The disorders of speech.

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THE
DISORDERS OF SPEECH.

A PHYSIOLOGICAL ALPHABET.

I.—VOWELS.

y* — i e a o u — *w

These should be pronounced in the Latin manner, as *ēē, eh, ah, oh, oo.* *y* and *w* are consonants, not vowels, but, as explained in the text, they have very close relationships to the vowels, initial *y* being very closely related to *i*, and initial *w* to *u*.

II.—CONSONANTS.

	Voiceless Oral Consonants.	Voiced Oral Consonants.	Voiced Nasal Resonants.
Labials.	***P***	***B***	M
(1st Stop Position.)	(W)	W	
Labio-Dentals.	F	V	
Linguo-Dentals.	Th[1]	Th[2]	
	S	Z	
Anterior	Sh	Zh	
Linguo-Palatals.	***T***	***D***	N
	(L)	L	
(2nd Stop Position.)		R	
Posterior	***K***	***G***	Ng
Linguo-Palatals.	H or Ch	Y	
(3rd Stop Position.)		(R)	

The voiceless *W* and the voiceless *L* have been given above within brackets, he former being now almost confined to Scotland, and the latter being eculiar to Wales. The burring or uvular *R* is also given within brackets.

ILLUSTRATIVE SENTENCES.

I.—VOWELS.

Even ancient elves are awed over oozing.

This sentence represents only long vowels. Their short equivalents can be represented, as shown by Mr Pitman, by attaching the letter *t* to each vowel, thus:—

ĕĕt, it, et, at, ut, ot, ŏŏt.

II.—CONSONANTS.

Labials. *(1st Stop Position.)*	Peter Brown made white wax.
Labio-Dentals.	Fine villages.
Linguo-Dentals.	Thinkest thou so, zealot?
Anterior Linguo-Palatals. *(2nd Stop Position.)*	She leisurely took down nine large roses.
Posterior Linguo-Palatals. *(3rd Stop Position.)*	Can Gilbert bring Loch Hourn youths?

To Dr Osler
with the author's
Compliments.

THE

DISORDERS OF SPEECH.

BY

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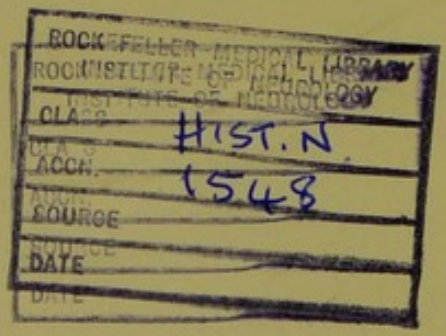

PREFATORY NOTE.

THE text of this work has already been published as a series of articles contributed to the *Edinburgh Medical Journal* between October 1891 and May 1894.

The Appendix consists of—(A.) Notes of three illustrative cases of Speech-disorder which have been under observation too recently to be available for the text of the work; and (B.) a Reprint of my Graduation Thesis (1865) on the Physiology of the Larynx, which was originally published in the *Edinburgh Medical Journal* for September 1866. I have thought it well to reprint this thesis, as its subject is intimately related to the physiology and pathology of Speech.

EDINBURGH, 1 MELVILLE STREET,
October 1894.

ERRATA.

For "Caprolalia" at page 56, lines 4 and 14, please *read* "Coprolalia."

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PART FIRST.

THE FUNCTIONAL DISORDERS OF THE VOCAL MECHANISM.

CHAPTER I.

On Stammering; and on the Study of the Alphabet.

The performance of a good player on the violin affords a beautiful illustration of co-ordinate movement. His two hands co-operate with each other, gracefully and easily, in the execution of their delicate task. Each hand has its own work to perform. The right, wielding the bow, is the producer of sound: in proper time, and with correct emphasis of touch, it calls forth the vibrations of the strings in rapid succession. The left hand moulds the sound into music, by its manipulation of the strings. Its fingers must not only keep pace, upon the strings, with the movements of the bow: they must touch each string, to a nicety, in the right place; otherwise the note will be out of tune. Let it be particularly noticed, as of special interest in connexion with our present subject, that the two hands must act in perfect co-ordination one with the other: that is to say, that each hand, in assisting the other, must perform its part of the work exactly at the right moment—neither too soon nor too late;—since the slightest inexactitude in this respect would be utterly destructive of the music. From the consideration of these independent and combined movements of the two hands of the violinist, one can form some conception of the wonderful facility and exactitude of execution that can be

acquired by the motor centres of the nervous system through the influence of education.

In the production of Speech, we find a series of movements just as rapid and exact, and in like manner effected, if not by two hands, at least by Two Mechanisms, acting, like the hands of the violinist, in exact co-ordination one with the other. These two mechanisms are:—

(1.) That of the Larynx, which is the producer of the vocal element in speech, and thus is comparable to the bow-hand of the violinist.

(2.) The Oral Mechanism, by which the sounds of the larynx can be modified in tone or timbre, though not in pitch, as they pass through the oral cavity; and by which new sounds, produced within the mouth itself, can be added to the vocal tones of the larynx. The oral mechanism may in some respects be compared to the string-hand of the violinist.

These Two Mechanisms must act together with a co-ordination as exact as that of the two hands of the violinist. Let there be a little inexactitude in this respect—only a little delay, let us say, in the production of the vocal element,—and speech is at once interrupted, so as to become discordant and laborious. It will be the chief object of this paper to make it perfectly evident that the common defect of Stammering is in the great majority of cases due to delayed action of the laryngeal mechanism; though it may, apparently, in a minority of cases be caused by delayed action of the oral mechanism. A further reference to the performance of the violinist may help to make the matter clear. We are told by those who play the violin, that, when a player begins to learn to play from the score, his chief difficulty is with the string-hand; and that sometimes, in his anxiety to place the fingers of that hand upon exactly the right places, he is tempted to devote too much attention to it, to the neglect of the bow-hand. For a moment, he may even forget about the bow-hand altogether; and, when no sound is produced, he may press harder upon the strings, until he discovers that the bow-hand has been neglected. So, in the common variety of stammering, the speaker neglects the laryngeal mechanism; and, when no speech is emitted, he unwittingly throws increased force into the wrong quarter, viz., the oral mechanism, whose nerve centres thus become surcharged with

energy, which may overflow into other centres and produce spasmodic complications. In explaining to a stammerer the real nature of his defect, this comparison between the violinist and the speaker will be found to be of use, as it is easily grasped and understood, even by young patients.

That the defect of speech in the common variety of stammering is due to Delayed Action of the laryngeal or vocal mechanism in attacking the first syllables of words, is an old proposition; and is also to the present day maintained by the best writers on the subject. Among the first to make the proposition, was, I believe, Dr Neil Arnott, in the very interesting chapter upon stammering in his work on *Physics*, first published in 1827. In later times, Melville Bell, in this country, and Merkel and Kussmaul, in Germany, have taught the same doctrine; and, in drawing up recommendations for the treatment of the condition, they have all alike insisted upon the necessity of attending in a special manner to the production of the vocal element in speech. That the doctrine is true can be shown by many familiar proofs. Thus, however severely a stammerer may stammer in speech, it is seldom that he has the slightest difficulty in song. Many stammerers are excellent singers. One writer describes the case of a man who stammered very badly, but who sometimes won money by wagering he would sing through a long song, from beginning to end, without once stammering. In my own practice, I have had one patient, a medical student, who did stammer occasionally during his musical performances; but his songs were "nigger melodies," and contained much conversation. It was in the conversational parts that he had difficulty; and the difficulty did not distress him, as the audience was always under the impression that the grimaces of his blackened face were a voluntary part of the performance. This case is therefore no exception to the rule that stammerers do not stammer when they sing; and possibly some of the reported exceptions to the rule might be explained in a similar way. In like manner, stammerers rarely stammer in intoning, which is a mode of singing upon a single note. Charles Kingsley stammered badly in ordinary conversation all his life; but his biographer tells that he preached well, and that he had no stammer in preaching, because he then spoke or intoned in musical monotones. Similarly the reading of poetry, with its musical cadences, is easier

to the stammerer than the reading of prose. Public speaking, with its full intonations, ought, on the same principle, to be somewhat easier than private conversation; but the stammerer's nervousness generally makes it more difficult. All this tends to show that when a primary demand for voice is made, as in song or in intoned speech, and a sufficiency of energy is thereby supplied to the laryngeal mechanism, the difficulties of a stammerer can be made, for the time, to disappear. Few stammerers would stammer at all, if they deliberately sang or intoned their conversation; but it need scarcely be said that it is hopeless to ask them to do anything so extraordinary. Yet a general injunction to the stammerer, that, in speaking, he should employ a full tone of voice, is always of use to him; as is also an injunction to practise reading aloud in a full voice for at least a few minutes every day. Melville Bell, whose experience in the treatment of the condition was very great, asserts that the success of stammer-doctors is very largely due to their almost universal practice of making their patients read aloud daily in this manner.

Recognising the great value of this prescription, I have been led to ask myself if nothing further can be done to facilitate the patient's intelligent use of the voice as one of the essential elements of speech. Experience has shown me that something else can be done; viz., to put it in the power of the patient to acquire with ease an accurate knowledge of the individual letter-sounds which compose his speech. Such a knowledge will enable him, with easy decision, to throw the voice into the vowel or consonant that contains voice; and to touch off lightly, without dwelling on it, any consonant that does not contain voice, bringing the voice out immediately in the vowel or vocalized consonant that succeeds it. The desire to communicate to stammerers a knowledge of such matters has led me to construct a physiological alphabet, so arranged that the voiced elements are separated distinctly from the voiceless, and so simply constructed as to be easily learned and remembered, even by young patients. It need scarcely be said that the construction of a physiological alphabet is no new thing. Dr Neil Arnott himself, with the very same object in view, constructed one; which will be given in the Appendix to this paper. Mention should also be made of the excellent phonetic alphabet of Mr Pitman, constructed by him in

connexion with his phonetic method of shorthand writing;[1] of the alphabetical table of Professor Max Müller, in his well-known *Lectures on the Science of Language;* of the vowel and consonant tables given by Dr Bristowe in his work on *Voice and Speech;* of the table of consonants by Norman W. Kingsley of New York;[2] of the elaborate tables of vowels and consonants appended by Dr John Hullah to his work on the *Cultivation of the Speaking Voice;* of the still more elaborate vowel and consonant tables in the work entitled *Pronunciation for Singers*, by Alexander J. Ellis; of Melville Bell's tables in his work on *Visible Speech;* and of the phonetic studies of the alphabet which have been made by the teachers of Deaf-Mutes.[3]

Before I proceed to draw up this alphabet, let us consider in the light of a few examples the delicately co-ordinated action which is carried on in combination by the two mechanisms, laryngeal and oral, in the production of ordinary speech. Take the word **satisfy**. Here the laryngeal mechanism is called upon to touch off three separate vocal sounds, each of which is evolved by the vocal cords during an instant of approximation, viz., the sounds of **a**, **i**, and **y**; and, between these sounds, the open glottis must permit the current of air to pass noiselessly into the mouth, where it will be utilized for the production of the voiceless consonants, which are made, as it were, to clothe the vowels in front and behind. Let the naked vowels, as they sound in this word, be pronounced, and then the full word itself; and the extreme delicacy and exacitude of the three separate co-aptations of the vocal cords will be realized. Let there be any delay in the pronunciation of the first vowel, and the initial **s** will be hissed and prolonged, exactly as it is by the stammerer. But the voice is not an exclusive possession of the vowels: many of the consonants are also in part made up of voice. Take the word **wonder**, for example. Here every letter, consonant and vowel alike, contains voice; so that the

[1] See Pitman's *Phonographic Teacher*, p. 4, *et seq.*

[2] Published in the *Internationale Zeitschrift für Allgemeine Sprachwissenschaft*, vol. iii. p. 246. This paper demonstrates in an ingenious way the parts of the palate, etc., with which the tongue is brought in contact during pronunciation of certain consonants.

[3] See *Education of Deaf-Mutes*, by Thomas Arnold.

larynx has to maintain its vocal cords in co-aptation throughout the whole word, which may even be repeated many times in a deliberate and continuous hum. But add to this word the final syllable **ful**; and, as the word, with this addition, is being hummed over, note the moment of interruption of the hum during the production of the voiceless **f**. For a moment the vocal cords have been thrown apart to permit of the passage of voiceless air for the **f**; but they are immediately brought together again for the production of the vocal **u**. These examples may suffice to show what a delicate and exact work the larynx has to perform, in supplying the vocal element to the vowels and vocalised consonants, and in intermitting the voice-production when the air is required for consonants that contain no voice.

Let it be noted that a stammerer experiences his difficulties only, as a rule, during the production of the first syllable of an ordinary word. The two mechanisms, laryngeal and oral, are, as it were, for the moment out of gearing, and can be put into gearing only by an effort; when this effort succeeds in educing the first syllable, the others follow, as a rule, without difficulty; and it is only after the completion of the word that the two mechanisms again fly out of gearing.

The Physiological Alphabet.[1]

Coming now to the description of the physiological alphabet, we find, on reference to the alphabetical table, that a vocal element is present not only in the vowels, but also in the majority of the consonants. It should be clearly understood, that every vocalized letter-sound is the product, not of one of the mechanisms exclusively, but of both combined. Even the vowels are not exclusively the products of the larynx, but owe their specific characters largely to the operation of the oral mechanism.

Vowels.—A little experiment with the piano, described by Helmholtz, brings home to one very clearly the true nature of a vowel. Let the cover of the piano be lifted up so as to expose the wires, and let the dampers be raised from these by pressure of the foot on the loud pedal. Then, with the head lowered to

[1] It may be of advantage to the reader to keep the Alphabetical Table of the frontispiece open before him when reading the following description of it.

within a foot or two of the sounding-board, sing one of the vowels, such as o or e, in a clear, loud tone of low pitch. The piano will not merely echo back the note in its correct pitch: it will distinctly, in its echo, pronounce the vowel, o or e, as the case may be. This is due to the fact that the different vowel-sounds consist in different combinations of the note with over-tones or harmonics. The voice, therefore, does not only excite a sympathetic vibration in that wire of the piano which represents its fundamental note and pitch: it also excites similar vibration in a number of other wires, which represent the over-tones or harmonics; and, as these over-tones differ in the different vowels, the piano reproduces the vowels distinctly and specifically. In the production of vowels, the larynx thus furnishes the fundamental note and its over-tones; but this material is modified in passing through the oral cavity, by the action upon it of a Resonating Chamber capable of great variation in size and shape, wherein the over-tones are individually suppressed or exaggerated; and the sound is thus moulded into the acoustic figure proper to the vowel to be produced. When the vowel is sung over the piano, this acoustic figure is represented by the grouping of the wires called into sympathetic vibration. It is chiefly to Willis,[1] Wheatstone,[2] and Helmholtz that we owe our knowledge of the real nature of vowels. The subject will be found fully discussed in Helmholtz's great work on *The Sensations of Tone.*

In English grammars, the vowels are given in the order a, e, i, o, u, and it is expected that these shall be pronounced in the English manner. But there are well-known objections to this order and pronunciation. The English i is really not a simple vowel-sound, but a compound of two vowel-sounds that may be represented by the letters a i. So, also, the English u is a compound sound really representing y u. It is better, therefore, to adopt the Latin pronunciation of the vowels, which gives to each a single definite sound. Further, in arranging them, it is best to place them in an order which will represent a gradual transition from the narrowest and tightest shape of the resonating chamber—that for i (English ee),—on to the hollowest and largest shapes—those

[1] *Trans. of the Cambridge Philosophical Society*, vol. iii. p. 231.

[2] *London and Westminster Review* for October 1837.

for o and u (English oo). The difference in the chambers for o and for u (oo) is that in the u (oo) sound the rounded labial opening is of smaller size than that in the o sound. The order thus becomes i, e, a, o, u. Any one, when deliberately pronouncing the vowel-sounds one after the other in this order, and using the Latin pronunciation, can from his own sensations realize that the resonating chamber within the mouth, very tight and narrow when the first vowel is being sounded, opens up more and more with each succeeding vowel, until, with the final o and u (oo), the chamber has attained its largest dimensions.

It should be carefully noted that in no one of these pure vowel sounds is there, throughout the oral cavity, any constriction sufficient to give rise to audible friction from the passing air. Let such friction be added, and in some instances the vowel will become a consonant. This is seen when the vowel sound i (ee) is pronounced with such accompanying friction of air. It then becomes the sound of the initial y in such a word as yes. So, again, when the pure vowel-sound u (oo) is made to pass through a very small labial orifice, it becomes converted by the added friction into a w, as in the word weary. Y may therefore be described as a tight i (ee), and w as a tight u (oo). These two consonants are thus closely related to the vowels, and may be regarded as transitionary steps or stepping-stones between vowels and consonants. They are both obtained from vowels by the simple addition of a fricative element, due to the friction of the escaping air. This relationship of y and w to the vowels is described by Merkel.[1] It is represented in the alphabetical table. As to the number of the vowels, it may be remarked that there are many possible shades of breadth in the pronunciation of each, and that these might fairly justify a considerable enlargement of the list by the insertion of a number of new vowel-letters to provide for them, but such shades of breadth are in the present connexion not of sufficient importance to be here described in detail. Further, it appears necessary only to refer in a word to variations in length, by reminding the reader that the same vowel may be long or short.

Consonants.—Coming now to the list of Consonant-sounds, we find, on examination of the alphabetical table, that they are there

[1] *Physiologie der Menschlichen Sprache*, p. 80.

arranged in three vertical columns, of which one column, the first, contains the voiceless consonants, whilst the second and third contain the consonants in which voice is a component element. In the sounds of the third column—Nasal Resonants,—the voice is, by the dropping of the soft palate, made to pass freely through the nose, the passage through the mouth being closed. It need scarcely be said that each consonant of this table should be pronounced as the letter is pronounced during the enunciation of a syllable containing it. Thus the letter **s** should be pronounced, not as **ess**, but as the sibilant sound at the beginning of such a word as **son**; and so with the others. Besides being divided vertically into columns, the consonants of the alphabet, it will be observed, are arranged horizontally in groups, according to the part of the mouth which is the seat of their production. The groups begin anteriorly, with the consonants which are produced at the lips—the Labials,—and pass backwards, by the Labio-Dentals, Linguo-Dentals, and Anterior Linguo-Palatals, to the group which is produced most posteriorly—the Posterior Linguo-Palatals. There are, in all, five groups. Of these, three are of leading importance, viz., the Labials, Anterior Linguo-Palatals, and Posterior Linguo-Palatals. These three groups are produced at the three great Stop-positions. In these three stop-positions there are greater possibilities of producing a variety of consonant sounds than in the other two. It is possible at each of the three stop-positions either to stop the current of air, or to allow of its escape with fricative noise through a narrow opening; and each of these two actions can be performed with or without the addition of voice supplied by the larynx.

Let us note in detail what effects can be produced at each of the Stop-positions, and also at two other positions where only fricatives can be produced.

A. Taking first the Anterior or Labial Stop-position, we note that it can produce—

(1.) The voiceless **p**, when there is complete closure of the lips, and the air is compressed behind the barrier. Occurring at the beginning of a word, this mute or voiceless consonant communicates an Explosive character to the vocal sound which follows it in the syllable, as in the word **pot**. Occurring at

the end of a word, it gives the effect of a sudden and silent Stop, as in the word **top**.

(2.) The Voiced Explosive **b** is also produced at this position. It is merely **p** with voice added, the air which accumulates behind the barrier being, as it were, voice-laden. The explosive and stop effects of **b** may be recognised in such a word as the monosyllable **Bob.**[1]

(3.) Closing the lips and sounding the voice as in **b**, drop the soft palate, and let the air and voice escape through the nose; and the effect will be to produce the Nasal Resonant **m**.

(4.) In these three consonants the labial stop-position was closed; but let it now be opened slightly, so that the air may escape by a small orifice between the lips; and if voice be added the effect will be the production of **w** as in **weary**, this consonant, as already explained, being a Voiced Fricative made up of the **oo** sound and the fricative noise produced by the passage of air through a very narrow opening.

(5.) Can we here produce a simple Voiceless Fricative? I hold that we can, and that we actually do so when we pronounce the initial **wh**, in the word **which**, for example, as these letters are, in words beginning with them, pronounced in Scotland. It should really be spelt **hw**, or more correctly *ww*, the first of these letters being given voicelessly, and the second with voice. In England, the voiceless letter has been dropped; and **which** has now been softened into **wich**.

These are the five possibilities at the first or anterior stop-posi-

[1] On careful experiment, I find that for the production of B it is not absolutely necessary that the air accumulating behind the barrier should be voice-laden. All that is absolutely necessary is that the voice should be emitted *as soon* as the air. In the pronunciation of an initial P, the air begins to escape just an instant before the voice. This can be made evident if a house-key be held before the mouth as if for whistling, and Pa and Ba be pronounced over it. And, no doubt, the same distinctions exist between T and D, and between K and G.

It has been pointed out to me that the pressure of air behind the barrier is greater in the voiceless than in the voiced explosives. In the voiceless explosives the pressure of the air in the mouth is the same as in the trachea; but in the voiced explosives the air meets with some amount of obstruction at the glottis, owing to the approximation of the vocal cords in phonation; and this obstruction in the larynx causes the air pressure to be less in the oral cavity than in the trachea.

tion. Their relations to each other are plainly shown in the Alphabetical Table.[1]

B. Turning now to the Second or Middle Stop-position—the Anterior Linguo-Palatal,—we find that five similar consonants are produced here also, as well as two others in addition. The complete stop is here effected by the apposition of the tip and edge of the tongue to the upper gum, which is the anterior part of the hard palate. **T**, the Voiceless Explosive, corresponds in its method of production and in its effect to **p**. **D** is simply **t** with voice in the air that accumulates behind the barrier. **N** is produced as **d**, except that the soft palate is lowered, and the voice allowed to escape through the nose. **Sh**, as in **she**, is the Voiceless Fricative of this position, produced when the stop is not complete; and **zh**, as in **treasure**, is **sh** with the addition of voice. (In English, **zh** is never spelt **zh**, and never occurs as an initial consonant; but in French it is common as an initial, being represented by the letters **j** or **g**, as in **Jean** or **George**.)

The tip of the tongue being, above all parts of the mouth, capable of rapid and delicate movement, it is not surprising to find that in this, the middle stop-position, two Additional Fricatives are produced, viz., **r** and **l**. **R** is produced partly by the purring friction of the air in passing over the vibrating tip of the tongue, and partly by the voice: it is a Voiced Fricative, which can be produced with different degrees of roughness. **L** is also a Voiced Fricative, produced by the fricative passage of air with voice over the sides of the tongue, whilst the tip is in contact with the palate at the stop-position. In English, there are no voiceless fricatives corresponding to **r** and **l**; but in Welsh there is a voiceless **l**, always succeeded by a voiced one; as in the initial **ll** of **Llangollen**. So far as I am aware, no language has utilized the voiceless **r**.

A curious point in the production of the letter **r** has been brought under my notice by my pupil Mr Thomas Macdonald, son of the late Dr Angus Macdonald. It is that the trilling motion of the

[1] Babies are fond of producing at the lips a trilling noise, sometimes without and sometimes with voice. Some authorities have described it as a labial R, and in Germany it is called the coachman's R, because it is used for urging horses; but, as it is not employed in European speech, I have not incorporated it in the Alphabetical Table.

tongue is not effected by the middle of the tip, but, in most individuals, by the tip at the right side of the middle line. Is this an indication that the speech energies are not distributed with absolute equality to the two sides of the tongue, but that the tongue in speech is to some extent "right-handed"? It would be interesting to find out, by further observation, if left-handed people trill with the left side of the tongue-tip.

From the above description, it is seen that seven consonantal sounds are capable of being produced at this, the most remarkable of the stop-positions.

C. Taking, lastly, the Third or Posterior Stop-position—the Posterior Linguo-Palatal,—we find that, like the first or anterior, it produces normally only five consonants. We find, further, that whilst complete stoppage is effected by the co-aptation of the back of the tongue with the palate, a considerable latitude is allowed, in this position, as to the exact spot on the palate against which the tongue may be pressed, or towards which it may be approximated. This latitude permits of an easier transition from the consonant to the succeeding vowel. Taking, for example, the words **key** and **coal**, it will be found that in **key** the **k** sound is effected by the contact of the tongue with the hard palate pretty far forward; whereas in **coal** it is effected by the contact of the tongue with the soft palate pretty far back. So also with the fricatives: **h** in **here** is produced further forward than it is in **home**. The five consonants which this position is capable of producing are—(1), the voiceless explosive **k**, corresponding in its mode of production to **p** and **t**; (2), the voiced explosive **g**, as in **gum**; (3), the nasal resonant **ng**; (4), the voiced fricative initial **y**, as in **yes**; and (5), the voiceless fricative **h** or **ch**.

Much discussion has taken place as to the situation where the voiceless fricative **h** (the aspirate) is produced. Some hold that it may be produced anywhere in the cavity of the mouth, by the friction of the air against the walls of the oral cavity. Kussmaul, on the other hand, asserts that it is well known that the aspirate is produced by the rush of air through the widely open glottis. Like some others, I venture to dispute both of these propositions, and hold that the aspirate is the voiceless fricative of the posterior stop-position, as above stated. I also hold that the soft **ch**, as in the German

ach or the Scotch **loch,** is merely the aspirate, occurring, in a somewhat pronounced form, at the end of a syllable, instead of at the beginning. The identity of the **h** and the **ch** will be recognised, if the two German words **ich hier,** or the two Scotch words **Loch Hourn,** be pronounced slowly and in continuity one with the other.

Another consonant of a somewhat abnormal character which the posterior stop-position is capable of producing is the guttural or Burring **R,** which is characteristic of the dialect of some districts, such as the county of Northumberland, and is also otherwise a frequent peculiarity of speech. It is produced by the trilling motion of the uvula against the back of the tongue. In Paris it is said to be fashionable to use this abnormal **r**; but in this country burring is regarded as a defect of speech.

Besides these three great Stop-positions, there are two other positions, both of them in connexion with the upper teeth, where several fricatives, voiced and voiceless, can be produced. These are:—

D. The Labio-Dental position, where **f** and **v** are produced by the passage of air between the upper teeth and the lower lip, **f** being voiceless, and **v** being **f** plus voice.

E. The Linguo-Dental position, where the tip of the tongue, in contact with the edge of the upper teeth, allows of the production of two varieties of **th**—a voiceless, as in **thin,** and a voiced, as in **thine**;—and where, applied against the back of the teeth, it allows of the production of the sibilant **s** and its vocalized equivalent **z.**[1] (The voiced **th** used, in old Anglo-Saxon, to be spelt **dh.**)

[1] It has been pointed out to me that **s** can be pronounced when the tip of the tongue is applied to the lower instead of to the upper teeth. In this case, the dorsum of the tongue instead of its tip acts with the upper teeth in producing the **s.** On careful experiment, I find that of the whole eleven consonants which the tip of the tongue normally takes part in the formation of, viz., **th**[1], **th**[2], **s, z, sh, zh, t, d, n, l,** and **r,** I can pronounce all, except one, when the tip of the tongue is held fixed behind the arch of the lower teeth; the dorsum of the tongue being employed instead of the tip in forming them. Even the **th** sounds can be thus produced, if the lower jaw be protruded, so as to permit of the dorsum of the tongue being brought into contact with the edges of the upper teeth. The only exception is **r,** which, without the agency of the tongue-tip, can only be given as the uvular or burring **r.** These remark-

In the alphabetical table, each of the various groups of letters is associated with a sentence whose words begin with the letters of the group. The value of such sentences for purposes of diagnosis, and for purposes of tuition, is obvious. A well-selected stock of such sentences enables one to diagnose and analyze a case of faulty speech with ease, and without loss of time. In the tuition of young stammerers, also, the sentences afford much assistance, as they are so easily remembered. For the sentences, I have to thank my house-physicians and pupils.

To sum up this part of the subject, the consonants may conveniently be divided into the three following classes:—

1. The Typical Five of each Stop-position; viz., a voiceless and a voiced explosive or stop, a nasal resonant, and a voiceless and a voiced fricative.

2. The extra fricatives that the second and third stop-positions are capable of producing; viz., the **l** and **r** of the second position, and the burring **r** of the third.

3. The voiceless and voiced fricatives produced at the two dental positions—the Labio-Dental and Linguo-Dental,—these being six in all; viz., the voiceless **f** and voiced **v**, at the Labio-Dental, and the voiceless **th** and **s** and voiced **th** and **z**, at the Linguo-Dental.

(It should be remarked that of these six the four last are formed in part by the tip of tongue. Adding these four of the Linguo-Dental position to the seven of the Anterior Linguo-Palatal, we have thus, in all, eleven consonants that the tip of the tongue takes part in the formation of. How well the dorsum of the tongue can play the part of the tip when the tip is fixed behind the lower teeth is shown in the footnote to page 13.)

able capabilities of the dorsum of the tongue help to explain the similarly wonderful capabilities of the stump of the tongue after partial excision of the organ.

Another very important point about the formation of **s** is that, whether produced by the tip or by the dorsum of the tongue, it is not necessarily formed at the back of the upper teeth. It can be formed almost equally well farther back, at the upper gum (2nd stop-position), where **sh** is formed; but when formed here it is less sharp and hissing than when formed at the back of the teeth. It can thus be pronounced pretty well even in the absence of teeth. Some children learn to pronounce **s** sooner than **sh**, others **sh** sooner than **s**.

Comparison with the Ordinary Alphabet.

It will be useful to compare the physiological alphabet above explained with the alphabet at present in general use. This will be easily done, if the ordinary alphabet be printed as below, and the letters of it which are omitted from the physiological alphabet, or are only in part represented therein, be denoted by special type thus:—

a b *c* d e f *g* h i *j* k l m
n o p *q* r s t u v w *x* y z.

Among the letters thus indicated in special type, *c* is not represented in the physiological alphabet, because its value is always exactly either that of **s** or that of **k**; **q** is not represented, because it is of no value without an attached **u**, while **qu** has the same value as **kw**; **x**, again has the same value as **ks**, and is therefore not in the physiological alphabet; **g**, in the physiological alphabet, represents the hard **g** as in **gum**, while the soft **g**, as in **George**, is not represented by any single letter, its phonetic translation being **dzh**; and the same translation applies also to the English **j**, as in **John**. In French, **j** and soft **g** are pronounced without the initial **d**; as in **Jean** and **George**. It is very important to explain to a stammerer the phonetic meaning of the English **j** or soft **g**. Some years ago, I had sent to me at the Royal Infirmary, by my friend Prof. Chiene, a boy of 12, who stammered so badly that he had been sent by his doctor to the Professor for surgical treatment of his organs of articulation. When he was passed on to my wards, he was asked his name; but he struggled long and severely without being able to pronounce it, and at last broke down in a burst of weeping. His name was James. When it was pointed out to him that his name really began with **dzh**, and he was shown how to throw the voice into the initial **d**, he became able to pronounce the name with ease; and when, some weeks afterwards, he was shown by me to a class of post-graduates, he gave his name, and replied to several questions, without the slightest difficulty. In this connexion, it may be added that the soft **ch** in **church** is phonetically **tsh**, and is thus the voiceless equivalent of the voiced **dzh** above referred to.

The Phenomena in Stammering.

The general nature of the defect of speech in stammering has already been explained, and it has been shown that the starting-point of the defect is a Want of Promptitude in the production of the vocal element in the first syllables of words. It remains to illustrate this proposition by examples from the different classes of letters, and to show in what degree the difficulty is exhibited during the pronunciation of letters belonging to each of these classes. Speaking generally, it may be said that the difficulty is least in the Vowels, which are vocals, and contain voice as their predominant element. The demand for voice in the production of initial Vowels is of so primary a nature, that the larynx usually supplies it without difficulty; just as the still greater demand for voice in song suffices, while the stammerer sings, to abolish the defect *in toto*. On the other hand, the Voiceless Explosives **t, p, k** occupy a place at the opposite extremity of the scale. They ought to be touched off lightly and easily; but when, in stammering, the succeeding vocal element in the syllable is not properly brought up to time, the stammerer, ignorant as to the cause of his difficulty, throws his energy into the wrong mechanism, and exerts a strong pressure at the stop-position, which may betray itself either in a Silent Sticking at the consonant, or in a Stuttering voiceless Repetition of its explosive effect. Instead of easily pronouncing a single small **p,** he produces a succession of these, or only one prolonged capital **P** of large size. The Voiced Explosives are only a degree less difficult than the voiceless. They are produced in the same manner and in the same variety; their radical defect in the stammerer being the absence or insufficient supply of the vocal element, which, in the case of a voiced explosive, should be thrown into the letter boldly. The other consonants, namely, the Voiceless and Voiced Fricatives and Nasal Resonants, occupy an intermediate place between the vowels and the explosives, as regards the difficulty in their production. In the Voiceless Fricatives, such as **s** or **h,** the sound of the letter is prolonged whilst the speaker waits for the lagging voice-sound of the succeeding letter. In the Voiced Fricatives and the Nasal Resonants, the stammerer produces the letter voicelessly, or with feeble and intermittent voice; and dwells upon it indefinitely. The voice is

not thrown into it boldly, as it ought to be; and the speaker therefore feels that the proper sound has not been produced. Thus in the word **mother** he emits a feeble, prolonged, and almost voiceless **m**; but if he is taught to throw the voice boldly through the nose, his difficulty, in that particular instance, entirely disappears.

The following list of sentences, arranged in the usual order of difficulty, will be found useful in testing the capabilities of a stammerer, and in differentiating the letters with which he may have special difficulty:—

(1.) Vowels (**i, e, a, o, u**).—**Eels ail amid ocean ooze.**

(2.) Voiced Fricatives (*the second column minus its three Explosives*).—**We visit the Zulus, like ramblers, yearly.** (**zh** *need not be represented, as it never occurs at the beginning of a word.*)

(3.) Voiceless Fricatives (*the first column minus its three Explosives*).—**Far shores seem thinly hazy.**

(4.) Nasal Resonants (**m, n, ng**).—**My nephew.** (**ng** *need not be represented, as it never occurs at the beginning of a word.*)

(5.) Voiced Explosives (**b, d, g**).—**Best gold dust.**

(6.) Voiceless Explosives (**p, t, k**).—**Two poor comrades.**[1]

Although the above table represents the order of difficulty in the great majority of cases of stammering—the Vowels being most easy and the Voiceless Explosives most difficult,—it does not represent the order of difficulty in all cases. I have had at least two cases in which the greatest difficulty was found in the pronunciation of the Vowels; and in not a few I have found the difficulty almost equally distributed over the whole list of sentences. When there is difficulty with the vowels, they are apt to be produced with feeble voice, and in an interrupted and tremulous manner.

[1] The following additional sentences will be found of use for testing-purposes:—

1. Mother make more mustard. No, no! not now.
2. Billy Button bought a buttered biscuit.
3. Davy Doldrum dreamt he drove a dragon.
4. Gaffer Gilpin got a goose and gander.
5. Peter Piper picked a peck of pepper.
6. Tiptoe Tommy turned a Turk for twopence.
7. Kimbo Kemble kicked his kinsman's kettle.

For these and many other similar sentences, see *Peter Piper's Practical Principles of Plain and Perfect Pronunciation.*

Analysis of the Phenomena.

Passing now to the more detailed analysis of the phenomena of stammering as exhibited in the Vocal and Oral Mechanisms, we may begin with the Vocal Mechanism, whose want of promptitude is the primary cause of the difficulty.

It should be understood that within the term Vocal Mechanism is to be included not merely the Larynx, which is the instrument of voice, but also the Lungs and Muscles of Respiration, which supply the larynx with the necessary blast of air.

A. *Faults in the Vocal Mechanism*, due to imperfect innervation.

1. Want of Promptitude in the supply of voice during the pronunciation of the initial syllable.

The voice lags behind, and the energies are misdirected into the oral mechanism, as already explained. Sometimes this is the only fault in the vocal mechanism; the lagging voice being, in such cases, strong enough in tone, when it is produced.

2. The voice may be not only lagging, but also feeble in quality —the *Leise Sprache* of the Germans. It is low and feeble because the speaker often neglects to fill his lungs with air, and is attempting to speak from a half empty chest.

3. There is often a marked sense of fatigue in the walls of the chest after the effort of speaking, due to the condition of things that has just been explained.

4. During the struggles of the stammerer, the voice may, in some cases, suddenly break from its normal baritone or bass into a piping Falsetto, the effect of which is sometimes very grotesque. This was particularly marked in one of my own cases.

5. There may be Drawback Phonation. This is the production of speech during *in*spiratory effort; the vocal cords being approximated, and made to vibrate, when air is being drawn in between them. It is a common phenomenon among stammerers. I have notes of one striking case in which it formerly existed with, and now exists *per se* as the troublesome remnant of, a severe stammer of the ordinary type. The patient himself gave a very distinct account of the development of the Drawback Phonation in the course of his case. He had stammered in the usual manner up to the age of about fifteen; but at that period of life he began to make great efforts to

overcome his impediment, and found that, when in difficulties he could always pronounce the word by having recourse to the "drawback" method of phonation. Practising this method voluntarily at first, he soon found that it became involuntary and habitual with him. It is now the sole remnant of his former impediment.

B. *The Oral Mechanism.*—Faults due to surcharge of energy.

1. The lagging of the voice, and the misdirection of energy already explained, cause the stammerer to surcharge his oral mechanism with energy, so that he sticks or stutters at his explosives, and prolongs his fricatives and nasal resonants, producing those of the latter which contain voice voicelessly or with feeble vocalization. He sticks and stutters very specially upon his explosives, both voiceless and voiced.

2. From the nerve centres of oral articulation thus surcharged, an Overflow, in many cases, occurs; so that spasmodic and involuntary movements may be excited, both within the organs of articulation, and in other parts of the face, or even of the body. Among the spasmodic movements thus produced, may be enumerated trembling movements and spasmodic twitchings of the lips and cheeks, working of the jaw, forcible winking of the eyes, twitching or tonic contraction of the sterno-mastoid on one or both sides, and sometimes spasmodic working of the arms. Some patients have been known even to stamp with the feet. One of the most unsightly spasms is that affecting the tongue. I had one patient, a highly educated and intelligent lady, who stammered very severely, and whose spasmodic phenomena specially affected the tongue. In the midst of her difficulties, she frequently lowered her head, turning it to one side, and at the same time protruded her tongue to its utmost extent at one side of the mouth, while she covered the unsightly protrusion with her hand. The case seemed to be merely an example of such spasmodic overflow as more commonly displays itself in spasm of the facial muscles. The overflow probably started from a surcharged portion of the hypoglossal nerve centre, and passed into other portions of the same centre which ought not to have been stimulated at all. Kussmaul treats of this protrusion of the tongue, which he calls Aphthongia, under a separate heading, as being apart from the

ordinary phenomena of stammering; but the case I have referred to, besides having this protrusion of the tongue, stuttered in the ordinary way upon the explosives, and under the ordinary treatment showed a marked improvement. At the same time it is probable enough that chorea, or certain local spasmodic affections of the nature of motor tic, may produce similar involuntary protrusions of the tongue independently of stammering.

C. *Overflow into the Upper Glottis.*—In a few cases the energy, imperfectly supplied to the vocal mechanism, flows excessively, not only into the organs of articulation, but also into the upper or non-vocal part of the larynx. This part consists of the structures that have the false cords for their inferior margins, and have beneath them the hollow spaces called the ventricles of Morgagni. It was my good fortune and privilege, in 1865, to demonstrate for the first time, by experiment and otherwise, the Valvular Actions of the larynx. In my graduation thesis, presented to the University of Edinburgh in 1865, and published in the *Edinburgh Medical Journal* for September 1866, I showed, with reference to one of these valvular actions, that this upper part of the larynx is a true valve which renders it possible for air to be held imprisoned within the chest under strong pressure, during such acts as those of straining and the compressive stage of coughing. My observations have been fully confirmed by a careful investigation carried on conjointly by Dr Lauder Brunton and Dr Cash, who published their conclusions in the *Journal of Anatomy and Physiology* in 1883; and these observers have further, in a very able manner, illustrated the action by experiment on the lower animals, and by investigations into the structure of this part of the larynx in different classes of animals. To any one who reads these two papers, it must be evident that this valvular action is the real use of the false cords and of the ventricles of Morgagni. It is to be hoped that at some future time the attention of physiologists in this country will be attracted to this important subject. So far as I am aware, no adequate description of the valvular actions of the larynx has yet been incorporated in the physiological text-books. This is, however, not the place to enter further upon the discussion of the valvular actions of the larynx; and it will suffice merely to ask the reader's attention to the one of them I have mentioned,

namely, the valvular action of the Upper Glottis, consisting of the false cords and the ventricles of Morgagni. During Phonation, this part of the larynx remains unclosed, while the true cords below are in apposition. What would happen if, during phonation, the false cords closed over the true, and, by their valvular action, shut off the passage of air? Exactly what does happen in a somewhat rare variety of stammering. The patient's voice is at once interrupted; and, with open mouth and congested face, he silently struggles, without effect, to emit the imprisoned air. During his repeated attempts to speak, the seat of impediment may be diagnosed, if one observes the peculiar sound which is made, from time to time, when the upper glottis is thus being spasmodically closed over the lower. It is a sound not unlike the **k** sound in **huck**, but produced lower down in the throat, and without contact of the back of the tongue with the palate. This variety of stammering is described by Kussmaul under the name of "Gutturo-Tetanic," and the open mouth is mentioned as one of its characteristics; but its mechanism is not satisfactorily explained by him. The fact is, that we have here in the upper part of the larynx a fourth stop-position which is not utilized in European speech, although perhaps the true gutturals of the Arabic may be produced by it. Its explosive is a cough, and its voiced fricative is a "clearing of the throat." I have had only one case in which the Gutturo-Tetanic overflow was the chief phenomenon. Arnott made the great mistake of supposing that the difficulties of stammerers generally were due to closure of the glottis.

The difficulties and troubles of a patient who stammers badly may be realized, when one studies such an analysis as the above, of the phenomena which result from faulty distribution of energy in the various mechanisms. Kussmaul has given a good picture of the painful struggle. Speaking of the stutterer, he says, "He closes the oral canal at one or other of the closing points, according to the nature of the letter to be articulated, and this he does as well as a man who possesses the faculty of speech could do it; instead, however, of allowing the vowel to follow without delay, he presses his lips, or his tongue and teeth, or his tongue and palate, more firmly together than is necessary; the explosive escape of the air does not take place, the other muscles of the

face and those of the glottis and even the muscles of the neck become spasmodically affected like those of articulation, gesticulatory movements are made, the abdomen is retracted, the head is drawn backward, and the larynx is drawn forcibly upward, until finally he works himself into a state of frightful agitation; his heart beats forcibly, his face becomes red and blue, his body is bedewed with perspiration, and he may present the appearance of a complete maniac."

The Causation of Stammering.

The phenomena of stammering having been thus pretty fully described, a few words may now be said about its causation.

It is notorious that the condition is developed much more frequently in the male sex than in the female. For every female case, there are probably four or five males. How this should be, it is difficult to say; but male children are, as a rule, slower in learning to speak than female children; and certainly this derangement of speech is commoner among them.

It would appear that some children, perfectly healthy in constitution and not of neuropathic diathesis, acquire the defect by simple imitation of their seniors who may happen to stammer. Stammering is, however, especially common among children of neuropathic inheritance. It is no indication of any defect of intellect, and may occur in children and adults who are gifted with very bright intelligence; but, nevertheless, even in the very intelligent, it may be found associated with nervousness and excitability, as well as sometimes with more distinct indications of instability of the nervous system. Occurring in a nervous subject, it is apt to aggravate his nervousness, and even to produce an unsociable and morbidly shy condition of mind.

In nervous subjects, temporary conditions which aggravate the nervousness always lead to exacerbations of the stammering. Thus the presence of strangers who require to be spoken to puts a strain upon the stammerer. Often he cannot go with confidence to make purchases in a shop; and I have known a boy, going home to the country for his holidays, sit crying bitterly at a railway station because he dared not make the attempt to ask for his ticket. So also any depressing influence, such as exhausting work or exhaust-

ing dissipation, or a sleepless night, or any temporary disturbance of health, is apt to make the stammerer worse for the time being.

Sudden and Violent Emotion, above all a severe fright, has often been known to produce stammering in children, and even in young adults. It seems certain that this and many other nervous disturbances are most frequently produced by fright when the constitution of the patient is essentially neuropathic or hysterical.

The defect may be transmitted by Inheritance, especially in neuropathic families. No doubt, however, the apparent transmission is in some cases really in large part due to imitation of a parent's speech by the children.

A degree of stammering more or less marked is found associated with many defects of speech that are of graver significance than itself. It is thus frequently found to be one of the elements in the deranged speech of imbeciles and idiots, in the speech characteristic of general paralysis of the insane, and also in the speech of patients suffering from true aphasia. Where it is thus associated with real organic disease or defective development, its treatment is always difficult and unsatisfactory; but when, as in the vast majority of cases, the intelligence is up to the average, the treatment may be undertaken with good hopes of a complete cure, and the certainty of at least a very marked amendment.

Treatment of Stammering.

Any one who has read the foregoing account of the causation and phenomena of stammering would be able, it is hoped, to draw up a scheme for the scientific treatment of the condition.

My own plan is as follows:—

1. First of all, it is convenient to impress upon the patient the simile of the violin player, and to show him, as forcibly as possible, that it is his bow-hand, or rather his larynx, that is at fault; and that he must therefore pay no attention to his mouth, but attend to his voice, and speak always in a full and resonant, though natural tone. With the view of cultivating his voice, he is recommended to read aloud for at least ten minutes every morning. He may begin with poetry, and afterwards, as reading improves, take to prose. If he be possessed of a musical ear, it is well for

him, further, to cultivate his voice in song, and learn to read music at sight. Everything that helps to give him a ready command of voice will help to get him out of his difficulty. Arago, somewhere in his writings, tells, as to Orfila, the great medical jurist, that on being severely frightened, when a boy, he was thrown into such violent emotion that immediately afterwards he began to stammer badly; and that he continued to do so for some years. At the recommendation of the family priest, he was induced to become a member of the Church choir; and, whilst he was developing into a very excellent singer, he gradually got quit of his defect of speech. To provide for circumstances which make the patient specially nervous, it is sometimes not amiss to recommend him deliberately to intone or sing, at the ordinary conversational pitch, the first word he utters in conversation. Among my stammering patients, I had, some years ago, a boy, who, when sent by his parents to make purchases in shops, always took his little sister with him, to act as his interpreter. As he had a good musical ear, I taught him to intone his first word; and, by way of experiment, sent him to a shop to buy some oranges. He was enabled to effect his purchase without any stammer, by simply intoning the word "If," when beginning his request with, "If you please."

2. A stammerer should be taught the physiological alphabet and its sentences. With the aid of the latter, he will very soon be able to draw up the alphabet for himself, and to understand it in every part.

3. He should also be made to read and learn the additional sentences given in the note at page 17; and the letters that he stammers on in them must be carefully noted, in order that their proper mode of enunciation may be thoroughly explained to him. In like manner, when at his daily occupation, he must himself note carefully the words that give him difficulty in conversation, so that in the evening he may, by reference to the alphabet, find the key to their pronunciation and be able to practise upon them specially. In the comparatively rare cases in which the patient stammers markedly upon initial vowels, it is well to confine the patient's attention for days or weeks to exercises upon vowels and words beginning with vowels. When the power of enunciating vowels readily is acquired, the patient can then proceed to practise upon the consonants.

4. In concluding the teaching of the alphabet, the teacher will do

well to give the pupil such a word as **street**, and ask him which of its letters first contains voice. If he has learned the alphabet well, he will know that the first voiced letter is **r**. Should this word be difficult of pronunciation, he will do well to practise first the pronunciation of **reet**, and then try **street** itself, touching off the **st** very lightly and throwing the voice boldly into the **r**; and so with other words with which he may have similar difficulties. With the aid of the two sets of sentences, the teaching of a young stammerer is by no means difficult. He will soon know the alphabet very familiarly, and will be easily made to understand the all-important distinction between the letters that contain voice and those that are voiceless.

5. When there is a tendency on the part of the patient to attempt speech from an empty chest, he should be instructed to fill the chest by inspiration at suitable intervals. It is wonderful, however, how seldom much training of this kind is required, if the patient has grasped the great principle that he must *speak with voice*. With this principle well established in his mind, he fills his chest for voice production instinctively when a new supply of air is needed.

6. In all cases where the patient is of nervous constitution, and apt to be depressed or put out of health by such causes as have already been enumerated, it will be well for the physician to pay special attention to the patient's health and mode of life, and, by tonics and tonic regimen, do everything in his power to raise the nervous tone and improve the general condition.

7. In cases of exceptional difficulty, it will, perhaps, be well to recommend that the patient should be placed under a tutor or specialist, who has time to devote much attention to his daily tuition. It is unfortunate that, at present, most of those who make a specialty of the treatment of stammering are persons without scientific training or knowledge. Many of them have secret methods which they bind their pupils not to divulge; and some of them teach their pupils to make exaggerated movements of the lips and face when talking. So long as the mystery and secrecy of a method is maintained, the imagination of the stammerer is worked upon; and if he has confidence in the remedy, this very confidence, and the courage it gives him, bring about, often enough, marked improvement in his speech. But the improvement is only temporary;

and the secret method always loses its efficacy, when it loses its secrecy. It would be easy to give an account of some secret methods which have had a great reputation in their day, but this would really be trespassing too much upon the reader's patience. If he is interested in their history, he will find much information about them in an article by Guillaume, which will be referred to in the Appendix to this paper. Rhythmic movement of the hand or of the head during speech has often been prescribed, as a means of diverting the patient's attention from his struggling organs of oral articulation; and good might possibly, in some cases, be done by such a prescription. But I am strongly convinced that the best and most permanent results will always be obtained from a treatment based upon an accurate scientific knowledge of the nature of the condition; and it is certain that the chief feature of such a method of treatment will be the attention it devotes to the correction of the lagging action of the vocal mechanism. A thorough course of vocal gymnastics could easily be elaborated; and here again I think there is work for the specialist. A well-educated specialist, who discarded all secret remedies, and devoted himself to the training of his pupils upon scientific principles, would do good work, and would not be without support and encouragement. At the same time, it must be remembered that many patients, especially those who are intelligent and persevering, do not require the aid of a tutor or specialist. If they are made to understand thoroughly the nature of their defect, they can themselves, by dint of persevering and intelligent practice, break their old vicious habits of speech, and acquire the new habit of speaking in a normal way. My own experience has shown me that this is often the case.

As to the performance of surgical operations for the cure of stammering, I shall only say that they should never be had recourse to, under any circumstances. They were tried extensively about the beginning of this century, and there are few more melancholy chapters in the history of Surgery than that which gives an account of them. The reader will find much information upon this subject in Guillaume's article, and in the writings of Kussmaul.

The introduction into the mouth of foreign bodies, such as pebbles and tongue-bridles, is equally out of the question.

Demosthenes, with his pebbles, has in this respect set an unfortunate example.

Prognosis of Stammering.

As regards Prognosis, it will be easily understood that the stammerer's progress will depend very largely upon his own intelligent comprehension of the principles above explained. An important factor is also the age of the patient. Perhaps the best age is between twelve and sixteen; when the patient is old enough to realize the importance of getting rid of his defect, and yet not so old as to have the defect rooted very deeply in his organs of speech by force of habit. I think that the stammerer's possession of a good musical ear is also a hopeful factor, seeing that it gives the stammerer a more definite comprehension of tone than he would have without it. Cases with very severe spasmodic complications are generally less satisfactory than those not thus complicated. The habit of Overflow in the nervous mechanism of articulation wears, in time, easy channels for overflow; so that very slight surcharge may eventually suffice to produce spasmodic movement of neighbouring muscles. Even in such cases, however, very great improvement may be looked for, if the patient is intelligent and persevering.

When patients are defective in intelligence, or, in a marked degree, defective in self-control, the prognosis can never be so good; and improvement can be looked for only after prolonged treatment under the supervision of an intelligent tutor or specialist, who entirely understands the nature of the defect, and the means that can be employed for its removal.

Rare and Exceptional Varieties of Stammering.

It may now be asked if the foregoing description applies to all cases of stammering; or if, on the other hand, there are some rare cases which belong to a separate category. The doctrines just explained are, with some variations, substantially the doctrines admitted by the best scientific authors since the days of Arnott. It is, however, interesting to note that Pro-

fessor J. Müller, writing not many years after the publication of Arnott's conclusions, makes some very pertinent objections to the inclusion of all cases of stammering under the one simple category. In his *Physiology*, published about 1840, he remarks, referring to the views of Arnott and Schulthess—"This view is founded on good observations; but, though an improvement on the previous erroneous opinions, it goes further than facts justify. I knew a young man of distinguished mathematical attainments who had formerly stammered very badly, and in pronouncing his own name was apt to say 'Te-Tessot' instead of 'Tessot.'" Here, Müller's case pronounced the greater part of the first syllable, *including its vowel*, and hesitated only about taking the succeeding consonants. He was therefore unlike a stammerer of the ordinary variety, who would have stuck or stuttered voicelessly on the T. Some years ago, I saw a patient who stammered in a similar way. In pronouncing the word "resident," for example, he repeated over and over again the syllable "rê-rê-rê," before he was able to take the succeeding s. For a long time I regarded this as a solitary case, in my practice, of stammering due solely to want of promptitude in the *oral* mechanism; but, on examining the patient again quite lately, I found that, whilst the old peculiarity still to a certain extent remained, there was also a distinct difficulty of the ordinary description, best marked during the production of the initial d, which was stuck upon because it was pronounced voicelessly. The case must therefore be regarded as one in which the want of promptitude affected both mechanisms, and displayed itself sometimes in the action of the one and sometimes in that of the other. I have not met with any case in which the want of promptitude was confined to the oral mechanism.

Another exceptional variety of stammering, of which I have had experience in at least two cases, is that in which there is merely an Interrupted Utterance; the words being brought out, often hurriedly, in groups, between which are pauses without compressive or other effort in the organs of articulation. A few words are rapidly uttered, and then there is a sudden stop and a pause, whilst the patient is apparently arranging the next group of words in his mind. Then follows the next group of words, then a second pause, and so on to the completion of the sentence. In one well-marked

case of this sort, the patient, a medical student, stated that in his boyhood he had suffered from a stammer of the ordinary kind, and that his own efforts to get rid of it had resulted in the development of this curious interrupted utterance, so suggestive of the emptying of a bottle.

A very simple classification of the varieties of stammering would be :—

I. The ordinary variety, in which the vocal mechanism shows want of promptitude.

II. A possible variety, with the want of promptitude in the oral mechanism.

III. A want of promptitude in both mechanisms. This may show itself sometimes in the one mechanism, sometimes in the other ; or there may be an Interrupted Utterance, without compressive or other effort, suggestive of a want of promptitude affecting both mechanisms simultaneously and equally, and displaying itself at short intervals in every sentence.

At present, however, I cannot say that the existence of the second and third classes is clearly established. I have had only one case in which there was distinctly a want of promptitude in the Oral mechanism ; and in that case, as already explained, it existed alongside of a similar peculiarity in the vocal mechanism. I have therefore thought it better to treat fully of the first great variety, whose peculiarities are clearly pronounced, and to say little about the others, regarding which I have as yet so limited an experience.

My study of this subject was begun some years ago, at a time when I was lecturing upon those other derangements of speech that are commonly more closely studied by physicians. It occurred to me at that time that here was a derangement of speech which, as a rule, was but little understood by professional men, and which was certainly an enigma to myself. I accordingly asked my professional friends to send me as many cases as possible, as I wished to study the matter. Very soon I had accumulated notes of about fifty cases ; and the total number of my cases has since risen to over one hundred. Studying the matter in the first instance exclusively from nature, I had the usual experience of those who work in this manner, of finding, when I came to look into the

literature of the subject, that my chief conclusions had been long anticipated by others; but, knowing that the subject is still but little studied by the profession at large, I have been encouraged to write this paper by the hope that a plain statement of the facts may render it possible for practitioners generally to undertake the treatment of stammering. It is a subject of very great importance. So many stammer severely, that it is probably no exaggeration to say that the sum-total of unhappiness inflicted upon a people by this single defect is not much less than that produced by all the other derangements of speech put together. At the same time, I am not without hope that the physiological alphabet, apart from its bearing upon stammering, may be of value for educational purposes. I am sure children would learn their alphabet more easily, if it were interpreted to them from the beginning on physiological principles. And I hope particularly that the physiological alphabet may prove of value in the education of deaf-mutes.

Further, I hope to go on, in future papers, to the consideration of the other derangements of speech, viz., those which are produced by defective development, and by disease of the nervous system; and, here again, I am strongly of opinion, that the very best method of entering upon the consideration of such a complicated subject is to begin at the beginning, with the study of the alphabet in the light of physiological analysis.

