the following plan of ascertaining more accurately the physiology of speech. With this view, I took an impression of my upper jaw, extending to the posterior wall of the pharynx, thereby including the soft palate and fauces; also an impression of the lower jaw, with the tongue in a state of repose. These I had engraved on one stone, with a drawing of the lips below (as shown in woodcut). A number of these I had printed. Then my trial began. The mode which I adopted at this stage was to make a mixture of gum and flour, and paint over the whole of the hard and soft palate and the surfaces of the teeth of my upper jaw. I then sharply articulated a letter. On the upper jaw, where the tongue had come into contact, the flour was removed, and deposited on that part of the tongue which had touched it. These localities were then faithfully transcribed on to the engraved plate with red paint.

This I believed to be a great step in advance, reducing the physiology of this subject to more defined limits. One point of the utmost practical importance to be determined was, as to when there was complete separation of the nares from the mouth by means of the soft palate. This I decided by means of a very delicate test, shown to me by Professor Czermak of Leipzig, some two years since, when on a visit to this country. By placing a highly polished table-knife under the nostrils during the articulation of any sound, the escape of air through the posterior nares is made at once perceptible by the deposition of moisture on the cold steel. This mode of observation is most valuable, not only for this purpose, but also for ascertaining how far an artificial palate completely separates the mouth from the nose. It may also be used with advantage after the surgical operation for cleft palate.

Having explained the origin of this work, and the way in which I have carried it out, I will pass to the consideration of the subject itself.

To begin, we must clearly recognise the difference between voice and speech. It may be stated, broadly, that voice is produced in the larynx, but speech is produced in the mouth.

A few words may not be out of place on the production of voice as a necessary antecedent to articulate sound or speech. The special organ of voice consists of the larynx. The trachea, lungs, and upper part of the pharynx may, however, be regarded as accessories to it: the lungs, as the active agents in propelling, by their contraction, the air through the larynx; the trachea, by its increased or decreased length, as affecting the tone of the voice; and the upper part of the pharynx, as aiding in the same purpose.

The larynx is an elastic box, consisting of the thyroid, cricoid, and arytenoid, cartilages. These are bound together by a system of muscles and ligaments, admitting a large degree of movement, and yet of singular elasticity.

Situated about one-third from the highest level of this chamber—and inserted into the thyroid cartilage at one point, but passing backwards, and by their separation forming two sides of a triangle—we have the vocal cords, attached at their extremities to the arytenoid cartilages. By the movement of these cartilages the margins of the vocal cords may be approximated so as to come into actual contact. The arrangement of the cartilages is such that these cords are capable of variable tension as well as approximation; and it is by the vibration of these cords, produced by the rapid passage of air from the lungs through the trachea, that voice is produced.

The differences in the sound of the voice are the result of the difference in tension of the cords, and their relative position to each other, aided by the difference in the length of the trachea, and the configuration of the upper part of the pharynx, and the position of the epiglottis and soft palate. Sound having passed from the larynx into the region immediately above, may then be modified or articulated, and produce speech. It is this which is of especial interest to us as dental surgeons, since it is here that our domain of labour and observation in practice begins.

Speech is due to the manner in which the column of air is arrested, condensed, or thrown into vibrations by the organs of speech, which consist of the tongue, hard and soft palate, teeth, and lips; the cheeks also may be said to take a part in the production of speech, though they cannot be regarded as organs of speech proper. The pharynx and nares may be put into the same class as the cheeks.

An examination of the plates, which need not be more fully described, will show how frequently the nares are separated from the mouth by the action of the soft palate and the constrictors of the pharynx. This is a point of great practical importance and value, especially when we notice how frequently defects arising from this action are brought under our notice.

