus* is figured as No. 1 in Fig. 1. It is the

FIG. 1.—FORMS OF CLOUDS.—1. THE NIMBUS.

rain cloud, and has a gray, black, or bluish color and fringed edges. It is generally of very wide extent.

The *Cirrus* (Figs. 2 and 3, No. 2) consists of slender filaments, which, as a whole, have the form of a pencil, crisped hair, a network, the feather of pen, etc. The cirri are the highest of clouds, and consist of particles of ice. Their motion appears to be always a slow one. They are certainly the most important clouds for observation, as they generally announce a coming disturbance of the atmosphere.

The *Cumulus* (No. 4, Fig. 4) often exhibits itself under the form of a hemisphere resting upon a horizontal base. Several of these hemispheres sometimes pile themselves one upon another, and form those great cloud masses in the horizon that from afar off resemble snow-clad mountains. Sailors call cumuli "balls of cotton." On fine, warm, summer days they are frequently seen forming at ten o'clock in the morning, and covering nearly the entire heavens toward three o'clock in the afternoon, and then dispersing in measure as the sun sinks toward the horizon.

The *Stratus* (No. 6, Fig. 4) is a cloudy band limited by horizontal lines. As a general thing, we remark several of these bands (which are parallel and very broad) at the rising and setting of the sun. The stratified form of these clouds is partly due to an effect of perspective. They are lofty, thin mists, which we see edgewise. Owing to their tenuity, we do not distinguish them at the zenith of the place of observation.

The *Cirro-cumulus* (No. 3, Figs. 2, 3, and 4) exhibits