As I have a sincere admiration for the work that Professor Kussmaul has done in connexion with the Disturbances of Speech, it has been to me a matter of regret that I have not been able to follow him in attaching quite different meanings to the words "Stammering" and "Stuttering." In this country, the two words are very closely related in meaning, "stammering" being the more general term, and "stuttering" the more specific. All of the derangements of speech described in this paper come naturally enough under the general designation of Stammering, and one of the more common phenomena is fitly enough called Stuttering. But Professor Kussmaul, following Schulthess, uses the word Stuttering (*Stottern*) as the general term for this whole class of speech derangements; and he applies the word Stammering (*Stammeln*) only to certain quite different derangements of Oral Articulation, which I hope to consider by-and-by, when I come to examine the Developmental Disorders of Speech. It would be

wresting the English word from its natural meaning, if we used the word Stammering in the same sense as Professor Kussmaul uses the German word *Stammeln*.

In my description of the elements of the Physiological Alphabet, the reader may have been surprised to observe that I have made no use of the terms "Mediæ," "Tenues," "Mutes," "Semi-mutes," "Liquids," etc. These are examples of a very venerable terminology, which for ages has clothed the knowledge of these matters, but which, I think, science has now outgrown. The terminology employed in this paper is much more simple, and the terms are more definite and clear in their signification.

APPENDIX.

The following is Dr Arnott's Alphabetical Table, referred to in the text. It may be compared with the Physiological Table of the text.

TABLE OF ARTICULATION.

Mutes.	Semi-mute.	Semi-vowel or Nasal.	Aspirate.	Vocal Aspirate.	Vibratory.	
P	B	M	F	V	*pr*	Labial.
...	...	...	th	th	...	Dental.
T	D	N	S	Z	R	Palatal.
...	L	...	sh	J	...	With the edges of the tongue depressed.
K	G	ng *n*	*ch* H	*gh*	*ghr*	Guttural.

There can be little doubt that Arnott would have done even more than he did to solve the whole problem of stammering, had the laryngoscope been in use in his day; but he had very false notions about the action of the glottis, and made the radical error of supposing that stammering was always produced by spasmodic closure of the glottis—a cause of stammering of only secondary importance, since it is comparatively rare. It was reserved for his successors to show that the obstruction was much more frequently at one or other, or at all, of the stop-positions. Otherwise, Arnott's conclusions were

thoroughly rational. He taught that the encouragement of the voice was the key to the difficulty; and recommended that, at the beginning of his treatment, the stammerer should maintain the voice as continuously as possible, by interposing the vowel sound "eh" between the words of a sentence; and that afterwards he should enable himself to dispense with this artificial aid, by studying the individual consonant sounds as shown in his table, and using the voice in their production when voice forms one of their constituent elements.

As to the literature of the subject, the best works that have come under my notice are:—

(1.) The Treatise of Dr Neil Arnott on *Voice and Speech*, beginning at p. 629 of his work on the *Elements of Physics*, 5th Edition.
(2.) Melville Bell's little work on the *Faults of Speech*.
(3.) Merkel's *Physiologie der menschlichen Sprache*, 1866.
(4.) Kussmaul's great article on the "Disturbances of Speech" in Ziemssen's *Cyclopædia of Medicine*, vol. xiv.
(5.) The very valuable historical article by Guillaume, entitled "Bégaiement," in the *Dictionnaire Encyclop. des Sciences Médicales*.

The reader who is interested in the subject will find a full account of its bibliography in Kussmaul's article. Kussmaul truly remarks that "the literature of this impediment of speech has reached enormous dimensions; every possessor of an establishment for the treatment of stuttering seems to have been impressed with the idea that the interests of suffering humanity necessitated his appearance as an author. Their treatises possess on the average about as much value as the current pamphlets on Balneology."

CHAPTER II.

PHYSIOLOGY OF WHISPERING. HYSTERICAL APHONIA. HYSTERICAL MUTISM. OTHER FORMS OF FUNCTIONAL PARALYSIS OF THE ADDUCTORS. FUNCTIONAL SPASMS. BILATERAL PARALYSIS OF THE ABDUCTORS.

IN the first chapter, it was shown that speech is the product of two mechanisms acting in co-ordination with each other—viz., the Vocal and the Oral Mechanisms;—and these were compared to the bow-hand and the string-hand of the violinist. It was shown, further, that Stammering is a disorder of speech which, in the great majority of cases, is due to a want of promptitude on the part of the Vocal Mechanism in attacking the first syllables of words.

In the present chapter, it is proposed to consider some other nervous derangements of speech in which the Vocal Mechanism is again chiefly at fault. It will be shown, however, that, in the derangements now to be considered, the fault is not a want of promptitude, but either, on the one hand, a want of power, or, on the other hand, a spasmodic disturbance of action.

Before entering upon the consideration of this group of disorders of the Vocal Mechanism, it may be convenient here to consider, by way of preface, the Physiology of Whispering, a subject of great importance in its relations to these derangements.

Physiology of Whispering.

What are the conditions necessary for the production of whispered speech? Regarding this question there is still much difference in the views of physiologists; and I may be allowed to express the opinion that the views taught by the text-books most commonly used in this country are not correct.

In Foster's *Physiology* it is held that—"Whispering is speech without the employment of the vocal cords, and is effected chiefly by the lips and tongue. Hence, in whispering, the distinction between consonants needing, and those not needing, voice, such as

b and p, becomes for the most part lost."[1] [In the fifth edition of Foster's *Physiology* (issued at about the same date as that of the first appearance of this paper in the *Edin. Med. Journal*) the author has rewritten the section upon the Larynx. He now holds views upon the Physiology of whispering that are the same as those advocated in this paper.]

Landois and Stirling remark—"When sounds or noises are produced in the resonating chambers, the Larynx being passive, the Vox Clandestina, or Whispering, is produced. When the vocal cords, however, vibrate at the same time, audible speech is produced. (Whispering therefore is speech without voice)."[2]

And in the latest edition of the *Encyclopædia Britannica* it is said—"If the vocal cords are called into action, and the sounds thus produced are modified by the muscular movements of the tongue, cheeks, and lips, we have vocal speech; but if the glottis is widely opened and the vocal cords relaxed, the current of air may still be moulded by muscular apparatus so as to produce speech without voice, or whispering."[3]

The view thus expressed is as old as the time of Arnott (1827), and probably a great deal older. Arnott says—"Whispering is articulation without voice; that is to say, articulation while breath only is passing."[4] In recent times, it has derived its chief support from certain experimental researches in Paris, which will be presently referred to.

If this view were correct, whispering would be speech produced by the simple agency of the oral mechanism, without the co-operation of the larynx. This, if we may use again the simile of violin-playing, might be considered as equivalent to the production of melody by the agency of the string-hand alone, the bow-hand being out of employment.

A very different view is held by many who have paid special attention to the subject. This view was first promulgated by Brücke in 1856,[5] and is thus explained by Von Meyer in his

[1] Foster's *Physiology*, 4th ed., 1883, p. 661.

[2] Landois and Stirling, p. 760.

[3] *Encyclop. Brit.*, articles on Stammering and Voice, by Prof. M'Kendrick.

[4] Arnott's *Physics*, 5th ed., p. 640.

[5] *Grundzüge der Physiologie und Systematik der Sprachlaute* (Wien, 1856). (Unfortunately now out of print, so that I have not been able to get a copy.)

work[1] published in 1883:—"Now it is not only possible to produce all the vowels and resonants in a whisper, but also to mark the difference between the 'hard' and 'soft' consonants. Undisturbed activity must therefore be allowed to those relations by which the laryngeal tone is moulded into those sounds. Thus we find that absence of tone cannot be regarded as the characteristic of whispering, but that we must seek some other element which will so stand in the place of tone as to be equally affected by those modifying influences, and thus perfectly replace it as an element of speech.

"This substitute for tone must have its origin in the larynx, or its subsequent fate in the air-passages would not be so entirely analogous to that of the tone produced in the larynx. Brücke takes the very probable view, that in whispering a *noise* is formed in the glottis instead of the tone which constitutes an element of loud speech. This noise is no other than that which has been described above as the *Strepitus continuus spirans* of the larynx."

These views of Brücke, arrived at by observation and reasoning, without the aid of the laryngoscope, were subsequently submitted by Czermak to the test of laryngoscopic investigation, and his results were laid before the Imperial Academy of Vienna in 1866.[2] Czermak entirely confirmed the conclusions of Brücke, and proved that in whispering a fricative noise is produced at the glottis by the partial closure of the vocal cords, which close and open during whispered speech very much in the same manner as they do in ordinary vocal speech. There is only this peculiarity in the action of the vocal cords, that, whereas in vocal speech the air passes the

[1] "Organs of Speech," *International Scientific Series*, p. 273.

[2] *Wiener Akademische Sitzungsberichte*, lii. Bd., 1866; also Czermak's *Gesammelte Schriften*, p. 750. It appears to me very unfortunate that, in this valuable investigation, Czermak was led to the opinion that the **h** sound in articulate speech is pronounced in the same manner by the larynx, as the *spiritus asper* of whispering. In the first chapter, I expressed the opinion that the aspirate **h** is the voiceless fricative of the posterior stop-position; and this, I believe, was the view enunciated regarding it by Brücke. That it is the correct view, any one can prove for himself, by deliberately pronouncing the **h** sound in the word **here**, and attending to his own sensations while doing so. When the tongue is pulled out for laryngoscopic examination, no true **h** sound can be produced so long as the parts within the larynx remain visible. If the attempt is made to pronounce **h**, the back part of the tongue is carried so closely up against the palate as to interfere with a view of the larynx. The *spiritus asper* of the larynx is, at the best, but an imitation of the true **h** sound

glottis through a narrow chink between the vibrating cords, in whispering the greater part of the air is made to pass through a triangular opening in the posterior part of the glottis, between the projecting parts of the arytenoid cartilages, whose bodies remain apart, although their vocal processes are more or less closely approximated. This fricative noise plays, in whispering, exactly the same part that is played, in vocal speech, by the sonorous tones of the voice. It is the material out of which the vowels are formed, and it adds itself, as an essential element, to those consonants, which, in vocal speech, contain voice. Anyone can convince himself of the truth of this view by personal observation with the aid of the laryngoscope. The fricative noise in whispering can be made soft or loud at the will of the speaker. The carrying power of a "stage-whisper" is thus made easily intelligible.

It might be objected to this view that patients have been known to whisper even after the total excision of the larynx; but there is every reason to believe that in such cases the condition of the parts was such as to permit of the production of a fricative noise at or about the level of the larynx, which could be utilized in the mouth for the production of speech.[1]

[1] In the well known case of total excision of the larynx effected by the late Dr Foulis of Glasgow, the patient was enabled to speak, even in a loud though monotonous voice, by the insertion into the laryngeal cavity of a reed like those of a concertina. But such a reed can never permit of the elaboration of perfect speech. It would necessarily throw voice into all the consonants, even those which ought to be voiceless; so that the first or voiceless column in our alphabet would be unrepresented. In the speech of such a patient, all his **p's**, for example, would be **b's**, and his **s's, z's**.

It would be interesting to consider in what degree the parts at the back of the throat are capable of assuming the voice-producing functions of the Larynx, after that organ has been totally excised, or has been cut off from connexion with the Pharynx by stenosis of its orifice; but that is a subject which cannot well be considered in this paper. For information regarding it, however, the reader may be referred to—(1) a paper by Professor Czermak (*Gesammelte Schriften*, i. 2, p. 598), in which he describes a case, where communication of the Larynx with the Pharynx had been totally cut off by disease; (2) a case of total excision of the Larynx, recorded by Dr Hans Schmid (*Archiv für Klinische Chirurgie*, xxxviii., 1889, p. 132), in which the air passage was entirely cut off, in process of cicatrization, from the cavity of the Pharynx; (3) another case of total excision of the Larynx, reported by Dr Greville Macdonald and Mr Charters Symonds in the *British Medical Journal* for 1889, p. 996. In both these latter cases, curious to say, a real, though rough, voice was produced in the absence of the Larynx, by other parts at the back of the throat.

The question about the true physiology of whispering is really an important one practically. If the larynx takes no part in whispering, then, in acute laryngitis, it would be good practice to allow the patient to whisper as much as he chooses; but if the larynx has work to do in whispered as in vocal speech, clearly the proper prescription would be to forbid even whispering, and allow the inflamed parts to have perfect rest. Further, in connexion with hysterical disablement of the vocal cords, to be presently considered, if the larynx does not work at all in whispering, its complete paralysis will not render the patient mute or speechless; but if its action is necessary even for whispering, then its complete paralysis means complete mutism. I thoroughly believe that the latter is the real state of the case. With a little practice one can allow the air to escape freely into the mouth, through the widely open glottis, while the oral mechanism is doing everything that is necessary on its part for the production of audible speech; and yet no speech will be audible, on account of the inaction of the larynx. By way of experiment, I articulated, close to the ear of my house-physician, the line "I shot an arrow into the air"; and, although he felt the breath distinctly impinging upon his ear, he could only make out clearly the fricative sound of **sh**, and much less distinctly that of the **r's**.

The simile of the violinist thus holds good with regard to whispered speech, as well as with regard to speech that is vocal. Both bow-hand and string-hand are necessary for its production, but the bow-hand is producing a fricative noise, instead of a musical resonance. In the absence of a laryngeal element in speech, the only elements of our alphabet which can still be produced are those of the first or voiceless column of consonants, and, even among these, the explosives are barely audible, because there is no sound from the larynx that can have communicated to it an explosive beginning or a stop-like termination. Without the agency of the glottis, the two voiced columns of the consonants and the whole of the vowels are inaudible. In the absence of these, the patient is necessarily mute; the first or voiceless column being insufficient in itself for the purposes of speech.[1]

[1] As regards the voiced consonants, perhaps it would be better to say that the attempt to produce them without the larynx would result in the production of their voiceless equivalents.

We now pass to the consideration of the disorders of speech which we propose to take up in this chapter.

Hysterical Aphonia.

This is a condition of extremely common occurrence in hysterical patients, and, naturally, it is most frequently met with in those of the female sex. Like the other manifestations of hysteria, it may be developed at any period of life; but, in the majority of cases, it occurs either during the earlier years of womanhood, or in the later years, at or about the climacteric period. The exciting cause is very frequently some emotional disturbance; and thus again it is like the other phenomena of hysteria. In many cases, on the other hand, the patient being of hysterical constitution, it owes its beginning to the mere catching of a cold, with attendant hoarseness. The difference between such a patient and an ordinary person with cold is, that, in the former, the aphonia remains for a long period, it may be for months, after the actual catarrh has passed off, whereas in the latter the voice returns at once when the catarrh is recovered from. It may thus begin more or less gradually with a cold, or appear suddenly after emotional excitement. Occasionally it is produced by some hysterical seizure, such as a fit, the aphonia remaining after the fit has passed off. Lastly, in not a few instances, it appears in hysterical subjects spontaneously, without any apparent exciting cause. Patients who have once had hysterical aphonia are more or less liable to a recurrence of it. As a rule, it admits of immediate cure by suitable treatment; but there are cases which prove exceedingly obstinate, in spite of any treatment that can be employed. Such cases are cited, for example, by Sir Morell Mackenzie.[1] I have myself met with one case of this kind. I saw the patient for the first time twenty years ago, in consultation with the late Dr Matthews Duncan; and, for the second time, four or five years ago. During the whole of this period, the lady had remained aphonic, although perseveringly treated by several specialists.

Laryngoscopic examination of a case of hysterical aphonia shows that the adductor muscles of the arytenoids and vocal cords are in a state of paresis, though not of complete paralysis. They are

[1] *Manual of Diseases of Throat and Nose*, vol. i.

strong enough to bring the arytenoids and cords into close enough approximation for the production of the *spiritus asper* of whispering, but they are not strong enough to bring the parts sufficiently together for the production of vocal tone. In the great majority of cases the chink of the glottis is straight or linear in its edges, its only fault being that it is too wide; and one may therefore conclude that all the adductor muscles are equally involved in the paresis. But there are exceptional cases, well figured by Mackenzie and others, in which individual adductors are specially at fault. In some of these the Rima Glottidis presents the form which it assumes in normal whispering, the greatest opening being a triangular one at the posterior part of the glottis, between the projecting parts of the arytenoid cartilages; so that the weak muscle is here evidently the inter-arytenoideus, which ought to have brought the bodies of the cartilages into close apposition. In others an elliptical slit, widest at its middle, is left between the vocal cords, owing to the weakness of the thyro-arytenoidei muscles, which lie alongside of the cords, and ought by their contraction to support and keep them in apposition during phonation. Or the vocal processes of the arytenoid cartilages are too wide apart for phonation, owing to the weakness of the crico-arytenoidei laterales. Or, again, the Rima Glottidis, instead of forming a straight line, presents a sinuous aspect, owing to the weakness of the crico-thyroid muscles, which stretch the cords during phonation. All of these latter appearances, however, are exceptional; the common condition being the one of general paresis of the adductors first described. Hysterical paralysis is essentially bilateral. Some hold that it is invariably so, but others admit the possibility of a few cases being unilateral.

Although the voice proper is thus absent in hysterical aphonia, it can, in a great many cases, be evoked during the act of coughing; and its retention of normal characteristics during a cough, together with the absence of any laryngeal pain or irritation, may sometimes help to lead one to a correct diagnosis, without the aid of the laryngoscope. In severe cases, however, the voice is sometimes absent even in coughing; though the cough rarely or never assumes that husky or laryngeal character which is suggestive of intra-laryngeal disease.

In treatment, it is well, at the outset, to inspire the patient with

a confident hope of immediate cure: and with that view, she may be asked to cough loudly; so that, if the cough be vocal, her attention may be directed to the vocal element in it. In a very great number of cases, the only further treatment that is necessary for the immediate restoration of the voice is to assure the patient that you are about to bring it back, and, allowing her to believe that you are performing something of the nature of a curative operation, to introduce the laryngoscopic mirror into the mouth in the usual way, and to ask her, in a commanding manner, to say or sing **ah**. Two or three commands of this sort very generally suffice to bring back the voice. The voice remains with the patient after the operation is over; and she often shows great astonishment at finding herself thus at once able to speak quite freely in a perfectly natural tone. When this simple procedure does not suffice, other means must be tried. Dr Olliver of Boston recommends that the physician should compress the larynx slightly between his fingers, pressing the alæ of the thyroid cartilage inwards towards each other. This gives additional support to the vocal cords within the larynx. It is a means which I have employed in some cases with success. Another, and very efficacious method of treatment, is the use of the Faradic Battery. This can be employed either externally, the electrodes being placed one on either side of the box of the larynx, or internally, by means of the very valuable intra-laryngeal rheophore, invented by Sir Morell Mackenzie. In using this instrument, one electrode is fixed by means of a fillet to the box of the larynx externally, whilst the other—the rheophore—is introduced into the larynx itself by the mouth. When its extremity is in contact with the vocal cords, the circuit is closed by the pressure of the operator's finger upon a spring. A point to be borne in mind in using this instrument is, that the shock communicated through the delicate mucous membrane will be much stronger than the shock of the same current transmitted through the resisting cuticle of the operator's hand. The operator will therefore do well to bear in mind the golden rule of electro-therapeutics, and try the current upon his own person, before he subjects the patient to it. He can easily do this, by applying the outside electrode to the outside of his throat and the rheophore to the surface of his tongue. I have had one case at the Royal Infirmary, occurring in the person of an apparently

robust young man, which resisted all other means of treatment, but was at once cured by the use of Mackenzie's intra-laryngeal rheophore; and the same treatment also cured the patient at once a second time, when, after a year or two, the condition recurred. Still another method of treatment which deserves attention is one also recommended by Mackenzie, viz., the inhalation of a stimulating vapour, such as that of ammonia. Some years ago, I had a patient, a young lady sent to me by my friend Dr Berry Hart, who resisted the laryngoscopic cure, being by that means only got to produce one note, and to read in a monotone; but who was subsequently cured, without my aid, on inhaling the vapour of the so-called ammoniaphone—an instrument which, at that time, was being much advertised in this city. A few drops of Liq. ammoniæ, sprinkled upon a piece of cotton wool, would probably have been equally efficacious. The element of faith is all-important in the treatment of these hysterical conditions. It need scarcely be added, that, in all such cases, it is desirable to attend to the patient's general health, and to prescribe such general tonic treatment and regimen as are appropriate in combating a constitutional tendency to hysterical manifestations.

Hysterical Mutism.

This is a subject which has, of late, been attracting much attention on the Continent. I do not know that much has been written about it, as yet, in English; but several cases have been recorded by Dr Wilks, in his *Diseases of the Nervous System*, and others by Wells, Bright, Willis, and Johnson.[1]

It is a very striking condition, occurring for the most part in patients who are obviously hysterical, but occasionally met with as a symptom existing *per se*, without any of the usual hysterical accompaniments or stigmata. It is very closely related to hysterical aphonia, both in its causation and in its tendency to ultimate recovery. Like aphonia, it often appears suddenly as a result of violent emotional excitement, such as fright, or as a result of a convulsive seizure. It frequently disappears with a suddenness equal to that of its onset; and, curious to say, the cause of its disappearance may be an emotional excitement or a fit, such as

[1] See collections of cases by Cartaz and others, to be presently referred to.

might originally have produced it. The difference between a case of Hysterical Aphonia and one of Hysterical Mutism is, that the aphonic patient, though the voice is lost, can still speak in a whisper, whereas the subject of hysterical mutism cannot speak at all, not even in a whisper; yet the intelligence and all the other faculties are maintained equally well in both cases, and the mute patient, if educated, can still, with the utmost fluency, give expression to thought in writing. I have, in my own practice, met with only one well-marked case of hysterical mutism. The patient was a young gentleman, who was brought to me some years ago by my friend Dr Sibbald, one of the Commissioners in Lunacy for Scotland. As this case presented the features of the condition most characteristically, I may be allowed here to insert, from my notes, a short abstract regarding it.

Mr X., aged 29, seen by me on the 15th of October 1886, was a tall, fair-haired, well-developed man, with a full, light brown beard; but was rather pale, and was somewhat excitable in manner. His history was shortly as follows:—

Five years before his visit to me, he had been working very hard, in preparation for the examinations required for his entry into the service of one of the public departments. During this period he sought recreation, from time to time, in boating; but it was thought by his friends that he exerted himself too much in that way. He was also, unfortunately, at the same time, subjected to a good deal of emotional excitement, owing to circumstances of a personal nature. It was when suffering from the exhaustion and disturbance produced by these various causes, that he first began to be affected with seizures, which his medical attendant believed to be of the nature of catalepsy. These attacks began with a dropping of the jaw, and produced a loss of all muscular power for several hours, without any loss of consciousness. They continued to afflict the patient from time to time, at intervals of two or three months, up to the date of his visit to me. From the first, the attacks always deprived the patient of the power of speech during their continuance; and gradually these periods of mutism became more prolonged, until, about a year after their first occurrence, the mutism became permanent. The fits had changed in their character some months before I saw him: instead of being passive during their existence, the patient had become the subject of

violent hysteroid movements, throwing his limbs about, clenching his hands, and striking his head forcibly if allowed to do so. The mutism had existed continuously for about four years before his visit to me.

When, five years before I saw him, the patient had thus broken down, he abandoned the intention of taking service in the public department, and emigrated to one of the colonies. Here he obtained employment in an office, and lived in comparative comfort, though mute and still subject to recurring attacks of the hysteroid seizures. He remained in the colony four years.

About a year before I saw him, he had met with a melancholy accident, when sailing with a companion on an inlet of the sea. His boat had been capsized, and his companion had been drowned. During the period of violent excitement which naturally attended upon this accident, the patient had cried for help; but on being rescued he had become mute as before. These cries for help were the only words he had uttered for years. During the whole period of his mutism, he was reported to be restless at night, and to groan, and even to cry out, in his sleep; but it was remarked that he never, even then, uttered any articulate words.

When I saw him, three months after his return to this country, he was evidently quick and intelligent; and he was very prompt in replying to questions by means of pencil and note-book which he carried for the purpose. When asked to pronounce a word or utter a vowel sound, he could emit no laryngeal sound, not even a whisper. He only made grimaces with his mouth. (Unfortunately I did not make a note of the specific character of the labial movements.) Persevering attempts were made to get the patient to pronounce some words, or at least to emit some vowel sounds from the larynx, but without result. Dr Sibbald afterwards informed me that the patient was much exhausted by the examination, so that on going home he had an exceptionally prolonged succession of his hysteroid seizures.

He was brought to me a second time a few days after his first visit, but the examination on this occasion was not so exacting. At this visit, it was found that when the patient coughed the ordinary vocal element was present in the cough, and presented its normal characteristics. This observation was made use of, and the patient was made to cough in imitation of coughs made by

myself; each succeeding cough having added to it a more and more prolonged vocal element, until the cough ended with a prolonged sound like "ah." The patient imitated thus far faithfully; but when asked to sing out the "ah" sound without the initiatory cough, he became as mute as before. He was asked to note well the fact that his larynx could still produce natural voice in coughing, and he was assured that in course of time he would completely, and perhaps suddenly, recover his voice for the purposes of speech.

The subsequent history of this case is instructive. Some months after I had seen the patient, when he was living quietly at home in the country, he went out one evening to dine with a friend in the neighbourhood. At first the conversation was, no doubt, carried on on his part in writing, as usual; but when the evening was somewhat advanced, a change occurred, and the patient, to the delight of himself and his friend, began to express himself with perfect freedom by word of mouth. The sitting seems to have been somewhat prolonged, but the patient continued to retain his powers of speech; so that when, at a late hour, he returned to his own home, he greatly surprised his friends by his powers of expression. Next morning, however, he was as mute as ever, and had once more to have recourse to writing.

Some months after this incident, the patient returned to the colony where he had formerly resided; and soon after his arrival he suddenly regained his power of speech. One Sunday, upon meeting his sister when she was walking home from church, he suddenly found himself able to converse in an ordinary way. He had thus been mute almost continuously for about five years. Since his recovery there has been no recurrence of the mutism.

Although it is only a few years since the title Hysterical Mutism was invented, cases of the condition were described under various titles as long ago as the middle of last century. Later, about thirty years ago, a number of cases were put upon record under the title of Functional Aphasia. Among others, several were published in 1874 by Kussmaul[1] under this title. The title Hysterical Mutism was first given to the condition in 1883 by Professor Revilliod of Geneva, who wrote a paper on the subject that attracted much attention. In 1886, Professor Charcot began

[1] Kussmaul's article on Speech, Ziemssen's *Cyclopedia*, vol. xiv.

to make the condition widely known to the profession by means of his clinical lectures. In the same year, his assistant, M. Cartaz,[1] published twenty cases collected by him from various sources. This paper contains also an excellent account of the literature of the subject. In the same year, 1886, a similar collection of cases was published by Dr H. Bock[2] of Berlin, who has the merit of first showing that Hysterical Mutism, unlike Hysterical Aphonia, occurs with equal frequency in both sexes. Later, in 1888, Dr Marcel Natier[3] of Bordeaux, published the largest collection of cases that has yet been made. He confirmed Bock's conclusion, that the condition was as common in the male sex as in the female. As this is the latest and largest collection of cases, it will be specially referred to presently.

The cases put upon record by Charcot are very illustrative. In his *Leçons sur les Maladies du Système Nerveux*, vol. iii. p. 422, he devotes the twenty-sixth lesson to Hysterical Mutism; contrasting a well-marked case of it with one of that partial mutism which results from glosso-labio-laryngeal paralysis. In his *Leçons du Mardi* for 1888–89, he returns at p. 247 to the subject, devoting his twelfth lesson to the description of a very interesting case of hysterical mutism, which, along with other grave hysterical manifestations, had resulted from hypnotism, practised upon the patient by a professional "magnetiser." In the first of these lessons, M. Charcot not only, in his peculiarly vivid manner, describes the symptoms, but also devotes some space to the consideration of the nature and causation of the condition. He shows that there are many features shared in common by hysterical aphonia and hysterical mutism. They occur in the same type of patients, are produced by similar exciting causes, and are not unfrequently found to alternate with each other in the same patient, the aphonia in some cases passing into mutism, and the mutism in other cases passing into aphonia. Obviously the mutism is the more severe condition of the two. It implies absence even of the power of whispering, as well as of that of speaking aloud.

[1] *Progrès Médical*, 1886; and Appendix to Charcot's *Leçons sur les Maladies du Système Nerveux.*

[2] *Deutsche Medizinal-Zeitung*, Dec. 1886.

[3] *Revue mensuelle de Laryngologie d'Otologie et de Rhinologie*, Nos 4, 5, 8, and 9, 1888.

I think it unfortunate that Charcot has been led to adopt the view of those physiologists who regard whispered speech as the product of the oral mechanism alone, without any participation of the laryngeal. He says, in the first lecture referred to, "Whispering, gentlemen, is nothing else than a language spoken and articulated. This phenomenon—remark it well—is absolutely independent of laryngeal voice: this fact has been demonstrated experimentally in the most conclusive manner, in the laboratory of M. Marey in 1876, and also by M. Boudet of Paris in 1879. These authors have, by means of the graphic method, conclusively proved that in whispering the larynx takes no part, the vocal cords not entering into vibration. The air then traverses the larynx as it traverses the trachea: it traverses an inert tube. That is all." According to this conclusion, M. Charcot must regard the larynx as inert alike in aphonia and in mutism, and he has to search elsewhere than in the larynx for the cause of the dumbness which distinguishes the latter from the former condition. He has to suppose that in every case of mutism the oral articulative mechanism is also disabled. He accordingly looks to the higher motor centres for speech, and he believes that in mutism there is a cortical disablement that is not present in aphonia. He concludes, page 427,—"There is here then, in short, a motor aphasia, and, I add, purely motor: a variety rare, very rare, in the domain of the common organic aphasiæ, with which there are found most frequently associated in diverse proportions other troubles of interior language, such as word-blindness, or word-deafness, or, again, agraphia."

With great respect for the opinion of an authority so eminent, I must be allowed to express the belief that this explanation does not cover the whole ground: in particular it fails to explain in any way the very close connexion that is known to exist between Aphonia and Mutism. It appears to me that, on this subject, M. Charcot has been misled to some extent by the erroneous conclusions of the physiologists whose views he cites regarding the nature of whispering. As already explained, I thoroughly agree with those physiologists who hold that the participation of the larynx is as necessary for whispered as for ordinary speech. It is a point upon which the reader may arrive at a conclusion by observation of the process of whispering when practised by himself.

Let him whisper in a "stage whisper," which is merely the ordinary whisper exaggerated, and I am mistaken if he will have the least inclination to regard whispering as an act which can be carried on without the participation of the larynx. Or, still better, let him sing in a whisper; which, after a little practice, he will be able to do, in tune, and yet entirely without voice.

Holding, as I do, that there can be no speech without the co-operation of both mechanisms, I believe that the disablement of either the one mechanism or the other may produce mutism. I believe that in the majority of cases it is the vocal mechanism that is at fault, and that in such cases the condition of hysterical mutism is essentially the same as that of hysterical aphonia, only more advanced. This view explains at once the transitions from the one to the other already referred to, and the existence of so many features which are common to both. These transitions and common features are well illustrated by the twenty cases collected by M. Cartaz, and appended to the third volume of the *Leçons* already quoted from. M. Cartaz, however, holds the same physiological views, and has the same theories as M. Charcot.

Quite recently the subject has been considered by another distinguished pupil of M. Charcot—namely, Professor A. Pitres of Bordeaux—in his recent work on Hysteria.[1] He describes a very interesting case, and cites the treatise of M. Natier, who has collected from various sources a great many cases of this condition. But M. Pitres unfortunately does not enter into any discussion on the exact relationships of mutism and aphonia.

The paper by M. Natier is an important one. He has collected, in all, seventy-one cases. Although the views expressed by him regarding the nature and etiology of the condition are not in any way different from those held by Professor Charcot, I think a careful study of the cases makes it evident that they can be grouped into several classes. It seems clear to me—(1) that, in a number of the cases, the mutism may be explained by the simple disablement of the Vocal Mechanism; (2) that, in others, the mutism has resulted from a disablement of the mechanism of Oral Articulation, the vocal mechanism being intact; (3) that, in a few, Both Mechanisms are involved; and, lastly, that, in some

[1] *Leçons Cliniques sur l'Hystérie*, 1891.

cases, there are important Complications which deserve to be specially mentioned.

Class 1.—As an example of the first class, in which there is simple disablement of the Vocal Mechanism, I would cite from the paper, Obs. IX.,—"A woman, 21 years of age, of nervous temperament. In consequence of a sore throat, which lasted eight days, she remained completely aphonic. All treatment was without result. When patient was seen a year afterwards, the voice was completely abolished; in spite of the greatest efforts, the patient could articulate no sound nor produce the least intonation or cry." After eight months of further treatment without effect, the patient was cured by the use of endo-laryngeal electrization, which caused her to have a prolonged hysterical fit, after which, on waking next morning, the voice reappeared. Obs. III., V., VI., XVIII., and XXII. seem to belong to the same class.

Class 2, in which the mechanism of Oral Articulation is disabled, is well represented by Obs. II., communicated to M. Natier by M. Pitres. Patient was a young woman of twenty-one. Without entering into details, it may be said that she could emit clearly only one sound, viz., the vowel-sound **a**, the pronunciation of the other vowels being very defective. The emission of this vocal sound shows that her laryngeal mechanism was unaffected. She could not at first articulate a single consonant, but, after persevering attempts, she was got to pronounce the consonants **b**, **f**, **l**, **p**, and **t**; and, with great hesitation, the syllables (pronounced in the French manner) **bas, fa, la, pas, tas.** "After a quarter of an hour of repetition of these five words, she is shown (by analyzing the movements) the articulation of the other consonants, and, after about half an hour of exercise, she can pronounce all the consonants of the alphabet followed by an **a**. It is in vain that one tries to make her pronounce the same consonant followed by another vowel. It is well to remark that she was nevertheless in full possession of her intelligence." From this time the patient progressed favourably, and was soon able to pronounce easy words, such as "Bonjour, Monsieur, Madame," etc. She soon began to speak and to make herself understood, although with much difficulty, the tongue appearing embarrassed in its movements. Next day she spoke very well, without any hesitation and without a shade of difficulty.

Class 3, in which Both Mechanisms seem to be involved, is illustrated by Obs. LV. The patient, a woman aged 43 years, lost her voice in October 1884, so that she could only speak in a whisper, and felt much fatigue in doing so. During the summer of 1886 the voice disappeared completely, so that she was not only affected with aphonia, but with a veritable mutism.

The voice was restored when the patient was under treatment with hypnotism. The physician caused the patient, when in this condition, to cough, and to clear the throat sonorously. He first made these sounds himself, and then caused the patient to imitate them; afterwards he got her to produce them of herself at command. He then passed to the pronunciation of vowels, and soon obtained **e** and **a**, a little later **o**, and with great difficulty **i** (ee), and then **u**, pronounced ou. Later still, he combined the vowels with the easiest consonants—the labials, in **em, am, pa, po,** etc.,—as one does for children who are being taught to read. Gradually in this manner the speech was restored, and eventually became perfect. Obs. LXXI. is also a good example of this 3rd class.

Among the Complications mentioned are,—(1.) Agraphia, in Obs. LXX., a case recorded by Charcot in 1888. There was, in this case, no word-blindness nor word-deafness. The case is described as one of Hysterical Apoplexy, which produced unconsciousness for five or six hours, and resulted in paralysis of the right arm, and paresis of the right leg. As patients with hysterical mutism, when educated, almost always write with perfect ease, the presence of agraphia must render the diagnosis exceptionally difficult. (2.) Temporary Deafness, exhibited in Obs. LVIII. This renders the patient for the time being a deaf-mute, but questions are understood if put in writing. (3.) Temporary Blindness has been observed in some cases.

I believe that the study of M. Natier's collection of cases thoroughly justifies the above classification. It will be observed that it is the same classification that I have already proposed for the varieties of stammering, with this difference, that the mechanism involved is not affected by a mere want of promptitude, but by a want of power, or, to express it in another word, by paralysis. If the view regarding the physiology of whispering which I have advocated is accepted by the reader, he can have no difficulty in

accepting also this classification of the varieties of hysterical mutism ; but if he takes the other view of whispering, and regards it as an act of the oral mechanism alone, without co-operation of the larynx, he will not be able to accept the classification, but must refer all varieties of mutism to disablement of the Oral Articulative Mechanism.

Whatever view be entertained regarding the Physiology of whispering, I think there can be no doubt that Hysterical Aphonia and Mutism alike must be referred, not to a mere peripheral disablement of the mechanisms of speech, but to a disablement of one or other or both of the cortical centres from which they are innervated. Many believe that the will itself is enfeebled, and that sudden cures are effected merely by the strengthening of the power of the will, through the influence of faith in the physician, and the tonic effects produced by a restoration of confidence.

If hysterical mutism of the first class and hysterical aphonia are essentially identical, the treatment already explained as suitable for aphonia would be equally appropriate for this variety of mutism : it ought to include both the employment of the local measures that have been described and the use of tonic remedies and regimen suitable to the constitutional state. For cases of the second class, it would seem rational to apply electricity and other local treatment to the organs of oral articulation, such as the Tongue and Lips, instead of to the Larynx ; and in cases of the third class the local treatment of both mechanisms would seem to be indicated.

For the examination of a case of hysterical mutism, with a view to determine the class to which it belongs, I would propose that attention should first be paid to the Laryngeal functions, and that, with the view of testing these, the patient should be asked to make some laryngeal sound, such as **a**. If no such sound can be produced, even in a whisper, the laryngeal function is obviously disabled. If the patient can produce a vocal sound at command, the function is probably intact. Secondly, in testing the Oral mechanism, the physician should ask the patient to try the pronunciation of the voiceless consonants of the first column of our alphabet, viz., those which are represented by the initials of the sentences, " Far shores seem thinly hazy," and "Two poor comrades." In the normal condition, the vocal cords take no part in producing these voiceless

consonants; so that when mutism is due to the larynx alone, the patient ought still to be able to produce these voiceless consonants. On the other hand, if the oral articulative mechanism be disabled, it will be impossible for him to produce even these. Of course the production of voiceless consonants alone would not enable him to speak. There may be other obvious signs of disablement in the oral mechanism, such as slowness in the movements of the tongue; and, among Natier's cases, some are mentioned in which the patients complained of a feeling of weight or heaviness in the tongue. When the patient requires to be taught the positions of the lips, tongue, etc., in the pronunciation of the various consonants, the oral mechanism is obviously at fault.

Other Forms of Paralysis affecting the Adductors.

Aphonia without mutism, the patient being able to speak in a whisper, results, frequently enough, from the operation of various conditions other than hysteria, such as Blood-poisoning, Fatigue, etc.

(A.) The most important are those connected with various kinds of blood-poisoning. It is now the belief of many authorities that paralysis in such cases is due to Peripheral Neuritis. If that is so, they ought properly to be classed as due to organic rather than to functional causes. As, however, the toxic paralyses are, in their curability and in their symptoms, allied to the paralyses of Hysterical origin, it may here be convenient to make a note of them. Paralysis following upon Diphtheria has been known to affect the muscles of the Larynx in some cases.[1] Other forms of paralysis are notoriously more common after diphtheria than paralysis of the laryngeal muscles, but the laryngeal paralysis is sometimes met with. It may present varieties, as regards the muscles involved, similar to those of hysterical paralysis; but it is said that paralysis of the muscles supplied by the superior laryngeal nerves, and more especially paralysis of the crico-thyroid muscles, occurs in a greater proportion of the diphtheritic than of the hysterical cases. In such cases, as the Superior Laryngeal is the sensory nerve of the Larynx, there

[1] Morell Mackenzie, *Diseases of the Throat and Nose*, vol. i. p. 145; also p. 434.

may be anæsthesia of the mucous membrane. It should also be noted that, after diphtheria, although the paralysis is sometimes bilateral, it is more frequently unilateral than that due to hysteria.

The other toxic conditions which are capable of producing aphonia from paralysis of the adductors are, more especially, chronic arsenical poisoning, chronic plumbism, and rheumatism; and here, again, the paralysis is more frequently unilateral than that due to hysteria, although, as in the other conditions, it appears to be oftenest bilateral. The existence of peripheral neuritis in one of the motor nerves would satisfactorily account for the limitation of the paralysis, in some of these cases, to one side or to one muscle.

In the treatment of these toxic varieties of paralysis, the local employment of electricity is again of great value. The constitutional state must, of course, be treated with appropriate remedies.

(B.) Still more closely allied to hysterical aphonia is the loss of voice which sometimes attends upon conditions of constitutional or Nervous Depression. Such huskiness of voice, or complete aphonia, is common enough in chlorosis and other forms of anæmia, being, no doubt, in such cases due to the mal-nutrition of the nervous system. It is also, in both sexes, a common accompaniment of constitutional neurasthenia, and of the depression of health and spirits which may be produced by mental trouble. It should be kept well in mind that the voice is in close sympathy with the mind, and especially with the emotions: its sound is cheerful or sad in close correspondence with the mental state for the time being. At times of profound emotion, it may become hoarse or husky; and, if the emotion be prolonged, it may be reduced even to a whisper. The reader will probably remember the striking picture, by Mr Archibald Forbes, of General Skobeleff, as he appeared upon his emergence from that scene of carnage, the final attempt to storm the redoubts of Plevna:—"He was in a fearful state of excitement and fury, his uniform was covered with mud and filth; his sword broken, his cross of St George twisted round on his shoulders; his face black with powder and smoke; his eyes haggard and bloodshot; and *his voice quite gone. He spoke in a hoarse whisper.* I never before saw such a picture of battle as he presented. I saw him again in his tent at night; he was quite calm and collected."

(C.) Paresis of the adductors may be produced by Fatigue of the

larynx, caused by public speaking or singing; but I shall reserve the consideration of this and other troubles of professional voice-users for my next paper.

Hysterical Stammering.

If the doctrines regarding the nature of stammering explained in the first chapter are remembered by the reader, he will not be surprised to learn, that, in several of the recorded cases of hysterical mutism, the patient has stammered markedly in recovery from the mutism. Evidently the voice, in returning, was produced with difficulty, and therefore did not, in the first syllables of words, come up to time. The case of mutism recorded by Professor Pitres illustrates this point. The patient in that case seems to have stammered in the ordinary way when he attempted to speak, and even to have had spasmodic phenomena, from overflow of energy, in his jaw, neck, and eyelids. It was further characteristic of ordinary stammering, that when the patient sang the stammer entirely disappeared. This case of mutism resulted from a fright; and Professor Pitres draws attention to the fact that fright is often the cause of stammering as well as of mutism, especially when the patient is of hysterical constitution. The same writer also refers to a case recorded by Professor Trousseau in his *Clinique Médicale,* in which the patient repeated many times, in echo-like fashion, the last syllable of the words she uttered. He speaks of this also as an example of hysterical stammering; but perhaps it should more properly be classed under the heading of Echolalia, which I hope to consider later, in connexion with aphasia and other conditions.

Rhythmic Spasms of the Vocal and Respiratory Mechanisms, of Hysterical Origin.

These rhythmic spasms are perhaps more intimately connected with the function of respiration than with that of phonation. It may here therefore suffice to make only a brief reference to them. They form a most interesting class of the rhythmic spasms which may affect almost any part of the body in the graver varieties of hysteria. In some cases the patient barks rhythmic-

ally; in others she coughs rhythmically; in others she sneezes; in others she snorts; in others she sniffs with the nose; in others she hiccoughs; in others she yawns; and in others she screams.

These various rhythmic spasms have certain features that are common to all of them. They are frequently associated with the ordinary stigmata of hysteria, but in not a few cases they may exist by themselves, as the sole manifestations of that condition. They are all alike apt to be produced by violent emotion, hysterical seizures, nervous shocks, or physical injuries. They may last but a short time—a few hours or days. But, in other cases, they may continue for months, or even for years. Often they occur with intervals of complete cessation. Each seizure may last for some hours; the spasm being, in different cases, repeated with very different frequency—occasionally over a hundred times per minute. Sometimes, on the other hand, it may continue to trouble the patient all day long, while she remains awake; and may even keep her awake during the night. It is a feature common to all the varieties, that the spasm entirely ceases when the patient falls asleep.

As already said, I do not intend to give any detailed account of these spasms. I may say that the reader will find them excellently described and classified in the recent work of Professor Pitres, which has already been referred to. I am tempted, however, to make the briefest possible reference to two cases of this description which have been under my own care. One of these was a case of Hysterical Barking, which was admitted to my wards in the Royal Infirmary, on the 15th January 1889. She was brought to me by my friend Dr Penman of Hawick. I remember well the first arrival of the patient. Dr Penman had previously come to my side-room, and was describing the case, when of a sudden he paused, and said, "Listen, that is the patient." We listened, and in the distance, along the corridor of the Infirmary, we heard a sound like the quick barking of a small terrier dog; and this sound gradually became louder, until, on the patient's arrival, she proved to be herself the source of it. It was a quick, high-pitched bark, repeated at the rate of about 120 times per minute, and maintained for several hours at each seizure. There was, along with it, no appearance of dyspnœa, and no disturbance of intelligence. Like the bark of a dog, the sound was destitute of the sudden valvular beginning which is characteristic of a true cough. The patient

was admitted to the side-room of the female ward; but she did not sleep much during the first night after arrival, and barked so much that one of the patients in the large ward asked the night-nurse, "When will that dog stop barking?" Under anti-hysterical treatment, this patient made an almost complete recovery.

The other case that I should like to mention was one of Hysterical Sneezing. The patient was a young gentleman, aged 21, of delicate appearance, whom I saw on the 15th September 1884. The sneezing had existed for about eight months, and had troubled the patient for several hours nearly every morning. It began immediately when he awoke, at 7 o'clock, and continued without intermission until about 10 A.M. It made the patient's nose run as in severe catarrh, and always left him with a severe headache and considerably exhausted. In this case an immediate cure was effected by very simple means. The patient was got to place under his pillow a small bottle full of crystals of carbonate of ammonium, and, immediately on waking in the morning, to put this smelling-bottle to his nose, and inhale from it as much as he could conveniently bear. He also took at the same time a full dose of tincture of assafœtida. From the date of the first employment of the smelling-bottle, the sneezing practically disappeared.

Hysterical coughing and hiccough are commoner than barking or sneezing. They cannot here be described in detail. In general features, however, the whole of this group of rhythmic spasms have characters which are closely similar. It may be added that instead of a long rhythmic succession of barks or coughs, sometimes a single harsh bark or cough may trouble the patient from time to time; and it is so also with the other varieties that have been enumerated.

The treatment of these conditions is that of the hysterical state. A measure of great efficacy is sometimes the morning shower-bath. The use of electricity, also, often cuts short an attack. In the case of hiccough, the poles of the Faradic battery may either be applied at each side of the chest, opposite the attachments of the diaphragm, or, one pole being applied over the epigastrium, the other may be placed over the phrenic nerve where it crosses the scalenus anticus at the root of the neck. In the latter case, only comparatively weak currents should be used.

Other Nervous Spasms, not necessarily Hysterical, of the Vocal Mechanism.

(A.) A curious variety of spasm is that in which the patient from time to time involuntarily ejaculates some word or syllable (Logospasmus Choreiformis). Occasionally the words ejaculated are of a disreputable character (Caprolalia). In that case, the ejaculations are often associated with a simultaneous convulsive tic, or spasm, of the upper extremity, or of some other part of the body. Prof. Charcot discusses this subject in the first lesson of his *Leçons du Mardi* for 1888–89. He suggests that these verbal ejaculations ought to be referred to a spasmodic disturbance of the higher functions of the brain, those of ideation; and he shows that they are often associated with other indications of mental enfeeblement, such as a striking loss of decision in the performance of the ordinary business of life. He records a case of a little boy affected with caprolalia and convulsive tic, who got into trouble by involuntarily shouting his bad words to other boys. Not understanding the nature of his case, they thrashed him for his supposed impudence.

(B.) Another spasm of the vocal organs which must not be omitted, is that tonic spasm of the adductor muscles of the larynx, which closes the glottis and produces the well-known Laryngismus Stridulus of infants, with its agony of dyspnœa. The causation and treatment of this serious condition cannot here be considered. The reader may, however, be reminded that an exactly similar condition occasionally occurs in adults as a symptom of hysteria, and that sometimes tracheotomy has even been performed in such cases for the relief of the dyspnœa. I can recall one such case, seen many years ago. It occurred in the person of a young woman, and produced such alarming and prolonged dyspnœa, with laryngeal stridor, that, had the patient's hysterical antecedents not been well known, the operation of tracheotomy would probably have been performed. When the case is really a hysterical one, tracheotomy is rarely or never required. The inhalation of a little chloroform and the administration of an antispasmodic, such as assafœtida, usually effect a speedy cure.

Bilateral Paralysis of the Abductor Muscles of the Larynx, viz., the Crico-Arytenoidei Postici.

This is a somewhat rare condition, and a very dangerous one. Its causation varies in different cases: generally it is due to disease of the nerves or nerve-roots; but in a few cases no organic cause can be detected. It has been known to succeed epileptiform fits. It has no distinct relationship to hysteria, is as common in the male as in the female, and is most common at a somewhat advanced period of life. It does not interfere with the voice. It produces stridor during inspiration, expiration being performed without noise. This inspiratory stridor is alarmingly loud when the patient sleeps. The condition is frequently the cause of death by suffocation. In the treatment of it tracheotomy is generally advisable. Sir Morell Mackenzie records a number of cases of this condition, in his work on *Diseases of the Larynx*. I have seen only one case, the patient being a man of about 60 years of age, who was brought to me many years ago by my friend the late Dr Angus Macdonald. The rough stridulous noise produced by this patient during inspiration strongly reminded me of the noisy breathing of a "roaring" horse; and on referring to one of the authorities on veterinary medicine, I found it stated that one of the possible causes of "roaring" in the horse is this paralysis of the abductor muscles of the vocal cords.

Having thus endeavoured to give a brief account of the leading paralytic and spasmodic affections produced by functional causes, I have now only to add that paralysis and spasm of the larynx may also result from organic disease of the laryngeal nerve centres or nerve trunks. I hope at a future time to take up the consideration of these organic causes of paralysis and spasm. They will naturally fall to be considered when we come to treat of the relations of organic disease of the nervous system to the function of speech. Meantime it may be remarked,—(1), that functional paralysis and spasm have a much more favourable prognosis than their organic equivalents; (2), that Functional Paralyses are essentially bilateral, and specially affect the adductors; whereas the Organic are in most instances unilateral,

and affect the abductors at least as much as the adductors; (3), that Bilateral Paralysis of the Abductors is much rarer than Bilateral Paralysis of the Adductors. It usually results from organic disease affecting the nerve-centres or nerve-trunks. Some hold that is never produced by functional causes in any case; but an organic cause cannot always be detected.

CHAPTER III.

The Troubles of Professional Voice-users; with Appendix as to Writer's Cramp.

In this chapter, we propose to consider the disturbances of phonation that are most apt to appear among those who require, in the daily business of life, to use their voices professionally. Preachers, lecturers, teachers, advocates, officers, singers, actors, auctioneers, and costermongers are examples of persons who follow such occupations; and the list might be greatly enlarged. People in general use their vocal organs, in speech and occasionally in song, in their daily life; but there is an important difference between the speech or song of private life and the speech or song required in a public oration or vocal performance. The public performances put a strain upon the vocal organs that they are seldom subjected to in the course of private life. Under strain these may break down. In this chapter, an attempt will be made to describe the various ways in which a break-down may occur; to explain the curative measures that may be used in the treatment of such cases; and to give some rules for the general management and hygiene of the vocal organs.

The systematic study of the troubles of professional voice-users has of late years been pursued by a number of good observers. But, although much progress has been made, it cannot be said that scientific knowledge regarding such affections is yet in a very advanced condition. Much, however, that is important has been learned; and the subject is well worthy of careful study, seeing that so many persons, in all civilized communities, depend upon the voice for a livelihood. In such persons, a break down of the vocal organs may be most disastrous to themselves and their families.

Points in the Physiology of Voice Production.

By way of preface, the reader may be reminded of a few physiological points that bear upon the subject.

Briefly, it may be said that song differs from speech in that it contains Music as its predominant element; but that it resembles speech in that it gives articulate expression to thought in words. Public speaking occupies, in this respect, an intermediate position between song and ordinary speech. It contains less music than song, but more than ordinary speech, since its tones must be fuller, rounder, and louder, if they are meant to travel to a distance. Dr John Hullah, in referring to the necessity for musical utterance in public speech, street cries, etc., makes, in his admirable little book on the *Speaking Voice*, the following remarks:—"The first person who ever attempted to address a very large assembly must have discovered, by the time he had uttered a dozen words, that, if what he had to say was to be made not only audible but intelligible, to any but those immediately about him, his utterance must be partially musical; and that the more numerous his audience, and the larger his auditorium, the more musical must that utterance be. . . . . Every factory, every ship, and (more familiar instance) every street, will furnish us with examples of *accentus* and even *concentus*, of partially or even of perfectly musical utterance." Of course the musical element in public speaking may be overdone: it is only the good public speaker who will be able to supply it abundantly in his tones without allowing them to assume the characters of "sing-song" or of monotonous intonation.

Dr Hullah also very neatly describes the differences between the varying Pitch and Intonation of speech and those of song. "In speech," he says, "the voice glides up and down what, by an allowable figure, may be called an inclined plane; in song it makes steps, the proportions of which to one another are ascertained. . . . . The variations of pitch in speech may be compared to the effect produced by sliding the finger up and down a vibrating string; those in song to that produced by stopping such a string at certain intervals and at no others." He further shows that the range of pitch in the gliding tones of speech is small, being confined, as a rule, to the musical interval of one-fourth, whereas the range of pitch in song is, of course, very much more extensive.

The Carrying or Travelling power of speech depends almost entirely upon the predominance of its vocal element. A shout would be no shout without an emphatic production of voice, and a public speaker will be well heard in a large hall only when he makes a sonorous use of his voice in speaking. We find, in like manner, that the letters of the Physiological Alphabet which carry best to a distance are those which contain most of the vocal element in their composition. Thus the vowels carry best of all; next them the nasal resonants; next these the voiced fricatives; next these the voiced explosives; and after these the voiceless explosives and fricatives, which carry worst of all. Helmholtz has made some remarks upon this subject. He says, "It is interesting in calm weather to listen to the voices of men who are descending from high hills to the plains. Words can no longer be recognised, or at most such as are composed of **m**, **n**, and vowels, as 'Mama,' 'no.' But the vowels contained in the spoken words are easily distinguished. They form a strange series of alterations of quality and singular inflexions of tone, wanting the thread which connects them into words and sentences."[1] Sitting in my room late one night, when working at this subject, I listened to a singer with a good voice, as he passed along the street on his way home. When he was under my window, I could make out distinctly every word of his song, but he immediately turned a corner of the street, and the words became unintelligible, most of the consonants having been lost on the way to my ear. Still, for some time, I could distinctly make out the vowels in the words he was singing; until, when he was farther in the distance, the vowels reached my ear shorn of the harmonics to which they owe their specific characters, so that I could no longer distinguish one vowel from another. Yet the fundamental note, with its pitch derived from the larynx, enabled me to follow the melody until it finally died away.

Musicians tell us that the four chief properties of voice are, Intensity, Compass, Flexibility, and Timbre; and that the last of these, which may be translated "quality," is the most essential of all, if the voice is to give pleasure in song. Training has great power in enhancing all of these, especially when Nature has provided an originally good organ, and a good musical ear. By

[1] Helmholtz, *Sensations of Tone*, p. 111.

training, the Intensity or Power of the voice may be increased; the energy of the muscles of the chest and larynx being increased by daily and systematic exercise. In like manner, training can increase the Flexibility and the Compass of the voice. Above all, training can communicate to the voice a precision in attacking musical notes that is seldom or never met with in the singing of an untrained musician. In the trained singer, the moment the air begins to act upon the vocal cords the note is emitted in perfectly correct tune, and sometimes, when desirable, with a sudden explosive effect, which has been called the "shock of the glottis," or "Coup de Glotte." This "shock of the glottis" is a subject about which much has been written by Mandl,[1] Lunn,[2] Lennox-Browne and Behnke,[3] and others who have written upon voice-production. The manner in which training communicates this precision to the vocal organs is a subject worthy of very careful consideration, although in this treatise only a few words can be said about it. We must remember that singing is, after all, the result of muscular action, carried on in obedience to impulses proceeding from certain cerebral nerve centres. It seems to me that more attention might, with advantage, be paid to the action of these centres. Writers upon the voice fully recognise the influence of training in strengthening the muscles, and in making them prompt to obey influences proceeding from the nerve centres; but perhaps they do not sufficiently recognise that its influence

[1] *Hygiène de la Voix*, par le Dr L. Mandl, 1876.