What is the practical use of the present paper? In the first place, to show, in a more satisfactory manner than has been hitherto done, the relative position of the parts concerned in the production of speech, and thus render the physiology of the subject more precise

in its nature. In the second place, to enable those who have been treated, by operation or mechanical appliance, for cleft palate, to acquire a more accurate knowledge of the different sounds in the English alphabet, and thus learn the means by which they may be combined to form words and sentences. In the third place, to enable the practitioner to determine what is the cause of any defect in utterance of a patient brought to him, by being able more accurately to fix upon the locality which is imperfect in action. And lastly, and by far the most important, and, to my own mind, interesting use of all—to help on the work of teaching to speak those who are unfortunately deaf mutes.

I shall shortly issue a complete monograph on the subject, with twenty-six plates, showing the precise position assumed by the tongue for the formation of each letter-sound, and indicating the movements which the deaf-mute must be taught to imitate for their production.

ON PARACENTESIS THORACIS.*

By G. H. PHILIPSON, M.A., M.D. Cantab., M.R.C.P. Lond.,
Physician to the Newcastle-upon-Tyne Infirmary, etc.

AMONG the valuable aids of surgery in the treatment of disease is the operation of paracentesis, and this no less in affections of the pleura than of the other serous cavities. Notwithstanding the division of opinion respecting the general advisability of paracentesis thoracis, unquestionably it has been sufficiently often completely successful, or it has been productive of such marked relief to distress and suffering, as to fully justify the procedure, even if an ultimate restoration cannot always be prognosticated. It is, however, in cases of empyema, and in inflammatory effusion, acute or chronic in nature, which threaten speedy suffocation unless relief be afforded, that puncture of the pleura is most appropriate and effective of good. The operation was had recourse to in the following case of chronic pleuritic effusion to avert threatening dissolution.

Thomas Baird, a seaman, aged 28, was admitted into the Newcastle Infirmary under my care on March 9th, 1871. He stated that he had been ill for sixteen weeks, and had suffered from difficulty in breathing, and from cough, and that at first he had severe and cutting pain in the right side of the chest. He was a strongly built man, and was not emaciated. Upon examination, there were marked dulness upon percussion over the whole of the right back, and a total absence of vocal fremitus, vocal resonance, and respiration. In front, there was dulness upon percussion from the right clavicle downwards to a line two inches below the umbilicus, the lower border of the liver being plainly felt at this line. There was an entire absence of vocal fremitus, vocal resonance, and respiration. The intercostal spaces on the right side were distinctly elevated. In deep respiration, the right side remained stationary. The percussion over the left side, front, and back was clear, and the respiration was slightly harsh. The heart's impulse was seen and felt about half an inch below the left nipple in the nipple line. The sounds of the heart were normal. The expectoration was small in amount, and consisted of thin frothy mucus. The right side, in the nipple line, measured twenty-one inches, and the left nineteen inches and a half. He was ordered a saline purge and a pill three times during the day, consisting of three grains of mercurial pill, a quarter of a grain of subchloride of mercury, and half a grain of opium.

March 11th.—He was in very great discomfort, and panting for breath. The respirations were 40 in the minute, and the pulse was 90. His lips and cheeks were livid, the skin clammy, and feet cold. It was decided to afford relief by paracentesis, which was performed by Dr. Page, the senior house-surgeon. A trocar about the size of a crow-quill was introduced between the sixth and seventh ribs, four inches to the right of the spine. After the escape of fifty ounces of clear straw-coloured serosity, the cannula was withdrawn, and the opening was closed with a pad of lint, strapping, and bandage. During the passage of the fluid, the breathing became slower and more tranquil, and the patient more than once expressed his relief and his gratitude.

March 12th.—Without solicitation, the patient expressed the relief he had experienced; and when interrogated, said that the difference in his feeling, before and after the operation, was to him as the difference between "night and day." The respirations were 30 in the minute, and the pulse was 96.

March 15th.—The duskiess of the face was much diminished, and the respirations were 28 in the minute; over the right scapula slight vocal fremitus was felt and harsh respiration was heard. The percussion note was comparatively clear from the spine of the scapula to its lower angle. The impulse of the heart was felt about a quarter of an inch

* Communicated to the Northumberland and Durham Medical Society.

within the left nipple. He was ordered ten grains of iodide of potassium in infusion of quassia three times during the day, and a large blister was applied to the right back. Subsequently, the back was rubbed night and morning with a lotion composed of perchloride of mercury and iodine.