[2] The *Philosophy of Voice*, by Charles Lunn, 1874. After the publication of my paper in 1866, Mr Lunn was one of the first to recognise that the valve-actions described in it are important functions of the Larynx. Unfortunately his consideration of the subject led him to think that the false cords and ventricles of Morgagni are concerned in the production of the "Shock of the Glottis." This I think is a mistake. I believe that the Ventricles of Morgagni have little or nothing to do with the function of voice. During phonation the false cords are widely separated, and the Ventricles of Morgagni are, I believe, collapsed and empty. I admit, however, that it is difficult or impossible to prove that the ventricles are collapsed. The "Shock of the Glottis," I believe, owes its almost explosive character to the force and precision given by training to the muscles that are called into play. The note is struck at once, in perfect tune, and it may be struck with great power: "as," says Dr Hullah, "the sound of the violin reaches the ear the instant the bow of the skilful violinist touches the string, so should that of the voice at the instant expiration—the bowing of the violinist—begins."

[3] *Voice, Song, and Speech*. 1883.

upon the Nerve Centres is more important still, inasmuch as the power of directing any finely co-ordinated muscular act can be acquired by such centres only after careful practice. That it is acquired, is apparently due, not only to the fact that the frequent repetition of the act habituates the nerve-cells to the discharge, and the nerve-fibres to the conduction, of the nerve-force required, but also to the fact that the muscular sense and the other senses excited by the performance of the act engrave, in the regulating centres, a perfect motor picture of the act,—this picture being copied and imprinted afresh each time the act is repeated.[1] This view helps us to understand the long and laborious training necessary for the development of a fine singer. The training has been exercising, not only his muscles and nerves, but also his nerve-centres, which have been acquiring motor memories or pictures, so well defined, that, by force of habit, they can be utilized in the production of song, without any strain of attention on the part of the singer using them.

The Timbre or Quality of the voice probably depends more upon the condition and management of the Pharynx, and other accessory parts such as the Oral cavity, than upon the condition or management of the larynx itself. Any disease or derangement of the Pharynx is apt to tell injuriously upon the quality of the voice. It will be well, however, to reserve the discussion of the vocal relationships of the Pharynx until we come to consider an affection of that part which is of common occurrence in public speakers, viz., Follicular Pharyngitis, the producer of Dysphonia Clericorum, or Clergyman's sore throat.

Meantime, let us consider those troubles of professional voice-users that are more immediately connected with the functions of the Larynx itself.

Laryngeal Troubles in Professional Voice-users.

A. *Reference to the effects of ordinary Laryngeal Disorders.*—Like other people, those who use the voice professionally are apt to suffer from Laryngeal Catarrh, an affection which produces hoarseness as one of its symptoms. This affection is specially serious to

[1] The formation of such motor memories or pictures of co-ordinated movements is discussed by M. Victor Horsley in a very interesting manner in one of his recent papers.

the professional voice-user, because it disables him more or less for professional work, and because, if he continue such work while suffering from it, the inflammation may be aggravated, and its duration prolonged indefinitely. The catarrh may even be originally excited by over-straining of the Larynx, as in costermongers or others who have to shout a great deal. So, in like manner, Nervous causes of disablement, such as the Hysterical, Neurasthenic, or Toxic conditions enumerated in the last chapter, may affect speakers and singers, just as they affect others, and may be specially important in them only because of the special importance to them of the organ affected. Further, the larynx of a professional voice-user may be disabled by any one of the many varieties of Organic disease, such as tubercular or specific disease, or new growths. All that need be here said about these diseases is that a very slight organic change, such as might be of little importance to those who do not use their voice professionally, is often disastrous to the professional voice-user, and more especially to the professional singer. Although slight, it may be sufficient to destroy the purity of his vocal tones.

B. *Fatigue Neuroses of the Larynx.*—These and the other Neuroses of the Larynx will be found described, with special fulness and care, by Gottstein, in his work on *Diseases of the Larynx.*[1] One of the other contributions to the subject is a very interesting paper by Professor B. Fränkel of Berlin.[2] As Fränkel's paper describes the three leading forms of Fatigue Neurosis with admirable clearness, I shall begin my account of the Fatigue Neuroses by giving a summary of its contents.

Taking writer's cramp of the hand as the most typical example of a Professional Fatigue Neurosis, Fränkel reminds his readers that that affection occurs in three different forms, viz., (1) the Spasmodic, (2) the Tremulous, and (3) the Paralytic. Comparing these varieties of writer's cramp with the Fatigue Neuroses of the Larynx that are met with in professional voice-users, he finds all three varieties represented.

[1] *Die Krankheiten des Kehlkopfes*, 3rd edition, 1890. Unfortunately the former edition, translated into English by Dr M'Bride, does not contain the section on the Laryngeal Neuroses.

[2] *Deutsche Medicinische Wochenschrift*, Feb. 1887. He uses "Mogiphonia" as a general term for these Fatigue Neuroses of the Larynx.

Thus the Spasmodic Variety is represented by cases of Phonetic Spasm of the Glottis, many of which have already been put on record by observers on the Continent and in this country. The leading characteristic of this variety is the sudden Stop, during public speech or song, from involuntary closure of the glottis. This closure may be complete; and then the patient emits no sound, although he may move his lips as if still speaking, and may give evidence, in his expression and congested face, of making a great effort. On the other hand, the closure may be incomplete; and then, in his efforts to speak, the patient emits sounds of suppressed vocal character, such as are so often produced in other conditions of straining. Fränkel makes no attempt to describe the appearances presented by the larynx during such involuntary closure. Other writers, however, who have recorded cases, have attempted to describe the appearances on laryngoscopic examination. They say that the true cords are seen to be in the closest apposition throughout their whole length; and this they consider to be the cause of the obstruction. I venture to express the strongest doubt as to the accuracy of this observation. I have already, in the first chapter, referred to the valvular closure of the false cords over the true, during any effort of straining. I may here add that, in the investigation therein referred to, I proved that the construction of the True cords is such as makes them as badly fitted as they could possibly be to offer an effective resistance to the Exit of air under strong pressure. When they are in apposition, the air-space below them is wedge-shaped, so that the column of air, pressing up from the trachea, can, as it were, wedge itself between them. In so doing, it will escape with a sound that is more or less vocal. Complete closure, with effective resistance to the exit of air, can be brought about only by the co-operation of the False cords and the ventricles of Morgagni, which act in the valvular manner already explained. I have never myself seen a case of this Spasmodic variety of laryngeal fatigue neurosis; but, from the description of its symptoms in recorded cases, I have no doubt that this is the correct explanation of its mechanism. A complete closure of the false cords over the true will cause the appearance of silent effort, as in the gutturo-tetanic variety of stammering; an incomplete, will permit of the escape of air, and the air in passing, will throw the true cords into vibration. In

the latter case, one will hear those straining vocal noises (half smothered owing to the almost complete apposition of the false cords) that are so characteristic of the act of straining. In doubting the accuracy of the observations above referred to, I have the less hesitation, inasmuch as I recognise that, in order that the state of the glottis during the spasm should be displayed, it would be necessary for the patient to speak or sing while the mirror is in his throat, and also at the same time to have a true *involuntary* spasm—not merely make, voluntarily, what he might consider an imitation of one. The condition appears to me to be one in which the whole glottis, true and false cords alike, is seized with involuntary spasm, and is closed up, completely or incompletely, as it normally is during any act of straining.

The Tremulous Variety of writer's cramp is thought by Fränkel to be represented in the larynx by certain forms of involuntary and irrepressible *Tremolo* in the emission of notes; but he thinks the subject is as yet imperfectly understood, and does not enter further upon the discussion of it.

To the third or Paralytic Variety, Fränkel devotes special attention. He has had, in all, six patients who suffered from it: four public singers (three female and one male), one female teacher, and one preacher. He describes, as those of a perfectly typical case, the symptoms as they presented themselves in one of the lady singers. She was young, and apparently in excellent health; and she suffered from no trouble in the larynx except when she sang. When requested to sing, she began in a beautiful, strong soprano, clear as a bell; but, after a certain time, the voice became weak, and one could see that it was becoming more and more difficult for her to bring out tone as she had done at the beginning. "Finally she stopped, with tears in her eyes, in the middle of the song. When asked why she did not go on, she answered, 'I cannot. In the first place it gives me pain in the throat. That, however, I should not care for. But I am not able to sing any more: my voice is gone.' Although in giving this reply she spoke in a perfectly clear voice, it was impossible for her to sing again. The attempt to do so only produced a noise that scarcely deserved to be called tone." Laryngoscopic examination showed nothing distinct, although Fränkel was inclined to think that the vocal

cords were no longer approximated quite so closely as they had been before the patient sang. In all the other cases the symptoms were closely similar to the above. The teacher, for example, after speaking for about an hour and a half, found that her voice became fatigued, and that she could not proceed further. The preacher found that his voice failed and disappeared in the course of the service. Like the other patients, *he had a painful feeling of fatigue* in the throat, followed by progressive failure of his voice, so that more and more effort was required to bring it out; and at length, bathed in perspiration from his exertions, he was obliged to bring the service to a close. In all other respects, the patients were in good health, and had no trouble, even with the larynx, except when they were using it professionally.

Fränkel devotes some space to the consideration of the treatment of such cases. He shows that hitherto the treatment of confirmed cases has been very disappointing; and he reminds his readers that the same may be said regarding the treatment of confirmed Writer's Cramp. As, however, in recent years, considerable success has been obtained in the treatment of Writer's Cramp by the use of Massage, he has, in one case, tried this treatment for fatigue neurosis of the larynx. The result he regards as encouraging. Anointing the throat of the patient with Lanoline, he stroked with the fingers the skin on each side of the larynx, along the anterior borders of the Sterno-mastoids, from the angles of the jaw downwards. At each sitting he made forty or fifty of such downward strokings; and, at the same sitting, ten or fifteen transverse strokings over the Hyoid bone. Improvement followed in a few days; and, although the lapse of time was not sufficient to enable him to say that a permanent cure had been effected, the patient had become able to sing for half an hour or more.

These cases of Fränkel's may be regarded as typical of the variety of fatigue neurosis which corresponds to the Paralytic Variety of Writer's Cramp. As has already been remarked, the larynx, in these cases, always performed its functions normally except when called upon to do professional work. There are other cases, however, in which a break-down occurring during professional exertion produces a hoarseness or aphonia that remains for weeks or months, showing itself even in ordinary conversation. Sir Morell Mackenzie records several interesting cases of this de-

scription. In the *British Medical Journal* for 1863, vol. ii., p. 313, he describes the case of a clergyman, in whom aphonia came on suddenly one evening when he was preaching in a large London church. "While in the middle of a sermon, he felt a sudden pain in the throat, and was obliged to finish in a whisper. He had, on two previous occasions, lost his voice in a similar manner, but on this occasion the aphonia persisted for about two months. Examination of the throat showed no trace of disease either in the larynx or in the pharynx." In the same paper, he also describes the case of a fish-hawker, in whom aphonia came on suddenly after he had been making great efforts one Saturday evening. The patient partially recovered his voice, but the weakness subsequently increased, so that, for four months, he was obliged to give up his vocation. Laryngoscopic examination showed nothing but imperfect approximation of the Cords during the attempt at vocalization. In both of these cases, a speedy cure was effected by the employment of Intra-laryngeal Electrisation.

Michel, in a paper to be presently referred to, says that when, in a public singer, a break-down resulting from over-exertion is succeeded by persistent hoarseness, one should be very cautious about making an altogether favourable prognosis. He thinks that, in the greater number of such cases, a loss to the voice in metal, in polish, and in fulness of tone, remains ever afterwards; and that the voice may never regain its former staying-power.

Many other phenomena have been observed to occur in the vocal organism, when it is thus overstrained and made to break down. The Respiratory part of the Mechanism, apart from the larynx, may suffer during the disturbance, and may show the symptoms of failure of nerve power, or those of inco-ordinate action, or those of overflow into centres which normally should not be stimulated during speech or song. Two cases that have come under my own observation presented phenomena of this nature.

The first case was seen by me in December 1881. The patient was a young Scotch clergyman, of good physique, and apparently in good health, who for a year had been troubled, when preaching, with a "quick, catching cough, and a feeling as if his throat flapped together." This trouble first occurred after the patient had preached eight sermons on seven consecutive days, and was feeling

fagged by the exertion. It afterwards recurred more or less severely every Sunday, so that he became nervous about it whenever he was called upon to preach. He thought that his nervousness aggravated the condition. The attacks were especially apt to come on if he felt tired. They always produced a quick succession of short, sharp coughs, which gave him much annoyance, and excited great sympathy for him among the congregation. He had had several holidays of some weeks' duration, but the cough had always returned when he resumed his service in church. He was recommended by me to try the effect of a dose of Bromide of Potassium half an hour before beginning the service; and, during service to take, from time to time, if threatened with the cough, a dose of a mixture containing Aromatic Spirit of Ammonia, Spirit of Chloroform, and Camphor Water. The case seemed one of spasmodic irritation of the coughing centre, produced by overflow of energy from the surcharged centre for phonation.

The second case, which I saw on the 10th of July 1888, was somewhat more complicated in its symptoms. The patient was a young English clergyman, engaged in Cathedral service. He, also, was of healthy appearance; but he informed me that during the previous winter he had been out of health, from a rather severe attack of diarrhœa, which lasted more than a week, and pulled him down a good deal. The first symptom that troubled him when speaking was a feeling of want of breath at the end of a sentence, and an inability to draw breath for the next sentence. Entering upon that sentence with scarcely any breath, he got "quite pumped"; but, when in this condition, he found that the power of inspiration returned to him spontaneously. He had a sensation "as if the tube were inclined to close;" and sometimes he had difficulty in getting breath out, as well as in getting it in. There was no pain. Sometimes, in reading, he had difficulty in pronouncing individual letters, such as **g**, and found it especially difficult to pronounce **o** without aspirating it. He found that he had more difficulty in reading in the low monotone required for the daily service in the Lady Chapel, than in reading in the high monotone required for the service in the Cathedral. His troubles caused a little gasping, with long pauses. Sometimes, when exhausted, he would end a sentence with a quaver. He always felt the services to be a heavy strain upon him, and was especially

nervous when about to read. Preaching was easier to him; as he could then change the pitch of his voice, or pause, as he pleased. He was given a nervine tonic, and recommended to try the effect of a little Bromide of Potassium before beginning the service. This case is rather complicated; but its chief feature seems to have been a failure of power, and of co-ordination, in the Respiratory portion of the vocal mechanism. The difficulty of articulating certain consonants and vowels seems to indicate that the innervation of the Oral Articulative Mechanism was also to some extent disturbed.

In connexion with the most typical and common form of fatigue neurosis, viz., writer's cramp, it is now well ascertained that persons who are subjects of neurasthenia are more frequently and easily affected by the condition than persons of strong constitution. It is also known that temporary nervousness, such as might be produced by the presence of an onlooker, aggravates the condition for the time being. Reasoning from this analogy, we may believe that Neurasthenia and nervousness may also act as predisposing causes of the Laryngeal Fatigue Neuroses. The two cases last described seem to confirm this conclusion, as both patients asserted that their nervousness aggravated their symptoms.

In the treatment of all such cases of Fatigue Neurosis, prolonged rest from professional work is undoubtedly the leading indication; and this rest should be taken early, before the habit of break-down has become confirmed by frequent repetition. When professional duty is resumed, the greatest care should be taken to avoid overstrain; and the method of delivery should be most carefully attended to. Something more will be said about these matters presently. In some cases, the use of massage and electricity has been attended with good effects. When the patient is young, and as yet so little accustomed to clerical duties as to be agitated and nervous during their performance, I think it is reasonable to prescribe for him a little Bromide of Potassium, of which a single dose may be taken half an hour before service begins.

Pharyngeal Troubles of Professional Voice-users.

We now come to consider an affection that is believed to be peculiarly ommon among clergymen—so much so, indeed, that it

has received, in this country, the name of Dysphonia Clericorum, or Clergyman's sore throat. Curious to say, it is an affection of the Pharynx rather than of the Larynx. In well-marked cases, it develops into the disease known as Follicular Pharyngitis; but in slighter cases there may be only Catarrhal Irritation with Relaxation and Congestion of the Pharynx, without special hypertrophy of its follicles.

The common occurrence of this condition among public speakers illustrates the fact that the Pharynx plays a most important part in the production of voice. Public orators, when speaking, have generally on the table beside them a glass of water, or of some special beverage, with which they refresh the throat if it begins to feel dry, or if the voice begins to be a little husky. Mandl, in his book upon the voice, devotes much attention to this subject, and gives us details about the practice of many well-known actors and singers as to it. He takes us behind the scenes: and tells how one celebrated artiste refreshes the throat, during the entr'actes, with soda water; another with beer; another with porter; and so on. How do these fluids act? Clearly they can never reach the larynx, but can only moisten the cavities of the mouth and pharynx. The necessity for them illustrates the great importance of the pharynx in voice-production. As a part of the vocal tube[1] or resonating chamber, the Pharynx helps to give volume and timbre to the voice: without it the notes of the finest larynx would be destitute of agreeable quality and of carrying power.

The views of Michel[2] on this subject are thus summarized by Schech[3]:—"The wall of the Pharynx forms the most important reflector for the sound-waves streaming out of the Larynx. Here, and against the Velum Palati, they first strike. If this wall is not smooth, but knotty and uneven, from granulations and hypertrophies, 'sound shadows' must be formed; just as an uneven

[1] The expression "vocal tube" is used in one of the best pamphlets on the Physiology of the Larynx that I am acquainted with, namely, that entitled *Experimental Researches into the Physiology of the Human Voice:* a Memoir, by John Bishop, M.R.C.S., etc., 1836.

[2] *Die Krankheiten der Nasenhöhle und des Nasenrachenraumes*, 1876.

[3] *Die Krankheiten der Mundhöhle, des Rachens, und der Nase.* 3rd Edition, 1890.

mirror surface can give only a distorted image of a body placed before it. Owing to the faulty reflection, the tone thus suffers loss: it is weakened; it does not carry far; or, what is the same thing, it loses its metal."

Further, the Velum Palati and the Pharyngeal wall, in acting as reflectors of the sound-waves, are not passive and inert. Both in speech and in song, they are constantly in a state of great muscular activity. In speech, the Pharynx shares with the Oral cavity the duty of shaping the Resonating Chambers for the vowels; and in song the Pharyngeal cavity is contracted or enlarged, shortened or elongated, in sympathy with the pitch of the notes,—being in the highest notes shortened and contracted, and in the lowest elongated and enlarged, to a remarkable degree. This constant activity may help to explain its known liability to inflammatory irritation when overworked by public speaking. Even dryness of the Pharynx tells unfavourably on the voice; and, naturally, disease has still more marked effects.

Schech[1] gives a very detailed account of the present state of knowledge as to the causation, symptoms, and treatment of Follicular Pharyngitis; and the subject will also be found ably discussed in Sir Morell Mackenzie's work on the *Diseases of the Throat and Nose*.

It appears, as the result of recent observation, that the affection is, in its slighter degrees, exceedingly common. Schech goes so far as to say that there is scarcely a grown man who is quite free from some amount of granular change in the pharyngeal mucous membrane. Children, up to the age of twelve, are generally free from it; and the female sex also enjoys comparative immunity.

Among the predisposing causes, are certain constitutional states, such as Scrofula, Heart disease, and the state of constitutional weakness that sometimes follows an attack of one or other of the acute infectious diseases. It is common among persons engaged in occupations that expose them to the respiration of a dusty or impure atmosphere. It is common, also, in those who exercise their voices professionally; more especially in clergymen and in military officers—being in the latter produced by straining of the voice in shouting commands. It may thus either be originally

[1] *Op. cit.*, p. 122, *et seq.*

produced by overstraining of the voice, or, having been produced otherwise, be aggravated in this way. Other causes, which seem capable of exciting or aggravating the affection, are the habitual use of tobacco in smoking or snuffing, and the use of hot spices or condiments with the food, or of irritating drinks such as alcohol. It will here be unnecessary to give a detailed description of the appearances in Follicular Pharyngitis, but it may be said briefly that three forms of the affection have been distinguished, viz., (1) the Simple Hypertrophic, (2) the Hypertrophic with excessive Secretion, (3) an Atrophic form, which seems to be the outcome of the Hypertrophic ones. In the Hypertrophic forms, rounded granulations, or elongated elevations, or extensive patches of thickening are visible on inspection; and these, on microscopic examination, are found to be made up of hypertrophied mucous glands, with surrounding infiltration of lymphoid tissue. In the areas of hypertrophy, the orifices of the mucous ducts are often observed to be widely open; and, from these openings, in the form of the affection that is attended with increased secretion, whitish masses or shreds of secretion may depend. In the Atrophic form, the mucous membrane in the atrophied parts is thin, smooth, and dry.

When the condition is well marked, the patient complains of a constant irritation at the back of the throat, as if some foreign body or irritating particle were lodged there. He is constantly hawking or clearing his throat to get rid of this irritation; and he may be rendered so miserable by it as to become hypochondriacal, or even, sometimes, suicidal. Cough is also frequently excited; and, as the inflamed surface may bleed, Hæmoptysis may occur. Besides cough, another result of reflex irritation is spasm of the glottis; which, however, is met with only in a very small proportion of the cases.

To the professional voice-user, one of the most serious of the symptoms is the Hoarseness that attends upon this affection. This may exist without direct involvement of the Larynx in the inflammatory change, as has already been explained; but there is no doubt that in some cases the disease extends into the Larynx; and that in others the constant coughing and clearing of the throat overstrain the Larynx, and, by exciting congestion and catarrh in it, tend materially to aggravate the hoarseness.

In treatment, the general health should be attended to. The use

of tobacco and of stimulating foods and drinks should be forbidden. Prolonged rest should be given to the vocal organs, and the inflamed parts should be treated locally. For the local treatment of slight cases, sprays have been found of great service. A two per cent. solution of Bicarbonate of Soda, or Bicarbonate of Potash, or a solution of Chlorate of Soda may be used in this way; or, with the view of soothing irritation, a four per cent. solution of Bromide of Potassium. For more severe cases, Schech speaks highly of Mandl's Iodine solution, which is made up of Iodine, Iodide of Potassium, Glycerine, and Oil of Mint. If a good result be not obtained from these measures, the granulations may be destroyed individually by means of escharotic paste, or by the actual cautery. Mackenzie prefers to apply to them the escharotic London Paste, by means of a wooden spatula. Schech and others cauterize them with the galvano-cautery. Sajous[1] prefers to use, for this purpose, the end of a thick wire, heated to redness over a spirit lamp. Of course such energetic treatment should be undertaken only by a skilled surgical specialist. All the authorities are agreed as to the efficacy of such energetic local treatment in cases that without it would be incurable.

The atrophic form, Pharyngitis Sicca, is not so amenable to treatment as the hypertrophic one. All that can be done is to keep the parts clean and moist, by means of nasal douches and oral sprays: the sprays that are preferred being those of warm milk, mucilaginous decoctions, one per cent. solution of common salt, sulphur waters, etc. The nasal cavities often require special attention in such cases, as the disease is apt to involve the walls of the Naso-pharynx.

Michel[2] has lately written an interesting paper as to certain slight morbid conditions that are apt to damage the Singing Voice, by interfering either with the free movement of the Velum Palati, or with the contractions of the Palato-pharyngeal muscles, contained within the Posterior Pillars of the Fauces. He holds that anything interfering with the free elevation of the Velum Palati tells injuriously upon the voice by interfering with the action of that part in its function as a Resonator. He also holds that the Palato-pharyngeal muscles, acting in association with the Thyro-hyoid, Sterno-hyoid, Crico-thyroid, and others, assist in shaping the Rima Glottidis for

[1] *Diseases of the Nose and Throat*, by Chas. E. Sajous, M.D., 1888.

[2] Dr C. Michel of Cologne, *Deut. Med. Woch.*, May 1889.

the production of high notes; and that anything interfering with their free contraction will therefore have a damaging effect upon the power and purity of the voice. Among the slight conditions that interfere with the action of the Palato-pharyngeal muscles, he enumerates a Paretic condition of the Soft Palate, adhesions of the Tonsil to the Posterior Pillar of the Pharynx, the growth of Tonsillar Tissue in the substance of the Posterior Pillar, and the presence of follicular granulations upon the surface of the Posterior Pillar. In treatment, he divides adhesions of the tonsil and removes tonsillar growths and follicular granulations by means of the galvano-cautery, and endeavours to restore the muscular power of the Velum by gymnastic exercises of it. Besides paresis of the soft palate, he mentions Hypertrophy of the Naso-pharyngeal Tonsil, as another condition which may interfere with the upward movement of the Velum. He recommends removal of the hypertrophied texture.

A question that has engaged the attention of many writers on Voice-Production is—How is it that, of all professional voice-users, clergymen are the most affected by Follicular Pharyngitis? The answer given by these writers almost always is, that in preaching, more than in other forms of public speaking, the voice is apt to be used in a strained and more or less unnatural manner. Dr Hullah teaches that the public speaker should find what is the most natural and easy pitch for his speaking voice, and that he should use this pitch in his public speaking. Macready, also, the English tragedian, has left us his opinion upon this subject.[1] He says, "Relaxed throat is usually caused, not so much by using the organ, as by the kind of exercise,—that is, not so much by long or loud speaking, as by speaking in a feigned voice. I am not sure that I shall be understood in this statement, but there is not one person in, I may say, ten thousand, who, in addressing a body of people, does so in his natural voice; and this habit is especially observable in the pulpit. I believe that relaxation of the throat results from violent efforts in these affected tones, and that severe irritation and often ulceration is the consequence. The labour of a whole day's duty in a church is nothing, in point of labour, compared with the performance of one of Shakespeare's leading

[1] See letter to Dr Mackness, printed in the latter's *Treatise on Dysphonia Clericorum.*

characters, nor, I should suppose, with any of the very great displays made by our leading statesmen in the Houses of Parliament. I am confident as to the first, and feel very certain that the disorder which you designate as the clergyman's sore throat is attributable to the mode of speaking, and not to the length of time or violence of effort that may be employed. I have known several of my former contemporaries on the stage suffer from sore throat, but I do not think that among those eminent in their art it could be regarded as a prevalent disease."

We are told by Mandl of the care that another actor took to use his voice at its natural pitch. He tells us, as to Talma, the great French actor, that immediately before going on the stage he used to ask some bystander, "What time is it?" and, on getting a reply, to say, "Merci, Monsieur." On passing to the stage, he kept in recollection the pitch of these everyday words of his own, and was careful to use it in his first words to the audience.

Much that is interesting and important upon this subject will be found in the work of Dr Hullah. But we need not dwell upon it. It is sufficient to say that when a clergyman begins to be troubled with sore throat, he should look well to his method of enunciation; and that, if the method be faulty, he should correct it without delay. In doing so, he may be encouraged by the example of Cicero himself, as to whom, in Middleton's Life of Cicero (quoted by Dr Mackness), there is the following passage:—

"Cicero says of himself, 'My body at this time was exceedingly weak and emaciated, my neck long and small, which is a habit thought liable to great risk of life if engaged in any fatigue or labour of the lungs; and it gave the greater alarm to those who had regard for me, that I used to speak without any remission or variation, with the utmost stretch of my voice, and great agitation of my body. When my friends, therefore, and physicians advised me no more to meddle with causes, I resolved to run any hazard rather than quit the hopes of glory which I proposed to myself from pleading; but when I considered that, by managing my voice and changing my way of speaking, I might both avoid all danger and speak with more ease, I took a resolution of travelling to Asia, merely for an opportunity of correcting my manner of speaking.'"

Other points to be attended to are:—(1.) The posture in reading should be such as to let the speaker stand upright; the reading

desk being raised enough to let him follow the print easily without stooping over it. (2.) The speaker must take care to correct any tendency to speak from a chest insufficiently filled with air. Cases are reported in which great relief was got by careful attention to taking breath at suitable intervals. (3.) Dr Hullah points out that the liability of clergymen to sore throat may also, in some degree, be due to the long intervals of rest between the weekly occasions of effort; and he suggests that clergymen, besides attending carefully to their mode of enunciation on Sundays, should exercise the voice in reading aloud, etc., on week days.

These recommendations appear to me to include all that is really essential as to measures of prevention. When the mischief is done, rest is the chief indication; and the medical treatment should include both such general tonics and regimen as may be required by the state of health and such local treatment as has already been described.

The habit of smoking should, in cases of Follicular Pharyngitis, be strictly forbidden. I saw, on the 10th of October 1891, a case in which the local appearances spoke eloquently as to the affection being due to the habit of smoking. Along with much congestion of the soft palate and pharynx, increased secretion of mucus in the pharynx, and enlargement of several follicles on its posterior wall, there was, in the buccal cavity, a most peculiar condition: over the whole of the roof of the mouth, as far back as the junction of the hard with the soft palate, the mucous membrane was thickened and whitened; and everywhere the whitened surface was dotted abundantly with little black spots, like the black tops of comedones on the nose. The black spots were the openings of dilated mucous ducts, blackened by tobacco smoke.

Many professional voice-users believe that some of the watering places, especially those with sulphur springs, are of value in the treatment of Follicular Pharyngitis.

Further, it may be added that, as the voice answers so sensitively to conditions of the health and nervous system, the professional voice-user should try to keep himself in good health and good spirits. No special rules can be laid down for him in this respect. The general rule that will be most valuable to him, as it is to us all, is that, in living, he should do his best, in every way, to pay respect, and yield obedience to the ordinary laws of health.

WRITER'S CRAMP.

As public speakers often become the subjects of Writer's Cramp, a few notes upon that affection, appended to this chapter, may not be out of place. Public speakers are liable to become the subjects of it, because so many of them require, in preparing their orations, to commit them in the first place to writing. Much writing brings about fatigue in the hand, and induces this condition, which is the commonest and most typical example of a Fatigue Neurosis.

Excellent accounts of the affection are so easily accessible, that it is here unnecessary to enter into any great detail regarding it. One of the standard papers on the subject, that by Dr G. V. Poore, is in the *Med. Chir. Transactions*, vol. lxi., 1878; and, more recently, Dr Poore has given an abstract of his views in the form of a short article contributed to Quain's *Dictionary of Medicine*. Further, a full and able account of the Professional Fatigue Neuroses in general, written by Dr Morris J. Lewis, will be found in the fifth volume of Pepper's *System of Practical Medicine*. In Ziemssen's *Cyclopædia*, also, there is the well-known article by Erb; and in Eulenberg's *Encyclopædie*, 1885, there is a full and instructive article by Prof. Berger of Breslau.

In this chapter, it will suffice to remind the reader of the leading features of the affection, and to note the means which have been used with most success in its treatment.

In speaking of the Fatigue Neuroses of the Larynx, the three chief varieties were noted to be,—(1) the spasmodic, (2) the tremulous, and (3) the paralytic, and it was remarked that, in presenting these varieties, the Fatigue Neuroses of the Larynx resembled the Fatigue Neurosis of the Hand called Writer's Cramp. Although the title "Writer's Cramp" seems to imply the existence of spasm as an invariable symptom, this is by no means actually the case. It is only in the Spasmodic variety that true cramp or spasm is the leading symptom; and in pure examples of the Tremulous and Paralytic varieties spasm is not met with. There are, however, many cases of a mixed character in which spasm is associated with tremulousness, or with paralysis, or with both. "Scrivener's Palsy" is another name for the affection almost as familiarly known as "Writer's Cramp."

As to the comparative frequency of each of the three forms, Prof. Berger, in the article above referred to, states that, of 64 cases which came under his own observation, 24 belonged to the purely Spasmodic Variety, 10 were cases of Writer's Palsy, and 8 were cases of Writer's Trembling. The remaining 22 were examples of combinations of two or all three of the above forms. Including some of the combined cases, it was found that spasm exhibited itself more or less in 34 of the 64 cases. A few words may be said about each of the leading varieties.

I. *The Spasmodic Form.*—When the patient is engaged in writing, spasm sets in in one or several of the muscles that are being used. Sometimes it is the Flexors that are affected, and then the pen is involuntarily grasped with great force between the thumb and fingers, or the thumb is bent strongly inwards upon the palm. Sometimes it is the Extensors, and then the index finger or thumb is straightened out and carried apart, so that the pen may drop from the hand. The spasms thus affecting the Flexors or Extensors may be either tonic or clonic: in the latter case the fingers, hand, or even whole arm, become affected with involuntary jerking movement. It may be said, however, that tonic cramp is far more common than clonic jerking, which is met with only now and again.

II. *The Tremulous Form.*—This variety, which is the most rare of the three, is constituted by the occurrence of trembling of the hand, and more especially of the fore-finger, whenever the patient attempts to write. At first, it is not so utterly destructive of the writing-power as is either of the two other forms; but, as it advances, it makes the handwriting more and more tremulous and wavy, until at last it makes it quite illegible. Lewis notes that the fore-finger may, in some cases, remain more or less tremulous, even when the patient is not writing and the hand is at rest.

III. *The Paralytic Form.*—The leading feature of this form is simple want of motor power, exhibited by the hand when the patient is engaged in writing. For all other manipulations, the motor powers of the hand may be unimpaired; but, in a severe case, no sooner has the patient taken pen in hand, and made a few strokes with it, than he finds the motor power of his hand ebbing fast away, so that presently it may be almost impossible for him, even with the greatest effort, to write a single letter. Accompanying this progressive loss of motor power, there is an increasing and

very distressing sense of fatigue in the hand and arm: the arm is sometimes described by the patient as feeling as heavy as lead, and as being at the same time quite sore with fatigue. Efforts to continue work with the disabled hand induce also a sense of profound general fatigue; and the exhausted patient, if he persevere, may, from his exertions, become bathed in perspiration. In rare cases, Vaso-motor changes are developed, the hand becoming turgid with blood and even slightly cyanosed. And, also in rare cases, shooting pains, of neuralgic character, may occur. The common troubles of sensation, however, are the sense of sore fatigue and the feeling of heavy weight; and these sensations may extend from the hand up even to the shoulder. Something of the feeling of sore fatigue and weight may be present even in the Spasmodic and Tremulous varieties, but it is most constantly developed, and most severe, in the Paralytic one.

Other points in the Symptomatology of Writer's Cramp, brought out especially by Dr Poore's careful examination of cases, are:— (1.) The occasional presence of neuritis in one or other of the nerves supplying the hand. This occurs most frequently in the trunk of the Ulnar Nerve, but is also met with occasionally in the Median, or in the branches of the Musculo-Spiral. It betrays itself by exciting Sensory disturbances, such as tingling and hyperæsthesia over the cutaneous area of distribution; and by producing, in the muscles supplied, a paretic weakness, which may be associated with perceptible wasting, with fibrillar movements, and with more or less diminution of response to the Faradic current. There may also be more or less tenderness to pressure over the trunk of the nerve. The occurrence of Neuritis in the Ulnar Nerve was well exemplified in a case of the Paralytic variety seen by me, for the first time, in October 1889. In this case, there was, along with a little tenderness over the nerve trunk, tingling sensation over the ring and little fingers, and very slight but perceptible wasting in the muscles of the Hypothenar Eminence. (2.) Alteration of Electrical Reactions in individual muscles. Dr Poore believes that the disablement of any one of the many muscles employed in writing may throw the whole process into disorder, by impairing a link in the chain of co-ordination. He examines the muscles individually with the electric current; and he states that, in a very large number of his cases, it was possible distinctly to make out, in the affected

limb, that one or several of the muscles presented an alteration of electrical reaction. Usually this alteration was only of a quantitative character, being, in slight cases, a quantitative Increase, and, in severer cases, a quantitative Decrease, of excitability to the electrical current. That such quantitative alteration existed, was made evident when the reactions of the muscles of the hand affected were carefully compared with those of the corresponding muscles of the other hand. Only in a few cases did he find, in muscles already wasting, the qualitative alterations known as the Reactions of Degeneration.

As to the Pathology of Writer's Cramp, much has still to be learned. It is unquestionably the result of over-fatigue, and is brought about by the continual repetition, hour by hour, and day by day, of the muscular movements required in the operation of writing. The mechanism of these movements is nervous as well as muscular, and the nervous impulses call forth the activity of many nerve-cells and nerve-fibres, from the starting points of these impulses in the Cortex of the Brain, down, through the Spinal Cord, to their ultimate expenditure in the muscles. All of these cells and fibres being exercised, it seems reasonable to suppose that any one of them may become fatigued. Many will have it that Writer's Cramp is always peripheral, and due to local change in the muscles or in the nerves at or near their muscular distribution. Some, on the other hand, point to certain resemblances between Progressive Muscular Atrophy and Writer's Cramp, and teach that the latter is essentially a spinal affection, due to fatigue of the large motor cells in the Anterior Cornua. A third opinion, at present very powerfully supported, is that Writer's Cramp is essentially a Cerebral affection, due to exhaustion of that part of the Cerebral Cortex that is the primary source of nerve-energy for the muscular movements of writing. Although the subject is involved in great obscurity, there is pretty good ground for supposing that there is truth in each of the three hypotheses represented by these several views. Most authorities now think so. That the symptoms may spring out of exhaustion of the cortical centres seems to be rendered almost certain by the circumstance, already alluded to, that Writer's Cramp is most easily induced, and occurs most frequently, in those who, by inheritance, dissipation, worry, or overwork, are subjects of Neurasthenia or Hypochondriasis. In

Neurasthenia, the supply of energy is below par, so that the motor cortex gets easily exhausted, and a Fatigue Neurosis is readily developed. It has also been observed that Nervousness, such as may be excited in the patient by the presence of an onlooker, aggravates the affection for the time being. Further, Dr Lewis has, in his observations upon the allied Telegraphist's Fatigue Neurosis, noted that, in some cases, when the patient feels the inability to perform with his hand the simple manipulations required in using the Morse instrument, he at the same time experiences an inability to form in his mind a proper conception of the dots and strokes required for representation of the letters. I saw last August a patient, now suffering from marked symptoms of Neurasthenia, who, when speaking in public, has of late observed a want of power in the tones of his voice. Five years before, he had consulted me on account of a very distinct threatening of Writer's Cramp, produced by over-fatigue in writing. In this case, Neurasthenia seems to have been the predisposing cause of weakness both in the hand and in the Larynx.

But, while thus fully recognising the importance of nervous exhaustion as a predisposing cause of Writer's Cramp, we yet cannot exclude the probability that many cases are of local or peripheral causation. It seems certain that, among professional scriveners, the simple fatigue of the muscles by work specially hard and long continued is of itself sufficient to induce the affection, even where the constitution is quite robust. In these cases, peripheral changes in the nerves or muscles may be expected to occur with special frequency.

As to the possibility of Writer's Cramp having sometimes its origin in over-fatigue of the Spinal part of the motor tract, Dr Poore, in his chief paper, points out that several of the leading affections of the Spinal Cord may begin to betray themselves first of all in the hand, during the act of writing. Progressive Muscular Atrophy shows itself in this way more frequently than any of the others; but Dr Poore also records a case of Locomotor Ataxia that began with inco-ordinate movement of the hand in writing, and that developed to a marked degree in the upper, before it affected the lower extremities. Dr Poore supposes that in such cases there existed, in the first instance, a strong predisposition to the form of disease ultimately developed, and that the fatigue of

writing merely acted as the accidental exciting cause that determined the locality for the first appearance of the symptoms. Quite lately, Dr Féré of Paris[1] has recorded a case of Jacksonian Epilepsy that first set in with tonic spasm of the fingers during the act of writing. He is disposed to think that there was in that case a predisposition to Epilepsy, and that the locality of the first convulsions was determined by the fatigue of the act of writing. He refers to the experiments of Schiff, who shows that when a muscular act involving the contraction of only a limited group of muscles is so oft repeated as to induce fatigue, there is produced in the corresponding area of the Motor Cortex a condition of over-excitement that tends to invade the whole hemisphere of the same side, and ultimately even to spread to the other hemisphere. He thinks that this process may account for the generalization of the spasm that occurred in some of the attacks exhibited by his patient. Fully admitting, however, the possibility that an affection of the Spinal Cord or Brain to which there already exists in the patient a strong predisposition may thus have the locality of its first symptoms determined by prolonged fatigue in writing, we may reasonably ask whether it be not possible, even in the absence of such predisposition, that Progressive Muscular Atrophy may in some cases be excited by reckless endeavours of the patient to continue the work of writing after a Fatigue Neurosis in the hand has become fully developed. Onimus showed, in 1876,[2] that in artisans, such as blacksmiths, prolonged fatigue was capable of producing what he called a Professional Muscular Atrophy, an affection that he regarded as distinct from Progressive Muscular Atrophy. It seems, however, questionable whether a distinct line of demarcation can properly be drawn between the two affections; and some of the best authorities upon Muscular Atrophy do not recognise the distinction.[3] I have notes of two cases in which very striking and extensive atrophy of muscles began in the hand, and was attributed by the patients, in both cases, to over-

[1] *Comptes rendus des séances de la Société de Biologie*, Jan. 10th, 1891.

[2] *Lancet*, 1876.

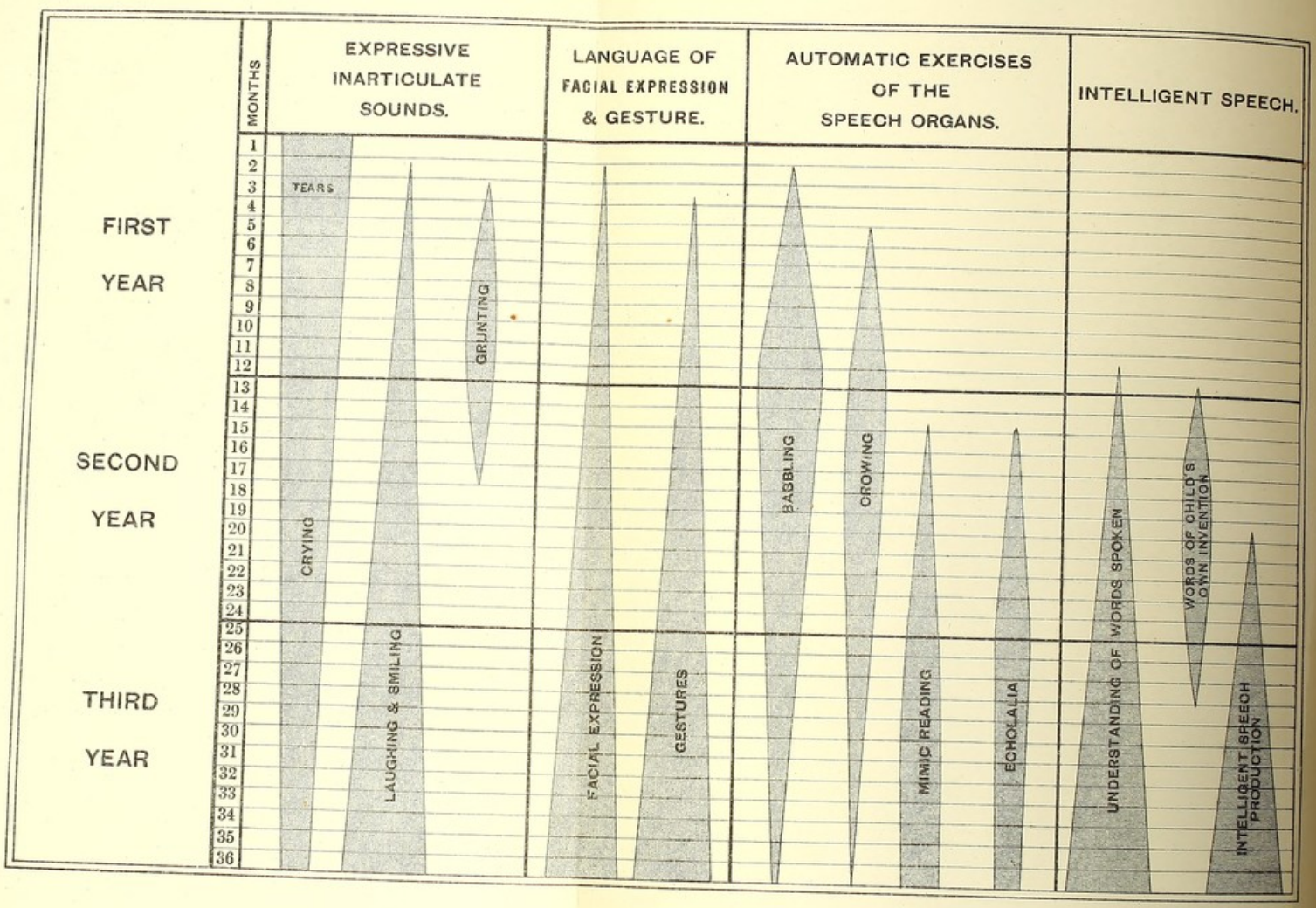
[3] As to the frequency with which Progressive Muscular Atrophy results from fatigue in special groups of muscles habitually and excessively used in certain occupations, see article by Eulenburg in Ziemssen's *Cyclopædia*, vol. xiv., p. 114; also article in Eulenburg's *Real-encyclopädie*, vol. xiii., p. 595.

fatigue. In the first of these, a clerk, aged 27, admitted into my Ward May 1st, 1886, the symptoms set in with a prickling sensation and numbness in the right hand and arm, when the hand was fatigued by writing. This was speedily followed by increasing loss of power and wasting in the muscles, so that he was soon obliged, in writing, to use the left hand. Presently, symptoms of the same kind appeared also in the left hand; and subsequently, year by year, the wasting increased, extending gradually to the arms and trunk. He had been the subject of these symptoms for about nine years before I saw him. When in Hospital, he presented extensive wasting of the muscles of the upper extremities and trunk, and was evidently the subject of an advanced Progressive Muscular Atrophy. His symptoms included well-marked fibrillar movements in the muscles affected. The second case was that of a blacksmith, aged 51, who was admitted into my Ward on Jan. 14th, 1888. His symptoms had set in eighteen months before, at a time when he was much overworked. One morning, in using the small hammer, the fingers of the right hand were seized with cramp. This continued to recur several times daily, and he soon noticed that the ball of his thumb was getting wasted, and that his fingers were getting weak, so that his grasp was too feeble to hold the hammer, which sometimes flew out of his hand. Wasting extended pretty rapidly both to the right arm and to the left hand and arm. When he came under my care, the hands and fore-arms were extremely wasted, the Extensor muscles of the elbow joints markedly so, and the Trapezius, Pectorals, Latissimus Dorsi, and Scapular Muscles, to a considerable degree. In this case, no fibrillar movements could be detected in the wasted muscles. It may be that in these cases there was a marked predisposition to Progressive Muscular Atrophy, and that the fatigue of certain groups of muscles merely played the rôle of an exciting cause. Nevertheless these two cases have suggested to my mind the possibility that there may be a form of Writer's Cramp in which the fatigued and exhausted portion of the motor tract is that part of the Anterior Cornu in the Spinal Cord that gives origin to the nerves for the hand; and that, in this form, a reckless persistence in the attempt to continue writing may lead, quite naturally, and without the co-operation of any marked predisposition, to the development of Progressive Muscular Atrophy.

As to the treatment of Writer's Cramp, complete abstinence from writing for a lengthened period is the measure urgently called for, whenever the development of the affection is distinctly threatened. Too much attention need not be paid to an occasional feeling of fatigue in the hand, or even to occasional cramp-like closure of the fingers upon the pen, if these symptoms occur only after very prolonged exertion in writing. It is probable that every one who has written much has had occasional experiences of this kind. But when these symptoms begin to trouble a patient whenever he writes a little, it is time for him for a while to give up writing altogether, if he can possibly afford to do so. If he must go on, then he should, if possible, use a pencil or stylographic pen; or, if this is not allowable, take care to use a penholder that is large and thick. Thick cork penholders are now sold, and a substitute for these can be easily made by fitting a cork upon an ordinary penholder. If the symptoms should still persist, it will be highly advisable that the patient should for a long period give up writing altogether. He might with advantage learn to use the American type-writer, which calls a different set of muscles into action; or, still better, employ an amanuensis. For cases in which the affection is distinctly threatened, as well as for those in which it is confirmed, the use of the Constant Current has been found of value, the anode being applied to the affected muscles and the kathode placed over some neutral part of the body. Of still greater value is the method of treatment by Massage and Gymnastics. This method has been systematized and developed more especially by Wolff of Frankfort (formerly a teacher of writing), and by Dr Schott of Nauheim. These specialists have obtained very remarkable results, which are testified to by many eminent Continental physicians and surgeons, such as Billroth, Charcot, and Bamberger. Lewis, who has had personal communication with Wolff, thus summarizes his method:—"It consists of a combined employment of gymnastics and massage; the gymnastics are of two kinds: 1*st*, the active, in which the patient moves the fingers, hands, forearms, and arms in all directions possible, each muscle being made to contract from six to twelve times with considerable force, and with a pause after each movement, the whole exercise not exceeding thirty minutes, and repeated two or three times daily; 2*nd*, passive, in which the same movements are made as in the former,

except that each one is arrested by another person in a steady and regular manner; this may be repeated as often as the active exercise. Massage is practised daily for about twenty minutes, beginning at the periphery; percussion of the muscles is considered an essential part of the massage. Combined with this are peculiar lessons in pen-prehension and writing." A fuller account of this method, by Dr Theodore Stein of Frankfort, with a record of ten cases successfully treated by it, will be found in the *Berliner Klinische Wochenschrift* for 1882, p. 527.

There seems to be no doubt that this method constitutes a decided advance in the therapeutics of Writer's Cramp. There are however, many cases,—especially, it would seem, those of Cerebral origin,—in which even this method is of no avail. On the whole, therefore, Writer's Cramp, when of long duration and thoroughly confirmed, must still be regarded as an affection that is apt, in a large number of instances, to prove persistent and incurable.


MONTHS
EXPRESSIVE INARTICULATE SOUNDS.
LANGUAGE OF FACIAL EXPRESSION & GESTURE.
AUTOMATIC EXERCISES OF THE SPEECH ORGANS.
INTELLIGENT SPEECH.
FIRST YEAR
SECOND YEAR
THIRD YEAR
1
2
3
4
5
6
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8
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10
11
12
13
14
15
16
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30
31
32
33
34
35
36
TEARS
CRYING
LAUGHING & SMILING
GRUNTING
FACIAL EXPRESSION
GESTURES
BABBLING
CROWING
MIMIC READING
ECHOLALIA
UNDERSTANDING OF WORDS SPOKEN
WORDS OF CHILD'S OWN INVENTION
INTELLIGENT SPEECH PRODUCTION

PART SECOND.

THE DEVELOPMENT OF SPEECH; AND THE DEVELOPMENTAL DERANGEMENTS.

CHAPTER IV.

Sketch of the Development of Language in the Normal Child.

Before entering upon the consideration of those derangements of speech which are due to arrested development, it is very desirable that we should have clear ideas as to the development of speech in the normal child. There are so many children in the world, and so many parents with full opportunities of observing them, that the various steps in the development of speech ought, one would think, to be very familiarly known. This, however, is far from being the case. Nature's processes in this development are so gradually completed as to exhibit no very striking steps that might serve as landmarks to the ordinary observer. Even a medical parent, however accustomed to accurate observation, would be able to give but a very poor account of the phenomena presented in the course of the development of speech in his own child, if he trusted entirely to memory.

A full understanding of the process of development of speech can be obtained only by systematic observation of the child's progress from day to day, and by noting down in writing, day by day, the observations made. This is a tedious process, requiring much self-denial and patience. It is a kind of work many are willing enough to begin, but few are capable of carrying to a

successful conclusion. Among those who have been most successful in recording the progress of their own children in speech, are Charles Darwin,[1] from whose valuable observations a selection will presently be given ; and W. Preyer,[2] Professor of Physiology in Jena, whose book upon the *Mind of the Child* ought probably to be regarded as the standard work on the subject. Other well-known writers on this subject are Berthold Sigismund,[3] Taine,[4] F. Pollock,[5] Perez,[6] and Dr G. J. Romanes.[7]

The book of Professor Preyer, which is in two volumes, has been translated into English by Mr H. W. Brown, teacher in the State Normal School, Worcester, Mass., U.S.A. Besides treating of the development of the senses and the will in the child, and of the intellect generally, this work contains, in its second volume, a series of very detailed notes regarding the development of speech in the Professor's own son, during the three first years of his life. In the Appendix, also, the author has brought together summaries of the conclusions of no fewer than thirteen or fourteen other observers (including some of those above mentioned) who have watched the development of speech in their children in a similar fashion. Professor Preyer has thus done invaluable service, both in recording his own observations and in bringing together a very considerable mass of observations made by others; and the reader will find, on perusal of his work, that these observations are classified and considered in a very interesting and instructive manner. For a brief sketch, however, we must adopt a plan different from that of Professor Preyer, and arrange the facts in a different manner. Preyer's method is essentially a chronological one; the progress of his boy in all particulars being noted down day by day. In a short paper like this, it will enable us to deal with the matter more clearly and succinctly, if, instead of a chronological,

[1] C. Darwin, *Expression of Emotions;* and *Biographical Sketch of a Child*, *Mind*, vol. ii., 1877.

[2] *The Mind of the Child.* International Educational Series, 1890.

[3] *Kind und Welt*, 1856; see Preyer's Appendix. The book itself seems to be now out of print.

[4] *Acquisition of Language by Children;* contributed originally to the *Révue Philosophique;* translated into English for *Mind*, vol. ii., 1877.

[5] *An Infant's Progress in Language*, *Mind*, vol. iii., 1878.

[6] *The First Three Years of Childhood*, 1889.

[7] *Mental Evolution of Man*, 1888.

we adopt an analytic method, and treat of each factor fully before proceeding to take up the next factor. This arrangement will, in the case of each factor under consideration, help us to bring together without confusion, as occasion may require, the observations that have been made on it by the various writers that have paid special attention to it.

The plan of this chapter will be quite clear to the reader if he will, before reading it, examine with care the accompanying Diagram. It is hoped that the Diagram will be found to be so easily understood as not to require description. The only point that requires to be specially stated is that the various factors of the Diagram will, in this chapter, be taken up from left to right, in the order of the Diagram, Crying being first considered, and the Production of Intelligent Speech last.

Independently of speech properly so-called, there are other means by which the child can give expression to its emotions and states of feeling. Such are Crying and Laughing, Crowing, and the Language of Facial Expression and Gesticulation. The development of these methods of expression is intimately related to the development of speech proper. There is a language in the very tones of the child's voice, and in the expression of its face—a language inherited rather than acquired—which is understood by mothers and nurses from a very early period of the child's life. The same language of vocal tone, facial expression, and gesticulation, used by the parents, is understood from a wonderfully early period by the child. It forms, indeed, the first means of communication between the minds of parent and child; and, later, it plays an extremely important part in the education of the child to the understanding of speech properly so called.

I propose in the following brief sketch to say, in the first place, a few words about each of these inarticulate methods that Nature has provided for communicating information to others regarding states of thought and feeling.

Expressive Inarticulate Sounds.

A. Crying.—Naturally, the first Expressive Inarticulate Sound that claims our attention is Crying. It is by crying that the child announces its arrival in the world; and for months after-

wards it occupies itself much in crying while awake, partly perhaps for exercise, and frequently as an indication of hunger or wetness, or some other form of discomfort. Both Preyer and Darwin make some valuable observations about crying. Preyer says that, in crying, certain vowel-sounds can be more or less clearly distinguished, viz., those of **uä, uä**, which may be represented in English by the sounds of **oo eh, oo eh.** These are repeated, with untiring uniformity, for many months; only a few other sounds being added to them, viz., the syllables **ma, nei nei**, which in his child made their appearance in crying on the 64th and 65th days. He observes that even within the first five weeks, notwithstanding the uniformity of the vowel-sounds, the tones of the voice are so varied, that it may be told with certainty from these alone whether the child feels hunger or pain. There is screaming, with eyes firmly closed, in hunger; whimpering in slight indisposition, etc. During the 18th month, he notes still greater precision in the expression of the various moods by these inarticulate tones; and states that by screaming, wailing, whimpering, and weeping, moods of grief, desire, hunger, wilfulness, and fear, are made easily recognisable.

Darwin, in his work on the *Expression of the Emotions*, says (p. 160) that infants, when young, do not shed Tears when crying, although tears may be caused to flow by reflex irritation of the conjunctivæ. On one occasion he accidentally brushed the open eye of his child with the cuff of his coat, and noticed that, although the irritated eye watered and the child screamed violently, the other eye remained dry. In this child, his first observation of the free effusion of tears during screaming was when the child was at the age of 139 days: they rolled down the cheeks. He states that in other children he has found the period at which the eyes become slightly suffused with tears during crying to be very variable, being in one child as early as the age of twenty days, and in another at sixty-two days. In one instance he was positively assured that tears ran down at the unusually early age of forty-two days.

Preyer thinks Darwin mistaken in placing the date for the shedding of tears so late as he does. He believes that in German children pain causes the shedding of tears almost from the first, and states that in them it is not weeping, but sobbing, that first comes so late.

Darwin directs attention to the closure of the eyes during screaming, and to the square shape of the open mouth. He quotes with approval the description by Mrs Gaskell of a baby crying. She says, "It made its mouth like a square, and let the porridge run out at all four corners." Darwin also directs attention to the contraction of the corrugators and the firm closure of the eyelids that are associated with screaming.

B. LAUGHING.—Darwin makes some interesting remarks regarding the Physiology of laughter. At p. 220, *op. cit.*, he says that whether laughter should be regarded as the full development of a smile, or a smile as the last trace of a laugh, we can follow, in infants, the gradual passing of the one into the other. Recognising how difficult it is to be sure when the motions about an infant's mouth ought to be interpreted as a smile, he carefully watched the phenomena in his own infants. He found in one of them a pretty distinct smile at the age of forty-five days; and eight days later, the smile was unmistakable—the eyes becoming bright and the nose transversely wrinkled. There was at the same time a little bleating noise which perhaps represented a laugh. At the age of 113 days this noise became more broken and interrupted, as in sobbing; and he then regarded it as certainly incipient laughter. In two other children, smiling appeared at about the same date as in the first child.

Preyer's boy seems to have smiled rather sooner than Darwin's children. Quoting Pliny's remark that no child laughs before the fortieth day, Preyer says, "I observed an audible and visible laugh, accompanied by a gleam of the eye, in my child for the first time on the twenty-third day. He was pleased with a bright rose-coloured curtain that was hanging above him; and he made peculiar sounds of satisfaction, which first led me to pay attention to him." The child afterwards laughed as a sign of joy, on looking at his mother's face, from the sixth to the ninth week; and by the sixth month his laugh had become merry, being accompanied by rapid raisings and droppings of the arms as a sign of the utmost pleasure. It first became persistently loud, in play with his mother, in the eighth month; so that every one could then at once recognise it as a laugh without looking in that direction. At such times, "the child made a peculiar impression of gaiety upon every one who saw him." The father notes that towards the

close of the first year the laugh became different, being more conscious, and indicative of more understanding than before.

Preyer notes that the child could by tickling be made to laugh even as early as the second month. Later, this reflex laughter was found to bear a close resemblance to that produced by the imitation of laughter in others. It did not seem to be fully possessed of the merry ring of the spontaneous expressive laughter.

Darwin says that in the gradual acquirement by infants of the power of laughing we have a case in some degree analogous to that of weeping: practice is necessary before the child can either laugh or weep; just as it is necessary before he can walk. The art of screaming, on the other hand, from being of service to very young infants, is finely developed from the earliest days. He holds that children probably laugh and cry by inherited instinct, and that they understand by instinct these actions in others. He says (p. 379) that one of his own children at the age of four months understood a smile, and responded to it by another; and that the same child, when a few days over six months' old, was brought by sympathy to the point of weeping, when his nurse pretended to cry. Darwin remarks upon the retention of weeping throughout life by savages as a means of expressing emotion; and quotes from Sir John Lubbock the case of a New Zealand chief "who cried like a child because the sailors spoiled his favourite cloak by powdering it with flour." He thinks that laughter is primarily the expression of mere joy and happiness; as we clearly see in children at play, who are almost incessantly laughing. He once heard a child a little under four years old, when asked what was meant by being in good spirits, answer, "It is laughing, talking, and kissing."

C. Grunting.—This is an inarticulate sound of a more or less expressive character, which may be placed alongside of crying and laughing. Preyer noted it within the first three months, as an announcement of completed digestion, or of wetness; and says that for the first of these states it was retained by the child into the seventeenth month. It was generally associated with "abdominal pressure," and with lively movements of the arms.

Language of Facial Expression and Gesture.

A. Facial Expression.

(*a.*) *Frowning.*—Darwin, carefully observing his own infants from under the age of one week to that of two or three months, found that "when a screaming fit came on gradually, the first sign was the contraction of the corrugators, which produced a slight frown, quickly followed by the contraction of the other muscles round the eyes." He states that, when an infant is uncomfortable or unwell, little frowns may be seen to pass like shadows over the face, and that these are sometimes followed by a crying fit. He notes a steady little frown on the face of an infant seven or eight weeks old who was sucking some milk which was cold and therefore displeasing to him.

(*b.*) *Rage.*—Darwin says that in one of his own infants under four months old he repeatedly observed that the first symptom of an approaching passion was the rushing of blood into the bare scalp. He says that "every one who has had much to do with young children must have seen how naturally they take to biting when in a passion. It seems as instinctive to them as in young crocodiles, who snap their little jaws as soon as they emerge from the egg." Preyer, referring to children about the age of seventeen months, observes that when no response is made to a persistently expressed desire they may be seized with a regular fit of rage, throw themselves on the floor, strike out when taken hold of, and scream furiously and most angrily; but he notes that it may also happen that disappointments of this sort produce tears of sorrow instead of fits of rage. Frowning, flushing, and screaming are noted as among the common indications of anger in children.

(*c.*) *Disgust.*—Darwin (p. 273) says that he never saw disgust more plainly expressed than on the face of one of his infants at the age of five months, when, on one occasion, some cold water, and on a subsequent occasion, a piece of ripe cherry, was put into his month. This was shown by the lips and whole mouth assuming a shape which allowed the contents to run or fall quickly out; the tongue being at the same time protruded. He remarks that the protrusion of the tongue in letting a nasty object

fall out of the mouth may explain how it is that lolling out of the tongue universally serves as a sign of contempt and hatred.

(*d.*) *Sulkiness.*—Darwin (p. 242) shows that sulkiness in young children is shown by pouting, or, as it is sometimes called, "making a snout." "When the corners of the mouth are much depressed, the lower lip is a little everted and protruded, and this is likewise called a pout. But the pouting here referred to consists in the protrusion of both lips into a tubular form, sometimes to such an extent as to project as far as the end of the nose, if this be short. Pouting is generally accompanied by frowning, and sometimes by the utterance of a booing or whooing noise. This expression is remarkable as almost the sole one, as far as I know, which is exhibited more plainly during childhood, at least with Europeans, than during maturity. There is, however, some tendency to the protrusion of the lips with the adults of all races under the influence of great rage. Some children pout when they are shy, and they can hardly then be called sulky."

(*e.*) *Guilty Expression.*—Darwin (p. 275) notes that he observed a guilty expression without a shade of fear in some of his own children at a very early age. "In one instance the expression was unmistakably clear in a child two years and seven months old, and led to the detection of his little crime—the taking of pounded sugar which he had been told not to take. It was shown, as I record in my notes made at the time, by an unnatural brightness of the eyes and by an odd affected manner impossible to describe. As he had never been in any way punished, his odd manner was certainly not due to fear, and I suppose it was pleasurable excitement struggling with conscience."

(*f.*) *Surprise.*—Both Darwin and Preyer remark on the elevated eyebrows and open mouth as indications of surprise; and Darwin tells an anecdote which shows that children at a distance can interpret the lifting up of the hands, with fingers extended and spread apart, as an indication of astonishment.

(*g.*) *Fear.*—Preyer (vol. ii., p. 132) notes screaming as a sign of fear, which in his child was most markedly produced by anticipation of the cold bath; and he observes (p. 131) that fear is one of the moods of mind which the child makes easily recognisable by the character of its screaming. Darwin, as is well known, has very fully described the indications of fear in man and in the lower

animals; but he says nothing regarding it that applies in any special way to children.

(*h.*) *Blushing.*—About the phenomenon of blushing, Darwin has a great deal that is interesting to say. He distinguishes it from the flushing of rage, which is common to man and some of the lower animals; and holds that blushing is the most strictly human of all expressions; that it cannot be produced by any physical means; and that the psychical condition which seems necessary for its production is self-consciousness and sensitiveness to the opinions of other people regarding personal appearance, conduct, etc. He shows that idiots do not blush, and that blushing never occurs in very early infancy. Excessive blushing is frequently an inherited peculiarity. When the tendency is strongly developed, it may appear at the age of two or three years. He has notes of two little girls blushing at the age, of between two and three years, and of another sensitive child a year older, blushing when reproved for a fault; and he states that many children, at a somewhat more advanced age, blush in a strongly marked manner. Young people always blush more freely than the old. He has a good deal to say about Shyness as a cause of blushing. He says, "with young children it is difficult to distinguish between fear and shyness, but this latter feeling with them has often seemed to me to partake of the character of the wildness of an untamed animal." In one of his own children he noticed a trace of shyness at the age of two years and three months. It was shown, not by a blush, but by the eyes being for a few minutes slightly turned aside. He thinks that shyness, and shamefacedness, and real shame, are sometimes exhibited in the eyes of young children before they have acquired the power of blushing. He holds that, as shyness apparently depends on self-attention, "we can perceive how right are those who maintain that reprehending children for shyness, instead of doing them good, does much harm, as it calls their attention still more closely to themselves." Remarking on the absence of self-consciousness in children at a very early age, he says that "it is one of their chief charms that they think nothing about what others think of them. At this early age they will stare at a stranger with a fixed gaze and unblinking eyes, as on an inanimate object, in a manner which we elders cannot imitate."

B. Gestures.

(*a.*) *Negation and Affirmation.*—One of the gestures which is soonest acquired by children is the moving of the head from side to side as an indication of negation. Darwin thinks that this movement, as well as the companion movement of nodding for affirmation, may have originated in connexion with the feeding of children. When the child is willing to take its food, it bends the head forward, but, if unwilling, it turns the head to one side. In the latter case, if the food be pressed upon it, it may turn its head alternately to the one side and to the other. Later, the child is easily trained to employ these movements as indications of affirmation or negation. Preyer states that his child first shook the head from side to side when any one said "No, no," to him in the thirteenth month, but that he did not learn the affirmative nod till the fifteenth month.

(*b.*) *Pointing with the Hand or Finger.*—This is a very important gesture, much used by young children. Preyer states that it is already employed with perfect correctness before the first attempts at expression in words. He refers to a little girl of eleven months, who, not yet able to speak at all, answered such questions as "Where is Papa?" "Where is Nanny?" correctly, without a single mistake, by movements of the eyes, and by indicating direction with the finger. He states that later this pointing is used as an expression of a wish. One of Darwin's children, for example, at the thirteenth month, picked up a piece of paper and gave it to his father, pointing to the fire, because he wished to have the pleasure of seeing it burn.

Many other gestures might be described, such as the stretching out of the hands and grasping with the fingers when something is wanted; such movements being developed from a very early period. Shrugging of the shoulders, as indicative of helplessness, is frequently developed, by inheritance or imitation, in the children of French and German parents; but is rare in English children.

Sometimes the child's Actions are full of expression,—for example, those of Preyer's child of twenty-two months when he wished to sit at the table. "No one listening to his entreaty, he goes into the corner of the room, tries with a great effort to get a heavy

chair, does not rest till he has placed it at the table, strikes with the flat of his hand on the seat of the chair, thus expressing plainly without words what he wants, and exults when he has been put up on the chair."

Preyer thus concludes his consideration of this subject:—"The variety in the expression of the countenance, when, in the second and third years, the separate passions gradually awake, is indescribable; and, on account of the transitoriness of the phenomena, is hardly to be reproduced pictorially. Jealousy, pride, pugnacity, covetousness, lend to the childish countenance a no less characteristic look than do generosity, obedience, ambition. These states could not be recognised by the expression of countenance unless each of them had its own expressional movements; and, in fact, these movements appear in greater purity in the child, who does not dissemble, than they do in later life."

As to the power of the passion of jealousy in children, Perez[1] has some interesting remarks. He says, for example, "One of my nephews at the age of three years used continually to talk of the little brother he was soon to have. 'I shall love him so much,' he would say every instant. But when he saw the baby taken up on his mother's lap, and kisses and caresses, and his father's care and attention, he expressed his annoyance loudly. He even said to his mother, 'Won't little Ferdinand soon die?' When the baby began to walk and talk, the elder child would torment him in hundreds of naughty ways; beating him, dragging him out of his chair in order to take his place, shouting in his ears, calling him naughty and ugly, taking away his toys, and mimicking his way of talking and walking."

Automatic Exercises of the Speech Organs.

A. Babbling. — This is a most interesting phenomenon, exhibited by all healthy children from a very early age. It is the Automatic and Unconscious Exercise of the organs, which at a future time will become the agents of Speech. Just as the child, before he can walk, must exercise his limbs in kicking and sprawling, so, before he can even begin to speak, he must exercise

[1] *Op. cit.*, p. 71, *et seq.*

his organs of Speech in a similar inco-ordinate fashion. In crying and laughing, as already shown, the organs of Phonation are abundantly exercised. In Crying, the Oral Mechanism has been observed to take a slight part, sufficient for the imperfect production of a few vowel sounds, and one or two consonants. But, in Babbling or Prattling, we have something altogether different: something more nearly akin to the movements of articulate speech, inasmuch as the Oral Mechanism takes part in it almost as actively as the Vocal. In babbling or prattling, vowels are produced in much greater variety, and with much greater distinctness than in crying, and consonants are for the first time produced abundantly, their variety being, indeed, astonishing.

From the very detailed notes of Professor Preyer, we may make a few illustrative extracts showing the progress of his child in the production of vowel and consonant sounds during this process of babbling.

On the forty-third day, Preyer heard the first consonant. "The child in a most comfortable posture, uttering all sorts of obscure sounds, said once distinctly, **am-ma**. Of vowels, **a o** was likewise heard on that day. But on the following day the child surprised me and others by the syllables, spoken with perfect distinctness, **ta-hu, ta-hu**.

"On the forty-sixth day, in the otherwise unintelligible babble of the infant, I heard, once each, **gö** (ö nearly like **i** in bird), **örö**; and five days later, **ara**.

"In the eighth and ninth weeks, the two utterances **örrö** and **arra** became frequent; the **ö** and **a** being pure, and the **r** uvular. It has already been noted that **ma** and **nei-nei** were produced, in crying, on the sixty-fourth and sixty-fifth days. On the sixty-fifth day, **a-omb** was produced, in babbling.

"On the day after, distinctly, once each, **la, grei, aho**; and, besides, **ma**, again.

"On the sixty-ninth day, the child when hungry uttered repeatedly, and very distinctly, **mömm** and **ngö**.

"In the tenth week, of the syllables earlier spoken, only **örrö** is distinctly repeated. On the seventy-first day, the child being in the most comfortable condition, there comes the new combination **ra-a-ao**; and five days later, in a hungry and uncomfortable mood, **nä** and **nāi-n**.

"On the seventy-eighth day, the manifest sign of contentment **habu** was very distinct; and likewise in the twelfth week, **a-i** and **uāo**, as well as **ä-o-a**, alternating with **ä-a-a** and **o-ä-ö**.

"It now became more and more difficult to represent by letters the sounds already more varied, and even to distinguish the vowels and repeat them accurately."

The above may be taken as an example of Preyer's detailed observations. But it will not be necessary for us to follow his description further in full detail. It may suffice to say that, within the first seven months, all the vowel and consonant sounds, with a few exceptions, had been recognised in the babble of the infant. The exceptions were **w**, which appeared in the twelfth month; **s**, in the fourteenth; **z**, in the fifteenth; **f**, in the sixteenth; and **sh**, which did not appear until the twenty-fourth month, when the child had already acquired some amount of actual speech power.

One of the chief occupations of a healthy child is this babbling or prattling, and he is most apt to practise it when he is feeling happy and comfortable.

B. Crowing.—When he is specially happy he frequently practises Crowing, which appears to be little else than a loud and joyous production of sounds of the same nature as those of babbling. Preyer notes that, on the seventy-eighth day, the manifest signs of contentment were **habu**, **ai**, **uāo**, etc. About the fifth month, began the amusing crowing of the child, an unmistakable expression of pleasure; the child pronouncing the strong aspirate sound **ha** with the labial **r** in **brrr-há**, as well as other sounds, such as **aja** (**j** like **y** in English). About the thirteenth month, the joyous crowing sound had become stronger and higher; the child crying out, on seeing his mother in the distance, a sound which might be represented by the letters **ăhijă**.

The habit of babbling and crowing is retained by the child even after he has begun to acquire the power of Speech. Preyer's child in the thirty-fifth month is reported to have been found repeating all sorts of meaningless syllables again and again, much as in the period of infancy, only more distinctly; "but, just as at that time, they cannot all be represented on paper, or even be correctly reproduced by adults."

C. Mimic Reading.—A further development of babbling is

the child's Mimic Reading of books and newspapers. This was first noticed by Preyer during the fifteenth and sixteenth months. He says, "The child likes to take a newspaper or a book in his hands and hold the print before his face, babbling **ä-ĕ, ä-ĕ, ä-ĕ,** evidently in imitation of the reading aloud which he has often observed. By giving the command, 'Read,' it was easy to get this performance repeated." It was again observed in the nineteenth month, when the child, spreading a newspaper on the floor, "read" over it for a long time in a monotonous voice, **e-já-e-e-ja nanana ána-ná-na atta-ána āje-já sā.** It was kept up in the same manner in the twentieth month. In the twenty-first month, the reading became still more frequent; but, singularly enough, the sounds, from the eighty-ninth week on, became different, the consonants becoming more prominent than they had hitherto been. In the twenty-seventh month, it is noted that babbling monologues are becoming less frequent.

D. Echolalia.—This curious phenomenon seems, in the progress of development, gradually to take the place, to a considerable extent, of the babbling monologues above described. The child may begin to practise it even before he has acquired the power of pronouncing any actual words, spontaneously or at command; the pronunciation of words by Echolalia seems at first to cost him much less effort than the pronunciation of words at command; and the words produced by Echolalia are, in the first instance at least, produced in a parrot fashion, without the slightest inkling of their meaning, and without any apparent effort on the part of the child to understand them. They are mere sound-imitations, and for the most part are repetitions of the last words in sentences that the child has just heard spoken in his vicinity. The child repeats the last word again and again mechanically. No doubt this mechanical repetition plays an important part, as a preliminary exercise, in the development of actual speech. The words will by-and-by be produced intelligently with all the greater ease, if their pronunciation has already been practised mechanically. Preyer, in the fourteenth month, first noted this parrot-like repetition; the first examples of it being given in the repetition of syllables that the child had in the first instance uttered of his own accord, and that his father, Preyer himself, had immediately afterwards pronounced

to him. "Thus **attäi, täi, atta,** were often easily and correctly repeated in this way; but, strangely enough, frequently in a whisper." In the twenty-third month, it is noted that if the child hears some one speak he often repeats the last syllable of the sentence just finished, if the accent be on it; as in 'What said the *man?*' when he says **man**; or in 'Who is *there?*' when he says **there**. Once the name Willy was called; and immediately the child called **ŭilē**, with the accent on the last syllable; and repeated the word many times. In the twenty-fourth month, Echolalia is still further developed: the child after hearing shouted the German word 'Herein!' ('Come in!'), repeated it as **arein, arrein, ha-arein**; at first as a sound, but afterwards with more intelligence, looking at the door. In the twenty-seventh month, articulation being further developed, the child is able to repeat by Echolalia little sentences which he has just heard pronounced; and some of these, at subsequent times, he would occasionally reproduce from memory without understanding them, to the great amusement of the family; for example, **Um Gottes willen** (for God's sake), and **Da hastn** (there you have him). He also imitated all sorts of noises, such as the whistle of the locomotive, and the voices of animals.

Intelligent Speech.

A. The Understanding of Spoken Words.—How early the awakening intelligence of the child begins to interpret the language of gesture, tone of voice, and facial expression, has already been illustrated by the case of one of Darwin's infants, who at four months smiled in response to a smile, and at six months was brought to the point of crying when the nurse pretended to cry. The Understanding of Spoken Words dawns upon the child considerably later. In learning to understand words and to speak, girls are, as a rule, earlier than boys. The case of one little girl has already been cited, who at eleven months correctly answered the questions, "Where is Papa?" "Where is Nanny?" etc., by pointing with the fingers, though not yet able to speak a word. In a process of development, it seems natural that words should be understood before they can be intelligently produced; and it is the fact that, throughout the process of learning to speak, the

understanding of what is spoken keeps far ahead of the power of independently producing spoken words.

In most children, the understanding of certain words in very familiar use, such as **papa** and **mama**, seems to dawn upon the child towards the end of the first year, or about the beginning of the second. Preyer notes that, in the twelfth month there was for the first time developed in his boy an *ability to discriminate* words heard. "The child turns round when his name is spoken in a loud voice: he does this, it is true, at other loud sounds also, but then with a different expression. In the thirteenth month, the word **mama**, which formerly had often been used by the child in his babbling, is now for the first time referred to his mother." Preyer remarks that in this month, the first of the second year, the most important advance consisted in the now awakened understanding of spoken words. "The ability to learn, or the capability of being trained, has emerged almost as if it had come in a night. The child is now easily taught to hold up his arms, when the question is asked, 'How tall is this child?' and to hand prettily an ivory ring to his father, when asked, 'Where is the ring?' If, when he is holding a biscuit to his mouth, he is asked to give, he holds the biscuit to the lips of the person who asks him."

In the fourteenth month, the understanding of words heard is found to have still further advanced. He knows where the clothes-press is; and turns his head in the right direction when asked, "Where is papa—mama—the light?" When asked to play the piano, he beats his hands on the table. If anyone speaks to him of the nose, he snorts. When 'No, no,' is said to him, he shakes his head from side to side. Yet, with all this rapidly advancing understanding of spoken words, there is, at this time, no power of producing speech properly so called. The child cannot even repeat 'Pa' or 'Ma' or 'o' or 'e,' and the only word which he employs with a definite meaning is one of his own invention, viz., **atta**, which with him signifies **away** or **gone**.

In the fifteenth month, when coughing is spoken of he coughs; when blowing, he blows; when kicking, he stretches out his legs; and when the moon, the clock, the eye, or the nose is mentioned, he raises an arm, spreads the fingers, and looks in the proper direction. He also gives his hand when asked to do so.

In the sixteenth month, he can point out the features of his own face, and knows where 'the other eye' and 'the other ear' are.

In the eighteenth month, a number of additional words are understood; such as finger, glass, door, sofa, thermometer, stove, watering-pot, and biscuit. Still, as yet, the repeating of syllables spoken for him is rare; even the word **Mama** being responded to by '**ta**.'

In the nineteenth month, **Pa** is at last correctly pronounced in imitation; and in the twentieth he can say **Papa**.

From this time forward, the vocabulary of words that are understood rapidly increases; and it continues to keep ahead of the vocabulary of words which can be pronounced by the child. But it will not be necessary for us further to follow the progress of the child from month to month.

B. Words of Child's Own Invention.—A few remarks may now be made about the specific word-sounds of their Own Invention which some children from a comparatively early period employ in making known their wants, or in giving expression to their emotions. Both Darwin and Preyer have noted some of these. Darwin says that one of his children, in the twelfth month, when he wanted food, began to say **mum**, instead of beginning to cry as formerly. At a later time, **shu-mum** was used for sugar, and still later, **black shu-mum** for black sugar, these words being pronounced with a very marked tone of longing. Preyer says that his boy frequently in crying said **momm** when hungry; that this was noticed even so early as the tenth week; and that a child observed by Frau Schultze of Dresden used to say **mäm-äm** in the same circumstances. **Mimi** was a word used by Preyer's boy as a general designation for food. It was supposed to be derived by the child from the word **Milch**, which he was in way of hearing frequently. It appeared first in the twenty-first month, and was often uttered with indescribable longing. **Hay-ŭh** was a begging sound associated with stretching out of the arms and forward inclination of the body, which began to be used during the first three months of the second year. **Atta**, as already indicated, was a word employed, for a considerable period, with the meaning of away, when anything disappeared or a light went out. It first began to be used in the fourteenth month.

Preyer thinks it a mistake to designate these words as "words of the child's own invention." He regards them as probably obscure imitations of words that the child has been in the habit of hearing: **Mimi**, for example, being probably derived from **Milch**. Cases, however, are recorded by others, in which a copious vocabulary of such words, each word with its definite signification, was employed by the child for a lengthened period before any serious attempt was made to employ words of the mother-tongue. Romanes[1] records two remarkable cases of this description.

In the first case, two twin boys, remarkably alike in personal appearance, invented, at the age when speech is usually first developed, a language of their own; and for several years no pains could induce them to speak anything else. Even the usual first words 'papa, mama,' they refused to use. They had their own names for their parents and for their aunt; and, talking in their own speech, they played together with all the liveliness and volubility of common children. Their word for carriage was 'ni-si-boo-a;' and when a carriage was heard in the street, they would shout this word, and run to the window to see it.

The second case was that of a girl, aged four-and-a-half years, sprightly, intelligent, and in good health. At two years, she had been backward in speaking, and used only the words **Papa** and **Mama**. After this, she began to use words of her own invention, and, though she readily understood what was said, never used the words used by others. Gradually she accumulated a considerable vocabulary of her own words. She had a brother, eighteen months younger than herself, who learned her language. When the two were together, they could converse with great rapidity and fluency. It is curious that in this case, although the parents were American and spoke English, and no French-speaking people lived in the house, some of the words employed were in sound closely allied to French. Thus **feu** meant 'fire, light, cigar, sun;' **too** (Fr. 'tout') meant 'all, everything;' and **nepa** (Fr. 'ne—pas') meant 'not.' **Petee-petee** (an apparent equivalent of the French 'petit') was the name given by the girl to her little brother; and **ma** (Fr. 'moi') meant 'me' or 'I.' The word **mea** signified both cat and furs; but this is almost the only trace, in the language, of words suggested by the imitation of sounds. A considerable list of other

[1] *Op. cit*, p. 138, *et. seq.*

words is given from the vocabulary of this curious case. **Migno-migno** signified 'water, wash, bath;' **go-go**, delicacies; **gar**, 'horse'; **deer**, money of any kind; **beer**, literature, books, etc.; **peer**, 'ball'; and so on. It will not be necessary to give the case in full detail: the specimens of words already given will suffice to show that the designation "words of the child's own invention" is probably the best that could be used for the words thus occasionally formed and used by children. In most cases, there is nothing in them to suggest, even remotely, imitation of the mother tongue.[1]

C. Intelligent Speech Production.—In following the progress of Preyer's boy as he began to accumulate a vocabulary of words which he understood but could not pronounce, we found that about the nineteenth month the vocabulary was already considerable. It presented a remarkable contrast to the small number of words with definite meaning that he was as yet able to use for the purposes of speech. These consisted merely of his old self-invented word **atta** and the words **pa** and **papa**. During the progress of that month, however, he made many efforts to imitate other words that were pronounced to him: thus, for 'bitte' (please) he said **bis, bits**; etc. For 'Fleisch' (meat) he said **daisch**. In the twentieth month, he correctly reproduces several words of two syllables, such as **Papa, Mama, bebe, baba**, and **neinei**; but 'trocken' yields **tokke**, and 'warm' and 'weich' become **wāi**. For 'adieu' he gives **adē**; and he declines to try 'Gute Nacht,' though he holds out his hand when one says it to him. In the twenty-first month, the father notes that words of unlike syllables are not repeated at all: not even 'bitte' (please). In place of 'danke' he gives **dank-kee**—at an earlier time it had been **dakku**. When asked, "Do you want milk?" he replied **Neinein**; and, on another occasion, when asked, "Does it taste good?" he answered **Jaja**. In the twenty-second month, he is remarked to obey orders with surprising accuracy. In the twenty-third month, the first spoken judgment is noted: he said **heiss** (hot), when he found milk too hot in

[1] The first of these two cases was originally published by Mr Horatio Hale, in the *Proceedings of the American Association for the Advancement of Science*, vol. xxxv., 1886.

The second case was originally published by Dr E. R. Hun, in the *Monthly Journal of Psychological Medicine*, 1868.

drinking it; and in the same week, looking at the stove, he suddenly said with decision **heiss** (30 weeks previously he had reproduced **heiss** by Echolalia without understanding it). 'Wasser' is now pronounced as **Watja**; and **Mimi** means milk and food in general. His grandparents he designates as **E-papa** and **E-mama**. A great many words can now be imitated more or less correctly; 'Ohr' being given as **Oa**, 'Haus' as **Hausesess**, 'Hand' as **Hann**, 'Finger' as **Finge**, 'Karl' as **Kara**, 'Butter' as **Buotõ**. (Echolalia is about this time noted as being very active.) Spontaneously the child says **Ab** (off), when he wants a neck-ribbon loosened. For "Guten Morgen" he says **Moigen**, and for "Gute Nacht" he says **Na**. In the twenty-fifth month, progress is noted as extraordinary. It is observed that the vowels give the boy no difficulty, with the exception of **u (oo)** and **i (ee)**, which he does not yet produce perfectly. Among the consonants, **sch** (sh) is still omitted; as also are many double consonant-sounds, such as **cht**. He now gives in his own fashion the names of many things when they are pointed to, saying, for example, **Nana** for 'Nase' (nose); **Ba** for 'Backe' (cheek); **Tenn** for 'Kinn' (chin); **Ann** for 'Hand.' In the twenty-sixth month, **sch** (sh) now appears for the first time, in the word **Handschuh** (glove), but not in other words. He now for the first time begins to use verbs, but always in the infinitive, as, **Mama auch tommen** (Mama come too); and he makes new infinitives out of nouns, saying, for example, **messen** from 'Messer' (knife), when he wishes to have an apple pared. He now in his own way expresses his feelings by words; exhibiting, for example, much sympathy when dolls are being cut out of paper, being afraid that the head (**Topf**) may be taken off; and crying "**arme Holz**" (poor wood), when a stick of wood is thrown into the stove. In the twenty-eighth month, besides other indications of great progress, he asks his first question, viz., "Where is Mima?" It is noted that, in his articulation, he still misses **s** and **sch** frequently. In the twenty-ninth month, he uses the first personal pronoun for the first time, saying "Bitte gib mir Brod" (please give me bread). He had formerly designated himself by his Christian name, Axel. In the thirty-second month, he uses this pronoun in the nominative case, saying, "**Ich komme gleich**" (I am coming immediately). In the thirty-third month he has progressed so far as to use sentences of some length; thus,

pointing to the picture of a cock, he says, "**Das ist der Hahn —kommt immer—das ganze Stück fortnehmt—von der Hand—und laüft fort**" (That is the cock—keeps coming—takes away the whole piece—out of the hand—and runs off). This refers to his previous feeding of fowls, at which a cock had actually behaved as described. During this month, he for the first time uses the second personal pronoun, remarking, "What a pretty coat you have." It is about this time remarked that a feeling of self-hood is becoming strongly developed, so that the boy wishes to do everything for himself, without help. When asked where he learned such and such an expression, he replies that he learned it "himself alone." In the thirty-fifth month, a feeling of causality begins to be expressed in language. Questions are now asked till it reaches the point of weariness: "Why is the wood cut?" "Why does Frederick clean the flower-pots?" and so on, *ad infinitum*. The father says that it seems remarkable that he did not once hear the child say "When?" until the close of the third year. "The sense of space is but little developed at this time, but the sense of time still less." It is remarked that the articulation is being speedily perfected, so that of German sounds the **sch** alone is seldom correct, being represented by **s**. It did not finally replace the **s** until the forty-six month.

In the thirty-sixth month, grammatical errors are becoming much more rare, and long sentences are formed correctly, though slowly and with pauses. The father remarks that the child's manner of speaking, now that he was three years old, approximated more and more rapidly to that of the family, through continued listening to them and imitation of them. He therefore, at the conclusion of the thirty-sixth month, gave up taking notes.

The above are but examples of the very detailed observations recorded by Professor Preyer regarding the progress of his boy. Many details have been omitted; but the work itself is easily accessible, and is worthy of careful perusal. It appears to me that one of the most striking facts brought out by this valuable record is the marked difficulty which a child experiences in his first attempts to pronounce syllables or words by a definite effort of the will, either spontaneously exercised or made at request. This difficulty becomes all the more striking when one considers

the apparent ease with which, for months previously, consonants and vowels have been produced in automatic babbling, and words, and even phrases, have been reproduced by the process of Echolalia. The first efforts at intelligent speech call into action the higher and more conscious functions of the Cerebrum, which, as yet, have had little or no concern with the processes of articulation. Everything goes to show that the higher centres can learn their own duties with regard to speech, and train the lower speech-centres to prompt and perfect obedience, only after a period of persevering effort. All such effort involves the exercise of intelligence and attention. In our next chapter, we shall find that the chief Developmental Derangements of speech are to be met with in children who are feeble minded, and therefore defective in intelligence and the power of attention. These children are incapable of making the sustained effort required for the training of the nervous mechanism.

Even in Preyer's boy, great difficulty, sometimes betrayed by efforts of straining, was observed in the production of syllables at command for the first time. But another case, reported by M. W. Humphreys, Professor of Greek in Vanderbilt University, Nashville, and referred to by Preyer in his Appendix (p. 257), exhibits the transition from automatic and mechanical Babbling and Echolalia to Intelligent Speech-production in an even more striking manner. This child, a girl, when only four months old, began in her babbling a curious mimicry of the tones of ordinary conversation. It is reported that, when she was six months old, the articulation in these babbling conversations was singularly distinct. When she was eight months old, it was found that she knew by name every person in the house, as well as a great many of the objects around her. At the eleventh month, she could imitate with accuracy any sound given her; and she indulged in monologues, in which she used a great many real or imaginary words without reference to meaning. But now came the transition step. "After the first year, her facility of utterance seems to have been lost; so that she watched the mouths of others closely when they were talking, and laboured painfully after the sounds. Finally, she dropped her mimicry of language, and, at first very slowly, acquired words with the ordinary infant pronunciation; showing a preference for labials (p, b, m), and linguals (t, d, n, but not l)." This case is no doubt exceptional, and Preyer regards it as, up to

this time, unique; but it is extremely instructive, as showing, in a very striking and exceptional way, how different is the action of the Cerebrum in babbling and echolalia, from its action in the production of voluntary and intelligent speech.

A subject upon which a few words may still be said, is the order in which the vowels and consonants are produced for the first time, during the earliest efforts at voluntary speech. This order certainly seems to differ from that observed in the production of the babbling sounds. In the latter, it would appear that the vowels and consonants are from the first produced almost indifferently, and with equal ease; only a few—viz., **w**, **s**, **z**, **f**, and **sh**—being, in the case of Preyer's boy, for some months delayed. In voluntary speech, on the other hand, there is certainly an order of difficulty; though to make out this order in detail many cases would have to be recorded and compared. At present, we can only say:—(1.) As to the vowels, that **i (ee)** and **u (oo)** are the only ones not pronounced with ease from an early period; (2.) As to the consonants, that the three pronounced during closure of the Labial, or first stop-position—viz., **p**, **b**, and **m**—and the corresponding three pronounced during closure of the Anterior Linguo-Palatal, or second stop-position—viz., **t**, **d**, and **n**—seem to be the easiest for the child, and generally the first employed. Everybody knows that the syllables **pa**, **ba**, **ma**, **ta**, **da**, **na**, rank among the first which can be reproduced by the child. The consonants produced during closure of the third stop-position—viz., **k**, **g**, and **ng**—are later in appearing as parts of voluntary speech; and sometimes their appearance is delayed for months, or even for years. Among the fricatives, those which most frequently present difficulties to the child are probably **r** and **l**, and, in a less degree, **sh**, **s**, **ch**, and **y**. Preyer's boy had special difficulty with the **sh** sound as compared with the **s**; but the reverse of this sometimes happens, as is shown by the case of a child observed by Gustav Lindner (see Appendix to Preyer's second volume), who for months used the **sh** sound instead of the **s**.

Another point well worth noting is the "Smudging" or Scamping of the syllables in baby speech. The child omits the consonants difficult to him; sometimes putting nothing in their stead, and sometimes substituting for them others that he can pronounce without effort. He also converts double consonants into single ones. Often

he reduces a syllable to such simplicity that the listener can guess at its intention only from the sound of the vowel. In our next chapter, we shall see these and other features of baby-speech reproduced in the 'lalling' of weak-minded children.

As to the developmental relationship between walking and speaking, much information will be found in Preyer's work. He shows that some children walk as early as the ninth month, and others not until they are a year and a half, or even two years old. He thinks that much depends upon the surroundings. He is of opinion that "children in sound condition mostly walk before they speak, and understand what is said long before they walk."

In this chapter, I have endeavoured to separate the various phenomena from each other, and to consider each by itself; although, as the reader will understand, the processes described are for the most part going on simultaneously during the child's development. Perhaps the Diagram may in some degree serve to keep before the mind of the reader the correlations of the various processes in point of time. Although I have adopted this method of presentation, which is different from that of Professor Preyer, I trust that this chapter will suffice to bring before the reader the general conclusions arrived at by Darwin and Preyer regarding the development of speech in the child. Many important facts and much detail have been omitted, but I trust that none of their observations have been mis-stated; and I hope that this brief statement of their views may be useful to the reader, as an introduction to the study of the developmental derangements of speech that I propose to treat of in my next chapter.

CHAPTER V.

The Three Functions of the Voice. Speech of Idiots and Imbeciles.

It will probably contribute to clearness of description if, before entering upon the consideration of the Developmental Disorders of Speech, I make, in the first instance, an endeavour to lay before the reader, in brief, some of the main facts regarding the Normal Development of Speech that were discussed, at some length, in the last chapter. This, I think, may be done most simply, if we concentrate attention specially upon the production of Voice, and try to realize the various functions that are, one after another, assumed by the Voice in the course of development.

The Three Functions of the Voice.

1. *An Exercise for the Lungs and Respiratory Muscles.*—The crying of a new-born child cannot properly be described as its method of expressing emotion. At this early period of its existence, there is probably no emotion to be expressed. The nerve force which first calls the crying muscles into action, has, in all probability, been furnished, not by the brain at all, but by the Spinal Cord, or, to be more precise, by the Medulla Oblongata. Even anencephalous children, if alive, will cry at birth, although they may be possessed of no trace of brain texture. The purposes of Nature, in thus calling the Vocal Mechanism into action so early in life, seem capable of easy explanation. It seems certain that the increased air-pressure put upon the lungs by the strain of crying must, immediately after birth, play a very important part in opening up the air vesicles for the entrance of air. At the same time, there can be no doubt that the act of crying affords a

means of exercising, in a beneficial way, all the muscles of the Respiratory System. It must tend to strengthen these muscles, much in the same way as, in after years, the muscles of the limbs will be strengthened by exercise or by gymnastics. Crying, laughing, singing, shouting and talking, practised freely by young children, are generally believed to be good tonics for the lungs; and it is entirely in harmony with this belief to find that deaf-mutes, who cannot talk, and who otherwise use their voices much less than normal children, are believed by many to have weak chests, and to be specially prone to chest affections. It would appear, further, in regard to deaf-mutes, that they derive benefit to their general health, and especially to their Respiratory Organs, from being taught to speak by the modern "oral method," which calls their vocal organs and respiratory muscles into play in the ordinary way, as in the speech of others. This tonic function of vocalization, especially important as it is to the health of the child during the first days and weeks of its life, when crying is its leading form of exercise, probably retains something of the same kind of tonic influence on the Respiratory Organs in after years, when vocalization is practised in other ways. The free use of the voice is probably an important tonic to the whole Respiratory System throughout the years of growth and development; and even in later years something of the same utility cannot reasonably be denied it. Thus we may conclude that, before the voice is used at all as a means of expressing either emotion or thought, it is used automatically as a means of exercising the lungs and the muscles of respiration; and that, even after the voice has become the chief expressive instrument of the mind, its exercise still continues, throughout life, to have something of its old tonic effect upon the Respiratory System generally.

2. *A Means of Expressing Emotion.*—Very soon, however,—even so early as a few days or weeks after birth,—the function of voice-production begins to fall more and more under the sway of the Cerebrum. The Sensorium has, in the meantime, been receiving many forms of stimulation from without, and is beginning to awake. It has been receiving impressions of many kinds, which have been poured in upon it through the organs of special sense and cutaneous sensibility. Light has begun to form images on the Retina; sounds have been falling upon the ear; the other organs

of special sense have been transmitting their various forms of sensation; the cutaneous sensibility has become more and more developed; and visceral sensations have been experienced, in connexion with the condition of the digestive and other internal organs. It is one of the far-reaching laws of Nature, that the child soon experiences pleasure or pain from the various sensations thus produced; and, further, that the sensations which give it pleasure are for the most part produced by causes favourable to health, whereas those giving pain are for the most part produced by causes that are really hurtful. These sensations of pleasure and of pain may be regarded as the first-developed and the most rudimentary forms of emotion. It has been appointed by Nature, that the child is no sooner capable of experiencing them than it is capable also of expressing them to others. They find their natural expression in the language of vocal tone, facial expression, and bodily gesture. Here then is a Second Function that is subserved by voice-production: the function of Expressing Emotion. How early the voice assumes this function, and how rapidly it acquires power in the performance of it, has been illustrated in the last chapter. Crying soon becomes wonderfully expressive: the shedding of tears converts it into pathetic weeping; and soon, as Preyer points out, "by screaming, wailing, whimpering, and weeping, moods of grief, desire, hunger, wilfulness and fear are made easily intelligible." Crying thus gives expression to emotions of a more or less painful character; and with crying are closely associated the equally expressive movements of the features that form almost an integral part of the act. The pleasurable emotions find no less eloquent expression in the vocal cachinnations of laughter, and in the facial expression which is united with these. Crying and laughter are as strongly contrasted in their sounds as they are in the emotions they so efficiently express: no two sounds could be more different than the wailing cadences of weeping, and the merry, ringing, broken notes of laughter. Grunting, as shown in the last chapter, is another mode of inarticulate expression that is sometimes used by children. Sighing, groaning, and sobbing, are also sounds of a highly expressive character that are partly vocal.

Further, in Ordinary Speech and in Public Speaking, the "emotional colour," as we term it, depends very largely upon the

tones of the voice,—emphasized as these are by associated facial expression and bodily gesture. The mind of the listener gathers something from the words uttered, and something from the tone and manner of their utterance. A child can interpret the tone and manner, long before he is able to understand the meaning, of the words addressed to him. We have seen, in the last chapter, how early children respond to smiling utterances, and how they may be brought to the point of weeping when others pretend to weep in their presence. Many of the domestic animals share with man this power of using and interpreting the language of vocal tone, facial expression, etc. The dog, for example, is a master of an inarticulate language of tone and gesture, which is closely allied to that of man himself; and though he may be able to interpret but few of the words addressed to him by his master, he is always most keenly alive to the interpretation of the vocal tone in which they are uttered, and of the expression and gestures that are associated with them. Whilst the expressive power of vocal tone is constantly exhibited even in the ordinary conversation of every-day life, we must observe its effect in the public speaking of a powerful orator, if we wish to estimate to the full the power of expression that can be embodied in the tones of the human voice. We all know with what burning effect the words of such an orator can be made to penetrate the minds of the audience, and with what wonderful power he can sway their emotions at his will.

Lastly, what shall we say of song? It is another form of expressive and highly emotional vocalization, not second in its power even to oratory; and it may therefore be placed in the same category. Yet there is something special in song which entitles it to be placed apart from all other forms of expressional vocalization. For its exercise, and even for its enjoyment, it demands the possession of a special faculty, which we call "a musical ear;" whose most essential feature seems to be the power of discriminating, to a nicety, the pitch of musical notes. The development of this special faculty seems to bear no intimate relationship to the development of the other faculties of the mind. It is known that many men of genius have been utterly destitute of musical ear: and it is further known that in idiots and imbeciles the musical faculty is often well developed; the proportion of individuals with musical ear being among imbeciles

almost the same as it is among the general population. That imbeciles should so often possess a good faculty for music alongside of other faculties so poorly developed, is a very striking fact, which I hope to illustrate further in the course of this chapter.

Thus, in many ways, this Second Function of the voice, that of expressing emotion, is exhibited throughout life. The power and variety of its expressiveness gradually increase during the years of growth and development, from the very early period when the voice first begins to express emotion in the acts of crying and laughing. Even ordinary individuals, in the ordinary course of development, attain to great efficiency in expressing their emotions. In a few exceptional cases, the highest levels of expressiveness are attained: when art and native genius combine to confer upon individuals the gift of song or of telling oratory.

3. *Acting with Oral Articulation, it forms Words.*—In the course of development, the Third Function assumed by the Voice is to take part with the Oral Articulative Mechanism in the production of those complicated and varied sounds that we know as Articulate Words; and thus become the instrument of Thought. How the two mechanisms, Vocal and Oral Articulative, work together in producing Articulate Words, has been pretty fully illustrated in the former chapters of this work. In the first chapter, in connexion with the study of stammering, it was shown how delicately the two mechanisms are co-ordinated one with the other in the production of speech; and in the second chapter, in connexion with the study of Hysterical Mutism, it was shown how complete dumbness may result from the paralysis of either the one mechanism or the other. The vocal element of Speech is supplied in short tones, broken up almost as much as the cachinnations of laughter, but differing from these in their much less regular duration and much more varied pitch and intonation. How these vocal tones of the larynx are, in speech, fitted or dovetailed into the other sounds that are produced within the mouth by the Oral Articulative Mechanism, and how the two mechanisms co-operate like the two hands of the violinist, has already been fully explained. As regards the specific value of the products of each of the two mechanisms, it is here important to remark, that whilst Emotion can, as we have seen, be expressed, in many ways, inarticulately, Thought can find its full expression only in articulate words. In

the formation of these articulate words, the Oral Articulative Mechanism takes a part no less important than that taken by the Mechanism of the Voice. Further, all experience goes to show that the development of functional power in the Oral Articulative Mechanism bears, in the child, a most important relationship to the development of the intellectual faculties. The intellectual faculties form, as it were, a superstructure, built, in the course of development, upon a foundation that is made up of the primitive instincts and emotions. So it is also with the expression of thought in articulate speech. It is a new function, added to the previously existing emotional function of the voice; and it is a function which the Vocal Mechanism can assume only when it is brought into the most intimate co-ordinate relationship with the mechanism of Oral Articulation. The intellect of the child may fairly be said to be budding, when it begins, for the first time, to understand the meaning of a few spoken words; and it may be said to be gradually expanding, when this vocabulary of words that can be understood is observed to be growing from day to day and week to week. The next step is for the child himself to produce articulate words. We have seen, in the last chapter, how, in the course of natural development, this step is led up to, by the instinctive and automatic exercises of the mechanisms of speech in the processes of Babbling, Crowing, and Mimic Reading. These preliminary exercises remind one of the automatic exercise of the voice before it has assumed its function of expressing emotion. Begun instinctively, and practised automatically from a very early period of life, it is curious to observe how these articulative exercises tend to assume an imitative character, and to develop into Echolalia. The child begins to catch up sounds of words that have just been uttered by others, and to repeat these mechanically, as mere sound imitations, without in the least attempting to decipher their meaning. It is about this time that the great step in advance is taken. The child has already learned to understand the meaning of a few words, and perhaps has reproduced some of these by echolalia; but now for the first time he begins to produce these words not as mere echoes of sounds, but as words with definite signification; or, being asked to pronounce a certain word, he attempts to do so by a distinct effort of his will. These are the real beginnings of speech-production. The words hitherto pro-

duced by echolalia have been evolved with almost no exercise of attention or effort of the will. But now the leading feature of word-production is that the requisite movements of articulation are produced under careful supervision of the attention, and by a distinct effort of the will. A new agent, namely, the higher Intellectual Consciousness, is thus beginning to interfere with the operations of the Speech-centres. Ultimately this new agent will take almost entire command of Speech-production. At this early stage, however, it has not yet acquired complete command; and it can get the Speech-producing centres to produce the simplest words only after many futile attempts and much persevering practice. I hope, at a future time, in connexion especially with Aphasia, to discuss at greater length the mutual relationships of the speech-centres and the higher consciousness. At present, I shall ask the reader's attention only to two facts:—(1.) That the speech-mechanisms are formed upon the Reflex Plan, with a sensory or receptive, and a motor or productive side, between which there are connecting fibres, by which influences can travel forwards from the sensory to the motor centres, so that sounds heard by means of the receptive centre may, in echolalia, be imitated mechanically by the motor. (2.) That with the development of the ruling faculties of the nervous system—namely, the intelligence and the will,—command is taken by these faculties of the reflex mechanism of Speech. Sounds formerly meaningless to the child are now interpreted as words with definite meaning; and soon, with ever increasing success, the productive side of the mechanism is compelled to reproduce these words by effort of the will.

Something has already, in the last chapter, been said as to the order of difficulty experienced by the child in the voluntary production of the various vowels and consonants. It may here be repeated that the vowels are more easily produced than the consonants. The middle vowels, such as **o** and **a**, are the easiest of all; and the vowels at the two extremities of the list, viz., **i (ee)** and **u (oo)** are somewhat more difficult, apparently because their production involves a little more muscular effort. Of the consonants, it has already been shown that the three produced during complete closure of the first stop-position, viz., **p, b,** and **m,** are generally the first to be learned; but that almost as early as these in making

their appearance are the corresponding three consonants produced during the closure of the second stop-position, viz., **t**, **d**, and **n**. Thus the syllables **pa**, **ba**, and **ma**, **ta**, **da**, and **na**, are usually the first that the child learns to pronounce. The consonants produced during closure of the third stop-position, viz., **k**, **g**, and **ng**, are later in appearing; and their appearance may be delayed for months, or even for years. As to the fricative consonants, it has already, in the last chapter, been pointed out that "those which most frequently present difficulties to the child are probably **r** and **l**, and, in a less degree, **sh**, **s**, **ch**, and **y**." Another matter which was commented upon in the last chapter was the "Smudging" or Scamping of the syllables in baby-speech. "The child simply omits the consonants difficult to him, sometimes putting nothing in their stead, and sometimes substituting for them others that he can pronounce without effort. He thus converts double consonants into single ones. Often he reduces a syllable to such simplicity that the listener can only guess at its intention from the sound of the vowel." When this Scamping articulation is but slightly marked, it is perhaps best described by the term Slurring or Thickness of Speech. A single consonant perhaps is omitted, or is imperfectly produced during the pronunciation of a difficult syllable. The most typical example of such slurring is perhaps met with, not in baby-speech, but in the slovenly articulation of a person somewhat inebriated, who, as is known, is apt to pronounce "British Constitution" as "*Brizh Conshishushon.*" A child who lalled slightly might possibly pronounce the words in a somewhat similar way; but if lalling were strongly pronounced, he would be more likely to give them as "*Bitte Tontitu,*" and this would be an example of scamping rather than of slurring.[1] These various forms of imperfect articulation, existing together, go to make up the variety of imperfect speech known as Lalling, a very useful term which has been applied to the imperfect utterances of baby-speech. Lalling is natural in every child at a certain period of

[1] We speak of a man "Scamping" his work when he performs it in a slovenly way, and takes as little trouble with it as possible. By some authors babies are said to "truncate" their words; and this is true enough: but they may omit consonants at the beginning and middle as well as at the end of a word; so that I think "Scamping" is preferable, as the descriptive term. Perhaps it is something of a "slang" word, but it is the most expressive I can think of.

its life. But in healthy children it passes away as the child, by efforts of attention and intelligent practice, gradually masters its difficulties of articulation. Lalling is, I think, much the best term for these imperfect performances of the Oral Articulative Mechanism; and when the above defects exist in combination, as they always do at a certain stage of baby-speech, the term is very specially appropriate. I also think it is justifiable to use it as a general term that may be applied even to cases where the above defects exist singly; and in this chapter I propose so to use it. In Germany, these defects of Oral Articulation have been treated of under the general term Stammering (Stammeln).[1] I have already, in the first chapter, protested against the use of the English word Stammering in this sense. In this country, the word thus used would be altogether misapplied; since, when we speak of Stammering, we always think of an element of hesitancy in the Speech. In these Oral Articulative defects, however, there is not necessarily any hesitancy: the words may be emitted with apparent ease, although the syllabic articulation is so imperfectly performed. It should, at the same time, be remembered that in its first efforts to speak the utterances of the child are often emitted very deliberately, and with much apparent effort. It should be noted also, that true Stammering, with Stuttering, very frequently appears, as a passing phenomenon, even in normal children. It is, further, most important to make note of the fact that in imbecile children this true Stammering or Stuttering, due to want of promptitude in the Vocal Mechanism, is often found associated with Lalling, due, as we have just seen, not to want of promptitude, but to want of precision in the performance of the Oral Articulative Mechanism. Lastly, the reader will remember that "Words of its own Invention" are employed, more or less, by almost every normal child, when true speech-production begins to be developed. In normal children, these words are, with the further growth of Speech-power, soon disused and forgotten. We shall find that in imbeciles similar words are often invented, but that, in them, they

[1] In Germany, the term lalling (lallen) is apparently applied to the imperfect utterances of baby-speech only when these are so inarticulate as to be almost or altogether unintelligible; Lalling being described as an extreme development of "Stammering" (Stammeln). See article "Stottern," by R. Arndt, in Eulenburg's *Real Encyclopädie*, vol. xix., p. 173.

are not speedily forgotten,—being retained as elements of Speech throughout life.

These then are the three functions that are fulfilled by the exercise of the Voice: (1.) It is a healthy exercise for the Respiratory Organs; (2.) In association with facial expression and gesture, it is an instrument for the expression of emotion; (3.) In close association with Oral Articulation, it is the chief instrument for the expression of thought.

Defects of Speech in Idiots and Imbeciles.

"Idiocy," says Dr Ireland,[1] "in its mental manifestations at least, may be viewed as a fixed infantile condition. Idiots remain all their lives children in intellect, often so in their feelings and desires. Of course there is always this difference between an idiot and another child, that, although at a given time the potential intellect of the one is no greater than that of the other, the idiot has the benefit of a larger experience." In estimating the degree of mental imbecility, and thus forming a practical classification of idiots and imbeciles according to the depth of their imbecility, many great authorities are agreed in thinking that there can be no better guide than an examination of the patient with special reference to the function of Speech. Griesinger[2] says,—"The relations of Speech are so interwoven with the whole process of mental development, and so necessary to education and intellectual advancement, that the classification of idiots according to their capability of speaking (generally into three degrees), is one of the best that can be established." Esquirol[3] has divided idiots and imbeciles into five classes, of which the lowest is utterly mindless and speechless, and the highest has a free and easy utterance, though a defective power of reasoning. I propose to give presently short notes of a series of cases which represent such a gradation of intellect and of Speech-power as is indicated by Esquirol; and I hope that these cases will bring very prominently before the reader's mind the permanent infancy, alike of the imbecile intellect and of the imbecile speech. We shall

[1] *On Idiocy and Imbecility*, by William W. Ireland, M.D., 1877, p. 264.

[2] *Mental Pathology and Therapeutics*, New Sydenham Society, 1867, p. 370.

[3] *Traite des malad. ment.*, t. ii. p. 288.

find in these notes all the peculiarities of infantile speech reproduced; and the cases will represent stages in the development of a normal child, mounting upwards from that total absence of faculty which is proper to the child newly born, to a level not far removed from the intellectual capacity and speech-power of an ordinary adult. Some of the cases to be described were seen by me at the Morningside Asylum. For opportunities of studying these, I have to thank Dr Clouston. In making notes of them, I was kindly aided by one of his assistants, Dr Middlemas, formerly my own house-physician. Some of the other cases were studied by me at the National Institution for Imbecile Children at Larbert; and for the privilege of making notes of these, I have to thank Dr Leslie of Falkirk, the Visiting Physician, and Mr Skene, the Resident Superintendent. My former house-physician, Dr A. S. Duncan, assisted me in taking notes of the Larbert cases. In all, I have before me notes of about twenty selected cases, all of which present points of special interest; but considerations of space forbid me to insert more than a limited number of the cases. Unfortunately I have, among them, no example of the very lowest depth of idiocy. To supply this defect, I shall give, as the first case, a brief note as to such a patient extracted from the valuable work of Dr Ireland. The rest of the cases will be from my own notes.

Case I.—(*Dr Ireland, p.* 267.) *Intelligence and Speech nil.*—"I have seen an idiot seven years old who only swallowed food when placed on the back of the tongue within reach of the reflex actions of the Pharynx. He was kept tied in a chair, for, although unable to design any motion, he would sometimes make involuntary bounds, which would throw him on the floor."

Case II.—(*Larbert Institution.*) *Only one word understood. Babbling.*—A lad of eighteen, slender and rather short; constantly walking about in shambling fashion with head much bent forwards; always smiling and laughing quietly to himself and to others. Never cries nor sheds tears; never blushes; good-natured and affectionate, but very stupid; utterly helpless as to evacuations and as to dressing himself. When his chair is set at table, knows to sit down upon it, and can use a spoon at meals. Understands

no word but his own name, "Johnnie," which he answers to by coming when called. He, however, responds readily to smiles and kindness. Often amuses himself by "babbling" the single syllable *mamamama* for a long time. Produces no single intelligent word. Nurse says that he has a good ear, seems to like music, and sometimes hums over a polka he has often heard played.

CASE III.—(*Larbert Institution.*) *Responds to his own name, and calls out name of cat. No other language. Echolalia well marked. Grunting.*—A boy, aged twelve; short, but not deformed; vacant, sometimes puzzled, expression; very stupid; sometimes inattentive as to evacuations; cannot dress himself, but can feed himself at table. Is affectionate, responding readily to smiles and kindness; gets excited when petted, grinning and working arms up and down; cries sometimes, and sheds tears; has "roaring tempers," during which he tears his collars; has turns of laughing aloud. Grunts to himself a good deal; shows marked Echolalia, repeating "Lizzie," when he hears any one call for the nurse, and repeating in similar fashion the name of any boy when it is shouted by another. Understands nothing but his own name; and the only intelligible word employed by him is, "pussy, pussy," which he addresses to the cat. Has no musical ear, and never sings.