Daily he continued to progress favourably up to April 9th, when he expectorated a little blood-tinged mucus, complained of shiveriness, pain and uneasiness in the left mammary region, inability to take his food, and renewed difficulty in breathing. Over the left back and in the left infraclavicular region, the respiration was feeble and accompanied with mucous and submucous rhonchi. Warm fomentations were assiduously applied over the left chest, and carbonate of ammonia, spirit of chloroform, and wine were freely administered; but his breathing became more and more impeded, and he died on April 9th.

At the necropsy, the right pleural cavity contained about three pints of straw-coloured serosity, together with fibrinous coagula; and the left pleural cavity about two ounces of clear serosity. The right lung was about half the size of the left, condensed, and at its apex firmly adherent to the chest-wall by old adhesions. The pleura pulmonalis and the pleura costalis on the right side were thickened. The left lung was congested throughout. The heart, liver, and kidneys were healthy.

This case has been recounted with the view of directing attention not only to the simplicity, painlessness, and efficacy of paracentesis in impending asphyxia from extensive pleuritic effusion, but also to the necessity of not delaying the operation until the lung has become totally unfitted for free expansion. The pathological changes disclosed at the necropsy afforded a clear exemplification of the irremediable effects upon the thoracic viscera of a prolonged pressure from fluid effusion. For the removal of the fluid to be successful, it is necessary that the operation should be performed early; for the endeavour to promote absorption by the use of medicinal agents, when that process is slow or non-progressive, is often only to lose invaluable time. The operation, also, if performed early, prevents a prolonged illness, and, it may be, a contracted chest and an inefficient lung.

PARACENTESIS IN PLEURISY AND EMPYEMA.

By W. S. PLAYFAIR, M.D.,

Physician-Accoucheur to King's College Hospital.

THE JOURNAL of February 3rd contains an interesting clinical lecture, by Dr. Fuller, on Paracentesis in Pleurisy and Empyema, on which I beg permission to make one or two observations. The author's high and well-earned reputation necessarily gives so much weight to his teaching, that I cannot but think it important to point out what seems to me to be erroneous in his views. Some weeks ago I read a paper on this subject before the Obstetrical Society, in which I advanced views directly at variance with Dr. Fuller's in regard to the importance of preventing the entrance of air in performing paracentesis in cases of empyema. My cases occurred exclusively in children; but the principle involved is, of course, the same.

With regard to tapping in serous pleurisy, I expressed opinions almost identical with his own. The operation there stands on a very different footing from paracentesis in empyema. All we wish to do is to remove a portion of the fluid, so that the remainder may be more readily absorbed; and, provided we exclude air, it is, I believe, of comparatively little importance how this is done. When the fluid is purulent, however, as Dr. Fuller correctly points out, it cannot be absorbed, and the sooner it is got rid of the better. And here it is that I venture to join issue with him. Dr. Fuller says: "It is not a question whether you shall or shall not let in the air. You cannot get the fluid out without it. You may withdraw a certain quantity of the fluid, but you cannot empty a cavity of this kind without the admission of air." Now I maintain that you can; and I say so, because in three consecutive cases carefully recorded in my paper, treated by the method of continuous subaqueous drainage which I advocate, every drop of pus was evacuated, and a perfect recovery obtained, without the slightest admission of air. A single well attested fact of this kind is better than any amount of theorising as to the mechanical condition of the chest-walls, and I might be well content to rest my views on the evidence of my cases. But I think it can be shown that, even theoretically, the statement that pus cannot be evacuated without the admission of air is erroneous. Dr. Fuller says: "We are dealing with a closed cavity, and its walls are more or less rigid. If you take a cavity, such as a cask, with perfectly rigid walls, you can get nothing out of that cask by tapping it unless you admit air." There is, however, this great difference between the pleural cavity and a cask, that the former contains the lung, which, as it gradually expands, takes the place of the fluid which it displaces. Un-