CASE IV.—(*Larbert Institution.*) *Understands only his name. No other words understood; no words produced except in Echolalia and in Song.*—Boy, aged thirteen; subject to fits; well-made; walks quite well; is very restless. Has fits of laughing, also of passionate roaring; is sensitive, and easily made to cry and shed tears; responds readily to smiles and kindness. Understands no word but his own name; and can produce no words except by Echolalia, or in song. Repeats by Echolalia any name that is called out in the Day-room. Nurse states that he has an excellent musical ear, and that he often sings hymns to himself when in bed, or sitting in the Day-room, the words being—though this seems almost incredible—pronounced quite correctly.

CASE V.—(*Larbert Institution.*) *Patient able to understand much of what is said, but not able to produce any speech whatever.*—A girl, aged sixteen; short stature, rickety legs, large head.

prominent forehead. Remarkably silent and sedentary; occupies herself chiefly in scraping up wood fibre of her chair with her nails. Does not play with other children, and when among them is apt to pinch them severely. Is very cleanly as to evacuations. Feeds herself at table with knife, fork, and spoon; but cannot dress herself. Nurse says that she understands almost everything that is said to her. Never utters a single word; seldom makes any gesture, or shows emotion; but on one occasion, when nurse hurt her finger, patient suddenly showed sympathy by kissing her and crying. The only sound she gives vent to is an occasional broken cry.

CASE VI.—(*Larbert Institution.*) *Understands speech well, and can speak a little, but in speaking talls very markedly.*—A boy, aged eight; small and bandy-legged; head very narrow in front and broad behind. Is very active, restless, and mischievous; is fond of catching insects, especially "clockers." Smiling, impish expression of countenance. Talks a good deal, especially to himself; but articulation so imperfect that scarcely anything he says can be made out. The following is his pronunciation of the numerals, when he is made to repeat them to dictation one after the other. "**One, foo, chree, four, fia, hik, seggen, eight, nine, ten, evven.**" Understands not only gestures, etc., but also spoken words; bringing chairs, etc., when asked to do so.

CASE VII.—(*Larbert Institution.*) *Well-marked Echolalia. Understands Spoken Language. Speaks a good deal, but talls. Has a special talent.*—A girl, aged thirteen; good figure; pleasant face, though rather dreamy expression. Imbecility dates from occurrence of Meningitis at three. When first brought to Institution, showed marked Echolalia; repeating several times "Maggie, Maggie," when her name was called out. If anyone said "Maggie, sit down," she would repeat the whole sentence several times over. Is very cleanly, and is able to dress and feed herself, but puts everything to her nose and smells it before putting it to her mouth. Used to be destructive of her dress, but on being beautifully dressed took a pleasure in her appearance, and gave up tearing her dress. Understands all that is said to her; bringing chairs, etc., to order. Is very

affectionate, and responds readily to smiles and kindness. In speaking, drawls her syllables, and pronounces them with marked lalling:—thus, for the numerals dictated to her one by one, she gives, "**One, two, free, four, fie, six, sim, eight, nine, ten, evven, el.**" Is remarkably neat handed, her sewing being really beautiful. No musical ear.

CASE VIII.—(*Morningside Asylum.*) *Understands a little Speech. Uses a few words, some of them being "Words of her own Invention." Language of Facial Expression and Gesture very well marked.*—A young woman, aged twenty-three; fairly well grown; rather lively expression, though obviously silly. Cries sometimes, shedding tears when hurt. Laughs and smiles readily. When pleased, grunts to herself in a characteristic way. Exhibits rage, fear, etc., well in facial expression. When sulky, pouts, making a true "snout" with her lips. Never blushes. Uses gestures, largely indicating her wishes in this way. Understands simple directions quite readily, and does what she is told. The following is a list of the words which she makes use of; and it will be observed that some of these are Words of her own Invention:—**Aye** for yes. When wanting to attract attention she often repeats **Aye** several times. **No** for negation, though she often shakes her head for this. **Tucka—tucka** is her name for herself. **Pia** she uses when she wants anything, and wishes to attract the nurse's attention. **Papia** when she wishes to go to the bath-room. **M-m-m-mia** when she wants food, or wants her hat to go out. **Puttyka** is for pussy cat. **Yahoo** is an apparently meaningless expression, often uttered when she is pleased. **Beh** when she is playing with something, and is pleased—she still plays with dolls. Cannot be got to repeat the numerals to dictation. Sometimes sings to herself part of a dance tune, the notes being given pretty correctly.

CASE IX.—(*Morningside Asylum.*) *Understands Speech fairly well; but in speaking lalls, lisps, and stammers.*—A young woman, aged about twenty; paralyzed on right side. Intelligence so good that in most respects she behaves like a grown-up person. Laughs readily, but seldom or never cries. In speaking, sometimes uses T for K, D for G, Th for S or Sh, and D for Z or Zh. She stammers over the explosives, and when

words begin with explosives she often tries to overcome the difficulty by means of "drawback phonation." Gives the numerals as:—**E-one, T-oo, Theree, Four, Five, Ishish, Theven, Eight, Nine, Ten.**

CASE X.—(*Larbert Institution.*) *Intelligence considerable. Understands Speech. No babbling, Echolalia, or pronounced lalling; but slurs slightly.*—Boy, aged eleven; well made; rather small; good head and face. Is cleanly, and is able to dress himself. No fits of crying unless when meddled with; but is hot-tempered. Laughs freely; blushes occasionally. No babbling or Echolalia. Understands Speech, obeying commands readily. Gives the numerals himself continuously, but omits 17 and 18 in naming them up to 20. Says 2+2=3. Slight slurring when he speaks; but no pronounced lalling. Sings in correct tune; but words are mixed up.

CASE XI.—(*Larbert Institution.*) *Intelligence now almost normal; Speech very good; excellent musical ear; sings admirably.*—A girl, aged twelve; rather short, but well made; pretty face, fine eyes and teeth, but deformed palate. Expression dreamy. Very affectionate; is of happy disposition and pleasant manners. Likes to work and help the nurse. Talks exceedingly well, and has good memory for words, repeating each test sentence as a whole when it is spoken to her. Sings remarkably well, having a good voice and ear. In singing the song called "The Cobbler," performs appropriate actions with much vivacity. Is the leader of the other children when they sing together.

This girl has improved remarkably since she was brought to the Institution eight years ago. She then spoke incoherently, and was passionate and mischievous. The only thing about her at present, indicative to a stranger, of anything unusual in her mental constitution is her decidedly dreamy expression.

One of the most memorable incidents connected with the pleasant and instructive day which I spent, some months ago, in the Larbert Institution, was the singing of the children, under the leadership of the patient whose case has been last described. The Superintendent having kindly asked them to sing to us, they sang

a number of hymns, very tastefully and tunefully. In visiting this beautiful and admirable Institution, one could not help feeling how much happier and healthier the children evidently are, carefully tended and educated, and living partly in the society of others like themselves, than they could, in most cases, possibly have been in private homes, where, if they are among other children, there is often so much to vex and humble them, and where they cannot have the advantage of being educated by teachers experienced in the education of children of weak intellect.

The above eleven cases have, as far as possible, been given in an ascending scale, from mental zero up to a level of intelligence and speech-capacity little removed from that of a normal individual. It is hoped that the cases bring out with sufficient clearness—(1), that Lalling is the leading defect in the speech of imbeciles; (2), that stammering is occasionally associated with it; (3), that in the lower grades of imbecility, babbling, grunting, echolalia, and the use of "Words of their own Invention," are met with in association with conditions of mental development closely corresponding to the conditions with which they are associated in the development of normal children. Thus Dr Ireland's axiom, that "Idiocy, in its mental manifestations at least, may be viewed as a fixed infantile condition," is illustrated at every point, when one examines into the powers of interpreting and of producing speech presented by any well-marked case of mental imbecility.

Dr Ireland, who was formerly Physician of the Larbert Institution, informs us (p. 263) that for purposes of education he used to divide the pupils in the Institution into five grades.

"I. Comprising those who can neither speak nor understand speech.
"II. Those who can understand a few easy words.
"III. Those who can speak, and can be taught to work.
"IV. Those who can be taught to read and write.
"V. Those who can read books for themselves."

He found that "most cases can be put under one or other of these classes. Where there is difficulty it is generally with the third class, for some can speak who cannot be taught to work, though very few."

CHAPTER VI.

DUMBNESS (CONGENITAL APHASIA) IN PERSONS NOT OBVIOUSLY IMBECILE. LALLING ON SINGLE CONSONANTS. CONGENITAL PARALYSIS OF MOUTH; AND ORAL DEFORMITIES. DEVELOPMENTAL DEFECTS OF THE VOCAL MECHANISM. CONGENITAL BRADYLALIA AND LOGORRHŒA. DEAF-MUTISM.

Dumbness or Defective Speech (Congenital Aphasia) in Persons not obviously Imbecile.

THIS is a subject which has of late been attracting a good deal of attention. Sir William Wilde, in his well-known book on *Aural Surgery*, published in 1853, was one of the first to direct attention to the existence of dumbness in individuals who are neither deaf nor the subjects of a pronounced degree of mental imbecility. The returns obtained in the Irish Census of 1851 brought out clearly that not a few individuals were dumb though they were not deaf, this being the condition reported to exist in 334 of 4485 mutes residing in Ireland. Of these, 115 were reported to be imbeciles, 45 to be paralysed, 43 to be both paralysed and imbecile, and 131 to be dumb only, without being either paralysed or imbecile. Inquiring into the circumstances of many of this last class, Sir William Wilde found that in a few the dumbness resulted from local paralysis of the tongue and other organs of articulation. To these cases, further reference will be made presently. In seven other cases, of each of which he has given a special account, there was no such local paralysis; the patients could hear well, could understand what was said, and displayed generally a pretty fair amount of intelligence; only they could not speak. A careful examination of these seven cases, however, shows, in all of them, the existence of peculiarities

indicative of some mental defect. They are noted to be restless or mischievous, or to display other indications of want of mental power. To my mind, the records of these cases are distinctly suggestive of the existence of a defective intelligence, strong enough to have acquired the power of interpreting words, but too weak to train the motor side of the Speech-centres to their production.

Dr Broadbent[1] has recorded an interesting case which he thinks may be fairly regarded as one of Congenital Aphasia. The boy, who had not yet learned to speak, was, at the age of six years, run over, and hurt on the left side of the head. When under Dr Broadbent's care at the age of eleven, he was bright and intelligent, could run errands, and saw that he got the proper change if told beforehand how much it should be. He was, however, irritable and passionate with younger children. For "father" and "mother," he said **favè** and **movè**; said **no** and **yes** indistinctly; and **dunno** for "don't know." These were all the words that could be got from him at the first visit. To most questions, he answered **keeger-kruger.** He wrote his name pretty well, and could copy several words, but could not write "yes" or "no" when asked to do so. At a subsequent visit, he showed some improvement. On being, for example, asked the time, which was 2.45, he said **free o'clock**; and when told that he was not quite right, said indistinctly, **about half-past two.**

Dr Hartman discusses the subject at some length in his work on *Deaf-Mutism*.[2] He says that apart from cases "in which Dumbness is produced by functional disturbance, or a malformation of the organs of articulation, he has succeeded in finding in the literature of the subject only one case, described by Waldenburg,[3] in which dumbness seems to have existed, although the hearing was normal and the intellect good. This refers to a boy whose mother was affected, in the third month of pregnancy, with total paralysis of the right side, and with complete loss of speech. From birth, the right half of the boy's body was not so well developed as the left, and he did not learn to speak, although his intellect proved to be well developed, and he could hear. Even when Waldenburg

[1] *Medico-Chirurgical Transactions*, vol. lxxv., 1872, p. 155.

[2] *Deaf-Mutism*, translated by Dr Cassels, 1881, p. 24 *et seq.*

[3] "A Case of Congenital Aphasia," *Berlin. Klin. Wochenschrift*, 1873, p. 8.

whispered behind the boy's back, the latter understood him, and did what he was asked—'Open your mouth'; 'Give me your hand.' This is the only case in which a complete Congenital Dumbness seems to have been ascertained where the power of hearing existed. Unfortunately Waldenburg was only able to examine the case once."

Dr Ireland, in discussing the subject (p. 275), says that among imbeciles "there is a certain class who may be styled Idiotic Aphasics, who remain obstinately mute, though it is clear that they have more intelligence than other children who talk volubly. Sometimes, indeed, they have so much intelligence that people doubt whether they are imbecile at all. I have seen three or four such cases," he says: "they all appear to me to be imbecile children." He records (p. 276) the case of a boy, who used a great many "Words of his own Invention."

Dr V. Uchermann[1] of Christiania has described three cases of Aphasia (two Congenital, and one caused by fright at the age of $2\frac{1}{4}$ years). One of these cases was complicated with stuttering, and another with some degree of deafness. They were treated with some success at deaf-mute institutions, by the "Oral Method" of instruction.

Dr W. B. Hadden[2] has recently recorded three very interesting cases—boys, aged respectively seven, eleven, and four,—in which, although the intelligence seemed to be fairly good, speech was very defective, the characteristic features of Lalling being very strongly pronounced. The cases are especially valuable, inasmuch as the education of them, when under Dr Hadden's care in St Thomas's Hospital, by the "Oral Method" employed for the education of deaf-mutes, was attended with excellent results.

Dr Frederick Taylor[3] has recorded a very interesting case in which the patient, a boy aged $8\frac{1}{2}$ years, who had been to school, could read little words, write in a child's hand to dictation, and copy words from a book, was yet very backward in speech. Along with the defects of articulation which I have classed under the term "lalling," this patient presented the interesting peculiarity that he was in the habit of adding to most of his imperfectly articulated words the superfluous syllables *da*, *eeda*, or *ida*. Thus

[1] *Archives of Otology*, October 1891; translated by Dr J. M. Mills, New York.
[2] *Journal of Mental Science*, Jan. 1891.
[3] *Med. Chir. Trans.*, vol. lxxiv.

he rendered the words "Our Father which art in heaven" as *Ouarda Fararda id arda a haāida.* In commenting upon the case, Dr Taylor says that this peculiarity reminds him of a childish trick sometimes practised by school-boys. Kussmaul (p. 814), referring to this youthful practice, states that in Germany it is exhibited among children in what is known as the "Erbsen speech" game, in playing which the child attaches the superfluous syllables "erbsen" to all monosyllabic words. He refers to two aphasic cases who in like manner attached meaningless syllables to their words. So far as I know, Dr Taylor's is the only case in which this curious feature has been recorded as met with in association with Lalling.

I have myself met, in hospital and private practice, with about ten cases of children whose speech was very defective, and who yet did not present any very pronounced features of imbecility. From among these I select three, about which I here insert a few brief notes.

CASE I.—*Intelligence not very obviously defective. Dumbness almost absolute. Sudden swearing under Emotion.*—A girl, aged seven, recommended to me by my friend Dr John Thomson, and at present under treatment in the Royal Infirmary. This patient was shy and apparently stupid on admission, but soon got accustomed to residence in the Hospital, and became very lively. She is now bright and merry, though rather mischievous. The expression of the eyes is bright and affectionate, and only now and again shows a little of the restless vacancy so common in imbeciles. Her manners, however, are a little peculiar. When at home in the country, she was in the habit of playing very much with dogs; and now, on rushing up to clasp one's hand, she opens her mouth, which is decidedly large, as if she would like to bite playfully in dog-like fashion. Understands orders quite well, bringing any article when requested to do so. She is almost totally dumb. The only words she is known to have pronounced before admission are **Bob** (the name of a brother) and **Jean** (the name of a sister). **Ba** is her own name for herself. She is much in the habit of biting her lower lip; and when asked to pronounce such a syllable as **pa** or **ma**, she bites her lip in this fashion, and, opening the mouth, emits the vowel without the consonant. The staff-nurse has succeeded

in training her to pronounce **pa, ba, ma, ta, da, na**; but as yet she cannot muster courage to pronounce these syllables to the doctors. She is sometimes mischievous: making inarticulate noises during prayers in the wards, and occasionally waking up, too early in the morning, patients who are friendly to her. On these occasions she has once or twice cried, "Get up, Ba." The most surprising incident in connexion with this case occurred a few days ago. It was the sudden pronunciation of two bad words, when the patient, in the bath-room, had some water thrown over her by another girl. The words were, "You d——d b——"!! During the last few days, this patient has been heard practising, for her own amusement, the pronunciation of the first of these two bad words; and on one or two occasions, when slightly annoyed, she has emitted both of them again. She has also once, from the opposite side of the ward, called to the nurse, "Here—come here." Her sister, aged eleven, who is also a patient in this ward, and who is possessed of good intelligence, states that the patient was never, at home, heard to utter either the words "Come here" or the expression beforementioned. She is now acquiring other new words. To-day she said, "**Go hame**;" and she repeated the word **hame** to me quite distinctly.

Dr Charlton Bastian[1] records a case in some respects similar to this. Patient was a boy who was subject to fits in childhood, till about the end of the second year. When nearly five years old, he had not spoken a single word, and physicians had been consulted as to his dumbness. But some months afterwards, "on the occasion of an accident happening to one of his favourite toys, he exclaimed 'What a pity,' though he had never previously spoken a single word. The same words could not be repeated, nor were others spoken, notwithstanding all entreaties, for a period of two weeks. Thereafter the boy progressed rapidly, and speedily became talkative." When, at the age of eleven, he was seen by Dr Bastian, he spoke in an ordinary manner, without the least sign of impediment or defect. This case recalled to Dr Bastian's mind the old story of the dumb son of Crœsus, who, when at the siege of Sardis his father was threatened by a Persian soldier, is reported by Herodotus to have cried out suddenly, "Oh, man, do not kill Crœsus;" also the story told by Aulus Gellius of the Samian

[1] *The Brain as an Organ of Mind*, International Scientific Series, p. 606.

athlete, previously dumb, who, on detecting foul play when casting lots for a contest, suddenly spoke, calling attention to the guilty party and to his act. Gellius adds that he spoke quite freely and clearly ever afterwards. Dr Bastian's observations upon the case are very interesting. He thinks that Speech has been practised by so many generations of men that the power of speech is now inherited by each succeeding generation almost as if the act of speech were an instinctive and automatic one; and that in the normal condition of things, including a normal condition of hearing and the mental faculties, the productive speech-centres easily learn to call forth the requisite movements, whenever the requisite level of structural development has been reached. The young swallow leaves its nest and flies automatically, when it is mature enough to do so. The young child, if it be normal in structure and development, presents something of the same automatic facility, in acquiring, at the proper time, the movements of speech. When a slight abnormality interferes with the action of the speech-centres, it may, Dr Bastian thinks, in some cases be overcome by the stimulus of strong emotion, which may break down a barrier that the weaker volitional stimulus has failed to penetrate.

Case II.—(*Private Case.*) *Intelligence fair, but speech extremely defective. Lalling very prominent.*—Boy, aged eight, fairly well grown, does not look imbecile. Father states that he began speaking at the usual time, but made little progress. His intelligence is considered by the father to be not quite so bright as that of the other children. The boy, however, attends school with the others, and can learn his lessons; being able to understand what he reads in books quite well, although not able to pronounce the words. The test sentences of the Physiological Alphabet show that he can pronounce **p**, **b**, and **m**, and **t**, **d**, and **n** quite well; but that he cannot pronounce **k**, **g**, or **ng**. Of the Fricatives, he can pronounce **sh** and **zh**, **f** (sometimes), **l** (sometimes), **h**, **ch**, and **y**. He cannot pronounce **w**, **v**, **th** (1) **th** (2), **s**, or **z**. He gives the numerals as—**un**, **two**, **he**, **hoa**, **hi**, **hit**, **hoten**, **eight**, **nine**, **ten**, **eatten**, **tel**, **hirteen**. The father was given a copy of the Physiological Alphabet, which was explained to him; and he was shown how to teach patient the pronunciation of the defective consonants.

CASE III.—(*Case seen at the Institution for Deaf and Dumb, Henderson Row, Edinburgh.*) *Speech now almost perfect, though patient was at one time dumb.*—This patient, a lad of about eighteen, happened to call upon Mr Illingworth, the head teacher, when I was visiting the Institution. He is now engaged as a tailor in the country. He gives one the impression of being perhaps a little weak in intellect; but, thanks to Mr Illingworth's careful tuition, is able to express himself in Speech quite easily, and in a natural way. Mr Illingworth has kindly furnished me with the following note of his case:—"The boy, H. R., entered this Institution at the age of seven years. His hearing was almost normal, but he had no power of speech, and did not *attempt* to articulate a single word. His general intelligence was below the average. After he had been at school for four years, an attempt was made to teach him to speak by the Oral Method (previous to this he had always communicated by signs and the Manual Alphabet). Exactly the same means were adopted as with a totally deaf child, and the difficulties in obtaining the correct sounds were almost as great. After four years' instruction by the Oral Method, H. R. was able to speak very distinctly, but with slight hesitation, which, however, was daily wearing off; and when he left school, a year ago, he gave promise of becoming (with encouragement and practice) a very good, free speaker."

A careful consideration of cases in which Dumbness or Lalling Speech exists without pronounced Imbecility or Deafness, leads one, I think, to the conclusion that in the great majority of such cases there is an element of weakness of mind. We all know that some normal minds are specially strong in their receptive qualities, being able to accumulate much information, and yet able themselves to originate but little that is valuable; whereas other minds, not so apt to acquire information, are strikingly original and productive. In imbecile minds, there are probably the same varieties; and one can find it likely that in the development of Speech, which is so closely allied to the development of Thought, the receptive faculties sometimes display a normal activity, while the productive are sluggish, and tardy in their development. Great variation in this respect is met with, as we have seen, even among pronounced imbeciles. In cases of slight imbe-

cility, the weakness may exist almost exclusively in the productive faculties, and the backwardness of Speech-production may be thus accounted for. There may be a want of the active energy required for the training of the Speech-centres, which is in all children a more or less laborious process. At the same time, it may be admitted that there may be cases in which, along with a good general development of both brain and mind, there is a local defect in the productive Speech-centre, due either to arrest of development in utero or to injury at or after birth. A very few of the recorded cases are suggestive of this explanation; but the great majority must, I think, be referred to an original defect of the mental faculties.

Another lesson which, I think, we may gather from a consideration of the foregoing cases, is that the proper method of treatment is to place them under the care of a teacher who can instruct them in articulation by the Oral Method now used for the teaching of deaf-mutes. Dr Hadden's cases illustrate the value of this method; and it is still more forcibly demonstrated by the case of which Mr Illingworth has furnished the record. Probably the best measure to take is to place the patient in an institution for the deaf and dumb. That is what I propose to recommend for Case I., the little girl at present in the Infirmary.

Inability to Articulate some Single Consonant.

I do not think it would be stretching the meaning of the term too much to include the faults of articulation now to be mentioned under the general term of Lalling, and to describe them as cases of Lalling upon some single consonant. In most cases, such an isolated difficulty with a single consonant seems to be but a lingering trace of those natural difficulties which the individual experienced in childhood with many or all of the consonants. With all the others, the difficulty has sooner or later been overcome, but with this particular one it still remains as a peculiarity of articulation. Kussmaul has given a full account of these conditions, and it will not, in this paper, be necessary to do more than enumerate some of the more common and important of them.

(1.) **R** is the consonant which in most of these cases proves the stumbling-block. Sometimes the Uvular **R** is substituted for the

Anterior Linguo-palatal (Burring). Sometimes **L** is substituted; a patient of my own, for example, giving, "Lound the lugged lock," for "Round the rugged rock." Sometimes W takes the place of R; in which case the name of the father of medicine would be pronounced as "Hippocwates." In rarer cases, R has been converted into two T's, or into **G** or **Ng**, or been prefaced by an initial **S**, **Ds**, or **Z** (see Kussmaul). There seems to be no doubt that Burring is sometimes due to shortness of the Frenum Linguæ; which prevents the tip of the tongue being elevated sufficiently for the production of a proper **R**. Burring has been termed *Rhotacismus:* when other letters are substituted for **R**, the condition has been termed *Pararhotacismus.*

(2.) **L** frequently presents similar difficulties. When the letter is omitted or defectively pronounced, the condition is called *Lambdacismus:* when other letters are substituted for it, *Paralambdacismus.* The letter substituted may be **T**, **D**, **S**, **Zh**, **N**, **Ng**, or **R**.

(3.) Difficulties with **S** (*Sigmatismus* and *Parasigmatismus*). It may be pronounced with unpleasant sharpness, or letters may be substituted, especially **Th** (Lisping), and **Sh** as in *Mozhesh.* A curious case of my own substituted **Ch** (tsh) for S, and instead of saying "Sarah sat sorrowful," said "Charah chat chorrowful."

(4.) So, in like manner, there may be difficulties with the **Sh** sound, for which **S**, or **L**, or the softened French **Gn**, is sometimes substituted.

(5.) A very common and important difficulty, persisting especially in children who have been slow in learning to speak, is inability to pronounce **K** or **G** (*Gammacismus* and *Paragammacismus*), the place of these letters being frequently taken by **T** and **D**. The **K** and **G** are sometimes not mastered for years after the articulation of all the other consonants has become quite easy.

Other difficulties occur with other consonants, but the difficulties already enumerated are the most common and important.

It is worthy of note at this point, that Lalling upon a single consonant is not entitled to be regarded as any indication of defective intellect, although, as we have seen, persistent Lalling upon many consonants is always very strongly suggestive of such a defect. Lisping, and the substitution of **W** for **R**, are sometimes affected by dandies. The Greek dandies used to substitute **l** for **r**—

Alcibiades, for example, pronouncing the word corax, a raven, as colax;—but this at the present day is too suggestive of mere childishness.

Defective Articulation owing to Congenital Paralysis of the Tongue, etc., and to gross Oral Deformities.

(1.) *Congenital Paralysis of the Muscles of the Mouth.*—A case of this kind has been recorded by Sir William Wilde.[1] Patient, a female aged forty, "can hear perfectly well, but has no power over the muscles of her mouth, so that she cannot drink without throwing back her head, neither was she able to suck when an infant, ... cannot protrude the tongue beyond the lips, nor elevate the palate. Can only say, 'No.'"

Another case has been recorded by Hartmann.[2] Patient, a coachman, had remained dumb ever after a passing attack of paresis of left arm and leg during childhood. Examination showed that the motions of the tongue were very sluggish and imperfect. He could not elevate the tip, nor protrude it normally; had marked Lalling in the pronunciation of the few words that he attempted.

Kussmaul observes that congenital or acquired Hypertrophy of the tongue sometimes renders speech impossible, and sometimes merely causes "Stammering" (Lalling).

(2.) As to *Gross Oral Deformities*, the most common and important are Hare-lip and Split-palate. The former, which necessarily interferes with the labials, can be remedied by Surgical operation. The latter, which produces, even in slight cases, a very disagreeable Nasal Snuffling during speech, and which in severe cases may render speech quite unintelligible, can be treated either by Surgical operation or by the insertion into the hiatus of an artificial Obturator or Velum. For full information regarding this latter method of treatment, the reader is referred to the very able work on *Oral Deformities* by Norman W. Kingsley, late Dean of the New York College of Dentistry. This author states that far more perfect speech can be obtained from the employment of suitable Obturators and Vela than has ever been obtained from Surgical operation.

[1] *Aural Surgery*, p. 466. [2] *Op. cit.*, p. 26.

Developmental Defects of the Vocal Mechanism, as Displayed in Speech.

(1.) There may be so great a defect of development in the Vocal Mechanism that Voice-production, even in the crying of infancy, is impossible. If, in such cases, the larynx is not even able to act with sufficient vigour to produce the *spiritus asper* of Whispering, the patient will necessarily be dumb. One of Sir William Wilde's cases seems to have belonged to this category, but to have presented, at the same time, malformation, and some degree of congenital paralysis, of the Oral Articulative organs. The case was that of an intelligent, well-formed, agricultural labourer, aged twenty, who was completely dumb, and "seemingly not capable of giving expression to even *inarticulate* sounds. His hearing was acute and correct, and he had no cerebral disease."

(2.) The Voice may retain during life that disagreeable "crack" which in the normal condition is its peculiarity only during the period of puberty. This is stated[1] to be a frequent peculiarity of the voice in adult idiots.

(3.) The voice may fail to undergo the usual change at puberty, and may retain throughout life much of the puerile character and pitch.

(4.) The great developmental Neurosis, in connexion with the Vocal Mechanism, is Stammering; which usually appears when the child first begins to speak, or very soon thereafter. The nature and phenomena of stammering have, in the first chapter, already been explained; but it is here well to remember that it is one of the most important, perhaps the most important, of all the *Developmental Disorders* of Speech. In the great majority of cases, as already explained, stammering is a fault of the Vocal Mechanism, and the essence of the fault is want of promptitude in attacking the first syllables of words. It may here be useful to contrast it with the almost equally important disorder of Speech which we have called Lalling, using this word in very much the same sense as the Germans use the word "Stammering" (Stam-

[1] Eulenburg's *Real-Encyclopädie*, edition 1881, vol. vii., article "*Idiotie*," by Dr W. Sander, p. 109.

meln). Lalling, as has been shown, is due to want of precision and want of cleverness in the action of the Oral Articulative Mechanism; and this want of precision, when persistent, and displayed in the enunciation of many of the consonants, is, in the great majority of cases, as has been shown, the result of imperfect education of the Speech-centres, owing to defective intelligence and power of attention. Apart from those cases in which defective articulation is displayed only in connexion with one consonant, and those other cases where local paralysis or deformity is sufficient to account for it, Lalling articulation, in the great majority of cases, means imbecility of mind. It is very different with Stammering (Stottern). Stammering, associated with Lalling, is indeed often enough found in imbeciles; but in the great majority of cases Stammering exists by itself, and is in no way indicative of deficient intelligence. It is, however, very frequently connected with the Neuropathic diathesis; being more especially apt to be associated with Nervousness, and instability of the Emotional nature. The frequent association of this defect of the vocal mechanism with a certain Weakness of Inhibition in the emotional nature, recalls to one's mind the physiological relationships of the voice as a means of expressing emotion. In like manner, the equally intimate connexion of Lalling with Imbecility, recalls the connexion which has been shown to exist between the development of Oral Articulation and the development of the Intellect. Some of the German authors[1] have described Stammering (Stottern) as a *Dysarthria Syllabaris* (a difficulty of articulating syllables), and Lalling as a *Dysarthria Literalis* (difficulty of articulating letter sounds), but I regard this as an erroneous method of classification. When a patient stutters on a voiced consonant, such as **m** or **d** for example, because he does not throw the voice into it, he stutters upon a letter, not upon a syllable. The above definition of Stammering (Stottern) is therefore founded upon a false basis. The true physiological basis upon which to found distinctions between the two defects, is the analysis of Speech into its two component elements, viz., the Vocal and the Oral Articulative. The common variety of Stammering (Stottern) is due to want of promptitude in the action of the Vocal Mechanism; and the faulty articulation

[1] See Kussmaul, *op. cit.*, p. 633. Also article *Stottern*, by Arndt, in Eulenburg's *Real-Encyclopädie*, vol. xix. p. 173.

of Lalling (Stammeln) is due to want of precision in the action of the Oral Articulative Mechanism. In the normal child, this want of precision must be attributed to insufficient practice; in the imbecile adult, to want of the intelligence required for the education of the Speech-centres.

For the examination of a case of Stammering the test sentences given in page 17, and in the footnote to that page, will be found to be useful. For the examination of a case of Lalling, the test-sentences attached to the Physiological Alphabet of the frontispiece are the most suitable. It is also well, in testing a case of Lalling, to take the consonants of the alphabet one by one, and to observe how each is pronounced, not only as an initial, but when occurring at the middle or the end of a word. Thus with the letter P let the patient pronounce *Pa*, then *ap*, and then *appa;* and so with the others. The reader may have remarked that I have frequently made use of the numerals as test words in recording the pronunciation of lalling patients.

Developmental Bradylalia and Logorrhœa.

Bradylalia (slowness of Speech) is a condition which displays itself normally, to a greater or less extent, in every healthy child, during the earlier stages of its progress in Speech-production. Speech is as yet difficult, and the difficulty betrays itself in a certain deliberation of utterance. The same deliberation is displayed permanently in the speech of a certain number of imbeciles. Even some adults who are not imbecile, but whose mental operations are habitually performed with exceptional deliberation, display it. Speech in these is slow and often scanty. They are "men of few words," and these few are always deliberately emitted.

The opposite condition, that of Logorrhœa, is also frequently met with in those of weak mind, or at least of weak mental inhibition. These are the chatterers, who say, in very many words, little that is worth listening to. When the words crowd upon each other so much as to interfere with their distinct articulation, the condition has sometimes been called "Cluttering." In his admirable work on *The Neuroses of Development*, recently published, Dr Clouston describes a case of this kind. The patient,

an imbecile man of middle life, expressed his feeble thoughts so volubly, that, although "articulation is normal when slowly performed, the moment ordinary speech begins, the mental co-ordination is lost, and we have a torrent of half-articulated words, following each other like peas running out of a spout."

The defects displayed in developmental Bradylalia and Logorrhœa are thus to be regarded as indicative rather of mental peculiarities, than of defects in the action of the Speech-Mechanisms.

The Language of Deaf-Mutes.

When a child of three or four years is brought by its parents for examination, because it has not yet begun to speak, and they are getting alarmed about its dumbness, the physician is called upon to decide as to the cause of the dumbness. At this early age, the case is not necessarily one of much gravity. If the child is found, on examination, to have good hearing; and is reported to show, in its play and in its general conduct, that it interests itself in matters that interest children; to be cleanly as to evacuations; and to be, in disposition, moderately affectionate and manageable; the case may be one in which the development of Speech, though tardy, will in the long run be satisfactory. All that the physician need do, in such a case, is to recommend patience, and the encouragement of the child in its attempts to speak. It will be well, at the same time, to examine the mouth, in order to see if there be any peculiarities about the Oral Structures that may be interfering with articulation; although it must be remembered, that, apart from Hare-lip and Split-palate, peculiarities of this kind are by no means common.

In every case of dumbness in a child, the two most important questions that the physician will be called upon to decide, are:—(1.) Is the child imbecile? (2.) Is it deaf? In many cases, unfortunately, the indications of imbecility will be only too evident. The child may have a vacant expression, in some cases torpid and passive, in others restless and yet purposeless; often it will be reported that the child is passionate and unmanageable; the parents may have been forced to observe its inability to interest itself so much as other children in toys and play; and it may also be heedless as to evacuations.

If the case be one of Deafness, and the child be otherwise normally constituted, its whole expression and conduct will be very different from those of an imbecile child. Already, even at this early age, there may be a certain wistfulness in the expression of the eyes, indicative of the child's instinctive employment of the sense of sight with a diligence that may in some measure compensate for the absence of hearing. The hearing should be specially tested. Some one should stand behind the child and clap the hands, or call his name, both aloud and in a whisper; and note should be taken of what response the child makes to such stimuli. It should be remembered that even partial deafness may cause dumbness. In such a case, it will be found that the child responds to loud sounds, but makes no response when his name is whispered or when other slight sounds are made close behind him. For the future training of the child, it is most important to ascertain whether the loss of hearing is very marked or comparatively slight. The majority of deaf-mutes are not absolutely deaf to very loud sounds.

About the various forms of language that may, for the purposes of expression, be employed by Deaf-Mutes, I should like to say a few words.

I. *The Language of Natural Signs.*—This is a most interesting subject, regarding which the reader will find full information in any of the works upon Deaf-Mutism, but perhaps nowhere a more striking account than in the second and third chapters of E. B. Tylor's well-known work on the *Early History of Mankind.* Without entering into any detail about the Natural Language of Signs, I may say that essentially it is merely a development of that language of facial expression and gesture that is employed by every child and adult, more or less. In the deaf-mute, it lacks the aid which is given to it, in the natural child, by the expressive tones of the voice,—the voice of a deaf-mute being harsh and discordant, and of very little expressive power. But, on the other hand, in the deaf-mute, gestures and signs attain to a development far ahead of that displayed in the normal individual. It is the only language which the uneducated deaf-mute can employ for purposes of expression, and Nature herself teaches him to employ it with wonderful power and expressiveness. The basis of the language is essentially Pictorial Representation of things and

actions. A red tent can be represented by making the outline of its shape in the air with the hands and touching the lip to show that it is red. Cowering or crouching may be used as the indication of fear; crossing the arms and shivering as that of extreme cold. "To put the forefinger against the closed lips is 'silence'; but the finger put into the mouth means a 'child.'" In the Berlin Deaf-and-Dumb Institution, "to pull up a piece of skin on the back of one's hand is 'flesh or meat.' Make the steam curling up from it with the forefinger, and it becomes 'roast meat.' Make a bird's bill with two fingers in front of one's lips and flap with the arms, and that means 'goose;' put the first sign and those together, and we have 'roast goose.' . . . . To express the pronouns I, thou, and he, I push my forefinger against the pit of my stomach for 'I'; push it towards the person addressed for 'thou'; point with my thumb over my right shoulder for 'he'; and so on." This Language of Natural Signs is the mother-tongue of the deaf and dumb. Without multiplying examples of it, I may add that its syntax is different from that of ordinary speech, in so far as it invariably follows the rule of putting the most important element of the sentence first in order. Thus, "I am hungry, give me bread," is expressed as "Hungry me, bread give"; and "Bring a black hat" becomes "Hat black bring." In every community of deaf-mutes, certain arbitrary or conventional signs are always added to the signs suggested by Nature; and the language is thus made fuller and more efficient. Thus we are informed by Mr Tylor that one of the teachers at the Berlin Institution was indicated among the boys by a sign suggesting the loss of an arm, not because he wanted an arm, but because he came from Spandau, and one of the boys who had been to Spandau had there seen a man who had lost an arm. This Natural-Sign Language of deaf-mutes has called forth the admiration of many who have had opportunities of studying it. The reader will find in Mr Tylor's work an eloquent description of the religious service conducted by one of the teachers of the Berlin Institution for the benefit of the uneducated deaf-mutes of the city. Mr Tylor says,—"No one could see the parable of the man who left the ninety-nine sheep in the wilderness, and went after that which was lost, or of the woman who lost the one piece of silver, performed in expressive pantomime by a master of the art, without

acknowledging that for telling a simple story and making simple comments on it, spoken language stands far behind acting." It must, however, be admitted that this language is, after all, little fitted to impart to a deaf-mute any high degree of intellectual culture. "Its poverty is obvious . . . . it is calculated for the expression only of the ordinary emotions and tangible things.[1]"

II. Taking the above Language of Natural Signs as a basis, the Abbé de l'Épée and his successor the Abbé Sicard added to it a vast number of conventional or arbitrary signs, to represent a great variety of words, including many prepositions, conjunctions, etc. They perfected their system to such a degree, that they could, in this language of natural and artificial signs, dictate to their pupils whole sentences of words, which the pupils could correctly transfer to writing. They supplemented this system by teaching their pupils to write and draw, and to spell words upon the fingers by means of the bimanual alphabet. These methods have been largely followed in many other countries throughout the world, but the artificial signs have, as a rule, not been so much adopted as the other parts of the system.

III. In some schools, the pupils are taught to express themselves by writing only, or by writing and the Manual Alphabet. Written words are directly associated with objects, and the mental images of these words are eventually made to play, in the processes of thinking, the same part that, in persons not deaf, is played by the sound images, or memories, of audible words.

IV. In many of the best schools, Oral Speech is taught; artificially, by means of articulation and lip-reading. The pupils are at the same time taught to write.

V. In many schools, the best parts of the Oral and Sign Systems are combined; only the most intelligent pupils being fully instructed in Oral Articulation and "Lip-Reading."[2]

At the present time, it may be said that, for conducting ordinary conversation, the chief rivalry is that between the practice of the Manual Alphabet, by means of which an educated deaf-mute can express himself almost as quickly as an ordinary person can by word

[1] Degerando, quoted by Arnold, in *Education of Deaf-Mutes*, p. 132.

[2] For a fuller description of these methods see Arnold's *Education of Deaf-Mutes*.

of mouth, and the practice of Oral Articulation and "Lip-Reading," which, when successfully acquired, enables the deaf-mute to express himself by word of mouth like an ordinary person, though his tones are apt to be more or less harsh and unmusical. The latter practice involves a difficult process of education, and the exercise by the patient of the closest attention and observation. But, when successfully mastered, it has the great advantage of enabling the patient to understand what is said to him by anyone, and make himself understood by anyone he may speak to. It thus enables him to mix in ordinary society, and to converse with people who cannot use the Manual Alphabet. This Oral Method, which was first systematically taught in a school, in the last century, by Samuel Heinicke, a Saxon schoolmaster,[1] has always, since his day, been much cultivated in Germany; and, at the present time, is beginning to find much favour everywhere, throughout Europe and in America. How successful it is sometimes, is illustrated by an anecdote told by Kussmaul regarding a conversation with one of his hospital patients. He had for some time been freely conversing with this patient; and, having observed nothing unusual in his manner of expressing himself, was afterwards much surprised to learn that he had been conversing with a deaf

[1] "It is hardly just to call Heinicke the founder of the German method. He only gave a more logical application to the principles taught by Bonet, Wallis, and Amman, but he clearly perceived that there could be no compromise between speech and signs as fundamental in teaching language." Arnold's *Education of Deaf Mutes*, p. 85.—Heinicke began teaching in Dresden in 1754. In 1760, Thomas Braidwood founded a school in Edinburgh, and taught "lip-reading" very successfully. He was visited by Dr Johnson, and is referred to in laudatory terms in the latter's famous account of his tour to the Hebrides. Braidwood afterwards, in 1783, removed to London, where he was soon the first head-master of the first public institution established in England for the education of deaf-mutes. The school founded by him in Edinburgh has been kept up ever since, and now occupies excellent premises in Henderson Row. Edinburgh also has, in Donaldson's Hospital, a splendid Institution which is partly devoted to the education of Deaf-Mutes.

A century before the time of Heinicke and Braidwood, "Lip-Reading" was successfully taught in Spain by Pedro Ponce de Leon, a Spaniard of illustrious birth, and his successor Juan Pablo Bonet, a capable man of business, employed in official services. It was in Spain, also, that the one-handed alphabet was invented. The two-handed alphabet, used generally in this country, was invented, at a later date, in France.

man, who had understood all his remarks by the method of lip-reading. In this country, many cases have already been successfully taught by this method; but it is universally admitted that success has hitherto not been so great as it has been in Germany. The reason alleged is that the English language is not so well fitted for "lip-reading" as the German is. There can be no doubt that the chief difficulty in regard to English is, not that the sounds of the words are more difficult of pronunciation, but that the spelling of the words has departed so widely from their sounds. The spelling, in English, is now far from being strictly phonetic, whereas in German it still continues to be almost strictly so. The deaf-mute can thus read a German word correctly if he has mastered the phonetic values of the component letters. Knowing the letter-sounds well, he can even practise reading aloud by himself without much danger of falling into errors of pronunciation. It is very different with the English deaf-mute. Even a person not deaf (say a foreigner), in learning English, finds the spelling of the words no sure guide to their pronunciation. What then must be the difficulties of a deaf-mute, who cannot always have a tutor at his elbow, to show him, by "lip-reading," how each word is pronounced? In America, this difficulty has been grappled with in a special way. It appears that, in some of the American institutions, Melville Bell's system of "visible speech" has been adopted, this system having an alphabet (altogether different from the ordinary one) in which each letter has a definite phonetic signification. In this country attempts are made to get over the difficulty by phonetic spelling. But I do not think that phonetic spelling has been made so accurate and easy of comprehension as it might be made. In particular, I think it would probably be of great advantage to deaf-mutes to have a phonetic alphabet in which the relationships of one vowel to another, and of one consonant to another, are clearly displayed. If such a Physiological Alphabet as I have given in the first paper were adopted for the teaching of deaf-mutes, each letter would have a definite phonetic signification, so that words spelt phonetically by it might be read with ease by the deaf-mute, if only he had previously mastered the individual letter-sounds. In order to adapt this Physiological Alphabet to the teaching of deaf-mutes, it would be necessary to write the vowel-sounds in such a way as to enable the deaf-mute

clearly to distinguish one from the other. No change would be required in the alphabet of consonants: they might be written exactly as they are in the alphabet of the first chapter. In making the following attempt to improve the manner of writing the vowels, I have taken a hint from Dr Hullah's method of indicating the varying breadth of vowel-sounds. I have also added to the English vowels several foreign vowels, and a few diphthongs. For the alphabet of consonants, the reader is referred to the Physiological Alphabet of the first chapter.

I. *Long Vowels*, as in the sentence:—

Even ancient elves are awed over oozing.

ē ā ê āā ât ō ōō

II. *Equivalent Short Vowels*:—

ĕĕt ĭt ĕt ăt ŭt ŏt ŏŏt

III. *Foreign Vowels*:—

German ü, as in *über*; French *u*, as in *user*;[1] German ö, as in *ölig*.[2]

IV. *Diphthongs*:—

(1.) English u as in p*u*re e͡u.
(2.) „ i as in p*i*le a͡i.
(3.) „ oi as in b*oi*l o͡i.
(4.) „ au as in h*ow* a͡u.

By way of example, take this sentence, spelt phonetically in accordance with the foregoing:—

Spĕĕtsh ĭz la͡ik klŏth̀ ŏv Arrăs, ōpĭnd ănd pŏŏt ăbrâât, whārba͡i thĭ́ ĭmădzhĕrĭ dŏth̀ ăppēr ĭn fĭgŭr; whārăz ĭn thấâts thā la͡i bŭt ăz ĭn păks.[3]

[1] I print the French *u* in italics merely to distinguish it from the other varieties of u.

[2] For the German ü, the Resonating chamber within the mouth is shaped as for ē in *even*; for the French *u*, it is shaped as for ê in *elves*; for the German ö, it is shaped as for āā in *are*. In all three, the lips are brought into very much the same position as they are for the pronunciation of ōō in *ooze*. The German ö might be used to represent the vowel sound in some English words, such as *bird*.

[3] Plutarch, *Life of Themistocles*.

If I were a teacher of deaf-mutes, I should, I think, have the first series of lessons printed entirely in such a phonetic alphabet. The next lessons I should have printed in double lines, of which one would be phonetic and the other in the ordinary spelling. Later, the two spellings might be given on opposite pages. Still later, only a few of the more difficult words might be repeated in phonetic spelling, after the ordinary spelling; and finally, the lessons might be printed entirely in the ordinary spelling. I submit this suggestion, respectfully, for the consideration of those who may be specially interested in the education of deaf-mutes. Perhaps I may not be considered too bold in offering it, since I have, of late years, been a good deal occupied with the study of the Physiological Alphabet.

The system of "Lip-Reading" is rapidly gaining ground everywhere. It has no rival in its capability of enabling deaf-mutes to mingle in ordinary society. It is also claimed for it, by its advocates, that it is a better aid to thinking than any of the other methods. Although, as has been truly said, the uneducated deaf-mute is a standing refutation of the opinion that there can be no rational thinking without words, it is nevertheless the case that his thinking can never attain to a high level until he has been educated to the use of words. In order to think in words, he must first be able to call up their images in his mind. No process of training will ever enable him to call up their sound-images. For him, sound has no existence. But, in the absence of sound, he can, when educated, store up the visual images of written words; and he can use these in the processes of thinking, in place of the sound-images employed by others. If trained to Oral Articulation and Lip-Reading, he can employ other word-images or word-memories, of a kind more closely allied to sound-images. He can then employ the memories of production that are imprinted by the muscular sense of the motor mechanism and by the tactile sense of the mucous surfaces used in speech. To these, in forming his concepts of words, he can add the sense of vibration produced by the voice, and also the visual memories of the movements observed in others when he is practising "lip-reading" of their speech. It seems that the memories or concepts of words thus obtained are the best working substitutes for the sound-memories which ordinary people employ in the processes of thinking. Even in

France, where the sign systems were formerly so much in vogue, the system of Lip-Reading is now rapidly coming to the front. Of recent works on the subject, one of the best is by a professor at the National Institute for Deaf-Mutes in Paris.[1] In this country also, rapid progress is being made; and many persons have been most successfully trained in Lip-Reading. Nevertheless, great difficulties are met with in the training of large numbers; and success is much more probable when a teacher devotes himself almost entirely to one or two pupils. The language is partly accountable for this, and especially, I think, the spelling of the language. I think it is reasonable to believe that the difficulty would be materially lessened, if phonetic spelling were rendered accurate and easy of comprehension.

[1] *Comment on fait parler les Sourds-Muets*, par L. Goquillot, 1889.

CHAPTER VII.

THE DEVELOPMENT OF SPEECH IN THE HUMAN RACE. CLASSIFICATION OF LANGUAGES. ORIGIN OF WRITTEN LANGUAGE. THE INVENTION OF PRINTING. PRINTING FOR THE BLIND.

ANY account of the Development of Speech would be most incomplete if it were content merely to treat of the subject in its relations to the individual Child, and made no attempt to indicate the views that are current regarding it in its relations to the Human Race. This consideration has weighed with me, and has led me to write the following chapter. Although the relations of the subject to practical medicine are somewhat remote, the facts brought out in the study of it are of great scientific value. They throw light upon the nature of speech and upon its relations to thought. Fortunately, in this country, the subject has been treated by a number of writers remarkable alike for eloquence and for learning. Any notes that I can make in this chapter, from the works of these authors, must of necessity be brief and fragmentary; but I shall try to make a statement of their chief conclusions, and, when possible, shall give these conclusions in their own words.

The Development of Speech in the Human Race.

"In examining the history of mankind," says Dugald Stewart, "as well as in examining the phenomena of the material world, when we cannot trace the process by which an event has been produced, it is often of importance to be able to show how *it may have been* produced by natural causes. Thus, although it is impossible to determine with certainty what the steps were by which any particular language was formed, yet if we can show, from the

known principles of human nature, how all its various parts might gradually have arisen, the mind is not only to a certain degree satisfied, but a check is given to that indolent philosophy which refers to a *miracle* whatever appearances both in the natural and moral worlds it is unable to explain." [1]

These words of the eminent Edinburgh Professor were written about the end of last century, when the science of Philology was yet in its infancy. Since those days, that noble science has been pursued by many eminent scholars with brilliant success. Their investigations have thrown a flood of light upon the real nature of human speech. They have shown how the languages of mankind can be classified, according to their affinities, into a number of great groups; all the members of each group having evidently sprung from a common parentage. Even between the great groups, they have shown the existence of certain affinities, not it is true of a very pronounced or intimate character, but yet sufficient to render it probable, even on strictly scientific grounds, that the human race possessed at least the rudiments of speech before it was scattered abroad in the various parts of the world. The method pursued by modern philologists has been to a very marked extent an analytic one. They have studied in detail a vast number of languages, ancient and modern, and, according to the affinities discovered among them, have grouped them as above indicated. The chief ground for such a grouping has been the discovery that among the members of each group the "roots" of the words are possessed in common; that in certain of the groups these "roots" are welded together in a characteristic manner; and that among the members of each group there is in grammar and syntax much that betrays a common parentage. Something will presently be said about the characteristics of each of the great groups thus differentiated. In the meantime, perhaps an example or two will best illustrate the manner in which a community of "roots" can be shown to exist among the members of a great group. I shall take these examples from the pages of Prof. Max Müller, the leading exponent of philological science in this country. In dealing with the great Aryan group of languages, this author uses among many other illustrations the root "ar." This he finds in the later Sanscrit in the word **arya**, a tiller of the soil. With the

[1] Quoted by Max Müller, *Lectures on the Science of Language*, vol. i. p. 391.

meaning of "to plough," he finds it in the Latin **ar-are**; the Greek **ar-oun**; the Irish **ar**; the Lithuanian **ar-ti**; the Russian **or-ati**; the Gothic **ar-jan**; the Anglo-Saxon **er-jan**; and in the modern English **to ear.** Shakespeare says (Richard II., iii. 2), "to ear the land that has some hope to grow." And in Deut. xxi. 4 we read, "A rough valley which is neither eared nor sown." He further traces this root into the words signifying the plough, or the instrument of earing; such as the Latin **ara-trum**; the Cornish **aradar**; the Welsh **arad**; and many other derivatives. "Even the word **earth,** the Gothic **airtha,** the Anglo-Saxon **eorthe,** must have been taken originally in the sense of ploughed or cultivated land." Taking again the word **respectable,** he separates from it its root "spac," to look or see, and demonstrates the presence of this root in a vast number of words of the various languages, ancient and modern, which constitute the great Aryan group. These are but two of the numerous examples of roots in the Aryan languages which are given by Professor Müller. He shows that after the most careful analysis of any one of the more highly developed languages of mankind, four or five hundred of such roots are what remain in the crucible; and that from these the thousands of words composing the language are essentially formed. He is very emphatic in his assertion that these roots are predicative, and the signs of general ideas:—Thus the root "mâ" in Sanscrit means *to measure*, from which is derived *moon*, the measurer; "man," a derivative root, means *to think*, and as a noun it therefore means *the thinker;* the *sun* is the begetter; the root "gâ" means going; "sthâ," standing; "sad," sitting; "da," giving; "mar," dying; "*k*ar," walking; "kar," doing. He has some interesting remarks about the struggle for existence which has to be carried on among these roots, when language is being developed. He shows that in the earlier stages of development a language is always very rich in synonyms; for example,—"In common Sanscrit dictionaries, we find five words for 'hand,' eleven for 'light,' fifteen for 'cloud,' twenty for 'moon,' twenty-six for 'snake,' thirty-three for 'slaughter,' thirty-five for 'fire,' and thirty-seven for 'sun.' The sun might be called the bright, the warm, the golden, the preserver, the destroyer, the wolf, the lion, the heavenly eye, the father of light and life. Hence the superabundance of synonyms in ancient dialects, and hence that *struggle for life*

carried on among these words, which led to the destruction of the less strong, the less happy, the less fertile words, and ended in the triumph of one, as the recognised and proper name for every object in every language." He says, "The fact that every word is originally a predicate, that names, though signs of individual conceptions, are all without exception derived from general ideas, is one of the most important discoveries in the Science of Language." He is strongly opposed to the doctrine of those who would trace the origin of language to natural interjections uttered under emotion, and to the imitation of natural sounds such as the cries of animals. Though recognising the existence of a few words of onomatopoietic origin in all languages, he thinks these neither numerous nor important. He holds that the *roots* must be regarded as ultimate facts in philology. The only explanation of their origin that he offers is a somewhat mystic one. He says, "All that we have a right to assert is that language begins with roots, and that these roots are neither more nor less than phonetic types or typical sounds. What lies beyond them is no longer, or, if we speak historically, is not yet language, however interesting it may be for psychological researches. But whatever exists in real language is the upshot of these roots. Words are various impressions taken from these phonetic moulds." In indicating how these phonetic types may have first displayed themselves, he says, "If we must look for analogies, however imperfect, they have been pointed out by others. There is a law, it has been said, which runs through nearly the whole of nature, that everything which is struck rings. Each substance has its peculiar ring; we can tell the more or less perfect structure of metals by their vibrations, by the answer which they give. Gold rings differently from tin, wood rings differently from stone, and different sounds are produced according to the nature of each percussion. It is the same, we are told, with man, the most highly organized of Nature's works. Man responds. Man rings. Man in his primitive and perfect state was not only endowed like the brute with the power of expressing his sensations by interjections, and his perceptions by onomatopœia. He possessed likewise the faculty of giving more articulate expression to the general conceptions of his mind. That faculty was not of his own making. It was an instinct, an instinct of the mind as irresistible as any other instinct. Man loses his

instincts as he ceases to want them. His senses become fainter, when, as in the case of scent, they become useless. Thus the creative faculty which gave to each general conception, as it thrilled for the first time through the brain, a phonetic expression, became extinct when its object was fulfilled."

The opinion thus expressed by Professor Müller as to "roots" being ultimate facts in philology, whose origin it is impossible to account for further than in some such vague manner as he suggests, has not met with acceptance among philologists generally. It is strongly opposed by many philologists of eminence, who hold that the development of language, including the development of roots, has been a very gradual process, whose first beginnings can be explained in a natural and comparatively simple manner. This school of philologists, which has been termed the Imitative School, is very strong in Germany. It is represented in this country chiefly by Mr Hensleigh Wedgwood,[1] and the Rev. Archdeacon Farrar.[2] These authors, and the school represented by them, are by no means inclined to accept the dictum of Professor Müller, that roots are ultimate facts in philology. As Mr Farrar puts it, "If we are told that a large family of words come from 'ar,' or 'ga,' or 'sal'; and if about 'ar,' and 'ga,' and 'sal,' nothing more can be said, then what have we learned? The roots are mere mysterious nonentities which have taught us nothing, and come from nowhere. The earth rests on the back of an elephant, and the elephant stands on a tortoise; but what does the tortoise stand upon?" In endeavouring to find what the tortoise stands upon, these philologists accept the conclusion which the Sciences of Geology and Natural History point to, viz., that man appeared late in the history of the world, and that he was slowly developed from a comparatively humble condition, in which he was probably devoid of any gift of speech properly so called. Mr Wedgwood remarks, "The mere absence of man among an animal population of the world, is felt by no one as repugnant to a thorough belief in the Providential rule of the Creator. Why then should such a feeling be roused by the complementary theory, which bridges over the interval to the appearance of man, and supposes that one of the races of the purely animal period was gradually raised in the scale

[1] *A Dictionary of English Etymology*, prefaced by an elaborate introduction.

[2] *Chapters on Language*, 1873, and *Origin of Language*, 1860.

of intelligence by the laws of variation affecting all procreative kinds of being, until the progeny, in the course of generations, attained to so enlarged an understanding as to become capable of appreciating each other's motives; of being moved to admiration and love by the exhibition of loving courage, or to indignation and to hate by malignant conduct; of finding enjoyment or pain in the applause or reprobation of their fellows, or of their own reflected thoughts; and sooner or later, of using imitative signs for the purpose of bringing absent things to the thoughts of another mind?"

In trying to guess at the means which man, as yet devoid of speech, would employ in expressing his thoughts and emotions to his fellows, the philologists of this school ask themselves:—(1.) What does a man of the present time do in trying to make his wants known, when, in a foreign country, he finds himself amongst those to whom his mother-tongue is unknown? (2.) How do savages eke out the expressive powers of their rudimentary and imperfect languages? (3.) How do deaf-mutes who have not been educated to speak express their thoughts? And (4.) How do children who have not yet learned to speak make their wants known? The answer is that, in all these cases, the language of Facial Expression and Gesture is extensively used; and, except in the case of deaf-mutes, that Emotional Tones or Exclamations are added, as well as, in many cases, Vocal Imitations of natural sounds. Further, this school of philologists examines carefully the languages of savage and civilized mankind. In all cases, they find that an Imitative or Onomatopoietic element is very abundantly represented, more especially, as it would seem natural to anticipate, in the languages of savage peoples, which may reasonably be regarded as representative in some degree of the speech that may have existed in the childhood of mankind.

A few illustrations, taken from the works of Mr Wedgwood, Archdeacon Farrar, and Mr E. B. Tylor, will help to make the position of this school of philologists intelligible to the reader.

1. Mr Wedgwood says that a traveller of the present day, "thrown among people whose language was altogether strange to him, would signify his hunger by pointing to his mouth and making a semblance of eating. Terrified by a bull, he would find it convenient to make known the object of his alarm by imitating,

at once, the movements of the animal with his head, and bellowing with his voice." Referring to the old story of the Englishman in China, who, when at dinner, grew suspicious about a dish placed before him, he shows how naturally the language of onomatopœia suggested itself in that case. Thinking that the dish might be duck, the Englishman said with an interrogative accent, "Quack, quack?" He received the clear and straightforward answer, "Bow-wow."[1]

2. As to the employment of Gestures by savages, Captain Burton says, regarding a tribe of North American Indians, "Those natives who, like the Arapahos, possess a very scanty vocabulary, pronounced in a quasi-unintelligible way, can hardly converse with one another in the dark. To make a stranger understand them they must always repair to the camp-fire for *pow-wow*".[2] Mr Farrar, at p. 39, alludes to the Puris of Brazil, who have to eke out their scanty language by a large use of signs; to the Fuegians, whose language has been described as an inarticulate chuckling; to the forest tribes of Malacca, who lisp their words with sound like the noise of birds; and to the wild Veddas of Ceylon, who have gutturals and grimaces instead of language.

3. The Gesture Language of deaf-mutes is so closely allied to that employed by uncivilized races, that deaf-mutes and savages are easily able to converse with each other by means of gestures. In illustration of this point, Mr E. B. Tylor[3] remarks,—"The best evidence of the unity of the gesture language is the ease and certainty with which any savage, from any country, can understand and be understood in a deaf-and-dumb school. A native of Hawaii is taken to an American institution, and begins to talk at once in signs to the children, and to tell about his voyage and the country he came from. A Chinese, who has fallen into a state of melancholy from long want of society, is quite revived by being taken to the same place, where he can talk in gestures to his heart's content. A deaf and dumb lad, named Collins, is taken to see some Laplanders, who were carried about to be exhibited, and writes thus to his fellow-pupils about the Lapland woman:—'Mr Joseph Humphreys told me to speak to her by signs, and she

[1] The above is Prof. Max Müller's version of the story, not Mr Wedgwood's.

[2] Quoted by E. B. Tylor, *Early History of Mankind*, p. 77.

[3] *Ibid.*, p. 54.

understood me. When Cunningham was with me, asking Lapland woman, and she frowned at him and me. She did not know we were deaf and dumb, but afterwards she knew that we were deaf and dumb. Then she spoke to us about reindeers and elks, and smiled at us much.' "

4. The early employment of the language of vocal tone, facial expression, and gesture, by young children, has been already treated of in a former chapter; and it has also been shown how soon they learn to imitate mechanically the sounds of words, the cries of animals, and other sounds, by the process of echolalia. The philologists of the Imitative School lay stress upon the fact that a child, ordinarily trained, always uses Onomatopoietic terms as its names for animals. **Bow-wow** is learned as the name for a dog, **moo** for a cow, **baa** for a sheep, and **gee-gee** for a horse. Thus the child is trained to know *that a sound may stand for a thing.* "This," says Mr Farrar, "is the most difficult lesson of all language, and when, by the use of a few words, the child has once learned it—when it has once succeeded in catching this elementary conception—the rest follows with astonishing rapidity. Hence very few onomatopœias, and these borrowed from the commonest and simplest objects, are sufficient for the purpose. . . . But how is he to learn this marvellous lesson? Only by observing instinctively that, since certain things give forth certain sounds, the repetition of the sound, by an inevitable working of the law of association, recalls the object which emits it. Nor is it the slightest objection to this to say that the child does not learn the onomatopœia for itself, but learns it from its nurse. Supposing that we grant this, what does it prove? Simply the fact that every nurse and every mother is guided by the swift, beautiful, and unerring beneficence of instinct, to follow the very same process which the great mother Nature adopted when man was an infant child; or, let us say, in language more reverent and not less true, that such a process is instinctive, unconscious accordance with the great method of the Creator."

The Imitative School thus hold that, before true speech began to be developed, there was probably a period during which our ancestors expressed their feelings in the language of vocal tone, facial expression, and bodily gesture. They believe that the first suggestions of true speech were obtained from the Imitation of Natural Sounds.

Many of the higher animals, such as fowls, horses, and dogs, are endowed with a power of emitting, when under excitement, certain expressive inarticulate vocal sounds; and in such sounds some of them, such as the dog, can express a considerable variety of emotional feelings. Man possesses this same power in still greater degree. He involuntarily, in many circumstances, expresses his strong emotion by inarticulate vocal exclamation, which may in one case express pain, in another disgust, in another horror, and so on; the exclamation being in each case associated with appropriate facial expression and gesture. The exclamations thus made, so long as they are inarticulate and involuntary, cannot be ranked, in any proper sense, as words. Soon, however, the discovery is made that these natural exclamations, if repeated voluntarily, are capable of calling back to the human mind the states of feeling that originally produced them; and, further, that, if thus repeated in the presence of others, they are capable of calling up, in their minds also, the same states of feeling. Used in this voluntary manner, these natural exclamations become Interjections. According to the Imitative School, such interjections go to form, in all probability, one of the first rudiments of true speech. In course of time, these interjections inevitably have consonant-sounds added to them, and thus become conventionalized and verbalized; but it must be noted that the added consonants differ much in the languages of different peoples, although the natural inarticulate exclamation that suggested the interjection has been the same in all cases.

One or two examples may be given from the treatise of Mr Wedgwood. Take the interjection "pooh." This, he believes, was originally suggested by the spitting-out of an unsavoury morsel; and he quotes a good deal of evidence to show that this was its real origin. He gives, for example, a quotation from the traveller Leichardt, who met with this mode of expression among the savages of Australia. "The men commenced talking to them, but occasionally interrupted their speeches by spitting and uttering a noise like *pooh-pooh*, apparently expressive of their disgust." He shows further, on the authority of Captain Burton, that certain African tribes use **tooh-tuh** in the same sense, spitting at the same time upon the ground. He finds, in certain other languages, that the word representative of spitting may be used with an initial **p**, as in the Maori **puhwa**, to spit out; or with **sp**, as in

the Latin **spuere**, to spit; or with **t**, as in the Arabic **tufl**. He gives many other modifications of it in other languages. He thus shows how differently a natural act, expressive of dislike, may in various languages be translated into an imitative interjection.

To take a second example. The sound of a sigh or groan is, in English, translated into the interjection **ah, ah**; in German it becomes **ach**; in Welsh, **ochan**; and the verb to groan becomes, in German, **achen** or **ächzen**; and so on. Other translations of the sigh he finds in the Latin **Vae**; in the German **Weh**, pain; **Die wehen**, the pangs of childbirth, etc.

He also treats of other interjections, such as **ugh, hush, hist, foch, fie, hem, blurt, pet, trotz**, etc.; indicating the natural sounds that possibly suggested them, and showing how differently they have been translated into different languages.

The second great source of primitive words that has been insisted upon by the Imitative School is the Voluntary Imitation of Natural Sounds, such as the natural cries of animals and the notes of birds (onomatopœia). So long as a child, or the "child-man," repeats these natural sounds in a merely mechanical manner, by echolalia, the natural sound has no claim to rank as a true word; but whenever the child-man began to use the imitation as a means of suggesting the animal, or other source of sound, to the mind of another person, then the imitation began to serve the purposes of a word; and it became an ordinary word when, after repeated use, it was modified and conventionalized by the addition of consonants, which made it more easy of articulation, though less true as an imitation. "Cuckoo" and "Peewit" are familiar words of such a derivation; and so is "Whip-poor-Will" and a host of others. All kinds of natural sounds have thus been reproduced, and are represented in various languages. We talk of "the clucking of hens, cackling or gaggling of geese, gobbling of a turkey cock, quacking of ducks or frogs, cawing or quawking of rooks, croaking of frogs or ravens, cooing or crooing of doves, hooting of owls, bumping of bitterns, chirping of sparrows or crickets, twittering of swallows, chattering of pies or monkeys, neighing or whinnying of horses, purring or mewing of cats, yelping, howling, barking, snarling of dogs, grunting or squealing of hogs, bellowing of bulls, lowing of oxen, bleating of sheep, baaing or maeing of lambs."[1]

[1] Wedgwood, *op. cit.*, p. 16.

Other sounds are imitated by the words "bump, thump, plump, thwack, whack, smack, crack, clack, clap," and a host of others, given at page 28 of Mr Wedgwood's treatise.

Interjections and imitations of natural sounds (onomatopœiæ) are thus evidently the sources of a great many roots and words in every language. Mr Farrar holds that at the present time no radically new word ever has a chance of being permanently adopted in a language, unless it be of onomatopoietic character. Once formed, words of imitative origin are apt to be much changed, by phonetic decay, in the course of their after-history; and in some cases the imitative origin of their decayed descendants is discoverable only by reference to their ancient forms in the same language, or to their existing forms in other languages of the same group. It is suggested that even in words where no evidence of imitative origin can now be discovered, there may be roots that at some far-off time had a form suggestive of that origin, which has been effaced only in the course of ages. It is not maintained by the Imitative School that more than a considerable proportion of existing roots can at present be proved, upon sufficient evidence, to be of imitative origin, but it is believed that further investigation will demonstrate this origin in an increasing number of cases; and, as the roots of each language are, in all, only a few hundreds in number, it is thought to be probable enough that even a majority of them may have originated in this way. Mr Tylor, indeed, recommends caution. He thinks that the evidence does not justify "the setting up of what is called the imitative or interjectional theory as a complete solution of the problem of original language. Valid as this theory proves itself within limits, it would be incautious to accept a hypothesis which can perhaps account for a twentieth of the crude forms of any language, as a certain and absolute explanation of the nineteen-twentieths which remain. A key must unlock more doors than this to be taken as the master key."[1] Mr Wedgwood, however, in making this quotation, remarks that this objection does not exactly meet the position held by prudent supporters of the theory in question.

Dr G. J. Romanes[2] has made an interesting suggestion as to another possible source of primitive words and roots. He reminds

[1] *Primitive Culture*, i. 208.

[2] *Mental Evolution of Man*, p. 291.

his readers that even civilized children will sometimes "coin a language of their own, in which the element of onomatopœia is barely traceable,"[1] and that uneducated deaf-mutes will sometimes spontaneously devise articulate sounds which they may use as names for their friends, etc., "which sounds are necessarily destitute of any imitative origin." He does not see "why it should be held antecedently impossible that primitive man can have found any other means of word formation than that which is supplied by mimicry."

Mr Farrar objects decidedly to the notion, expressed by Prof. Müller, and apparently common to most philologists, that verbal or "predicative" roots, such as "going, moving, tasting, etc.," were the earliest. This to him is inconceivable. The invention of a verb "requires a greater effort of abstraction than that of a noun, for obviously we must have generalized from individual phenomena before we can express them verbally under the conditions of motion, action, or existence. . . . It requires but the feeblest power of abstraction—a power possessed even by idiots—to use a name as the sign of a conception, *e.g.*, to say 'sun'; to say 'sheen,' as the description of a phenomenon common to all shining objects, is a higher effort; and to say 'to shine,' as expressive of the state or act, is higher still." He thinks the correct view to be that the roots or words first used by the primitive child-man stood for any and every part of speech, as to this day is the case in that language of arrested development, the Chinese. Even in our present English language, as Mr Wedgwood shows, there are many words that can be used indifferently as noun, adjective, verb, adverb, or interjection. A loud **bang** is a noun; **Bang** went the gun! is an interjection; Do not **bang** the door, is a verb; He ran **bang** up against the wall, is an adverb qualifying the verb ran. It is further suggested that the primitive words of the child-man may, aided by the language of gesture, etc., have had each the significance of a short sentence,—like some of the words first used by children of the present day. When a child says "Up" to its mother, with appealing look and out-stretched arms, the single monosyllable stands for the whole sentence, "Please take me up on your knee." When Professor Preyer's boy said "Heiss" as he looked at the stove, he meant to express the opinion, "This stove is hot."

[1] See two cases already quoted from his work, in the chapter upon Baby-Speech.

Much discussion has taken place as to the *primum cognitum*, that is, as to the first kind of knowledge of objects acquired by the child, and possibly by the child-man. Is it a knowledge of particular things, that ascends, with advancing development, into a general knowledge of their classification or relations to each other; or, on the other hand, does knowledge begin with more general ideas, and descend, in the course of development, into an accurate knowledge of particulars? Both propositions have been supported by learned authorities, but perhaps a compromise between the two views is more in harmony with the real facts of the case than the exclusive advocacy of either. Such a compromise is expressed by Sir Wm. Hamilton (*Lectures on Metaphysics*, ii. p. 327). "As our knowledge," he says, "proceeds from the confused to the distinct, from the vague to the determinate, so, in the mouths of children, language at first expresses neither the precisely general nor the determinately individual, but the vague and confused; and, out of this, the universal is elaborated by generification, the particular and singular by specification and individualization."[1] Thus the young child who has learned to address its father as "Papa" and his mother as "Mama," is at first apt to bestow the same titles upon others of the male and female sex. It is only when it is a little more advanced, that the true "Papa" and "Mama" are distinctly particularized in its mind. It is suggested that possibly the child-man, in beginning to accumulate knowledge about the objects around him, began with notions that were similarly confused and indistinct; and, from these, developed only by degrees towards a clearer notion of the particular and a more comprehensive of the general.

But, leaving these difficult questions about the first beginnings of speech and knowledge, about which there is still so much difference of opinion, let us turn to a subject about which there is among Philologists substantial agreement, viz., the classification of languages.

Classification of Languages.

"As all languages, so far as we can judge at present, can be reduced in the end to roots predicative and demonstrative, it is

[1] Quoted by Prof. Max Müller, vol. i., footnote to p. 43.

clear that, according to the manner in which roots are put together, we may expect to find three kinds of languages, or three stages in the gradual formation of speech:—(1.) Roots may be used as words, each root preserving its full independence. (2.) Two roots may be joined together to form words, and in these compounds one root may lose its independence. (3.) Two roots may be joined together to form words, and in these compounds both roots may lose their independence.

"What applies to two roots applies to three or four or more."[1]

(1.) *Radical Stage.*—Chinese is the interesting example of a language in which each root is a monosyllabic word, preserving its full independence, and having its own substantial meaning. The expression "With a stick" would in Latin be expressed by the single word *baculo*, but in Chinese by the two words **ỳ ćáng**: **ỳ** having the meaning "employ"; so that the expression means literally "employ stick." The expression "at home"—in Latin *domi*—is, in Chinese, **ůŏ-li**: **ůŏ** meaning "house," and **li** originally "inside." There is no trace of grammar in ancient Chinese: the genitive case, for instance, is represented simply by placing the word that is in the genitive first in order,—"a man of the kingdom" being given as **koue** kingdom, **jin** man (the kingdom's man). The parts of speech are determined by the position of the words in the sentence:—thus **ngò tà ni** means "I beat thee"; but **ni tà ngò** would mean "thou beatest me." The adjective has the force of an adjective because placed before a noun. The same word placed before a verb would have the force of an adverb. "In Chinese," says Prof. Müller, "no analysis of any kind is required for the discovery of its component parts. It is a language in which no coalescence of roots has taken place. Every word is a root, and every root is a word. It is, in fact, the most primitive stage in which we can suppose human language to have existed. It is language *comme il faut;* it is what we should naturally have expected all languages to be."

(2.) *The Agglutinative Stage.*—In the second great group of languages, the Turanian, we have the group to which, according to Professor Müller, by far the largest number of languages belong. It, in fact, comprises all the languages spoken in Asia and Europe, except those that belong to the Aryan and Semitic families. It

[1] Max Müller, vol. i. p. 330.

is the type particularly characteristic of the races which have been at one time, or are even at the present day, of nomadic habits. In it, two roots may be joined together; and in these compounds one root may lose its independence. Its parts of speech have been considerably elaborated; the nouns having declensions and cases, and the verbs conjugations and tenses. The verbs are said to be particularly elaborate. Turkish is one of the best examples of the group. In Turkish—to take one or two examples,—the general idea of **loving** in the abstract is expressed by the root **sev**. Whatever additions be made to this root by agglutination of other syllables, it always remains itself unchanged, and is never modified, as the English **fall** is, in **fell**; or **take** is, in **took**. It becomes the participle **loving**, or the noun **lover**, by the addition of **er**,—**sev** + **er**;—and in this form it is used as the verb, **sever-im** being I love, **sever-sen** thou lovest, and so on. **Sev-mek** is to love; **sev-ish-mek** is to love one another; **sev-in-mek** is to love oneself, or rather, to rejoice and be happy.[1]

In illustrating the nature of this agglutinative group of languages, Dr Romanes uses the English word **un-cost-li-ness**, in which each syllable represents a root,—although in some of them, as in the syllable **li** (like), the root has suffered serious deterioration. Strung together into one word, the syllables have yet distinct meanings which can still be recognised, though in some cases with difficulty. He says, "If all our words had been formed on the type of this example 'uncostliness,' English would have been an agglutinative language." Prof. Max Müller says, "The agglutinative languages preserve the consciousness of their roots, and therefore do not allow them to be affected by phonetic corruption; and though they have lost the consciousness of the original meaning of their terminations, they feel distinctly the difference between the significative root and the modifying elements."

(3.) *The Inflectional Stage.*—The third great group of languages, that in which two or more roots, joined together to form words, may, in these compounds, all lose their independence, is that of the Inflectional languages, of which there are two families, viz., the Semitic and the Aryan. It is curious that the higher civilisation of the world has been, to a most remarkable extent, owing to

[1] For the above, and many other, examples of Chinese and Turkish, see Max Müller, vol. i.

the races of mankind who have spoken or continue to speak these languages. Hebrew, Chaldee, and Arabic, may be instanced as examples of the Semitic family; Sanskrit, Persian, Latin, Greek, the Teutonic languages, the Celtic, and the Slavic, as representatives of the Aryan. In this great Inflectional group, the roots have been welded together into a closer relationship than in the Agglutinative languages. To use the simile of Professor Müller, they represent a mosaic in which the elements are so closely applied to each other that the joinings cannot be discovered, whereas in the Agglutinative languages each separate element is still distinctly definable among the rest. In the Inflectional languages, "the various elements which enter into the composition of words may become so welded together, and suffer so much from phonetic corruption, that none but the educated would be aware of an original distinction between root and termination, and none but the comparative grammarian able to discover the seams that separate the component parts."[1]

Thus the English word **lord** would be nothing but an empty title "unless its original form and meaning had been discovered in the Anglo-Saxon **hlâf-ord**, meaning the source of bread, from **hlâf**, a loaf, and **ord**, place." The word **lady** is similarly derived from **hlâf**, loaf, and **dige**, from **digan**, to care for or help. "Hence **lady** means one who helps or serves bread to the family." In like manner it would be impossible to know how the terminal letter in the word **loved** puts the verb in the past tense, were we not assured by philologists that the expression was originally **I love did** (I did love), and that the **did** has been attenuated to the single letter **d**.

When the union of roots has thus become more intimate, the structure "can be manipulated in a variety of ways without involving its disintegration;" so that the languages of this type admit of more artistic employment than those of any other.

Romanes gives the following formula (from Hovelacque) regarding these three great groups of languages. R representing a root, a sentence in a language of the radical or isolating type (Chinese) might be represented thus, — R + R + R, each root maintaining its complete independence. In the agglutinative type, the chief roots still maintain their independence, but the subordinate roots undergo some modification, though still remaining distinctly recog-

[1] Max Müller, *op. cit.*, vol. ii. p. 370.

nisable as roots. The formula given for these is Rr, Rrr, rR, or rRr. In the inflectional type, either the chief roots or the subordinates may undergo inflectional change so as to become irrecognisable as roots, except to the learned, who can trace out the history and affinities of the word; and this inflectional change is, in the formula, denoted by attaching the letter x to the root changed. As either the chief root or the subordinates may undergo such inflection, the formula is, Rr^x, R^xr, Rrr^x.

Professor Müller (p. 372) is of opinion that every language can be classified as a member of one or other of these three great groups,—the Radical, the Agglutinative, and the Inflectional. He thinks that the second of these was developed from the first, and the third from the second. At page 378, he says—"As far as the formal part of the language is concerned, we cannot resist the conclusion that what is now *inflectional* was formerly *agglutinative*, and what is now *agglutinative* was at first *radical*."

Analogy between the Species of Languages and the Species of Plants and Animals.—Darwin has made some very interesting remarks about the obvious parallelism that exists between the development of different languages and the development of different species of plants and animals. He says—"The formation of different languages and of different species, and the proofs that both have been developed through a gradual process, are curiously parallel. But we can trace the formation of many words further back than that of species, for we can perceive how they actually arose from the imitation of various sounds. We find in distinct languages, striking homologies due to community of descent, and analogies due to a similar process of formation. The manner in which certain letters or sounds change when others change, is very like correlated growth. We have in both cases the reduplication of parts, the effects of long-continued use, and so forth. The frequent presence of rudiments both in language and in species is still more remarkable. The letter **m** in the word **am** means **I**, so that, in the expression **I am**, a superfluous and useless rudiment has been retained. In the spelling, also, of words, letters often remain as the rudiments of ancient forms of pronunciation. Languages, like organic beings, can be classed in groups under groups; and they can be classed, either naturally, according to descent, or artificially by other characters.

Dominant languages and dialects spread widely and lead to the gradual extinction of other tongues. A language like a species, once extinct, never, as Sir C. Lyell remarks, 'reappears.' The same language never has two birthplaces. Distinct languages can be crossed or blended together. We see variability in every tongue, and new words are continually cropping up; but, as there is a limit to the powers of the memory, single words, like whole languages, gradually become extinct. As Max Müller has well remarked:—'A struggle for life is constantly going on amongst the words and grammatical forms in each language. The better, the shorter, the easier forms are constantly gaining the upper hand, and they owe their success to their own inherent virtue.' To these most important causes of the survival of certain words, mere novelty and fashion may be added; for there is in the mind of man a strong love for slight changes in all things. The survival or preservation of certain favoured words in the struggle for existence is natural selection."[1]

Phonetic Decay and Dialectic Regeneration.—By the processes of Phonetic Decay and Dialective Regeneration, curious changes have been brought about in the words of every language. Abundant illustrations of such changes may be found, for example, in any language belonging to the Inflectional group. If we take French, which is one of the direct descendants of Latin, we find, as Professor Müller points out, that many of the Latin terminations are substantially retained in the spelling of words, though, having become mute, they have disappeared from pronunciation. "Thus, **j'aime** is **ego amo**; **tu aimes, tu amas**; **il aime, ille amat.** There was originally a final **t** in the French **il aime,** and it comes out again in such phrases as **aime-t-il?**" In the future of the same verb, the process of Dialectic Regeneration is exhibited. The old Latin is **amabo,** but the French is **j'aimerai.** "How did the termination **rai** bud forth like a blossom in Spring? . . . The Latin future was destroyed by means of phonetic corruption. When the final letters lost their distinct pronunciation, it became impossible to keep the imperfect **amabam** separate from the future **amabo.** The future was then replaced by dialectical regeneration, for the use of **habeo** with an infinitive is found in Latin, in such expressions as **habeo dicere,** I

[1] *Descent of Man*, p. 90.

have to say, which would imperceptibly glide into, I shall say." The future **j'aimerai** is, literally translated, I have to love. In English, the effects of phonetic decay are as strikingly exhibited as in French, and dialectic regeneration has in English been brought about to an extent perhaps without parallel in any other language. In the ancient languages of Teutonic type from which English has descended, it was at one time the practice to place the pronoun after the verb, the word **am**, for example, being, as already indicated, complete in itself, with the meaning of "I am," the terminal **m** having originally the signification of "I." So, in like manner, **art** was originally complete in itself, the final **t** representing the second personal pronoun. In Latin and Greek, all verbs exhibit these personal terminations, but in English the verb **to be** is one of the few that still retains some of them. Long ago, these terminations became so decayed as no longer distinctly to indicate personal pronouns, and, by process of dialectic regeneration, new personal pronouns were placed before the verb. In these circumstances, the genius of the English language had, in most cases, the good sense to drop the useless terminations altogether, retaining them neither in the spelling nor in the pronunciation. The grammar of English has thus been reduced to the greatest simplicity, so much so, indeed, that some authorities will have it that English, like Chinese, has no grammar at all;—for "What is grammar," says Max Müller, "but conjugation and declension?" and conjugation and declension have in English been reduced to a simplicity that contrasts remarkably with their condition in the other languages of the same group.

Among a people speaking the same language, the processes of phonetic decay and dialectical regeneration always bring about the development of different dialects in different districts of the country. The accent differs in different districts; certain words are pronounced differently; words and expressions are retained in some districts, though they have become obsolete in others; and even the pronunciation of certain letters may be such as to be characteristic of the district,—as is the use of the burring R in Northumberland, and the substitution of Z for S in Somerset. The different dialects struggle with each other for predominance, until at last the contest is decided by one dialect becoming the literary dialect of the country, and the spoken dialect of all educated people

in it. A standard of good taste is thus established, and any marked departure from it, if the articulative powers are normal, comes to be branded as either an affectation or a vulgarism.

It would be easy to give abundant examples of Affectations, but it may suffice to remind the reader of the affectations practised in the substitution of **th** for **s** (lisping) and in the substitution of **w** for **r**;—which, however, are affectations only when they are practised voluntarily. A new affectation, which seems to be gaining ground at present, is the substitution of **n** for the terminal **ng** in words ending with **ing**.

The most striking Vulgarism in English is the omission of **h** where it ought to be pronounced, and the insertion of it where it ought not. Omitted in one place, it takes its revenge by cropping up where it has no right to be. It is much the same with the letter **r**. Even in polite English, the **r** sound has, when occurring after a vowel, been so softened as to be effaced. It takes its revenge by appearing where it has no right to be. In southern English we hear it in such expressions as "Isabellar of Spain." This obtrusive **r**, Dr Hullah regards as unpardonable; but it is so common even among highly educated people that it is beginning to acquire a respectable position in society. The unpardonable errors are those connected with the letter H. These are the Shibboleths of modern English society. The reader will remember the passage about this word Shibboleth, the **sh** sound of which was in one of the dialects of the Hebrews given as **s**:—"And it was so, that when those Ephraimites which were escaped said, Let me go over; that the men of Gilead said unto him, Art thou an Ephraimite? If he said, Nay; then said they unto him, Say now Shibboleth: and he said Sibboleth: for he could not frame to pronounce it right. Then they took him, and slew him."

The English Language.—When a language of the Inflectional type has dropped its useless terminations, and thereby greatly simplified its structure and grammar, it is said, by some authorities, to have passed into the Analytical stage. As already indicated, the English language has more than any other language passed into this condition. It is, in fact, the chief representative of what has been called the analytical modification of the Inflectional type. It is well known that Grimm, one of the illustrious founders of Modern Philology, has paid a remarkable compliment to the English lan-

guage. He says,—"The English language possesses a power which probably never stood at the command of any other nation. This singularly happy development and condition has been the result of an intimate union of two of the noblest languages, the Teutonic and the Romance; the former supplying the material groundwork, the latter, the spiritual conceptions. In truth, the English language, which, by no mere accident, has produced and upborne the greatest and most predominant poet of modern times (I can, of course, only mean Shakespeare), may, with all right, be called a world-language, and, like the English people, appears destined hereafter to prevail with a sway more extensive than its present one over all portions of the globe. For in wealth, good sense, and closeness of structure, no other of the languages at this day spoken deserves to be compared with it,—not even our own German, which is torn even as we are torn, and must rid itself of its defects before it can enter into the lists as a competitor with English." [1]

The total number of words in the English language has been variously estimated, one dictionary of repute giving 43,566, another 58,000, and a third 70,000. It is said that a perfect dictionary would include as many as 100,000. Professor Müller says,—"The Hebrew Testament says all that it has to say with 5642 words, Milton's works are built up with 8000, and Shakespeare, who probably displayed a greater variety of expression than any writer in any language, produced all his plays with about 15,000 words." [2] The same authority states that a well-educated person in England seldom uses more than about 3000 or 4000 in actual conversation; and he quotes an observation made by an English clergyman, Mr D'Orsey, in his *Study of the English Language*, that some of the labourers in his parish had not 300 words in their vocabulary. This observation, Mr Farrar informs us,[3] has been widely disputed; but he seems himself, from his own observations, inclined to accept it as substantially correct.

Alphabetical Letter-sounds used in Different Languages.[4]—No language uses more than a comparatively small number of the sounds

[1] Quoted by Lennox Browne & Behnke, *Voice, Song, and Speech*, p. 37.

[2] Max Müller, *op. cit.*, p. 309.

[3] *Chapters on Language*, p. 52.

[4] This subject is discussed at considerable length by Kussmaul, who gives many other examples.

which the organs of articulation are capable of producing. Each language makes its own selection of these sounds. Even among European nations employing the same alphabet, there are differences in the sounds given to some of the letters. Thus the English **th** sound is peculiar to English, and is with difficulty acquired by foreigners. Terminal **n**'s have only a half-nasal pronunciation in French. In German, **s** is pronounced like the English **z**, and **z** like the English **ts**. Still more striking peculiarities are exhibited among non-European peoples. The Chinese, for example, have no R in their language, and say "Yamelika" for "America;" the Japanese have no L, and say "Horrand" for "Holland;" and the Mohawks have no labials or labio-dentals, and therefore have in their language no p, b, f, v, w, or m. The Arabs have their true gutturals, pronounced deep in the throat, about the upper part of the larynx. The Hottentots make much use of clicking noises, of which some are made by the tongue, and others by the lips.

Song.—Among those who hold the view that Speech developed itself gradually out of a previously existing language of vocal tone, facial expression, and gesture, an interesting difference of opinion has arisen as to the period at which Song was probably developed. Herbert Spencer, in his *Essays*, holds that song was late in coming, and that it probably developed itself out of the cadences of impassioned speech. Darwin, on the other hand, has advocated the opposite view, and holds that song in all probability preceded speech. He says,[1]—"As we have every reason to suppose that articulate speech is one of the latest, as it certainly is the highest, of the arts acquired by man, and as the instinctive power of producing musical notes and rhythms is developed low down in the animal series, it would be altogether opposed to the principle of evolution, if we were to admit that man's musical capacity has been developed from the tones used in impassioned speech. We must suppose that the rhythms and cadences of oratory are derived from previously developed musical powers. We can thus understand how it is that music, dancing, song, and poetry, are such very ancient arts. We may go even further than this, and, as remarked in a former chapter, believe that musical sounds afforded one of the bases for the development of language."

[1] *Descent of Man*, p. 570.

Origin of Written Language.

The language of Gesture employed by deaf-mutes, savages, and others, has been described as substantially a picture-language, by means of which objects are, as it were, pictured in the air. As already indicated, it is held by many that this language of pictures in the air must have played an important part in preparing the way for the language of Spoken Words. This, however, cannot be proved to be a fact: it is only a proposition, with much to be said in its favour. It is very different in regard to the origin of Written language. Here the evidence is conclusive. All authorities are agreed that there can be no possible doubt about the fact that picture-writing preceded word-writing, and that out of picture-writing, word-writing was slowly evolved. From the writings of Mr E. B. Tylor, I shall endeavour to extract a few of the most illustrative facts bearing upon the question.

The various tribes of North American Indians have made, on rocks and tombstones and blazed pine-trees, many excellent examples of the most primitive type of picture-writing. They practise such picture-writing to the present day. Everything indicated is rudely but clearly drawn. In the record of a hunting expedition, for example, two comparatively large figures, those of a bear and a cat-fish, indicate the clan names or totems of the chiefs who took part in it; and a number of smaller figures, those of six cat-fish and one bear, indicate the spoil of the expedition. A warlike expedition, in like manner, is rendered by the figure of the chief on horseback; the totem of his principal ally, a king-fisher; six canoes, with upright lines in them to indicate the number of men in each; a tortoise, apparently to indicate that the expedition got to land; and three discs under a vault, to indicate that there were three suns under heaven, that is, that the voyage took three days.

Among the semi-civilized Aztecs of Mexico, the Indian picture-writing made some steps in advance. Pictures, better drawn than those of the ruder Indians, continued to be used in writing, as the representatives of the things pictured, but already, long before the conquest of the country by the Spaniards, a new element had been added to the writing. It was the employment of a large number

of pictures to represent, not the things pictured, but syllabic sounds identical with the spoken *name* of the thing pictured, or at least with the first syllable of that name. Thus a *phonetic system of signs for syllables* added itself to the older pictorial representations of things. "The device," says Mr Tylor, "is perfectly familiar to us in what is called a 'rebus,' as where Prior Burton's name is sculptured in St Saviour's Church as a cask with a thistle on it, 'burr-tun.'" It is known that by this compound picture-writing the Aztecs made known to their king at the capital the first arrival of the Spaniards on their coast.

Chinese writing, though at the present day its characters have little in them that is suggestive of pictures, is really the direct descendant of a picture-writing of the ordinary type. As the ancient picture characters have been preserved, the whole history of this development can be traced. In the ancient characters, the sun was a disc, the moon a crescent; and a fish, a dog, a mountain, and a tree were represented by conventionalized sketches of these objects. Gradually these pictures underwent change, by a process equivalent to the phonetic decay of spoken words; so that eventually they became, to all appearance, merely conventional signs for the objects indicated. At the same time, Combinations of the signs were constantly invented. By these combinations Ideas or Concepts were represented; so that the title Ideographic has been given to this type of writing. The adjective *bright* is thus represented by the combined signs of the sun and the moon, and the verb *to divide* by the combination of the sign for a knife and that for the number eight. As in the case of the Aztec writing, one step was made towards the formation of a phonetic alphabet; and it was made in the same way. Many of the signs became phonetic syllable signs, like Prior Burton's "rebus." But here a difficulty, inherent in the "poverty-stricken" Chinese language, had to be encountered. In Chinese, the same spoken word has in very many cases a great variety of meanings, and in speech the specific meaning is generally made intelligible merely by accent or intonation. But accent and intonation could not be faithfully represented in the characters, and therefore another device had to be adopted. The word **chow** in Chinese means many things. Among others it means "ship." Therefore a ship stands for the sound **chow**. But the same sound means a "ripple." To

make this clear, when ripple is indicated, the sign for **water** is added to that for **ship**. In like manner, as the sound **chow** may mean **loquacity**, the sign for **speech** is added to that for **ship** when **loquacity** has to be indicated. Thus "the great mass of characters at present in use are double, consisting of two signs, one for sound and the other for sense." [1]

"Egyptian Hieroglyphic Inscriptions consist of figures of objects, animate and inanimate, men and animals, and parts of them, plants, and heavenly bodies, and an immense number of different weapons, tools, and articles of the most miscellaneous character. These figures are arranged in upright columns or horizontal bands, and are to be used in succession, but they are not all intended to act upon the mind in the same way. When an ordinary inscription is taken to pieces, it is found that the figures composing it fall into two great classes. Part of them are to be read and understood as pictures, a drawing of a horse for 'horse,' a branch for 'wood,' etc., upon the same principle as in any savage picture-writing. The other part of the figures are phonetic. Thus, the figure of a strap, the name of which is **m — s** becomes a phonetic sign to write the sound **m — s** with. (The — stands for some vowel, which is represented by **ou** in the Coptic form of the word, **mous**.)" [2] Here then we have represented the "rebus" or syllabic stage of phonetic writing, as it is met with in Aztec and Chinese writing. But the hieroglyphics went further than this. Along with the two sets of characters above indicated, there is a third set, which, by most authorities, is held to represent simple consonant sounds without attached vowels. Thus it appears that the figure of a **mouth** is often used with the simple signification of the letter **r**—the Egyptian word for mouth being **ro**;—and there are many other signs which apparently stand for simple consonants. In the same inscription, all three stages in the development of written characters may thus be found to be represented: (1.) Pure picture-writing; (2.) The "rebus" stage of syllable phonetic writing; and (3.) Alphabetical phonetic writing.

In ancient Egyptian, as in Chinese, the poverty of the language displayed itself in the employment of the same spoken word in a great variety of senses. To indicate the specific meaning to be attached to the word, the same device was employed in the Hiero-

[1] E. B. Tylor, *op. cit.*, p. 400. [2] *Ibid.*, p. 98.

glyphics as in the Chinese. After the phonetic symbol, came the "determinative sign," in the shape of a picture to be read as a picture. Thus, the signs for "the letters **k k** followed by the picture of a star hanging from heaven mean 'darkness' (Coptic **kaké**)."[1] Mr Tylor says that had there been none of these determinative signs in the inscriptions, the deciphering of them in modern times "could hardly have gone a step beyond the first stage, the reading of the kings' names."

The third element in the hieroglyphics is believed, by most authorities, to have furnished the first suggestion to the Phœnicians for the construction of a complete phonetic alphabet, in which each letter would represent a single consonant or a single vowel. This is the final step in the development of written speech. Obviously, it reduces the written characters to a number exceedingly small, as compared with the number required for syllabic sounds, or the still greater number required for pictorial representations. Learning to read and write becomes a comparatively easy matter when words are thus represented by signs of their component letter-sounds. If the Phœnicians were, as is generally believed, the first to construct such an alphabet, the world owes them a debt of gratitude. Whether some sage among them, taking hints from the hieroglyphics, evolved the whole alphabet as it is found in their literature, or whether it was developed gradually, by a process of gradual improvement, is now, I suppose, impossible to determine. In whatever way it was elaborated, there can be no doubt that the Phœnician alphabet was the parent of the Greek and Roman, and therefore of the alphabet which we use at the present day.

The Invention of Printing.

A full and instructive article on Typography has been contributed to the last edition of the *Encyclopædia Britannica*.[2] I shall avail myself of it in making here a few brief notes as to the development of printing.

Before the invention of printing, books were of course published in manuscript, and all figures or pictures in them were drawn with the pen or painted with a brush. "In the thirteenth century there

[1] E. B. Tylor, *op. cit.*, p. 99.

[2] By J. H. Hessells and John Southward.

already existed a kind of book trade. The organisation of universities, as well as that of large ecclesiastical establishments, was at that time incomplete, especially in Italy, France, and Germany, without a staff of scribes and transcribers, illuminators, lenders, sellers, and custodians of books, and persons who prepared and sold the vellum or parchment required for books and documents."

It was when the production of manuscripts had thus attained to its greatest development, that the art of Block-printing or Xylography first made its appearance. This was, in fact, nothing more than wood engraving. On a single block of wood, a picture was engraved, and, along with it, were engraved the words explanatory of the subject. At a later time, upon a single block a whole page of reading was engraved. Whole books were thus printed from engraved blocks, each page from its own block. Many of these "block-books" have been preserved to the present day. This art of block-printing seems to have been practised as early as the 12th Century, and it is certain that about 1400 it was known all over Germany, Flanders, and Holland.

With such blocks of engraved words in their hands, it must have required no great exercise of the imagination, on the part of the engravers, to see that if the letters of the alphabet were engraved on a block in this fashion, and then cut apart from each other so as to form movable "types" of the individual letters, an immense saving of labour would be effected. It would no longer be necessary to engrave the letters anew for every new book. It would be possible to use the same types over and over again for the printing of a multitude of books,—their re-arrangement for each being all that would be required. The carrying of this idea into effect constituted the great and beneficent invention of printing, which, in these last centuries, has contributed so enormously to the advance of civilisation. The types were first cut in wood, but in a very few years it was found to be much more convenient to have them cast in metal. Who was it that first cut out the movable wooden types and printed from them? About this question there has been a controversy for about four hundred years. In the article alluded to, the reader will find the facts of the case very fully stated. The Dutch claim the invention for their countryman, Lourens Janszoon Coster, who worked at Haarlem. The Germans, on the other hand, hold that the inventor was Johann Gänsfleisch, commonly known

as Gutenberg, who worked at Mainz. After a most elaborate examination of the evidence, the authors of the article conclude thus:—"As the case stands at present, therefore, we have no choice but to say that the invention of printing with movable metal types took place at Haarlem, about the year 1445, by Lourens Janszoon Coster." Gutenberg and the other printers, established a few years after this date at Mainz, seem to have improved the art and made it more artistic.[1]

By means of the primitive hand-press, very beautiful printing was done by the old printers; but the work was slowly executed. In recent times, great improvements have been effected in rapidity of execution. The use of steam-power; the valuable invention of "stereotyping" (taking metal casts of the types after they have been set up; so that the printing surfaces can be multiplied indefinitely); and the exercise of great mechanical ingenuity in the construction of printing machines; have all contributed to make printing, in these latter days, a process which can be carried out with the most wonderful rapidity. The celebrated Walter machine, for example, employed at present by most of the leading newspapers, when working at its average speed, is capable of turning out in an hour 12,000 copies of a large newspaper, printed on both sides.

Printing for the Blind.

Within recent times, several valuable inventions have been made by modifying the letter-signs of the alphabet so as to make them available for special purposes. Among these may be mentioned the representation of the letters by the combined dots and dashes employed in the Morse system of telegraphy; also the lines and dots used for phonetic shorthand writing. It will here not be necessary to say anything about either of these valuable inventions. Nor will it be necessary to describe the signs used for musical notation; nor the symbols that have been invented, from of old, for arithmetical, algebraic, and astronomical purposes. But with regard to some of the last mentioned I may quote an

[1] It should be noted that the arts of Block-printing and of Printing from Movable Types were both practised in China and Japan for centuries before they arose in Europe.

interesting remark made by Mr Tylor. He says, "'☉ before clock 4 min,' and '☽ rises at 8 h. 35 m.,' survive to show that even in the midst of the highest European civilisation, the spirit of the earliest and rudest form of writing is not yet quite extinct." I should like, however, to say a few words about the Raised Letters that have been invented for the benefit of the Blind. Full information on the subject may be found in the work by Dr T. R. Armitage, Hon. Secretary to the British and Foreign Blind Association.[1]

The inventor of raised characters for the blind was M. Valentin Hauy, the founder of the *Institution des Jeunes Aveugles* in Paris. He invented raised characters in 1784; using, for the purpose, the Italic or written form of the Roman letter. This system was introduced into this country in 1834, but it was soon superseded.

Mr Gall, of Edinburgh, in 1834, printed the Gospel of St John in a modified Roman letter, using serrated lines and replacing curves by angles.

Mr Alston, of Glasgow, adopting the idea of Dr Fry, the typefounder, used ordinary Roman capitals,—a method still used in some of the English and American asylums.

The system of Lucas, introduced about 1838, is a stenographic shorthand; and the characters are altogether arbitrary, consisting mainly of lines with or without a dot at one end. It is used by the London Society for teaching the blind to read, and in several of the provincial asylums.

The Braille system was invented in 1829, by M. Louis Braille, a blind pupil of the *Institution des Jeunes Aveugles* in Paris. It has been recommended for adoption by every European Congress of educators of the blind since 1878. "Its signs are purely arbitrary, and consist of varying combinations of six points, placed in an oblong, of which the vertical side contains three, and the horizontal two points." There are sixty-two possible combinations of these six points, "so that after the modest requirements of the English alphabet have been supplied, there remain a sufficient number of signs for punctuation, contractions, etc." For the letter A, only one of the six dots—the uppermost of the left vertical side—is raised; for B, this same dot and the one below it; for C,

[1] *The Education and Employment of the Blind.* Second edition, 1886.

the upper dot of each vertical side; for D, the same two and the second of the right vertical side; and so on. These raised dots are found to be more clearly perceptible to the touch than any kind of lines. In the Braille type, not only words, but also music has been extensively printed. In the Edinburgh Asylum, the Braille type has been in use for the last twelve years, and gives great satisfaction. With the aid of simple apparatus, the pupils print letters for themselves. They also stereotype the characters upon metal plates, from which copies can be taken with a printing-press. In this way, they have themselves printed many volumes.

Among the other systems that have competed in this country for adoption, may be mentioned those of Frere, Moon, and Carter; but it will not be necessary to describe them.

As the human mind is, in the natural condition of things, primarily educated to speech through the "ear-gate," a person born blind is as to speech undoubtedly in a less unfortunate condition than is a congenital deaf-mute. The blind child learns to speak and to understand audible speech like other children. Though he cannot appreciate expressive gestures and facial expressions, he can fully appreciate expressive tones, and has the enormous advantage of being educated to speech early, and in the normal way. Still, even as regards speech, he is in a very unfortunate position. It has been said that in the case of most educated persons a full half of the new thoughts that daily reach the mind reach it through the medium of the eye, from printed and written characters. No invention can put the blind in a position to read the words of ordinary print or writing. The learned blind—and there have been many such—have employed others to read aloud for them. Still, the invention of raised characters has been of immense service to the blind, as has also been the education to various kinds of work that is given them in the Asylums for the Blind now established in every great city. By the education of the unfortunate blind, and the still more unfortunate deaf-mute, humanity has, during the last hundred years, done itself great honour.

In the foregoing notes, I have tried to indicate the chief facts in the development of speech, audible and visible. These facts, I

think, are well calculated to illustrate the relationships between speech and thought. This, however, is a difficult metaphysical subject which, for the present at least, I cannot do more than glance at.[1] I shall therefore only say a few words about the relations of nouns to percepts.

The facts before us show very clearly that the human mind forms images of things, which it can recall in imagination at will. These images are memories of sense impressions. There are sight-images and sound-images; and there are also images or memories of taste, touch, and smell. By combining these sense impressions, the mind forms percepts of objects. A percept thus represents a knowledge of the sensible properties of the object, so far as, in any given case, these have been ascertained. As all intelligent minds form such percepts in the same way, and hold them in the memory ready to be revived, no elaborate description is needed to revivify, in the mind of another person, a percept already familiar to him. A mere hint is sufficient. The deaf-mute thus suggests a familiar percept to the mind of another person by his imitative gesture or picture in the air. The early inventors of picture-writing, in like manner, suggested familiar percepts by making actual drawings of the objects, as visible to the eye. Audible speech fulfils its function largely by calling up percepts in the mind. And it does so much more efficiently than either gestures or pictures. The wonderful law of association in the human mind permits of the linking together of a certain sound and a certain percept, and this word-sound represents not merely *one* of the sensible properties of the object, such as its external form,—it is equivalent to the whole percept,—it is its symbol or equivalent. Thus, to call up in the mind of another person the percept, say, of a horse, the horse need not be described: a single word is sufficient. Something has already been said as to the speculations regarding the manner in which these word-symbols first came to be developed. It has been shown that according to one opinion the first words were voluntary imitations of natural sounds, and that according to another the "roots" of languages, which may be regarded as in some measure representative of the primitive words, ought to be regarded as "ultimate facts" in Philology, ad-

[1] The subject will be found to be fully discussed both by Farrar and by Romanes, *op. cit.*

mitting of no explanation. Whatever may have been the primitive origin of words, they are, in their essential nature, symbols. They are suggestive of percepts, in virtue of the law of association; and they are so subtly suggestive that a long train of thought expounded by a speaker can be called up to the minds of his hearers in instantaneous response, while he is in the act of speaking. These word-symbols are so superior to all others in their power of calling up percepts, that, in the development of written characters, the final triumph was attained only when the *sounds* of speech were at last analysed into their component letter-elements, and a written character was given to each of these. The visible writing then for the first time accurately suggested to the mind the audible sound, in virtue of the wonderful law of association. Written words are thus the visible symbols of sound symbols. In this respect they are so efficient that, when we read the words upon a written or printed page, they almost seem, to the imagination, to sound audibly in our ears.

So efficiently has language linked itself to thought, that many have difficulty in conceiving of thought as capable of existing at all without at least a mental embodiment of it in language. Prof. Max Müller even goes so far as to say, "There is no thought without words, as little as there are words without thought."[1] "What a strange definition," says Darwin, "must here be given of the word thought." It seems pretty clear that if the disputants upon this question agreed to attach the same meanings to the terms employed in their arguments, they would soon come near to a general agreement. Many eminent authorities, as we have seen, hold that speech itself was *invented* by thought; and truly a man must be a master of words before his best thoughts can be expressed in language that is worthy of them. Some hold that thought can never be adequately expressed, but can only be suggested. Thus, according to Du Ponceau,[2] "Thought is vast as the air; it embraces far more than languages can express, or rather languages express nothing; — they only make our thoughts leap out in electric sparks from the speaker to the listener. A single word suggests a crowd of ideas which the

[1] Quoted by Darwin, *Descent of Man*, note to p. 89.
[2] Quoted by Farrar, *op. cit.*, p. 263.

spirit combines and collects with the rapidity of lightning." The truth probably lies, as usual, between the two extreme views. Words are wonderfully suggestive, but they are so closely equivalent to percepts as to be at the same time wonderfully expressive. They are naturally most expressive with those who have best learned how to use them.

PART THIRD.

SPEECH IN ITS RELATIONS TO DISEASES OF THE NERVOUS SYSTEM.

CHAPTER VIII.

Speech in its Relations to Insanity.

As the peculiarities of speech in Congenital Imbeciles have been already pretty fully discussed, that subject need not be included in the present chapter. It is the other class of insane persons that I now wish to treat of: persons who at one period of their lives have been sane, and in the full possession of the faculty of intelligent speech; but who are now insane, their minds having, in one way or another, become disordered or degenerate.

I think it desirable at the outset that we should, as clearly as we can, distinguish between the faculty of Thought and that of Language. They are so closely and intimately bound together that it is difficult or impossible to draw between them a strict line of demarcation. Damage done to the one tells in most cases more or less unfavourably upon the other. The union, indeed, is so intimate, that, as we have already seen, there are philosophers who would have us believe that there can be no thought without speech and no speech without thought. That view, however, is not one that seems to me to derive any support from the study of the language of imbeciles, deaf-mutes, aphasics, and insane persons. The study of such cases, on the contrary, seems distinctly to strengthen the more generally accepted view, viz., that,

however natural it may be for thought to embody itself in speech and in the other forms of expressional language, and however difficult it may be to draw a line of demarcation between the one and the other, they are yet in their essence distinct. Thought, intelligence, mind, are terms which we use synonymously to indicate the highest endowment of the brain. Language, though so wonderful in itself, must take a lower place. It is the instrument of thought, the magic mirror in which a man may look and read the thoughts of another person, or into which he may cast his own thoughts for another's information. It was by the mind's own efforts that the mirror was originally polished and made efficient; and it is only by the mind's constant attention that it can be kept in good order for daily use. When the mind is damaged, the mirror truthfully reflects a damaged and distorted image. When the mirror is damaged, the reflected image of the mind is not a good and true one; it is blurred, if not distorted, owing to fault in the reflecting power of the mirror.

There are facts, however, in the relationships of the two that this familiar metaphor gives us no help in understanding. Such, for example, are the Morbid Activities that are assumed, in certain cases, by the Cerebral Organs of Speech, independently of the will, and sometimes in spite of any inhibitory power that can be brought to bear upon them. When the strong correcting and controlling influence of a healthy mind is no longer exercised upon the organs of speech, a variety of Speech Hallucinations may be developed. Voices may be heard, or Writings may be seen upon the wall; or Motor Hallucinations may be developed in the motor centres; and these last may become Impulsions, and compel the patient to ejaculate words or phrases involuntarily, or even in spite of every effort to suppress them.

It is further to be noted, that, in conditions of Dementia (loss of mental power) the function of thought seems often to decay more rapidly than the function of articulate speech; so that even when thought has been reduced almost to zero, the speech organs may yet retain their articulative power, and be able to produce, automatically, words and phrases that had been stored up within them in happier times. Here, again, the disorder of speech does not quite keep step with the advancing disorder of the mind.

But these semi-independent actions and changes in the speech organs, though important in themselves, play, on the whole, but a secondary part. In the majority of cases of mental disease they are not prominently exhibited. The function of language, in the majority of cases, shows little independent activity of this sort. Its activities are, for the most part, in strict correspondence with those of the mind, whose disorder it mirrors with striking fidelity. Still, these independent or semi-independent activities of the speech-organs deserve to be carefully studied, as they are not only important but extremely interesting. They, however, render the subject that we have now to consider more complicated than it would otherwise be. On their account chiefly it will be expedient for us to look at the Speech of the Insane from several different points of view. I propose therefore:—

(1.) To make the Mind our first standpoint, and to give a few illustrations of the faithful manner in which the disorder of the mind is mirrored in the speech of the patient.

(2.) To treat of Speech-Hallucinations and other disorders of action that are met with in insanity in connexion with disturbances of the cortical speech-centres.

(3.) To treat separately of the affections of speech in Dementia; showing how, in such cases, the decay of speech is slower than the decay of thought; and how, in some of them, the disease of the mental cortex spreads downwards into those cells of the cortex that form the executive motor centres for articulation, thus causing the appearance of an ominous paralytic element in articulation, that is of the greatest significance both diagnostically and prognostically.

Illustrations of the manner in which Language Mirrors the Condition of the Mind.

"Observation," says Griesinger,[1] "shows that the immense majority of mental diseases commence with a state of profound emotional perversion, of a depressing and sorrowful character. Guislain was the first to elucidate this highly interesting fact, and make it at all serviceable. Of its general correctness, there can be no doubt; and we can have no hesitation in speaking of

[1] *Mental Pathology and Therapeutics* (New Syd. Soc.), p. 210.

a *stadium melancholicum* as the initiatory period of mental disease. Of course, there are exceptions. Thus in senile dementia, in periodic mania, in meningitis, in the mental diseases consecutive to typhus fever, pneumonia, cholera, sunstroke, etc., the outbreak of mania is generally observed without being preceded by melancholia; but the cases are much more frequent in which the *stadium melancholicum* only *appears* to be absent, because it was less intense, and was not then recognised as a stage of mental disease."

Probably many persons have had experience of the *stadium melancholicum*—the debatable land between sanity and insanity—who yet have never passed over the border into the state of pronounced insanity. When the disastrous passage is made, the patient may either, on the one hand, sink deep into the depression of true Melancholia, or, on the other hand, pass into the condition of Mania, and become unnaturally exalted in his thoughts and emotions. In some cases, again, there is a rotation, which presents alternately the conditions of melancholia and mania, the *Folie Circulaire*. In others the mind goes wrong only in some limited and partial way: there may be Moral Insanity, for example, in which deterioration is exhibited chiefly or solely in the sense of right and wrong; or there may be Monomania, in which a single delusion on some particular subject alone betrays the insanity.