questionably we cannot hope to empty the pleural cavity at one sitting. The plan I advocate, which I cannot here describe in detail, consists essentially in leaving one extremity of a fine drainage-tube in the pleural cavity, certain precautions being taken to prevent any entrance of air at its point of penetration, the other end being placed in a bottle of water under the bed. Time is thus given for the expansion of the lung, and a gradually decreasing amount of pus is daily forced through the tube into the bottle, and at last the pleural cavity is quite emptied. In my paper I specially pointed out that, if the lung were tightly bound down by adhesions which prevented its expansion, the operation would probably fail; we would then have a condition resembling a barrel, a simile which I myself used, and I quoted in illustration a case recorded by Bouchut. Adhesions are, I believe, more common in adults than in children, and, therefore, I can quite conceive the possibility of this plan being less successful in the former than in the latter; but of this I have no experience.

Now as to results. Of the three cases recorded by me—two having been under the care of my colleague, Dr. Hilton Fagge—one was perfectly convalescent, with a fully expanded lung, in seven days; the other two in thirteen and twenty-eight respectively; and in none of them was there any subsequent deformity of the chest. I recorded at the same time two cases treated (as Dr. Fuller advises) by freely opening the pleural cavity and admitting the air, in one of which a drainage-tube, on Mr. De Morgan's plan, was also used. In one of these, close upon two months elapsed after the operation before the child was able to go to a convalescent home, with a pleural fistula still discharging; in the other, five months passed before the child could be removed from the hospital. It would be satisfactory to know what was the average time in which Dr. Fuller's patients were under treatment after the admission of air into the pleural cavity.

Then, I think, it can hardly be doubted that the free admission of air greatly increases the risk of subsequent chest-deformity, the prevention of which must be most important. In connection with my paper I exhibited careful drawings of the chest in these five cases taken by Dr. Gee's cystometer, in which the difference between the cases in which the air was and was not admitted was very appreciable.

I feel convinced, therefore, that those who, with Dr. Fuller, believe that the complete evacuation of pus without the admission of air is impossible, would alter their opinion if they gave this method—for the details of which I must refer to my paper—a fair trial. That the object, if feasible, is an important one, no one, I think, can doubt. If it be of primary importance, as many eminent modern surgeons teach, carefully to exclude the entrance of air in opening an ordinary abscess, how infinitely more so must it be when we have to deal with a pus-secreting surface so large as the entire pleural cavity! Of course such a method cannot always be expected to succeed; should it fail, I know of nothing better than freely opening the chest, as Dr. Fuller advises. Still I believe it to be well worthy of more extended trial.

ON PARACENTESIS IN PLEURISY AND EMPYEMA.

By R. DOUGLAS POWELL, M.D.,

Senior Assistant-Physician to the Hospital for Consumption and Diseases of the Chest, Brompton.

I MUST plead the very great interest I have long taken in all questions connected with the treatment of pleural effusions as my excuse for making a few comments upon some points in the clinical lecture by Dr. Fuller, an abstract of which appeared in the JOURNAL for February 3rd. The high esteem in which Dr. Fuller is held as a clinical observer and teacher renders it almost unnecessary for me to add that I do so with the greatest respect for one so much my senior.

Dr. Fuller states that "the idea that it is possible to draw off the fluid from the chest without admitting air contravenes a well established physical law, and therefore these contrivances (designed to prevent the entry of air in paracentesis) fail in their object." Dr. Fuller admits, however, that "in a flexible chest you may withdraw thirty ounces without the admission of air." I published a case in the *Clinical Transactions*, vol. iii, p. 244, in which four pints of purulent fluid were removed from the chest of a man without admitting a particle of air; and I have repeatedly seen a large quantity removed in a similar way.* In this respect, then, my experience, and, I fancy, that of many others, is not in accordance with Dr. Fuller's teaching, "that it is impossible to withdraw the fluid of empyema without admitting air." Dr. Fuller continues, speaking of purulent fluid: "If this be

* More might have been removed from the case referred to, but that the patient began to complain of pain.