A. Melancholia.—In true melancholia all forms of outward expression exhibit the profound mental suffering of the patient. The condition has been aptly described as one of mental pain, and in acute cases the suffering may be most pathetically expressed. "The patient," says Griesinger, "bewails himself, heaves deep sighs, and is engaged in prayers and supplications, but always on the same subject."[1] Often there is much motor excitement. "The patients," says Dr Clouston, in speaking of excited (motor) melancholia, "rush about, are violent to those about them, wander ceaselessly, walking up and down like tigers in a cage; or roll on the floor, or wring their hands, or shout or groan, or tear their clothes, or in their cries, attitudes, and motions express loudly their mental pain. In short, the muscular expression of the

[1] *Op. cit.*, p. 227.

prevailing emotion is strong, and uncontrollable by volition."[1] In chronic cases, the same features may be presented, although their manifestations are less violent. The patients may continue to bewail their condition for years. In the Royal Edinburgh Asylum I was lately shown a case of this kind, the patient being a middle-aged woman with prematurely gray hair. Her constant cry is to be taken to jail, where she may expiate, by suffering imprisonment, the fearful crimes she imagines herself to have committed. The tones of her voice are curiously deep and strong, —so much so, that when I first heard them from a neighbouring ward I could not tell whether it was the voice of a man or of a woman. They have evidently been deepened by their habitual expression of painful and sombre emotion.

But there are many varieties of phenomena exhibited by different cases of melancholia, according to its degree of intensity, and to the various kinds of delusion and hallucination that are associated with it. These varieties of type I shall not attempt to enumerate, but I think it may be well to make note of one special type that in its expressional manifestations contrasts remarkably with the violence and excitement of ordinary acute melancholia. I mean the variety of melancholia known as "Melancholia with Stupor;" a condition that sometimes supervenes upon the acutely violent type, and sometimes is developed primarily. In this variety the sufferer is the picture of silent despair. He seems lost in a fearful dream, and sits silent and immobile, perhaps listening to the internal utterances of the evil spirits by which he often imagines himself to be possessed. He may not utter a single word even for years. If he do reply to questions, it may be slowly, and often in a whisper. There is often a pause before his reply, owing to the feebleness and slowness of all mental action that is not devoted to the delusional ideas with which the mind is possessed. Sometimes the enfeebled will is not capable of producing even a whisper, though in the attempt to speak the lips may slightly and silently move. Often there is no response at all, not even this slight movement of the lips. The attention cannot be roused from without; it is wholly concentrated within, upon the mental suffering, or upon delusions or hallucinations. Such a

[1] *Clinical Lectures on Mental Diseases*, p. 90.

case, on superficial examination, might be mistaken for one of dementia; "but the glance of such a patient," says Griesinger, "does not indicate the nullity proper to dementia; it expresses a painful emotion—sadness, or anxiety, or concentrated astonishment."[1] I saw lately, in the Royal Edinburgh Asylum, a female patient suffering from this variety of melancholia. She was silent, but her eye was not vacant of expression. I was informed that if the nurses left the patient for a moment she would immediately attempt to commit suicide. She had many times been caught in the act of making such attempts. Melancholia with stupor may gradually pass into the condition of true and permanent Dementia.

All classes of melancholia are peculiarly apt to be troubled with speech hallucinations. They may hear voices, or they are conscious of being prompted internally by thoughts which seem to them to be articulated within some part of their own body. I shall have something more to say about those hallucinations in the second part of this chapter.

The Facial Expression in cases of melancholia varies according to the variety of melancholia that is presented, but it is always faithfully indicative of mental suffering. In acute cases the features are expressive of violent excitement and mental agony; in melancholia with stupor, they denote the condition of dull despair. Darwin has treated fully of facial expression in conditions of grief and despair; but as we do not require detailed descriptions in order to be able to recognise such expressions on the human countenance, it will not be necessary here to enter upon any description of them. I shall only make a note of one point of special interest. It is that according to Sir James Crichton Browne, who contributed some observations on the point to Darwin's work on the *Expression of the Emotions*, the "grief muscles" are especially often seen to be in a state of contraction in patients with melancholia who have hypochondriacal delusions about the condition of their internal viscera.[2] These "grief muscles," as Darwin has called them, are the corrugators of the eyebrows, and their elevator, the occipito-frontalis. When these muscles act together, they form a horse-shoe wrinkle on the

[1] *Op. cit.*, p. 247.

[2] See Darwin, *Expression of the Emotions*, p. 193.

middle of the forehead, the convexity of which is upwards. In long-continued cases of melancholia the expression of mental suffering gets stereotyped on the countenance, and the lines expressive of it often get deepened to a marked degree.

B. Mania.—In Acute Mania the excitement is often extreme. Loud speech and violent motion of the body may be incessant. Hurry, excitement, incoherence, and incessant noise are the characteristics of acute mania. The characters of the speech are well summed up by Esquirol. He says, "Speech, given to man to express his thoughts and affections, betrays the disorder of the intelligence of the maniac. His thoughts present themselves in crowds to his mind, press upon each other, push each other aside *pêle mêle*. Thus words and phrases escape from his lips without connexion, without consecutive order, and with an extreme volubility." This may be taken as the usual state of matters in the most acute cases. Referring to cases less acute, the same authority goes on to say, "Some maniacs, full of confidence in themselves, speak and write with facility, and make themselves remarkable by the *éclat* of their expressions, by the profundity of their thoughts, and by the most ingenious association of ideas. They pass, with the greatest rapidity, from expressions the most affectionate to insults and to threats; they pronounce words and incoherent phrases that have no agreement with their ideas and actions; sometimes they repeat for several hours together the same word, the same phrase, the same passage of music, without appearing to attach to it the least meaning. There are some who create for themselves a language quite peculiar; others, in speaking of themselves, never do so except in the third person. Sometimes the maniac takes a tone of bombast and vanity, and holds himself at a distance. Nothing being able to fix his attention, he yields to the fugitive desire of the moment, and directs himself towards an object that he may not be able to reach. Diverted in his course, though it be rapid and precipitate, he suddenly arrests himself, dreaming and pensive, and seems to be preoccupied with some plan. He escapes from this state of mind immediately, runs with speed, sings and cries; then he stops himself, his physiognomy takes an expression of joy, he weeps, he laughs, he dances, he speaks in a whisper, in a loud voice; in this unconquerable activity his

movements are lively, sudden, uncertain. The movements and the gestures of maniacs, which appear every one more meaningless than another, are but the expression of the exaltation and disorder of the ideas and emotions of these patients."[1]

In Simple Mania the same characteristics are exhibited as in Acute Mania, but they are greatly toned down. There is incoherence of speech and inconsistency of conduct, with comparatively mild exaltation and excitement. Here is what I got taken down from the mild delirium of a middle-aged woman in the Royal Edinburgh Asylum, who sat talking to herself quietly, and laughing occasionally :—"You're not dead yet. I'll not get you. When I was in York Lane why did you not take the candidate I had then ? When you was in Seafield you would not say that to Robert. That beautiful face of thine. When I forget Spittal Street I'll shine. If I'm no religious, can you lift it up in Spittal Street ?" If the amount of thought that presumably suggested these sentences were put into the balance, it would evidently weigh as nothing in comparison with the amount of speech produced. This suggests a very important question, viz., the question whether in such cases the speech centres are not to a large extent displaying restless activities of their own that are almost independent of the normal stimulus of thought. I shall refer again to this question in the next part of this chapter.

It is generally admitted that the condition of mania is more perilous to the mind than that of melancholia. Mania, more frequently than melancholia, causes the mind to sink into a stupor which is apt to be prolonged into permanent Dementia. Even in cases where there is apparent recovery, the patient has not often completely restored to him his former power of mind and fineness of sensibility. The edge has generally been taken off his intellect, and his affections also have been blunted.

C. Monomania, Moral Insanity, etc.—I do not think it will be necessary to treat in this chapter of the speech of patients suffering from Monomania, Moral Insanity, or the other special forms of mental derangement. In fact, nothing could be said about the speech of such patients except that, as in melancholia and mania,

[1] Esquirol, *Maladies Mentales*, vol. ii. p. 151.

it faithfully mirrors the mental condition of the patient. But it does so rather in the meaning of what is said than in the manner of saying it. There is one curious form of monomania, however, of special interest in connexion with speech, that I may be allowed to say a few words about. It is that in which the patient is under the delusion that, for some special reason, it is necessary that he should be absolutely and permanently *taciturn*. Such an individual, though generally insane, is not necessarily so. He may be under a religious vow never to utter a word. Thus we know that the Carthusian monks, in their monastery, keep silence, and converse with each other solely by gestures and in writing, except on Sundays and festivals. In other cases the reason for the taciturnity cannot be discovered. Thus Kussmaul tells of a pedlar in Switzerland who, for at least 15 years, carried on his business entirely by means of signs. "For some unaccountable reason he had condemned himself to absolute dumbness." Such cases, however, must be rare. In general, when an individual condemns himself to dumbness, he does so in obedience to some insane delusion. Dr Clouston has recorded a good case of the kind. He says,—"I have a man in the Asylum, D. T. K., who for ten years has never spoken a word, but who, I may say, in all other respects behaves sanely, showing no symptoms of morbid pride or suspicion. He is about the best joiner we have. We know he has a delusion which prevents him speaking, but what it is we can't find out. If he wants instructions about his work he writes, but nothing will induce him to write why he won't speak."[1]

Speaking of this form of mutism, Séglas remarks,—"Often it is a special hallucination which is the origin of the patient's mutism. He hears, for example, an imperative voice which forbids him to speak; and, in spite of all entreaties, he keeps silence. In other cases the mutism is the consequence of a delusional idea, which, moreover, may vary in character. Sometimes it is an idea of unworthiness, of humility: the patient believes himself fallen from his position as a man, and unworthy to communicate by speech with his fellow-creatures. Sometimes it is an idea of expiation: he keeps silence to expiate the imaginary sins that he reproaches himself with. In other cases it is the fear of hurting some one,—

[1] *Clinical Lectures on Mental Diseases*, p. 260.

of compromising, by speaking, some one that he loves,—that makes him keep silence. A patient under the care of M. Falret, who had shut himself up in absolute mutism, avowed at intervals that it was for fear of compromising his son by speaking. Sometimes this mutism has its source in an idea of hypochondriacal nature: if the patient does not speak any more, it is because he has the idea that he has no longer a tongue, or that his larynx is destroyed." [1]

In curious contrast to this last class of patients are those who speak incessantly, owing to the fear that if they do not do so they will lose the power of speech. "I have known," says Morel,[2] "a lady possessing a certain dose of hypochondria who, fearing to lose the power of speech, believed herself obliged to repeat the same word, the same phrase."

The Action of the Speech Centres in Insanity.

Having in the foregoing remarks endeavoured to illustrate, by a few examples, the fidelity with which the mental disorder of an insane person is mirrored by his speech, I think it may now be of advantage to look at the matter from another standpoint. Instead of fixing our chief attention upon the mind, and observing how its thoughts are expressed in language, let us now fix our attention upon the Cerebral Organs of Speech; and observe how, in cases of insanity, these are operated upon by the mind; and how, in some cases, they seem capable of displaying activities on their own account that are almost or altogether independent of any mental stimulus.

In the brains of uneducated people there are only two centres for articulate speech: one for the Hearing of it, and the other for its Production. In educated people, two other centres in the brain have been appropriated and trained for speech purposes, namely, one for Reading, and the other for Writing. I shall say for the present as little as possible about the anatomy and physiology of these four centres, as I hope to take up the consideration of that subject in a future chapter. For the present it will be enough to remind the reader that the two receptive centres (those for hear-

[1] Séglas, *Les Troubles du Langage chez les Aliénés*, p. 29.

[2] Morel, *Traité des Mal. Ment.*, p. 300, quoted by Séglas.

ing words and reading them) belong to the class of organs that are sensory in function, whereas the two productive centres belong to the class that in function are motor. Let us then, beginning with the two centres for spoken language, take each of the four *seriatim*, and see if we can gather about each some of the chief phenomena that are, in insane subjects, displayed in its functional operations. In making this attempt I shall avail myself largely of the copious information detailed in the very valuable work of M. Séglas, recently published.[1]

Verbal Hallucinations.

1. *The Word-Hearing Centre.*—Among all the gates through which impressions may be made upon the mind from without, the Ear-gate is probably entitled to the first place in point of importance. Through it words first reach the mind, and, with words, knowledge and the possibility of intellectual development. Words that are heard, it is now known, imprint memories or images of themselves in a certain part of the brain—the centre for word-hearing. These images can be revived in the mind, by effort of attention and will. It seems probable that, in the processes of internal thought, we owe, in part at least, our distinct internal perception of the words we are using to this internal revival of their sound-images. In the sane and wakeful condition of the mind, we have no difficulty in distinguishing between a word heard from without and the same word revived from within. In dreams it is different: our critical faculties being then asleep, we dream that other people are talking to us, when we ourselves, by internal revival of word-images, are in reality making all the conversation. There seems to be little doubt that, as in dreaming, so in many forms of insanity, inactivity of the critical faculties renders the mind an easy prey to auditory hallucinations. Yet this is evidently not the whole explanation of the matter. It would appear that, in some cases, in which the patient is awake, and in all respects considered sane, words are internally and spontaneously revived, and start into such prominent distinctness as to "exteriorize" themselves, and so be easily mistaken for words that are heard from without. Socrates was accustomed all his life

[1] Séglas, *Les Troubles du Langage chez les Aliénés*, 1892.

to hear what he considered a Divine voice, which always came to him as a prohibition or warning—never as an instigation to action. Joan of Arc saw visions and heard voices from her thirteenth year; and the voices presently called upon her to act in defence of the Dauphin and her country. She lost faith in herself, as a leader of armies, only when the voices had finally left her. We do not know if Socrates and Joan of Arc, or any of the other eminent historical personages that might be cited, would have put implicit faith in the voices, had they lived in modern times, and known something of the nature of hallucinations. But we know that, in our own times, persons are sometimes met with who are afflicted with voices, although their knowledge is sufficient to inform them of their true nature, and their judgment strong enough to prevent their being imposed upon by them. Séglas records a very interesting case of this kind. After remarking that such cases are common in medical literature, he says,—"Here is a very characteristic case that we have met with in the person of an accountant, aged 38 years, who presented himself as an out-patient at the Salpetrière, complaining of peculiar symptoms which he had had for four months. At the beginning, there were hissings in the right ear; then, insensibly, he began to hear voices in both ears. At first they were confused, like a kind of whispering, now they are distinct; and he recognises usually the tone of the voice of his uncle. Sometimes, he says, he forgets himself and replies. When he is undecided, these voices counsel him. At present, when he reads, he hears pronounced that which he reads, as if some one read aloud at his side; and even when he thinks, his thought is at once formulated aloud in his ear. This phenomenon, at first intermittent, is now continuous. He is conscious of the subjective nature of these symptoms, and says, of his own accord, that they are hallucinations; but he would like to be cured, because he finds it very fatiguing always to hear spoken whatever he thinks or does; and it worries him greatly in his business as an accountant."[1]

It is, however, among the obviously insane that auditory hallucinations are most commonly found. In many forms of melancholia, especially such as are associated with delusions of persecution, in epileptic insanity, in chronic alcoholism, and in

[1] Séglas, *op. cit.*, p. 157.

mania, nothing is more common than this particular kind of hallucination. The misery of many cases of melancholia seems to be greatly due to the incessant persecution that the patient sustains from the voices. They seldom say things that are complimentary or agreeable. Often they seem to the patient to be the whisperings of enemies who are hatching plots against him. Sometimes they sound in one ear, sometimes in both; sometimes it is one voice always, often there are several; and, among them, the voices of men can be distinguished from those of women. They may sound as if speaking near the ear, or they may be heard in the far distance, perhaps in another country, and the patient may explain that they reach his ear by the telephone or some form of electricity.

Opprobrious epithets seem to be, in most cases, the burden of what is said by the voices; but in some cases friendly voices are heard, from time to time, which may take up the defence of the patient, and deny the insinuations that are being made on the other side. I had lately, in the Royal Edinburgh Asylum, an opportunity of conversing with a middle-aged melancholic woman who was troubled with voices. She had been sitting quietly in the room while we were examining other patients, and I had noticed her weep silently from time to time. I asked her presently to tell me why she did so. She told me that it was the voices, a man's and a woman's, which came to her, sometimes from the corner of the room, and sometimes from the window. She proceeded to tell me, with great frankness, what they were saying and insinuating about her; and when I had heard a little of it, I was not surprised that she was feeling aggrieved.

2. *The Word-Speaking Centre.*—This, as already indicated, is the motor centre from which in speech-production are discharged the motor impulses that pass along the speech tract to the medulla oblongata, and thence to the organs of phonation and oral articulation. Reserving, for future consideration, the more detailed discussion of the physiological and anatomical relationships of this centre, I may here ask the reader's attention for a moment to a very important conclusion regarding the function of this centre, and of the motor centres generally, that has now been arrived at by physiologists. The conclusion is that these centres are not purely motor; but are, in fact, as Hughlings-Jackson suggested

many years ago, sensory-motor. It seems certain that within them are stored up the memories of past muscular acts, and that these memories are specially recorded in them by the muscular sense, whose cortical centre seems to be in the same portion of gray matter as that for the motor discharge. In building up a memory or picture of any finely co-ordinated movement, other memories are no doubt associated with those imprinted by the muscular sense. Something is contributed, for example, by the tactile sensibility of the skin or mucous membrane; something by the sense of sight; and something, perhaps (though this is doubted by some physiologists), from a memory left in the motor cells by the motor discharges themselves. (In previous movements of the same kind the motor cells had discharged individually so much or so little nerve force; perhaps they retain the memories of these individual discharges, and are thus enabled, by training, to repeat them with exactitude almost automatically.) Without attempting to discuss the question in detail, I think we may accept the conclusion now arrived at by the most eminent authorities on cerebral physiology, that the centres in the motor cortex are not purely motor, but that they are also sensory, in so far as there are formed within them, from memories of various kinds, images or pictures of all the delicately co-ordinated movements that they are accustomed to produce. These are known as psycho-motor images or pictures, and are to be associated with the motor centres, just as the psycho-sensory images or pictures are to be associated with the sensory or receptive centres.

When we are about to perform any delicately co-ordinated action, say with the hand, we always call up in the mind the psycho-motor picture of the act before we execute the necessary movements. Having called up the picture, we are at perfect liberty either to execute the movements or to refrain from doing so. When we do execute the movements, we may be said to have *exteriorized* the picture.

Now there are conditions of motor hallucination in which these psycho-motor pictures are so vivid and obtrusive, that the patient is tempted, or compelled, to think that they have been exteriorized or executed, when they have not really been so. Everybody knows that when a limb has been amputated, the patient for a time is apt to complain of pain and other sensations that, to him,

appear to be localized beyond the level of the amputation, in parts that have really been removed. These may be described as psycho-sensory hallucinations. It is not so generally known that the patient may have hallucinations of *movement* in the same parts. Weir Mitchell has paid special attention to this subject, and describes, for example, some of his patients, after amputation of the arm, as most vividly experiencing movements in the fingers of the absent hand, and as being able at will to perform these imaginary movements, even causing the hand to execute the delicate movements of writing. Of course, these patients were merely calling up the psycho-motor pictures of the movements within the motor centres for the hand and arm; but if the pictures were very vivid, the patient experienced almost or altogether the same sensations as if they were exteriorized or carried into execution.

Now, speech is a very finely co-ordinated action, rendered possible only after long training, and based, like all finely co-ordinated movements, upon the distinct formation of motor pictures. We are all conscious that when we are thinking we are apt to speak internally. Though not moving the lips or the tongue, we have the most vivid consciousness of the words that our thoughts are using; and we even recognise in them the same variety of tone and emphasis that they would present if they were spoken aloud. No doubt, therefore, we are using in part the psycho-sensory sound-images of the words; but it is equally certain that we use also at the same time the psycho-motor images. It is said that people may, on the whole, be divided into two classes: the auditory class, who in thought employ chiefly the sound-pictures; and the motor class, who employ chiefly the psycho-motor pictures. The reader can judge for himself whether, in expressing his thoughts internally, he employs the auditory or the motor image, or both combined. If he is specially motor he will have a strong tendency to exteriorize the word-images, so as, in thinking, to whisper or even to talk aloud to himself.

One of the most valuable parts of Séglas's work deals with the hallucinations which are due to the abnormal vividness of the psycho-motor word-images. It is a subject that he has, since 1888, devoted special attention to; and, of late, others have joined with him in the study of it. I can here only give a few brief

notes as to the facts that have been brought out by these studies.

Séglas finds that psycho-motor hallucinations are common in various forms of insanity; and that they are especially so among those patients who are under delusions of persecution or of possession by evil spirits. He brings out, in strong relief, the contrast between the patients who are subjects of the psycho-auditory hallucinations already described and those whose hallucinations are psycho-motor. The former hear the voices, the latter do not properly hear voices at all (unless they are also the subjects of auditory hallucinations), but are conscious of internal utterances. They are possessed by spirits (good or evil, but mostly evil), or demons, or enemies, who live within their bodies. If the spirits are bad, they torment the patient by saying things that are utterly repugnant and abhorrent to him, by insulting him in every way, or by hatching plots against him (for several personalities may be represented). If good, the spirits comfort the patient by conversing with him, and inspiring him with good thoughts. The spirits may appear to the patients to live in various parts of the body. Sometimes they appear to inhabit the epigastrium, or some other part of the abdomen. Thence the utterances may appear to ascend to the mouth. Very often the spirit is supposed by the patient to live in the mouth itself—it may be under the tongue—or in the upper part of the throat; and sometimes, when the spirit is supposed to live lower down, it is felt by the patient to ascend to the mouth when it is about to speak.

The whole aspect and expression of the patient suffering from this variety of hallucination are different from those of the patient who hears voices. The latter listens intently, turning the ear to the localities from which the voices are supposed to proceed. This patient has no need to listen with the ear. The utterances are made apparently within his own body. Absorbed in attending to them, he is often found in a state of apparent stupor, with the head bent forward, and the hand pressed upon the chest to keep the utterances from ascending from the epigastrium.

It is extremely significant of the real nature of these utterances, to find that what is said by the supposed spirits is often (quite involuntarily) articulated audibly by the patient,—sometimes in a whisper, and sometimes aloud.

The hallucinations are really due to the involuntary formation by the patient of psycho-motor word-images; and sometimes these are so vivid that they are exteriorized and involuntarily articulated.

From Séglas's numerous examples I shall select two: one in which the hallucinations are solely psycho-motor, and the other in which such hallucinations are associated with other hallucinations of psycho-sensory nature.

(1.) "A patient, whom we have had under observation at the Salpetrière, supposed herself to be in relation with various celebrated men. At first she conversed with them mentally; they spoke to her internally, in the head, but not in the ear. At such times she felt her tongue move as if she wished to speak. Afterwards she obeyed this solicitation of the tongue, and began to speak under the inspiration of the spirits. She speaks in spite of herself. Her voice at such times is more agreeable than it usually is, and what she says is admirable. It is, as it were, a superhuman power that makes her speak. Lammenais, Paganini, Pinel, speak in this way by her mouth."[1] This is one of the rare cases in which the supposed spirits have had anything agreeable to say.

(2.) "Mlle. L. is pursued by 'injectors,' who say in her ear all kinds of insults. But a little internal voice, which comes from the stomach, puts her upon her guard, saying to her, for example, 'They are trying to poison you, mother!' This little voice makes her move the tongue and open the lips; she understands it by the movements of the tongue. She replies often to this little voice in the same way, by moving the tongue, very much as when one speaks in a whisper. When her thought is in accord with the little voice, she finds that she speaks aloud. She has since found, thanks to this little voice, that she can prophecy, discover thieves, etc."[2]

A great number of cases have, like the last, both psycho-sensory and psycho-motor hallucinations. Séglas believes that in the ordinary progress of such cases the psycho-sensory appear before the psycho-motor. The appearance of the latter he thinks indicative of a more advanced deterioration of brain function than is

[1] Séglas, *op. cit.*, p. 185. [2] *Ibid.*, p. 187.

implied by the existence of the former alone. He holds, therefore, that the prognosis in cases of psycho-motor hallucination must always be very grave.

3. *The Word-Seeing Centre.*—I do not think it is generally known that among sane people visual hallucinations, of various kinds, are of not very uncommon occurrence in certain circumstances. They may occur, for example, at night, when the individual has reached the border-land between waking and sleeping; and, of course, they form a very important element in dreams. More rarely, a sane person may experience them with exceptional vividness if his brain be exhausted by want of sleep, or by overwork. In such a condition, he may have them when he thinks himself wide awake, if he be in the dark, or merely shut his eyes. I have myself met with several instances: some among my hospital patients, whose illness had produced persistent sleeplessness; and two in professional men, who had been made sleepless by overwork and professional worry. I quite believe that systematic inquiry would show that sleeplessness is capable of producing them in people of any class, though they be possessed of average health. In my experience, the commonest hallucination in such cases is the appearance of a kind of colourless wall-paper pattern, which may possibly be but a partial revival of the image of the wall-paper pattern of the patient's bedroom or sitting-room, but which, I think, is more probably a creation *de novo*, as it may change, like the pattern in a kaleidoscope, while it is being gazed at. In aggravated cases, all kinds of visions appear before the mental eye, and they may be so vivid as to be endowed with natural colouring. An overworked professional man whom I attended had reached this stage; but one sleeping-draught took the colour out of his pictures, and another, on the following night, banished them altogether.

Some years ago I had, in my wards at the Royal Infirmary, two patients: one a middle-aged man with aggravated neurasthenia, the other a boy with chronic meningitis of tubercular origin, which proved fatal after a course of nine months,—both of whom were troubled with visual hallucinations whenever they shut their eyes or were in the dark. In both I could call up the hallucinations by suggestion. At my ward visits, for example, I used to have such conversations as the following with the boy, he keeping his

eyes closed in the meanwhile:—"Now, tell me, do you see your mother's cottage?" "Yes, quite well." "Do you see your mother sitting at the door?" "Yes." "Who is with her?" "My little sister." "Do you see the horses passing along the road?" "Yes." "Their tails are tied up with ribbands, are they not?" "Yes." "What is the colour of the ribbands?" "Blue."

I have notes of both cases, but as the hallucinations were not verbal in nature, I do not feel that I am entitled to insert them in this chapter. I may add that I have also notes of a third case, in which one of the patients in my ward saw very distinctly, one night, what he took to be the ghost of another patient recently deceased.

Visual hallucinations *of Printed or Written Words* must, one would suppose, be most common among those who are engaged in literary pursuits, and are, therefore, in their daily occupation constantly called upon to look at words, printed or written. Over-fatigue and prolonged sleeplessness in such men ought, one would think, to be capable of producing such verbal hallucinations, especially at times when sleep is being courted in vain. Here is a case in point. In a letter written during his last illness—which was attended with prolonged sleeplessness—the eminent Scottish judge, Lord Jeffrey, describes his experience of these verbal hallucinations, which used to come upon him at night when he was trying in vain to sleep. The description is so good that I shall venture to copy here in full, from Lord Cockburn's *Life of Lord Jeffrey*, the passage that includes extracts from this letter. Lord Cockburn says, "On the same evening he dictated the last letter he ever wrote to the Empsons. In reference to his old critical habits, parts of it are very curious. It was long, and gave a full and clear description of the whole course of his illness, from which he expected to recover, but had made up his mind not to continue longer on the Bench. 'I don't think I have had any proper sleep for the last three nights, and I employ portions of them in a way that seems to assume the existence of a sort of dreamy state, lying quite consciously in my bed with my eyes alternately shut and open' enjoying curious visions. He saw 'part of a proof sheet of a new edition of the Apocrypha, and all about Baruch and the Maccabees. I read a good deal in this, with much interest,' etc.,

and 'a huge Californian newspaper, full of all manner of odd advertisements, some of which amused me much by their novelty. I had then prints of the vulgar old comedies before Shakespeare's time, which were very disgusting.' 'I could conjure up the spectrum of a close printed political paper, filled with discussions on free-trade, protection, and colonies, such as one sees in the *Times*, the *Economist*, and the *Daily News*. I read the ideal copies with a good deal of pain and difficulty, owing to the smallness of the type, but with great interest, and, I believe, often for more than an hour at a time; forming a judgment of their merits with great freedom and acuteness, and often saying to myself—This is very cleverly put, but there is a fallacy in it, for so and so . . .'"[1]

Lord Jeffrey died, 26th January 1850, æt. 76, on the evening of the day following that on which he had dictated this letter.

Griesinger (p. 90), referring to the frequency with which such hallucinations of the senses occur in sane people, especially between sleeping and waking, and noting the fact that visual hallucinations, when vivid, may be brilliantly coloured, says,—"Nothing could be more erroneous than to consider a man to be mentally diseased because he had mental delusions (hallucinations). The most extensive experience shows rather that such phenomena occur in the lives of very distinguished and highly intellectual men, of the most different dispositions and various casts of mind, but especially in those of warm and powerful imagination." He instances the cases of Tasso, Goethe, Sir Walter Scott, Lord Byron, Jean Paul, Benvenuto Cellini, Spinoza, Pascal, Van Helmont, and Andral, who, for the most part, had experience of seeing visions. Mr Nisbet, however, is no doubt equally ready to quote all these instances as examples of the "Insanity of Genius."[2]

All sane people have the power of forming internal visual images of things and words, and the faculty is probably strengthened by practice in such occupations as that of an artist; but among sane people it is only in unhealthy conditions, such as those of fatigue of the mind and prolonged sleeplessness, that these images exteriorize themselves, and give the same distinctness of impression as if real objects were being looked at.

Among the Insane, visual hallucinations are exceedingly common.

[1] *Life of Lord Jeffrey*, vol. i. p. 407.

[2] *The Insanity of Genius*, by J. F. Nisbet, 1891.

They may exist alone, or be associated with hallucinations of the other senses, such as that of hearing. It is only in a few cases, however, that the hallucinations take habitually the form of printed or written words. Séglas records several of these, among others the following:—

A patient under treatment in the Bicêtre Asylum, "one day at dinner could read distinctly upon the porcelain lamp the words, 'Je t'aime,' which, according to him, had been thrown upon the lamp by the aid of a mirror. Subsequently he saw letters with his eyes more and more frequently. He said that he then accustomed himself to write with his eyes, and thus to throw words into space. The letters go out from the eye: they are yellow, have the appearance of small printed characters, then they grow in size and retreat to a certain distance, after which they diminish in size and fade away. He has, since that time, been able by this means to correspond from Bicêtre with certain persons at Clichy, and he asks them, in this way, to try to get him a patent for writing with the eyes. Let us add that this patient, who, along with these visual verbal hallucinations, has other hallucinations, auditory and above all motor (mute voices), is extremely visual. When he has taken a good look, for example, at a part of the court-yard, he shuts his eyes, and the place detaches itself very neatly *en bloc*, and then fades away as it flies towards the west. This faculty of visualization is regarded by him as a special *photographic* power, which he has at command, and which excites the jealousy of his enemies. The photographs are much more beautiful, he says, when he shuts his eyes, because the eyelid acts then as a reflector; they are then clear and lively."[1]

4. *The Motor Centre for Writing.*—It remains for us now only to consider the hallucinations which are, in some few cases, displayed in connexion with the motor centre for Writing. Such hallucinations are rarer than any of the three other varieties. They are rarer, because, in the first place, motor hallucinations are rarer than sensory, and, in the second place, because the motor hallucinations of writing can be expected to occur only in those who have been much in the habit of writing, and of course these are but a small minority of the general population.

[1] Séglas, *op. cit.*, p. 181.

It will not be necessary to explain the physiology of these graphic hallucinations, since almost everything that has been said regarding the physiology of the hallucinations connected with the motor centre for speaking applies equally to them. The writing-centre, like the centre for speaking, is a centre which, according to the most recent views, is not only motor in function, but also sensory, inasmuch as it is the centre for the psycho-motor pictures of the delicately coördinated movements of writing. The picture is first formed, and then it is exteriorized, by being imprinted, as it were, on the executive motor cells. Forming the picture, and yet refraining from exteriorizing it, we can write mentally, just as we can speak mentally; though, owing to the act being less habitual to us, it is not so easily accomplished. The psycho-motor picture of writing may, in certain abnormal circumstances, be so distinct that the patient has the hallucination that he is writing when he is not actually doing so. In other cases, the picture may become so very distinct and obtrusive as to compel its own exteriorization. It is then an "Impulsion" which causes the patient to take up the pen and write at the dictation of the "spirit" by which he supposes himself to be "possessed."

Séglas records cases of both these varieties. One of his examples of the psycho-motor hallucination of writing without actual impulsion is that of a female patient aged forty. She was the subject of other and more common forms of hallucination, "but on one occasion she exhibited, when under our observation, *a motor verbal hallucination of writing.* She had come as an out-patient to the Salpetrière, and while we were speaking, we noticed her carry her right hand to the region of her heart, become very red, and tremble. These symptoms were the ordinary accompaniments of her hallucinations. At our request she explained to us that whilst we were speaking to her, she had had all of a sudden the idea of taking up a penholder that lay upon the desk. She had not done so, but nevertheless *she had felt as if her hand moved, and wrote the reply that she had wished to make to us.* The patient is perfectly conscious of all the varied hallucinations that she experiences, and that provoke in her incessant sufferings. She has no delusional ideas."[1]

[1] Séglas, *op. cit.*, p. 247.

Of several cases recorded by Séglas which exhibit the hallucination converted into an impulsion, one is that of a patient with delusions of persecution, who supposed himself to suffer, when in his bath, frightful tortures from the electrical experiments practised upon him by the spirits. He was in the habit of writing very full descriptions of these tortures. But in the midst of these descriptions, bits were interpolated in an apparently different handwriting, and these the patient declared to be the writing of the spirits, executed by means of his hand. For example, when in one passage he is enlarging upon his sufferings, the spirits suddenly interpolate the clause, "And we hope again to make experiments, and to cause thee to suffer frightfully, in contortions and contractions."[1]

I have devoted some space to the consideration of these psycho-motor hallucinations, so well described by Séglas, because the subject is a comparatively new one. It is also a subject of great importance; and the conclusions arrived at are evidently in entire harmony with the latest advances in cerebral physiology. The psycho-sensory hallucinations have been long familiarly known.[2]

A very important question now being discussed by specialists is,—What is the starting-point of the cerebral disturbances which produce these various hallucinations? Is it a disorder of the mind, which acts upon the speech-centres, and produces hallucinations by exciting them in the same way as they are excited by the uncontrolled imagination of a person who is dreaming; or may the disorder be primarily situated in the speech-centre itself? In the latter case, the hallucination in the speech-centre would disturb the mind; and, if the mental balance were not very good and true, it might overthrow the judgment, and be therefore the

[1] Séglas, *op. cit.*, p. 248.

[2] Psycho-motor Hallucinations and Impulsions may occur in connexion with motor centres other than those connected with Speech. It would appear that they may even prompt a lunatic to criminal violence. Dr Elkins, one of the assistant-physicians in the Royal Edinburgh Asylum, has recorded the interesting case of a young man affected with homicidal mania, who on several occasions had attempted to commit murder. "A few days after admission he volunteered the statement that his muscles were urging him to do things that he knew were wrong."—*Journal of Mental Science*, January 1891.

starting-point of insanity. There seems no good reason for rejecting either of these suppositions. It seems quite probable that in some cases hallucinations in the speech-centres are excited by delusions in the mind, and that in others delusions in the mind are excited by hallucinations in the speech-centres. The tendency of late has been to concede to the speech-centres a position less immediately and strictly dependent upon the mind and consciousness than they were previously supposed to hold. Their powers of storing up the images of words and even of phrases, and of producing these automatically or by rote, without the active co-operation of the consciousness, have of late been brought into pretty strong relief; so that we now hear more of Reflex and Automatic Speech than we did some years ago. Reflex speech is now, indeed, attracting the attention of many students of insanity. It is so frequently exhibited by certain classes of the insane that I think it will be well to insert here a few words about it specially.

Reflex and Automatic Forms of Speech, exhibited by Insane Patients.—(1.) *Echolalia.*—The simplest form of reflex speech is Echolalia. As we have already seen, echolalia is exhibited by all healthy children at a certain stage in the process of learning to speak. We have also seen that it is often retained permanently by such imbeciles as have never got beyond the first steps of that process. It consists simply in the echo-like repetition of words that have just been heard. They are mechanically repeated as sounds, without any attempt being made to attach meanings to them. Every parrot that speaks does so by echolalia. Only a few parrots of very superior intelligence (see Darwin and others) have apparently advanced a step further, so as to be able to attach the right meanings to a few of their words and expressions. Words and phrases learned by echolalia are repeated by a parrot automatically, when it is in lively humour.

If we wish to hear Echolalia practised by the insane, we must go to cases where the mind is decayed; in other words, we must go to cases of Dementia. In all forms of dementia, Echolalia is common. In my recent visits to the Royal Edinburgh Asylum, I found it typically exhibited by one of the patients who was the subject of adolescent dementia. I may refer again to the subject

when I come to treat of the speech of dementia, and shall also have something to say about it in connexion with aphasia.

(2.) *Conventional Replies.*—A higher development of reflex speech is also often met with in cases of dementia,—especially, it would appear, in cases of senile dementia. It consists in the giving of Stereotyped or Conventional Replies to ordinary conventional questions. "How do you do?" says the questioner. "Quite well, thank you," says the answerer, though he may be very ill indeed. This is a sort of reply we all make sometimes, when we are absent-minded. The poor dement is always absent-minded; his mind is gone. Such conventional answers are so often repeated in the course of a lifetime that the speech-centres learn them by rote, and can repeat them automatically, if only the stimulus of the conventional question be supplied. Some would have us believe that the process is entirely reflex, and that the consciousness has nothing to do with this kind of speech in dements; but, for my own part, I am inclined to think that there must be a little mental consciousness in all these cases, roused into activity, perhaps, by the question; and some feeble glimmering of the meaning of the question, though the answer given may be so far from true. How low the consciousness may have sunk in some of the dements who exhibit this form of reflex speech is demonstrated by such a case as that recorded by Dr George M. Robertson, senior assistant in the Royal Edinburgh Asylum, in a paper which has attracted attention.[1] The patient was an old man with senile dementia, so mindless that he "was dirty in his habits, would not touch food if it was placed before him, never made a single request for food or anything else, and would not do the simplest thing that was asked him." When left to himself he was in the habit of talking to himself automatically, thus:—"If you would just come be—with the way—what now!—oh dear, dear! Oh, that is the whole closh—that's what! Oh dear, dear me—an it is the other macock or macockiness—See! Who is what?—that—is it? oh age." Yet this patient, when conventional questions were asked him, could answer them "reflexly" with some semblance of intelligence. Here is a bit of Dr Robertson's conversation with him:—

"It's a fine day, Ross." "It is that." "It's a wet morning."

[1] "Reflex Speech," *Journal of Mental Science*, April 1888.

"Oh, no, not now." "It's a rainy day." "Yes, it is." "Ross!" "I hear, sir." "You're an old rascal." "Yes." "How are you this morning?" "Oh, very well, thank you."

(3.) *Other Forms of Automatic Speech.*—(*a.*) Patients who are the subjects of advanced dementia are frequently occupied in talking to themselves, sometimes in a drawling monotone and sometimes in a whisper. The words of these Monologues are sometimes distinctly articulated, as in the specimen that has just been given. Often, in dementia of long standing, they have become for the most part merely semi-articulate sounds, that have only a superficial resemblance to words. But, whether they are composed for the most part of articulate words, or of mere sounds like words, it is impossible, as a rule, to detect any meaning in them. A little study of these monologues is apt to suggest to one's mind that the mental faculties of the patient have little or nothing to do with their production. It seems rather that, in these monologues, the organs of speech are taking exercise on their own account.

(*b.*) In connexion with certain forms of Mania, with great volubility of incoherent speech, the question has of late years been debated, whether each incoherent fragment of a sentence represents an incoherent fragment of thought; or, if it is not rather the case that the speech-centres themselves participate in the general excitement of the brain, and display their excitement by pouring out automatically the words and phrases whose images are stored up within them. The term "Verbigeration" is now coming into use among alienists. It is a term meant to designate that noisy, incoherent, and meaningless speech so often met with in certain forms of mania. The term seems specially suitable for the speech of such cases when this is largely composed of the constant repetition of a very few words or phrases.

(*c.*) In the foregoing notes upon pyscho-motor word-hallucinations, as described by Séglas, it was indicated that such an hallucination, when very vivid, is apt to become an Impulsion, which compels the patient to exteriorize the hallucination by pronouncing the word. This again may perhaps be taken as an example of automatic action on the part of the speech organs. Some regard it as a kind of coördinate spasm in the motor word-centre, the motor disturbance resulting in the involuntary ejaculation of a

word. The condition has by some authorities been termed Logospasmus Choreiformis; but when the words thus ejaculated are habitually of a dirty and disreputable character, the term Coprolalia is generally preferred. It is suggestive of the nature of the condition to find that, in coprolalia, a convulsive movement (spasmodic tic) of the arm or face is frequently associated with the ejaculation of the word. Professor Charcot, however, seems inclined to refer coprolalia to a deranged condition of those higher centres that are the organs of ideation, rather than to a mere local disturbance of the lower centre for speech production. I have already made a short reference to coprolalia in the second chapter. It is worthy of remark that in some of these cases the patient is so much possessed and tormented by the word-hallucination, as to feel it as a "veritable foreign body loading his stomach," which he tries to expel by efforts of spitting.[1]

Superstitious Significance attached to Words by some Insane Patients.—Everyone knows that among peoples who are savage, ignorant, and superstitious, words have often a mysterious and superstitious significance attached to them. Some are held to be lucky, and others unlucky; and forms of words, often meaningless in themselves, are used as spells, invocations, or incantations. One is therefore not surprised to find that similar superstitions abound among the Insane; who are held by some authorities to exhibit in some ways a kind of retrogression towards the savage state. Sometimes new words (neologisms) are invented by the insane, to give expression to the delusions which have taken possession of them. Lucky and unlucky words, spells and incantations, are also met with among them. Without going into further detail on this subject, I may quote the answer which a patient in the Royal Edinburgh Asylum gave us when we asked him how long he had been in the Institution:—"By the time of *sane*, I have been here six years; by the time of *fuisographic*, I have been here ten years; fourteen years by what they call *penance*." He explained that "fuisographic" is "how your life is put together."

[1] See Séglas, p. 163; also a paper by Charcot and Magnan, "De l'Onomatomanie" (*Arch. de Neurologie*, 1885).

AGONIZING SEARCH FOR A NAME, WORD, OR NUMBER THAT HAS BEEN FORGOTTEN.—Under the name Onomatomania (name- or word-madness), MM. Charcot and Magnan have, in a very important series of papers,[1] grouped together the phenomena connected with word-possession, word-impulsion, and superstitious interpretation of words, that we have just been examining. In the group they include also a form of Onomatomania that I have not yet alluded to. It is the form in which a person who has forgotten some name, word, or number, cannot prevent his mind from searching for the word in his memory, though the search becomes more and more painful, and even agonizing to him. In the agony of search he may become intensely excited, or even furious; be seized with a constrictive pain, and a sense of suffocation, about the chest, and break out into profuse perspiration. The symptoms are at once relieved if the word is at last remembered, or is communicated to the patient.

This condition is sometimes met with among those who are the subjects of pronounced insanity; it is common also among people who, owing to bad heredity, are on the verge of insanity. It is one of the *stigmata* by which an unstable mental equilibrium, due to bad heredity, may be recognised; being in that respect like the other eccentricities manifested by such individuals, such as the fear of pins, or of cats, or of thunder, perversions of the sexual instinct, dipsomania, etc. The authors of the papers have recorded several interesting cases.

EMBOLOLALIA.—This consists in the frequent interpolation into speech of a useless or meaningless word or syllable. Like "hemming and hawing," it is a phenomenon occasionally displayed by sane people. Kussmaul[2] has recorded a number of curious cases, among others that of an old general in whom this peculiarity made its appearance after a sunstroke. In his case the word interpolated was "mama." He said, for example, "This miserable—mama—fellow has expected—mama—other people to—mama—pick his chestnuts out of the fire—mama." Sometimes it is not a word that is interpolated, but a syllable, which is attached as an affix to other words.

[1] "De l'Onomatomanie," *Archiv. de Neurologie*, tom. x., 1885, p. 157, also Nos. 70 and 71, 1892.

[2] *Op. cit.*, p. 813.

Séglas (p. 63) states that these various forms of embololalia are met with occasionally among the Insane.

Logorrhœa and Bradylalia.—I have already, in the second chapter, made some reference to these two conditions of speech. Neither of them can be said to be unknown, or even very uncommon, among people who are not insane; but the best examples of both are probably met with among the insane. The "Verbigeration" of the maniac is a kind of logorrhœa; and the condition is typically presented by some garrulous and rapidly speaking Imbeciles. Bradylalia (slowness of utterance) is met with most frequently in connexion with conditions of depression. It is, as already indicated, common in cases of Melancholia with stupor.

Formation of Sentences, and Articulation of Words, in Insanity.—It has already been shown that in some forms of mania with exaltation and excitement the ideas may, for the individual, be unusually brilliant; and they may be expressed with unusual felicity of diction, and with perfect articulation. But such cases are somewhat exceptional, the more common characteristics being voluble incoherence and mere noise, with incomplete and often ungrammatical sentences. Sometimes, again, when excitement is not so great, and speech is more deliberate, there may still be defects in grammar (agrammatismus), which the patient did not exhibit when sane. He may return to a kind of baby-speech, and use *me* for *I*, convert the terminations of irregular verbs into those of regular ones, or use the verb only in the infinitive; or, like a child, he may speak of himself only in the third person; or, in obedience to some delusion about his personality, he may, in referring to himself, always use such an expression as "the person of me." Such errors in syntax and prosody are common enough.

As to Articulation, I think we may say that in the earlier and more active stages of insanity articulation of individual words is usually perfect. In chronic cases also it very often remains perfect throughout. Even when insanity sinks into partial dementia, there is often nothing special to remark about the articulation of the words, however barren of meaning the patient's use of them may be. In Advanced or almost Total Dementia, however, as already indicated, the maundering and mumbling Monologues

in which the patient often indulges, besides being destitute of meaning, are often articulated in so slovenly and careless a manner that the individual words, if they are words at all, cannot for the most part be recognised as such. It is a careless and imperfect kind of speech that puts one in mind of the scamped articulation of lalling imbeciles. Yet if such a patient can be roused to reply to questions, the articulation of his replies may be normal, or almost so. There are, however, exceptions to this rule. In Senile Dementia there may be noticeable a paralytic slurring in the patient's replies; and in the dementia of General Paralysis of the Insane there are, along with this slurring, other peculiarities, which indicate that the motor apparatus of articulation is undergoing changes which are paralyzing both its motor power and its power of coördination. I shall have something to say about these paralytic peculiarities of speech in the next part of this chapter. The existence of this paralytic element in the articulation is of grave significance prognostically.

The Writing of the Insane.—This is a subject which has been treated of by Séglas and others at considerable length, and there are many points of interest in connexion with it. I can only afford, however, to make a very few notes about it. (1.) It will be readily understood that the incoherence, the verbigeration, and the delusions of the patient, are made quite as manifest in his writings as they are in his speech. Some of the insane (graphomaniacs) would write for ever, if allowed to do so; and a few, if not prevented, would have their writings printed for the information of the public. The Inventors would have their inventions made known for the sake of humanity, and the Persecuted would appeal to the public in print for succour from their tormentors. (2.) All kinds of fantastical peculiarities are met with in the Handwriting of letters written by some of the insane. The *t*'s may be doubly barred, the *i*'s doubly dotted. Punctuation may be wholly absent, or practised in excess; the words may be underlined or doubly underlined to a most unusual extent; and capitals may be used in unnatural profusion. (3.) A paretic or paralytic element may be betrayed in the tremulousness of the handwriting. This may be due to functional debility, as in the handwriting of some melancholics, and of some hysterics; but it may also be due to

organic changes in the motor centres for writing, as in the tremulous writing of many cases of senile dementia, and in the still more tremulous and disorderly writing of patients suffering from general paralysis of the insane. In the latter condition the characters may be converted into irregular zigzags, and so crowded together as to be totally illegible.

Aphasia among the Insane.—This is a subject which I propose to defer the consideration of until I have discussed the subject of aphasia as produced by coarse organic lesions of the brain. I shall here only say that aphasia, in all its forms, is of not uncommon occurrence among the insane. In some cases it is a functional and temporary complication of the insanity. In other cases a gross lesion of the brain has caused the aphasia, and, it may be, has also led to the development of the insanity.

Speech in Dementia.

Permanent injury of the mind is a common result of an attack of insanity. In not a few cases the damage amounts to total disablement and destruction of the mental faculties. The sad and hopeless condition of Secondary Dementia, exhibited by so many of the patients in every lunatic asylum, is thus brought about. I know few sights more impressive than that which one sees on visiting, at a lunatic asylum, the day-room set apart for these hopeless dements. There they sit, wrecks from the fires of the various forms of insanity. Passive and inert, inattentive even to the calls of nature, they take no notice of each other. They sit still for the most part, and many of them would never move from their seats if not made to get up, and taken out for exercise. In some, the fire of insanity is quite burnt out, and the mental faculties are totally extinct; in others, it smoulders on in the form of some enfeebled remnant of the delusions with which the mind was once all ablaze. Some of the patients exhibit curious forms of automatic activity. One may constantly rub his hands together; another may stand upon the floor and perform perpetually a curious swinging or balancing movement; and some may be constantly engaged in muttering to themselves those curious automatic maundering monologues already described, in which few articulate words, and no definite

meaning, can be detected. Among this assembly of people deprived by insanity of their mental faculties, are usually a few who owe the deprivation to the disease known as General Paralysis of the Insane. In these cases, the terrible disease of which they are the subjects will soon destroy life itself. In this day-room the wrecks left by most of the various severer forms of insanity will be found collected together. Some have been Melancholic; a larger number have been Maniacal; others are Epileptic; others have been Alcoholic; some are cases of Senile Dementia; and others are the subjects of General Paralysis of the Insane. The hopeless condition of Secondary Dementia may be the consequence of any one of the graver forms of insanity.

It is among these patients with dementia that the Reflex and Automatic forms of speech already described are so often met with. Echolalia is common among them, especially when dementia is far advanced. The reflex speech exhibited in the giving of Conventional Replies to conventional questions is also often met with. Their automatic maundering Monologues have already been described: in some of the cases of advanced dementia to be presently noted, these monologues will be found to have become so degenerate as to have lost all resemblance to words, and be comparable only to the babbling of infants.

Even in patients, however, in whom the monologues have been reduced to mere babbling, it is very striking to find that if by any means the attention can be roused, and the patient got to reply to a question, he will reply to it in words whose articulation is practically perfect. I am, of course, speaking now of cases where the dementia is pure, and not complicated by motor paralysis. The speech-centres thus evidently retain their store of verbal images, even for many years after the mental faculties have almost ceased to employ them.

A. Cases of Simple Dementia without Motor Paralysis.—When treating, in the fifth chapter, of the Speech of Imbecile Children, I gave, from notes taken at the Larbert Institution, a series of cases showing a gradual ascent in intelligence and speech-power, from mental zero up to an almost normal level of intelligence. These were cases of Amentia, in which mental Development was more or less incomplete. In dealing now with

cases of Dementia, in which the mind has become enfeebled or been annihilated, it might be possible to give a somewhat similar series of cases. They would begin with cases of slight enfeeblement, not far removed from the normal level; and descend, step by step, until the last case displayed a condition of mental zero. But, in order to make up a complete series of this kind, one would require to look for the slighter cases, not in asylums, but at their private homes. The short series of cases of dementia which I now present, having been selected at the Royal Edinburgh Asylum, is therefore incomplete, none of the slighter grades being represented. But, such as it is, it may be of use, as showing gradations in intelligence and speech-power. I select, for the series, exclusively, cases of the secondary dementia that so often results from Adolescent Insanity. Dr Clouston, who is the chief authority upon this form of insanity, points out that the dementia resulting from it is very often total, and that it is usually pure and uncomplicated, being much less frequently than the other forms of secondary dementia associated with paralytic or other conditions that might obscure its symptoms.[1] It is a form, therefore, better suited than any other to show the effects of Dementia, pure and simple, upon the speech of the patients.

Case I.—*Replies in absent-minded manner to questions, occasionally reads, but does not understand what he reads. Exhibits Echolalia. Generally sits silent and still all day, unless told to move. Is cleanly.*—W. C. (male), æt. 27. Admitted three years ago, suffering from Adolescent Insanity with melancholia. Heredity very bad. In reply to most questions, says, "No, Sir." Occasionally, "Yes, Sir." Can give his name and age. Asked where he is, says, "I don't know, Sir." Then says he lives in Edinburgh. Says this place is Hell. Occasionally reads a newspaper, and sometimes does so aloud, but probably does not understand what he reads. Asked why he reads, says, "Because it pleases me." "Do you read any other paper?" "I don't remember." Has gradually spoken less and less with advance of dementia. Now, would sit still in one place all day, unless told to move.

[1] See Dr Clouston's paper on "Secondary Dementia," *Journal of Mental Science*, October 1888.

Occasionally exhibits Echolalia. Occasionally sings to himself in good tune.

Case II.—*Patient in much the same condition as Case I., only a little worse. Echolalia. Babbling monologues. Is dirty.*—I. A. A. (male), æt. 28. Heredity very bad. Adolescent Insanity (mania) at 23. When this passed off, dementia set in. At first the patient read a good deal, and seemed to understand what he read. Now he never reads, but he often looks at the pictures of the *Illustrated News*. When spoken to, sometimes repeats the last words spoken to him by Echolalia. Sometimes laughs and grunts to himself in a silly way. Sometimes he babbles to himself unintelligible sounds in a whisper. To-day, in reply to every question, he replies "elves," in a whisper. He varies a good deal, being sometimes very silent, and sometimes babbling to himself for a long time in baby-like fashion.

Case III.—*Deeply demented, being dirty in habits and eating anything she can pick from the floor. Babbles to herself. Can, however, do a little simple house-work; and, when attention is roused, can give her name; and can name correctly, and with perfect articulation, a number of articles shown to her.*—M. M. (female), æt. 32. The dementia is now of some years' standing. Has a good head, face, and figure; looks healthy; and at first sight looks intelligent enough, eyes being clear and bright (though rather restless), and there being an upright wrinkle between the eyebrows, as if from habit of thought. Patient, however, mutters (babbles) to herself unintelligible sounds in a whisper. Can be got to do nothing useful, except to brush the floor with a long brush. Would eat anything she can pick up (cat's meat for example), if not prevented. When a bag of sweetmeats is brought to her, would eat up "bag and everything." Never speaks except when spoken to. Gives her name, and names correctly and with perfect articulation, a watch, a chain, a key, cuffs, a penny, a handkerchief, etc. Requires assistance in dressing and undressing. Is dirty. Never shows affection for any one. Does not sing.

Case IV.—*Speech production nil; but understands simple orders, and is able to dress himself and keep himself clean. Is quite taciturn,*

and is dull and listless. No emotions.—J. M. (male), æt. 33. Admitted eleven years ago, suffering from Adolescent Insanity in its maniacal form. From the first beginning of the dementia, he spoke little; but he sometimes whispered to himself, and his replies to questions were always given in a whisper. At present he never speaks, and has not been heard to do so for years. Never laughs or gets angry; emotions seem gone. Is generally sedentary, but sometimes wanders about the room, picking things off the floor. Is able to dress himself and keep himself clean. Understands and obeys simple orders; moving from chair to chair, for example, when asked to do so. When looked at, keeps his eyes shut. When asked to put out the tongue, protrudes its tip slightly beyond the edges of the teeth. Never sings.

Case V.—*Dementia complete. Habits dirty. Never speaks. Cannot understand anything. Babbles incessantly to herself. Sings well! and in singing is said to pronounce the words perfectly.*—C. T. (female), æt. 20. Dementia came on after an attack of adolescent insanity. Was formerly a bright girl. Is well grown and developed, and, physically, appears healthy. She has a vacant but not unhappy expression. Is quite heedless as to evacuations. Sitting in her chair, she occupies herself almost incessantly in doing one of two things, or both of them together. (1.) She rubs the flexed fingers of her right hand rapidly upon the extended palm of her left. (2.) She babbles to herself continually, looking before her, or to one side, as if addressing some one in conversation, and nodding her head from time to time as if to give emphasis to what she is saying. At a little distance one would suppose that she was talking to an imaginary companion; but, on listening more closely, it is found that the monologue is composed of babbled consonant and vowel sounds, very similar to the sounds produced in the babbling of babies, only that the execution is more rapid and vigorous. I tried to write down some of the sounds, but found it very difficult to do so, owing to the rapidity of their utterance. I got, however, **th, man, th, what, whe, tan, m, m, hi, i.** At my first visit the only words I could catch were **man** and **what,** as shown above; but I was told that occasionally bad words appeared in the monologue; and this observation was verified when I saw the patient for the second time, several such words

being then pronounced with unmistakable distinctness. The monologue in this case has thus degenerated to a stage almost as low as it is possible for it to reach,—to a stage far lower, for example, than the really verbal, though meaningless, monologue of Dr Robertson's case of senile dementia already quoted. The emotions of this patient are gone. She never shows affection and never gets angry. Occasionally, instead of rubbing one hand upon another, she tries to tear her dress; but her dress is now of such material as to resist tearing. *She sings well.* As it is generally in the night-time that she sings, I did not hear her; though the nurse kindly tried to entice her to sing, by singing to her her favourite song. The song is "Love's golden dream is past," which, the nurse says, she sings in perfect tune, and with perfect articulation. There is positively no other way in which the patient's attention can be aroused. She never pays attention to anything else, and never replies even to the simplest question.

To hear a patient in the condition of advanced Dementia sing well is very startling. It is even more so than to hear the good singing of imbecile children. How is it that the musical faculty is thus often preserved intact, or almost so, when the mind has been laid in ruins? I do not know that physiological science can yet answer that question. To find the faculty intact in such a case as this last one, produces in one's mind the same kind of feeling as one would experience, if, in searching in the ruins of some dwelling-place that had long since been destroyed by fire, one found some pretty domestic ornament, unbroken among the débris.

It is not only in the dementia resulting from adolescent insanity that the musical faculty is thus able to maintain itself intact. It may be found equally so in dementia resulting from many other forms of insanity. Thus, there is at present in the Royal Edinburgh Asylum a man now far advanced in dementia, in whom the condition resulted, in middle life, from repeated attacks of mania brought on apparently by alcoholism. This patient was once a clever workman, and used to play the violin. Although now dull and stupid, he wakes up a little when asked to give his favourite musical performance. This is an imitation of the notes of the bugle, which he does with his mouth, placing the right hand vertically against the right side of the mouth. The performance is

surprisingly good and tuneful, the notes being wonderfully like those of the bugle.

B. Dementia with Paretic or Paralytic Elements in the Articulation of Words.—The leading element in this paretic articulation is Slurring, which renders the speech thick and slovenly. Apart from insanity, there are many conditions which may cause the speech to be slurred and slovenly. During Inebriation, for example, the speech may be slurred. A few glasses of wine may make it risky for the individual to attempt the articulation of such an expression as "mutual eligibility"; and we know what becomes of "British Constitution" when there is distinct inebriation. Other conditions may, in like manner, impair the articulation for a time. Great Mental Fatigue or Depression may cause, for the time, a little carelessness and want of precision in the articulation of difficult words. The symptom is also a common one, and may be permanently established, in many cases of Organic Disease of the Brain, due to coarse lesions. But I do not wish to look at these conditions at present. I want now to speak of this symptom, and other associated peculiarities of speech, as they occur in certain forms of Dementia. The two forms of dementia in which it is most commonly met with are—(1), Senile Dementia, and (2), Paralytic Dementia—the General Paralysis of the Insane. In both of these the symptom is of ominous significance. It shows that paralysis is creeping down from the higher mental to the lower motor centres in the brain. This downward march is apt to proceed until the functions of the brain that are concerned with the maintenance of life itself are finally involved. Referring to this paretic element in the articulation of dementia, Esquirol has said—"L'embarras de la parole est un signe mortel." The axiom applies with double force when the form of dementia is that of General Paralysis of the Insane. Let us, then, consider the two forms of Dementia in which this paretic element in articulation is specially exhibited.

(1.) *Senile Dementia.*—When age is far advanced, the mind is naturally more or less enfeebled. This is the rule, though we all know that, in exceptional cases, the mind remains wonderfully strong and vigorous long after the ordinary term of human life has

been overpassed. When the mental feebleness, natural to extreme old age, is exceptionally well marked, the case may be reckoned as one of Senile Dementia. This may set in prematurely, owing to a bad heredity, or to former habits of intemperance or over-work, or of hard living of any kind. It may be predisposed to by atheromatous degeneration of the cerebral vessels. It may be rapidly established after an attack of senile melancholia, or a passing attack of mania, or in consequence of the depressing influence of a great sorrow, or of a mental strain of any kind. In some cases the dementia is total, or almost so; and in these the Monologues, and some of the forms of Reflex Speech already described, will generally be exhibited by the patient: but in a great many cases there is marked enfeeblement rather than abolition of the mental faculties. The old man passes into his second childhood. As in all other forms of dementia, the memory is one of the first of the mental powers to suffer deterioration. New impressions are not retained by it. Though the old man may be able to live in the memories of the past, and to tell long stories of the events of his youth, he is apt to forget such simple things of the present as the day of the week, or what he had for breakfast. It is the exceptionally severe cases that one finds in asylums.

Passing over the features which are common to this and the other forms of dementia, let us look for a moment at the Intonation and Articulation of speech in senile dementia.

In extreme age the Voice loses its former volume, its depth, and its variety of intonation. It tends to become monotonous, and of higher pitch than it was wont to be.

> ". . . . . his big manly voice,
> Turning again towards childish treble, pipes
> And whistles in his sound."

But this change in pitch is due rather to physical than to mental decay, and it is not usually met with in cases where senile dementia sets in prematurely. Much more closely associated with the dementia are the changes observable in Articulation. In the articulation there is usually observable a distinct element of Slurring. Here is what Dr Clouston, who has made a careful study of this form of speech, says about it:—"No one can look to a man in his extreme dotage talking without perceiving that the

motor apparatus of articulation is as much affected as the mental apparatus. When looked at carefully, we see, in the first place, that there is a certain amount of slowness, indistinctness, and hesitancy of speech—a paresis, in fact. Then, in some cases, we see that, like the general paralytic patient, there is a certain amount of convulsive tendency, seen in the tremor of the labial and lingual muscles. The first words of a sentence, or the first syllables of a long word, are far more distinctly enunciated than the last, showing an easily exhausted stock of nervous force, as well as a paresis. Then there is a want of coördinating power. The words having many *th* sounds are not properly enunciated, *e.g.*, the patient cannot say, 'The astonishing thing is that those thieves should think this.' The power of rolling the *r*'s is deficient too. There is also a distinct tendency to reversion, in the resemblance of such speech to that of a child learning to speak. Finally, there are well-marked aphasic symptoms in some rare cases. I have a woman now in the Royal Edinburgh Asylum who when she wants to say, 'Now you take that,' says, 'Now you ter ter ter.'" There are thus features in senile speech which relate it to the speech of general paralysis of the insane; but there is not on this account much risk of error in diagnosis. General paralysis is very rare at the advanced age when senile speech appears; and, as Dr Clouston remarks, "A close study of the speech will usually determine the difference. There is not the true general paralytic trembling, or the spasmodic convulsions of the smaller facial and labial muscles."[1]

(2.) *General Paralysis of the Insane.*—Every one knows the terribly fatal character of general paralysis of the insane. On the average it runs its course in two or three years. The stages of the malady in its common form are also familiarly known. First there is the stage of Mental Exaltation, with its extravagant notions of grandeur, and its foolish and sometimes criminal actions; also with its slight tell-tale disturbances of speech, which the alienist looks to specially, in trying to distinguish the case from one of ordinary mania with exaltation. Then, in the second stage, with persistence of the exaltation, there is more distinct loss of memory; more evident affection of speech; and the appearance of incoördination in such other complicated movements as those of

[1] Dr Clouston on "Disorders of Speech in Insanity," *Edin. Med. Journ.*, April 1876.

walking, washing the hands, and buttoning the dress. Lastly, in the third stage, the mind is sunken deep in dementia; the speech totally inarticulate; and the body paralysed, not only in its powers of voluntary movement, but also even partly in its reflexes, so that feeding must be carefully performed, lest the patient should choke, owing to paralysis of the reflex for deglutition. Utter ruin of both mind and body could not be more terribly exhibited. Mercifully, in a great number of cases, before this stage is reached, life is cut short by one of the "congestive" or epileptiform attacks that tend to occur in the course of the disease, with increasing frequency from the first stage onwards.

In this typical course, the disease proceeds, as it were, from above downwards—first mind is affected and then motion; and the mind displays the typical exaltation that has been referred to. But there are many cases in which the typical course is not strictly adhered to. In the first place, there is a group of cases that never display the typical exaltation with delusions of grandeur. In these the mental failure sets in with simple loss of memory and mental power, and often with depression of spirits. But these cases present the same speech peculiarities, and run ultimately the same course, as cases that have the delusions of grandeur. In a third group, the motor symptoms may appear before the mental, and keep in advance of them almost throughout. When I was making my notes of cases at the Asylum, one poor man in this condition was pointed out to me. His motor functions were deeply involved and his speech much affected, but his mind remained comparatively clear, and he seemed to realize his own sad condition in a manner that is rare among general paralytics.

It is well known that the victims of this disease are generally men in the prime of life, and often previously of fine physique. Hard living and dissipation, especially if associated with hard work, physical or mental, are usually regarded as its most potent causes; the influence of heredity being by no means so marked as it is in the case of other forms of insanity.

Before proceeding to attempt a more detailed analysis of the defects of speech in General Paralysis that can be detected by the ear, let us, in the first place, take note of an associated symptom that is perceptible to the eye: I mean the presence of abnormal movements in the lips and features, and in the tongue.

The most characteristic of these movements are occasional quick, momentary Twitchings or Shiverings in the upper lip, or in the naso-labial fold, or sometimes in the muscular fibres of an eyelid. They occur most markedly when the patient is speaking, or is otherwise moving the lip, as in opening the mouth to protrude the tongue. A portion of the Levator Labii Superioris, or of the Orbicularis muscle of the mouth or of the eyelid, or of a muscle in the chin, suddenly and slightly twitches from time to time. In most cases these slight twitchings do not exhibit themselves when the features are at rest: it is when a voluntary movement is made, as in speaking or opening the mouth, that they appear. With the slight twitches there is often associated, during speech, a general trembling of the lips, like that sometimes seen in the lips of a healthy person during great emotional excitement. The twitching and trembling in the facial muscles may sometimes be brought out with special distinctness if the patient be asked to open the mouth and protrude the tongue, especially if the mouth is not widely opened, and the tongue is only half protruded.

In the tongue, when it is protruded, there is generally much movement. There is often trembling and general restlessness of the whole organ, and there are also, as a rule, wave-like contractions in bundles of its muscular fibres; yet in some cases, when the mouth is merely opened, and the tongue is not protruded but allowed to lie in position, the movements are absent, the tongue being then quite still.

I take it that these wave-like contractions and tremblings in the features and tongue, appearing as they do almost exclusively during voluntary movements of the parts, are due to disease in the motor cells of the Cortex. But as the motor cells of the Medulla are also often involved in General Paralysis, I think we should also, in some cases, find small fibrillar movements going on constantly in the muscles, even when they are otherwise at rest. These fibrillar movements, of medullary origin, should be associated with wasting. We see such wasting and fine fibrillar movement in the tongue, when it is becoming paralyzed owing to the disease in the motor nuclei of the medulla known as Glosso-Labio-Laryngeal Paralysis. I do not suppose that anything comparable, in degree, to the wasting exhibited in this disease will be met with in the general paralysis of the insane; but one would expect

fine fibrillar movements of the same kind to be exhibited, when the disease has involved the motor cells of the medulla. The twitchings in general paralysis certainly for the most part involve larger bundles of muscular fibres than do the fibrillar movements of glosso-labio-laryngeal paralysis. They may be termed fascicular rather than fibrillar; and, for the most part, they appear only during the performance of voluntary movements. The question whether true fibrillar movements, associated with wasting, ever occur along with them, my own observations do not yet enable me to answer.

As the disease advances, these movements of the features and tongue, very slight, if noticeable at all, at the beginning of the first stage, become more and more marked; and, at the same time, Paresis of Movement in the features and tongue becomes more and more apparent. In the features, the upper lip sometimes assumes a flaccid and pendulous appearance, as if it were imperfectly supported by its suspensory muscles—the "veil-like upper lip." In the tongue, impairment of voluntary movement soon becomes very evident. Dr Clouston says:—"In the second stage of the disease, the want of coördination is very choreic in its character, but with the convulsive tendency in addition. Tell a paralytic patient in the first stage to put out his tongue, and he at once does so; but you see quiverings running down groups of the fibrillæ of its muscles. Tell the same man in the second stage to do so, and he puts it slowly out, the whole organ being pushed about in a very unsteady way, through its muscles not acting harmoniously towards the desired end. Tell him, in the end of the third stage, to do so, and the only response is his moving the organ about a little, without being able to protrude it beyond the mouth. Any one accustomed to see much of the disease can often diagnose it, and the stage it has reached, from the tongue alone."[1] But, at the beginning of the first stage, perhaps the little occasional shivering or twitching in the upper lip or naso-labial fold is more important and distinctive, in a diagnostic sense, than even the quiverings that run down the muscular fibres of the tongue.

Coming now to the consideration of the Defects of Articulation in General Paralysis, we have to note:—

[1] "Disorders of Speech in Insanity," *Edinburgh Medical Journal*, April 1876.

a. The Slurring of difficult consonants, like that so distinctly exhibited by inebriates. At the beginning of the first stage it is often absent, or, if present, may be only exhibited in such test-words as **truly rural, British Constitution,** or **mutual eligibility**; but it becomes, with the increasing paresis, more and more marked as the disease advances. In the first stage, it may sometimes be brought out by causing the patient to repeat one of the above expressions several times over. Often after a few such repetitions the limited supply of nerve force gets exhausted, and slurring becomes evident. Similar fatigue and slurring may be induced by causing the patient to repeat an alliterative sentence. At the Royal Edinburgh Asylum, the favourite sentence for this purpose is:—"**Round the rugged rock the radical rascal ran.**" There are few cases, even in the first stage, that will repeat this sentence once or twice without at last getting into a sort of inarticulate slur about the end of it.

b. Even more diagnostic than slurring is the derangement of articulation termed by Kussmaul Syllable Stumbling. For the purpose of testing patients for this defect, the favourite test-words at the Royal Edinburgh Asylum are **Hippopotamus** and **West Register Street.** Here is what one of the patients made of Hippopotamus:—"Tahippotapotapos." **West Register Street** is in like manner often put into some such condition as "West Regigistrerer Street." Kussmaul recommends the use of the test-word **artillerie,** and tells how it is often converted into "artrallerie" or "rartrillerie." He adds that **Peking** may be converted into "keping," and **guten morgen** into "goten murgen."

What does the evident incoördination of speech in this Syllable Stumbling depend upon? It is probably, as Kussmaul suggests, a defect in the formation of the psycho-motor word-images; the images being most imperfect when the words are complicated and difficult. A word is composed of letter-sounds arranged in sequence. If the sequence of the letter-sounds is imperfectly remembered some of the letters may be sounded in the wrong places. This is one of the two characteristics of Syllable Stumbling: the other being a stumbling and rapid repetition of one or more of the syllables. In Slurring, on the other hand, one may suppose the image to be perfect, and that the defect is merely in the power of exteriorizing or executing it.

Syllable Stumbling may be exhibited in the articulation of difficult words even in the earliest stage of general paralysis, before any slurring can be detected. Kussmaul says :—" Syllable stumbling may make its appearance in the *earliest stage of general progressive paralysis*, at a time when the motility in general does not present the least sign of diminution, and when the movements required for the production of sounds, and for all other voluntary objects, are still perfect (Parchappe, *Bull. de l'Acad. de Méd.*, t. xxx. p. 702)." [1] It becomes more and more marked as the case progresses.[2]

c. Owing to increasing difficulty of articulation, the utterance of the patient, in the advanced stages, often becomes Slow and obviously Laborious. It may even, for a time, assume something of a " Staccato " character. Ultimately, about the end of the third stage, speech may become totally Inarticulate.

d. The above being defects displayed specially by the Oral Articulative mechanism of speech, we have now to remark that the Vocal mechanism does not wholly escape. In the advanced stages, the voice is apt to become monotonous and sometimes high-pitched, and to assume a peculiar Ægophonic Trembling. It has, in fact, been likened to the bleating of a goat.

e. It should be noted that the failure of memory which is so marked an element in the symptomatology of the disease may be displayed, when the disease is advanced, in the difficulty the patient experiences in committing a few words to memory. I tried hard to get one poor man to repeat accurately after me the lines, " Mary had a little lamb, Its fleece was white as snow," but he could not master perfectly even the first line; although, in former times, when he was in health, he had often repeated the verses to his children. I remarked, in this case, that any emotional expression, such as " Oh dear me," " This is very sad," was much more per-

[1] Kussmaul, *op. cit.*, p. 808.

[2] It is to Syllable Stumbling more especially that Esquirol's axiom as to the deadly significance of embarrassment of speech applies. Slurring is met with even in the monologues of Adolescent Dementia: and these cases notoriously often live for many years. I think Slurring in Dementia should be regarded as a symptom of advancing change in the *motor* centres only when it is exhibited in the patient's speech even when his attention is fully roused, as in replying to questions. In the Monologues it is due to absence of mind and want of attention, not necessarily to disease in the articulating centre.

fectly articulated than anything the patient said that was not dictated by emotion,—another instance of the power of an emotional stimulus.

f. Lastly, it may be added that temporary Aphasia is common in general paralysis, especially after congestive attacks.

In the whole range of the disturbances of speech that are met with in connexion with Insanity, there are none of so much practical significance as the disturbances in General Paralysis of the Insane. That is why, in the above notes, I have ventured to treat of these disturbances in some detail. A knowledge of their earlier manifestations is important, not only to the alienist, but also to the ordinary physician and the general practitioner.[1]

I cannot conclude this chapter without making grateful acknowledgment of all the kind assistance I have received in studying the speech of the insane at the Royal Edinburgh Asylum. Dr Clouston granted me free permission to visit the Institution as often as might be necessary; Dr Robertson, his senior assistant, selected suitable cases for me; and Dr Middlemass, one of the junior assistants, helped me greatly in taking notes of them. Without these opportunities for study, and the assistance so courteously given, I could not have written this chapter.

[1] It should here be remarked that, while in almost all cases the peculiarities of speech and the other symptoms in General Paralysis render the diagnosis comparatively easy, there are two other morbid conditions which sometimes produce the very same symptoms, viz., Chronic Alcoholism, and Syphilis of the cerebral cortex. But these cases often recover under treatment.

CHAPTER IX.

APHASIA :—PHYSIOLOGICAL PREFACE ; WITH NOTES UPON THE LEADING FEATURES OF APHASIA, AND UPON THE HISTORY AND LITERATURE OF THE SUBJECT.

Mental Percepts of Objects.

PSYCHOLOGISTS tell us that our primary and most simple idea of an object is formed by the revival in our minds of the impressions that the object has made upon the sensorium, through the organs of sense.

With the view of bringing home to my own mind the truth of this proposition, I made, some time ago, a series of little experiments with a number of apples. I found these experiments of value to me, not as teaching anything new about the relations of sense-impressions to ideas, but as illustrating those relations in a vivid and interesting way. In the hope that they may, in like manner, be helpful to the reader, I shall here make a brief note of them. They consisted simply in appealing to each of the senses separately, by means of an apple, and in watching how readily the sense-impression would suggest to the mind the idea of an apple ; and how the name or word-symbol "apple" would rise up in the mind along with the idea.

At the Royal Infirmary I got together a few children from the surgical wards, and, having put them together into a room by themselves, I called them one by one into my own side-room.

The first, a boy aged six, was shown an apple lying upon the table, and was asked what it was. He said at once, "It is an apple."

The second, also a boy of six, had his eyes bandaged, and was asked to smell the object put before his nose. He too said at once, "It is an apple."

The third, a boy of nine, had a bit of apple put into his mouth, after his eyes had been blindfolded and his nostrils closed. He chewed it, and said immediately, "It is an apple." (Although the nostrils were closed, it is of course quite possible that some of the flavour of the apple may have reached the Schneiderian membrane by the posterior nares.)

The fourth, a boy of ten, having been blindfolded, had an apple put into his hands. When asked what it was, he said, after having felt it for a moment, "It is an apple."

Hitherto, in the experiments, the mind had promptly come to a correct conclusion from the information supplied to it by the sense appealed to. But now we proceeded to make an appeal to the sense of Hearing, which is much less frequently called upon to receive impressions from apples than any of the other senses. As was to be expected, we found that the conclusion arrived at by the mind from the evidence of sound was not so often correct. We made the sound by paring an apple with a table-knife near the ear of the person experimented upon, after his eyes had been blindfolded and his nostrils closed. Sixteen persons in all, mostly adults, were tried in this fashion, and of the whole number only three answered correctly, "You are paring an apple." The others thought we were paring wood, clipping paper with scissors, rubbing salt, rubbing two surfaces of cloth together, etc.

Lastly, I have frequently had occasion to observe that the Muscular Sense has made itself familiar with one of the properties of an apple, viz., its weight. I have in my possession a beautiful imitation-apple, made of some heavy metal, but painted on the surface in excellent imitation of a Newtown pippin. With the eye alone, no one can tell that it is not an apple, but when I ask a friend if he has seen "this new variety of apple," it is interesting to watch how, in all good faith, he prepares to examine it, and how instantly he detects the deception when the object is put into his hand. From the information given by the eye, the mind thinks it is an apple; but this conclusion is at once flatly contradicted by the evidence furnished by the muscular sense.

Now I think such little experiments are helpful, when we are trying to realize the relations between sense-impressions and ideas. As I have already indicated, it is now generally held that the primary and most simple idea we form of a thing—say, an apple—

is but a revival of the sense-images or memories of it that have been stored up in the cortical centres belonging to the various senses. Each organ of sense has its cortical centre in the brain. Here new impressions, received from without, are constantly presented to the consciousness. If the impressions are not attended to, they appear to pass away utterly in a short time, leaving little or no trace in the memory. But if the attention is either voluntarily directed or involuntarily attracted to them (and some impressions are so powerful, or so fraught with pain or pleasure, as to demand attention), then they are registered in the local memory of the centre; and, so long as the registered impressions remain distinct in the memory, they may be revived in the imagination, either by effort of the will, or, involuntarily, at the suggestion of some associated sense-impression or other memory. Thus each cortical centre for sense-impressions should be regarded as not only a receiving office for fresh impressions, but also a storehouse of old impressions that have been duly attended to, registered in the memory, and linked with associated sense-impressions stored in other centres.

When the apple was put to the child's nose, the smell of it was recognised as one already registered; and the revival of this registered smell called up at once, in the mind, revivals of the other sense-impressions derived from apples; the members of the group of impressions being so linked together by association that one member cannot be revived without there being a more or less distinct revival of the others along with it. It is this congeries, or complexus, of revived images that we call the Idea, or Percept, of an apple. No doubt, in the complexus, some one of the sense-images is generally more distinct and important than the rest—our percept of an apple, for example, contains the visual element more distinctly than the olfactory;—but all the senses that have received impressions are at least ready to contribute; even the muscular sense being ready, as we have seen, to give distinct evidence when appealed to.

This reference to the Muscular Sense leads me to add that according to the teaching of some eminent psychologists, especially of Professor Bain, Memories of Motion are always stored up in the brain along with the memories of sensation, and are revived along with them when the idea of an object is formed. Each

organ of sense possesses muscles (such as those of the eyeball, the nose, the middle ear, etc.), and these are called into activity when the organ is actively receiving impressions. It is held that the muscular activities record their memories in the brain, and that these motor memories blend with the sensory in our percepts of things. Dr Ferrier thus illustrates the views on this subject which he shares with Professor Bain,—"Our ideas of form are not mere revived optical impressions, ... but optical impressions combined with ideal ocular movements. Our idea of a circle is a combination of an ideal coloured outline, with an ideal circular sweep of the eyeballs, or it may be of the tactile impressions coinciding with an ideal circumduction of the arm or hand, or perhaps both these factors combined. . . . . To revive any of these ideas is to revive both the sensory and motor elements of their composition, and we tend in ideation to repeat the actual movements which were concerned in the primary act of cognition."[1] I may here note, as further interesting in this doctrine of an element of motor memory in our primary ideas of Objects, that it recalls to our minds the motor memories that form, in addition to the sensory memories, so important a part in our ideas of Words; a subject I shall return to presently.

We come now to a very important question. When the idea of an apple is thus formed in the mind by the blending of the various memories, sensory and motor, that have been revived at their respective centres, how is this blending effected? Are the revived images gathered together into a special Ideational Centre, in some particular part of the brain, and there blended; or are the images allowed to remain each in its own original situation, and merely taken cognizance of by the intelligence, while thus remaining *in situ?* The latter seems to be the view that derives support from all the facts known to us. There is no proof that there is anywhere in the brain a local ideational centre. If there were such a centre, the local destruction of that particular spot would make ideation impossible. But there is no case recorded in which mere local destruction of a limited portion of the cerebral cortex has produced such an effect. The evidence, as it stands at present, seems all to point to the conclusion that the presiding Intelli-

[1] *The Functions of the Brain*, 2nd edition, 1886, p. 437.

gence, which takes cognizance of, fixes, and groups together these impressions, so as to form Ideas from them, is not a faculty that is specially localized in the anterior part, or in the middle or in the posterior part, of the brain-substance, but is one that belongs to the cortex as a whole. It would appear to be more especially connected with the more superficial layers of the cortex; but the evidence in favour even of that supposition is not entirely conclusive. It is by this pervading faculty, the Intelligence, that the images are revived and taken cognizance of, while they yet remain *in situ*.

It is now generally believed that if one of the cortical centres for sense-impressions were extirpated from both hemispheres, the store of memories amassed at that centre would be utterly obliterated from the mind. On this subject Dr Ferrier says:—"The destruction of the visual centre, therefore, not only makes the individual blind presentatively, but blind representatively or ideally, and all cognitions into which visual characters enter in part or whole, become mangled or imperfect, or are utterly rooted out of consciousness."[1]

Granting, then, that our primary and most simple cognitions of things are merely the results of this revival and blending of sense images, and that the group of images constitutes in fact the Idea in our minds which represents the Thing, let us now look at the relation of this idea of an object to its name.

In the first place, it should be noted that the simple idea of a concrete object may be perfectly distinct in the mind, even when we have, for the time, utterly forgotten the object's name. Although we are not liable to forget the names of common and familiar objects, we have, most of us, had experience of forgetting, for a few minutes, the proper name of some familiar acquaintance. We know that, in these circumstances, the mental image of his personality loses nothing, in distinctness and completeness, from the loss of the name. It is so with regard to everything of which the mind can form a clear and distinct image or memory: we can think of it clearly, even when the word expressive of it is for the moment forgotten. I believe that if we had no words to express such actions as walking, running, or flying; or such colours as red,

[1] *Op. cit.*, p. 429.

blue, or yellow; or such qualities as prettiness or ugliness; or such emotions as affection or anger,—we could yet, after having had frequent experience of them, recall them to mind, and think of them, without the aid of words. The fact that those deaf-mutes who have not been educated to speak can yet, as their actions show, think rationally, though not profoundly, proves that this must be the case.

But there are some forms of thought that cannot be carried on without the aid of verbal symbols. Names of concrete objects are the verbal symbols of the simplest ideas we have of things, ideas so simple that they can be easily grasped by the mind without the aid of their verbal symbols. But we have also a long array of names or nouns that are the symbols, not of concrete individual things, but of classes of things, as well as many nouns that are the symbols of abstract qualities; and such nouns are very largely used even in ordinary conversation. These nouns are the products of that effort to classify things which has always been carried on by the human mind. Any classification of things, however rude, represents much labour of observation and comparison. Concrete objects have been placed side by side, and the like have been separated from the unlike; and when a number of objects that are related to each other in their qualities have been grouped together, a name is given to designate the group. Then groups are compared, and are classified into groups of groups, and so on, until ideas of things in general have fallen into some kind of order in the human mind. This is a process that has, instinctively and almost unconsciously, been carried on throughout human history; it is also the process that is carried on consciously, and with a definite view to classification, by the cultivators of every branch of natural science. As the conceptions rise from the particular to the general, a name is given to mark each step in the process; and the more general and abstract the conception, the more necessary is it for the mind to invent a name that may be used, in the processes of thought and speech, as a definite symbol for a concept that is itself, of necessity, indefinite and shadowy. "A word or sign," says Sir William Hamilton, "is necessary to give stability to our intellectual progress, to establish each step in our advance as a new starting point for our advance to another beyond. A country may be overcome by an armed host, but it is

only conquered by the establishment of fortresses. Words are fortresses of thought: they enable us to realize our dominion over what we have already overrun in thought, to make every intellectual conquest the basis of operations for others still beyond. . . . . Though, therefore, we allow that every movement forward in language must be determined by an antecedent movement forward in thought, still, unless thought is accompanied at each point in its evolution by a corresponding evolution of language, its further development is arrested." Speaking of the formation of concepts by the abstraction of the resembling qualities in objects, he says,— "The concept thus formed by an abstraction of the resembling from the non-resembling qualities of objects, would fall back again into the confusion and infinitude from which it has been called out, were it not rendered permanent for consciousness by being fixed and ratified by verbal sign."[1] Surely these sentences put the relationship of words to the higher and more abstract class of ideas very clearly and succinctly.

The great fact having been realized that a sound can be made to serve as a symbol for anything that is perceived or imagined by the mind, the effort of all cultivated speech is to make the symbolic representation as complete as possible. Nouns indicate things, verbs actions, adjectives the qualities of things, adverbs the manner of acting, prepositions and conjunctions the relations of things and actions to each other; and so a whole train of thought finds its expression in a train of words. But, as we have seen, the use of words does not stop here. Words not only express thought, they also support and assist it. When an idea is abstract and vague so that no well-defined image is formed by it in the mind, a word is invented by some thinker who has realized the idea with exceptional clearness. This word adds to the thought something that has distinct body and definition, so that, afterwards, the thought, with its associated symbol, can be grasped and retained by ordinary minds. Language also facilitates and improves the operation of the thinking faculties in many other ways. The fact, for example, that we have in books the well-digested thoughts of the best thinkers of our own time and of past ages is a fact of infinite importance in relation to the development of the power of

[1] *Lectures*, vol. iii. pp. 138-140, quoted by Bastian in *The Brain as an Organ of Mind*, p. 418.

thought; because books not only supply knowledge, the material for thought, but also do much to train the mind to habits of accurate thinking.

Mental Percepts of Words.

In the foregoing remarks I have treated of the nature of our mental percepts of objects, and have noted briefly some of the relations existing between thought and speech. I now wish to devote a little attention specially to the question—What is the nature of the mental percept that we form of a word?

We have seen that when the child smelt the apple a percept of the object was immediately formed in his mind, by the revival of a group of images or memories; and we have seen that this group probably included motor as well as sensory elements. But, alongside of this percept of the object, there arose in his mind, at the same time, what I shall venture to call *a second percept*, viz., that of the verbal symbol of the object, the word "apple." Now, what is the nature of this second percept? The tendency of the best physiological and psychological research seems to be to answer this question by saying that the mental percept of a word is, like the mental percept of an object, a blending of memories or images that have been stored up in special centres of the cerebral cortex. The memories are two in number, a sensory and a motor.

In the language of a nation a certain articulate sound has come to be the symbolic representative of a certain definite idea. This sound is learned by each child of the nation; at first, it may be, as a mere sound, but presently as a symbol also. It is in the cortical centre for hearing that the sound is first registered. By-and-by, under the guidance of the auditory centre, the child trains the motor centre to reproduce the word heard; and by this training it acquires a second image or memory, which is imprinted at the motor centre. Presently this motor reproduction of sounds becomes so interesting an exercise to the child, that, as we saw formerly, he reproduces many words that he hears, in parrot-like fashion, by Echolalia, without making any attempt to understand them. But before the stage is reached at which echolalia is exhibited, and before, indeed, the child can articulate any single word, a number of word-memories have been imprinted upon the auditory centre, and have even been associated with their proper

meanings. At this early stage, as Prof. Bain points out,[1] the child will turn his head towards his brother when he hears the name "Johnny" pronounced; though it is very improbable that the word "Johnny" rises up in his memory when he spontaneously looks at his brother. The child has not yet acquired the motor picture of the word. He is as yet at the stage at which the education of the receptive centre is obviously ahead of that of the productive or motor. In the process of learning a foreign language, we all have experience of a stage in our educational progress that is somewhat similar to this. I mean the stage at which we can read and understand the language, but cannot yet speak it. The sensory word-pictures have already been extensively acquired, and they have been associated with the ideas of which they are the symbols; but the motor pictures have not yet been acquired to the same extent. Until the motor pictures are also fully acquired, we are not able to call up words readily in our minds when we wish to use them in conversation. Practice in speaking the language will alone be able to give us this facility. The sensory images are thus of special importance in relation to the reception and interpretation of speech, the motor images in relation to its production. A foreign language is not perfectly acquired until both sets of images have been securely imprinted. Our mental percepts of words are not perfect until both sets of images are revived simultaneously, and are blended together into one in the consciousness. How this blending is effected is as difficult of explanation as is the blending of the sensory and motor images into the percept of an object. But everything goes to show that in this case again there is no special centre for the process of blending: the images remain *in situ*, and seem to be taken cognizance of simultaneously by the presiding consciousness or intelligence, the nature of which is so great a mystery to us.

Here I come to say a few words about a problem regarding which much that is interesting has been written. What is the nature of the Internal Speech which we employ in the process of thinking?

Some hold that we do much of our thinking without the aid of words. Thus Bastian[2] says:—"There can be no doubt that when

[1] *Fortnightly Review*, vol. v., 1869, p. 494.

[2] *Ibid.*, 1869, note to p. 62.

thinking, much of the process is carried on automatically, and our consciousness is engaged but to the smallest possible extent with the mere vehicle for our thoughts, whatever be its nature; we are intent only upon the ideas for which the symbols are used, and not upon the symbols themselves." But, granted that this is true, it is also generally admitted that when we are working out difficult thoughts, and preparing them for articulate expression, we become more and more conscious of shaping them into words and phrases: and that, in ordinary processes of thinking, words and phrases associate themselves in our minds so readily with the thoughts, that the thought and the word seem to be almost inseparable. Now, what is the nature of this internal speech? Let us carefully attend to our internal sensations as we mentally repeat a line of poetry, or as we silently read a sentence from a printed page. We find that we are most distinctly and definitely conscious of the words we are thus repeating internally. We are conscious even of the cadences of the internal voice, and of the emphasis that is put upon the more important words. Is it the auditory images that we are conscious of? Bastian[1] says it is; and there can be no doubt that there is a large auditory element in this internal speech, its tones being so distinct in our consciousness. But Bain has long taught that in internal speech the motor element is much more prominently represented than the auditory.[2] In proof of this, he points out that internal speech seems sometimes at the very verge of utterance; as is shown by the little movements we may feel in the tongue, from time to time, when we are silently thinking. Stricker of Vienna[3] insists even more than Bain upon the predominance of the motor pictures in this internal speech of silent thought; and he thinks that even in internal song the motor images are the predominant ones. We can sing a song silently, in our minds, either with the words or without them. I find,

[1] See article on the "Physiology of Thinking," *Fortnightly Review*, 1869, p. 57; and the author's works on the *Brain as an Organ of Mind*, 1880; and on *Paralysis, General, Bulbar, and Spinal*, 1886.

[2] See *The Senses and the Intellect*, 3rd edition, p. 399; and an article in the *Fortnightly Review*, 1869, p. 492.

[3] *Du Langage et de la Musique*, 1885. This French translation of the German work is really a new edition, containing chapters on the Physiology of Music not previously published.

when I mentally sing a song, with or without its words, that it is impossible to prevent my *pomum adami* from moving upwards when the mental melody passes into its highest notes; but, at the same time, I am most clearly conscious of the varying pitch and cadence of the internal voice. Evidently, in internal speech and in internal song, we revive both images, the sensory and the motor; and the two seem to our consciousness to be welded into one.

There is good reason to believe that the discussion and difference of opinion regarding the relative importance of the two word-images in Internal Speech may be due to the fact that individuals are differently constituted: in some the sensory image, and in others the motor, being the more vivid of the two. Further, educated people, who can read and write, have, in addition to the two ordinary speech images, also two others, viz., the visual, by revival of which they read, and the graphic-motor, by revival of which they write; and among such people we certainly meet with cases where the visual images are extraordinarily vivid. So that it is reasonable to suppose that, among people generally, the predominant image in internal speech may in some be the auditory one, in others the motor, and in yet others the visual. Prof. Charcot has paid special attention to this subject. His pupil Bernard[1] says,—"M. Charcot emphatically teaches that the memories of signs, like other memories, present, in different individuals, different degrees of comparative development, owing, it may be, to inheritance, or to custom, or to education. One individual will appeal more frequently to the visual memory of signs, another to the auditive, and another to the motor. It may thus happen that the pre-eminence of a centre may become so marked, that it may hold under its sway, not only what properly belongs to it, but also another or several other centres. For example, the visual centre for words may control not only that for writing, but also that for articulate language. In the same way, the motor centre for speech may become independent of the sensorial centre which had presided at its education. Thus are constituted, among speakers, the *visuels*, the *auditifs*, and the *moteurs*. This is not a speculation pure and

[1] *De l'Aphasie*, p. 48.

simple. I have already recorded several notable examples of such selection." Charcot and Bernard think that the majority of people are *auditifs*.

Bearing in mind that the auditory and motor images are revived together, but that the auditory images are of special importance in relation to incoming, and the motor to outgoing, speech, I think we may sum up the ordinary relationships of the two sets of images in the following propositions:—

1. That, when we hear words spoken to us, our auditory images are strongly revived, and our motor images are revived only faintly, if at all.

2. That, when we ourselves speak *aloud*, our motor images are particularly vivid, our auditory images being much less so. [Nevertheless the auditory images play, even here, in most persons, a very important *rôle* in guiding the formation of the motor images; as is shown by the fact that in cases of word-deafness—which implies the obliteration of the auditory store of images—the motor centre may emit the *wrong* words when the patient tries to speak; as will further be shown by-and-by.]

3. That, when we use words *internally*, in process of thinking, the auditory and motor images are revived together with about equal distinctness. [For simplicity's sake, we may term this combination of the auditory and motor images the Primary Couple.]

4. That when we read printed or written words, we revive the visual images, and that these at once call up, by association, the Primary Couple used in internal thought; so that, in reading, at least three sets of images are revived. [There is some reason to believe that the mental percept of a written word is not complete without the presence in it of at least a faint oculo-motor element. This point will, however, be considered in connexion with Word-blindness.]

5. That when we are about to write, we first revive the Primary Couple, in thought. Then we revive the visual image of the letters and words we are about to write; and lastly we revive the graphic-motor images, and forthwith exteriorize them by the act of writing. The act of writing thus implies a revival of all four sets of images—the primary couple that we use in thought and speech, and the secondary couple that we use in writing. [Observe

that, in ordinary circumstances, the graphic-motor images are formed in accordance with, and at the guidance of, the graphic-visual images. It follows that the destruction of the visual images (in word-blindness) will damage the power of writing. It is so in most cases; but, in some patients previously much practised in writing, word-blindness does not materially interfere with the power of writing; the graphic-motor images having, by long practice of writing, become so strongly imprinted as no longer to require the guidance of the visual images. In such cases the patient may write well, though, being word-blind, he will not be able to read the words he has just written.][1]

Union of Words with their Meanings.

Using the idea and the name of an apple as examples, I have already directed the reader's attention to the simultaneous rising up in the mind of two percepts—that of the object and that of its name;—and have shown each of them to be constituted in a similar way by the revival and blending of images. Now, how is the idea-percept or meaning attached to its verbal symbol? Does the meaning, as is held by some, always attach itself in a special manner to the auditory word-image, and filter thence down into the other word-images? There is a good deal to be said in favour of this view, inasmuch as it is found that word-deafness (obliteration of the auditory word-images) not only cuts off the mind from incoming audible speech, but also makes it difficult for thought to find expression in out-going words. The Primary Couple, in such cases, has been mutilated by destruction of its better half; and, in some of them, the words supplied by the unguided motor-centre are given at random, and may fail to express the thought that is seeking utterance. In most of these cases, however, considerable power of expression remains; and in some the power of expression seems to be but little affected. No doubt these differences are to be explained, as Charcot has explained them, by referring them to the varying development and prominence of the individual

[1] There is, however, another explanation of the fact that some word-blind patients can write and others cannot. But as this explanation is new and still *sub judice*, I reserve its consideration until I take up the subject of Word-blindness.

images in different individuals. In the majority of persons, the auditory image seems to be the most prominent; in the minority the motor. The idea-percept or meaning seems to attach itself to *both* images of the primary couple, but the attachment is strongest to the more prominent image. In reception of words, the auditory image is most prominent; in production, the motor.

The Secondary Couple of images, those for reading and writing, lie, during the process of ordinary thought and speech, in the background, unrevived. Even when revived, as they are in reading or writing, they are not, in ordinary persons, brought into direct association with the idea-percepts. They are connected with these only indirectly, through the primary couple, as has been explained in Nos. 4 and 5 of the foregoing propositions. In only a very few individuals does this law seem to be infringed by the visual images. It is said that, in a few rare cases, literary men have acquired the power of directly associating printed words with their meanings, without translating the printed symbols into "internal speech." But such cases must be extremely rare. The normal law evidently is that the secondary couple shall act as the servants and the symbols of the primary couple, and that the word-percepts of the primary couple shall alone be brought into immediate association and union with the idea-percepts.

It has already been indicated that an Idea-percept may be formed in the mind without its associated word-symbol: as when we think of a person or an object whose name we have forgotten. It should also be noted that we can form in the mind the percept of a word, without the percept of its meaning: as when we think of a word whose meaning we have forgotten. To a young child, it is easier to form in the mind the one percept or the other, singly, than to form both together. The child forms in its mind a distinct percept of, say, the pet-dog, long before the word-percept "bow-wow" has come to rise up in its mind, as the dog's name, when the dog is looked at; and, again, at a later stage, the child delights in repeating in parrot-fashion words just heard, without as yet attempting to attach any meaning to them. In the first case it is forming object-percepts, in the second word-percepts, pure and simple. To form the two percepts, word and meaning, simultaneously, and to weld the two firmly together so that the one will at once call up the other, is a more difficult accomplishment, that

comes later.[1] How difficult it is, we can realize when we are trying to learn a foreign language. At first, we read the foreign words but do not understand them. They are as yet to us pure word-percepts. Then we use our dictionaries, and find the translation into our own speech. Having acquired the power of translation, we mentally translate the foreign into our own language before we can arrive at the meaning. But if we thoroughly master the foreign language there will, in due time, be no necessity for translation: the foreign word-percepts will gradually establish the same direct relations to the meaning as the native word-percepts, so that we shall be able to *think* as well as speak in the foreign language. It is a long and difficult process, this of securely imprinting new word-pictures in the cerebral centres, and associating them directly with meanings. The recognition of its difficulty should bring home to our minds the truth that, when we are easily and pleasantly reading a book, we are not imprinting new word-images in our speech-centres, but are only reviving old images, and refreshing them by re-imprintation. These images have been long established in our word-centres, and have been linked in our minds with the ideas of which the words are the symbols. They can be revived from without, by speech that is heard or seen. They can be revived from within, by the thoughts that arise in our minds.

Departure of many Words from their Original Meanings.

This interesting subject the reader will find fully discussed by Archbishop Trench in a well-known work of his.[2] He shows

[1] The lower animals undoubtedly form percepts of objects abundantly; but few of them can form percepts of words. The more intelligent of them, however—the dog, for example—can acquire some auditory images of words, and can attach these to their proper meanings, so that they understand the word when it is spoken to them; but, having no motor-image or articulative power, they cannot themselves speak. The parrot and other speaking birds acquire both images, auditory and motor, so that their word-percepts are complete; but only in a very few rare cases has a parrot intelligence enough to attach a few of its acquired words to their proper meanings. Thus the chief difficulty in learning to speak intelligently seems to be for the brain to acquire the capacity and the habit of embracing in its consciousness at the same moment two percepts, that of the word and that of its meaning.

[2] *English Past and Present*, chap. vii.

that:—(1.) Words may become changed in meaning by acquiring a signification *narrower* than that which they originally possessed. Thus, to take one of his examples, the word *girl* meant originally a young person of either sex, but is now narrowed to half that width of signification. (2.) Words may gradually acquire a meaning much *wider* and more general than that which they originally possessed. Thus, *bombast* originally meant the down of the cotton plant; then it became the wadding with which garments were stuffed out and lined, and in this sense it is used by Shakespeare; and, thirdly, "bombast was transferred in a vigorous image to the big words without meaning or solidity wherewith the discourses of some were stuffed out, and knows at present no other meaning but this." (3.) Words, thus sliding away from their original meaning, may at last acquire a meaning *altogether different* from the original one. Thus a country serf or peasant was at one time styled a *villain* because he was attached to a villa or farm. Secondly, the word came to mean a serf or peasant who was at the same time a bad character. Thirdly, any thoroughly bad character came to be styled a *villain*, though he might not be a peasant at all. For further illustrations, I must refer the reader to the interesting work from which the above are taken.

But there is a lower depth to which language may sink. Words and phrases, losing entirely their definite meanings, may come at last to be used as *mere sounds* to give an emphasis to speech, such as might otherwise be given by mere loudness of tone; or they may come to be used as mere emotional or conventional expressions, whose meaning is contained as much in the tone of the voice as in the words employed. Swearing best exhibits both of these degraded uses of words. Nobody has better treated of these degradations of words into mere conventional and emotional expressions than Dr Hughlings-Jackson. In concluding an excellent analysis of common swearing, he says,—"Vulgar people insert an oath 'at the proper intervals of their speech' as a sort of detonating comma, and thus they render forcible, statements which might otherwise strike their hearers as common-place."[1]

[1] *Lond. Hosp. Clin. Lect. and Reports*, vol. i., 1864, page 453.

Why the Speech Memories or Images are imprinted almost exclusively within the Cortical Centres of only one of the Cerebral Hemispheres.

When Broca, in 1861, published his epoch-making observations upon two cases of Motor Aphasia observed by him in the Bicêtre Hospital, the conclusion that these observations pointed to, viz., that the function of articulate speech is discharged by *one* of the cerebral hemispheres, not by the two acting together, was naturally regarded by the profession with much scepticism. *A priori*, it seemed very improbable that the two anatomically symmetrical halves of the brain should be physiologically so asymmetrical as to have a most important function discharged by one side only. It required the after experience of case after case to convince the profession that the conclusion was really well grounded on fact. Broca himself, almost from the beginning, looked for an explanation of the apparent anomaly. So early as in 1863, he expressed the belief that, in a few rare cases, aphasia would be found to be due to disease of the *right* third frontal convolution. He says,—"The author still hopes that others, more happy than himself, will find at last an example of aphemia produced by a lesion of the right hemisphere. Hitherto it has always been the left third frontal that has been affected. If it were necessary to admit that the two symmetrical halves of the brain have different attributes, it would be a veritable subornation of our convictions in physiology."[1] When, in 1865, he returned to the consideration of this point, cases of aphasia due to lesion of the *right* hemisphere had already been published, and, as compared with the number of cases due to lesion of the left hemisphere, had been found to occur in the proportion of about one to twenty. Broca, in these circumstances, offered the explanation which has since been generally accepted. He pointed out that, for all the finer manipulations, the majority of mankind are right-handed, and therefore left-brained; and he suggested that we are probably left-brained also for the finely coördinated actions of speech. He says,—"Just as we direct the movements of writing, of drawing, of embroidery, etc., with the left hemisphere, so we speak with the left hemisphere." In explanation of the fact that so great a majority of

[1] *Mémoires d'Anthropologie*, p. 61.

people are right-handed and left-brained, he quotes the statement of Gratiolet, that "in the development of the brain the convolutions of the left hemisphere are in advance of those of the right." Returning once more to the consideration of this subject in 1877, Broca expressed the opinion that the explanation of the earlier development and greater activity of the left hemisphere had been furnished by observations recently made, showing that the left hemisphere has a more abundant supply of blood than the right. Two observers had submitted this question to the test of experimental observation, viz., Professor Armand de Fleury of Bordeaux, and Dr Wm. Ogle of London; and both had found the left internal carotid to be larger than the right in subjects who had been right-handed. Dr Wm. Ogle had further examined three subjects who had been left-handed, and had found that in two of them the carotids of the two sides were of equal size; and that in the third the right common and internal carotids were nearly twice the size of the left.

But even if we grant the earlier development of the left hemisphere,[1] and its greater blood-supply, it must still be regarded as a very extraordinary thing that of two symmetrical hemispheres one should be so elaborately trained to speech, and the other should, in this matter, be so greatly neglected. It seems the more extraordinary when we consider that the muscular movements necessary for speech are not executed on one side only, like the movements of a trained right hand, but are executed bilaterally. The developmental and vascular differences do not seem sufficient to afford a full and satisfactory explanation. It is even conceivable that the larger blood-supply of the left hemisphere may be rather a consequence than a cause of its greater activity.

An explanation which, to my mind, seems more adequate and satisfactory has been obtained from the study of the laws of Attention. But, as the relations of Attention to the faculty of speech are of the highest importance, I should like to pause here for a short time, in order that I may gather together a few observations about the Faculty of Attention.

Every teacher knows how futile his efforts to instruct are, if the pupil cannot be got to pay attention. In the pupil's mind, if he

[1] It is denied by C. Vogt and Ecker; see Kussmaul, p. 738.

is not attending, the teacher's words are mere empty sounds—word percepts imperfectly perceived, which he is not taking the trouble to interpret by uniting them to the corresponding idea-percepts. The teacher's voice sounds in his ear like a "tinkling cymbal."

Every student knows that, if his wits are wool-gathering, he may mechanically read a page from beginning to end, and, at the end, have little or no idea of what it is all about. The word-percepts have been passing in procession through his mind, but, the attention being partly absorbed by other matters, have only here and there excited a little feeble ideation. The student must "gather in his wandering thoughts," concentrate his attention, and read the page again.

Even among the brute creation, an animal is intelligent and teachable in proportion as it possesses the faculty of attention. Darwin says,—"Hardly any faculty is more important for the intellectual progress of man than attention. Animals clearly manifest this power, as when a cat watches by a hole and prepares to spring on its prey. Wild animals sometimes become so absorbed when thus engaged, that they may be easily approached. Mr Bartlett has given a curious proof how variable this faculty is in monkeys. A man who trains monkeys to act in plays used to purchase common kinds from the Zoological Society at the price of £5 for each; but he offered to give double the price if he might keep three or four of them for a few days in order to select one. When asked how he could possibly learn so soon whether a particular monkey would turn out a good actor, he answered that it all depended upon the power of attention. If, when he was talking and explaining anything to a monkey, its attention was easily distracted, as by a fly on the wall, or other trifling object, the case was hopeless. If he tried by punishment to make an inattentive monkey act, it turned sulky. On the other hand, a monkey which carefully attended to him could always be trained."[1]

The relations of the faculty of attention to Insanity are curious and interesting. Esquirol has treated of the subject with his usual point and lucidity. He mentions three conditions in insanity which interfere with the normal exercise of the attention:—(1), The crowd of fugitive ideas that hurry through the mind when it is in

[1] *The Descent of Man*, p. 73.

the state of maniacal excitement; (2), the perverted concentration of the attention upon fixed ideas and delusions, in monomania and other forms of delusional insanity; and (3), the enfeeblement of attention, as of the mental powers generally, in dementia. He says that the attention of all the insane is essentially injured by one of these three causes. But "if a strong sensation, agreeable, painful, or unexpected, fixes the attention of the maniac, or diverts the attention of the monomaniac from his delusion; or if a violent commotion awakes the attention of him who is in the state of dementia, immediately the insane patient becomes reasonable, and this return to reason lasts just so long as the effect of the sensation,—that is to say, just so long as the patient retains the power of directing and sustaining the attention."

At the present stage of investigation into the physiology of the brain, it cannot be definitely said in what part of the brain the faculty of Attention specially resides. It has perhaps no special centre. Being, in fact, only the Intelligence *in concentrated activity*, it should perhaps be regarded as a faculty of the cortex as a whole, that is capable of exciting special activities in one centre of the cortex or in another, according to the nature of the sensation, action, or idea that is the subject of its exercise for the time being. There seems to be some ground, however, for the hypothesis that the Frontal Convolutions have special relations to the faculty of attention. This is the conclusion that experimental physiology points to. Ferrier, after giving an account of the observations that have been made upon the point, adds,—"The observations of Hitzig and Goltz appear to me to illustrate and confirm the occurrence of a mental deterioration from lesion of the prefrontal regions, which I have characterized as essentially a defect of attention."[1] Ferrier finds in the frontal lobes the centres for those movements of the head and eyes which occur when the attention is about to be fixed. He says,—"Destruction of the frontal lobes, according to the degree of its completeness, impairs or paralyzes the lateral movements of the head and eyes. Though some ocular movements may be excited reflexly by retinal impressions, there appears to be loss of the power of looking at, or directing the gaze towards, objects which do not fall spontaneously

[1] *The Function of the Brain*, 2nd edition, p. 403.

within the field of vision. Correlative with the immobility of the head and eyes, there is the aspect of uninterest and stupidity, the absence of that active curiosity which is normally manifested by monkeys, and the mental degradation which seems to depend on the loss of the faculty of attention, and all that it implies in the sphere of intellectual operations."[1] It remains yet to be seen if clinical observation upon the human subject will fully confirm these conclusions. It may be said, however, that the evidence furnished by the clinical cases of lesion of the frontal lobes already upon record does not seem to be entirely in harmony with them. Some of these cases, indeed, seem entirely opposed to them.[2]

Let us now inquire how the exercise of the attention should result, in obedience to the laws of its operation, in the education to speech of one hemisphere only.

We speak, figuratively, of the *light* of the intelligence or consciousness. When our minds are awake, but in the condition of easy repose, this light may be supposed to be softly diffused in all our faculties. But when our attention is strongly awakened, we become conscious of two things—an increased expenditure, and a concentration of our mental energies. Indeed, the concentration of thought upon one idea may be so marked that the individual may, for the time, become almost oblivious to other matters; and thus it is, no doubt, that so many eminent thinkers have appeared to the public to be "absent-minded." In close thinking, the light is no longer softly diffused; it is gathered or concentrated into a glow in every part of the mind and brain that is actively engaged. If, for example, the mind is engaged in receiving and interpreting impressions coming from without, the light, we may imagine, glows in the cortical receptive centres, as well as in those layers or regions of the cortex, wherever they may be, that are concerned with the higher function of interpreting the meaning of the messages received. Thus brightly illuminated on reaching the cortical centres, impressions from without are promptly received and interpreted. At the same time, they are registered within the gateway; becoming thereby images in the

[1] *The Function of the Brain*, 2nd edition, p. 465.

[2] See, for example, the record of the well-known "American Crow-Bar Case" Bigelow, *American Journal of the Med. Sciences*, July 1850); also Velpeau's case of the loquacious barber, referred to by Bateman, *Aphasia*, 2nd edition, p. 28.

local memory and possessions of the mind, which can be afterwards revived and made use of. They are fixed or burnt in at the first, as afterwards they can be revived and refreshed, by the light and heat of the Attention.

Within each entrance gateway for incoming impressions, there are thus amassed, by this process of educative attention, myriads of sensory images of all kinds. Within each exit or motor gateway, in like manner, there are amassed, by efforts of the attention, the motor memories of finely associated movements. That these various memories of reception and production are linked together into the groups which go to form our primary ideas of objects and of words, we have already seen.

Now, clearly, such an exercise of concentrated attention is particularly necessary for the education of the sensory and motor centres concerned with the reception and production of speech. The sounds of speech that have to be distinguished and registered are particularly delicate and complex; and so also are the muscular acts necessary for its production. If it is sufficient for the purposes of speech that these delicately complex memories of reception and production be impressed upon one side of the brain only, clearly it will be a great saving of nervous energy to train one hemisphere only, rather than to train both. This, in fact, is evidently the explanation of the apparent anomaly that the two symmetrical hemispheres should, in so far as this particular function is concerned, be so markedly asymmetrical in physiological capacity.

It was the late Dr Moxon who first suggested such an explanation. In a short but remarkable paper,[1] published in 1866, he discusses the operation of the attention in the education of the brain to speech, and to other forms of finely coördinated action. Taking piano-playing as one of his illustrations, he points out that it is comparatively easy for a beginner to play in unison on different octaves with the two hands. This seems to require only one attention for the two hands, that attention being directed to the motor centre for the right hand, which in all probability is made not only to innervate the muscles of the right hand, but also to guide the centre for the left hand. To train the centre in the one

[1] *British and Foreign Medico-Chirurgical Review*, 1866, p. 481.

hemisphere to play the treble, and that in the other to play the bass, is a much more difficult matter. The attention is then not concentrated upon one hemisphere only, it is divided between the two. He compares the tongue to two hands permanently united into one, and suggests that, like the two hands playing in unison, it performs the delicately associated movements of speech in obedience to the centre in one hemisphere only; acting under the guidance of memories of associated movements, which have been stored up within the centre during the process of its education. He says,—"We cannot, perhaps, conceive in what shape these ideas of associated movements persist, but it is quite certain that they do persist, and that in such perfection that, in ordinary speech, the word, or even the part of a sentence to which we are accustomed, comes to the tongue without the attention of the mind to the particular movements required, and often with an appreciably low degree of attention to the word or sentence, as when long strings of sentences are muttered unconsciously by one absent in mind.

"Wherever and whatever the local seat of this connexion may be in the brain, it will be seen that if the seat of these ideas of associated movements be destroyed, then the person so injured will be thrown into the condition of a child who has learned to understand speech, but not speak it."

Further light was thrown on this subject by Dr Broadbent, when, in 1872,[1] he formulated his hypothesis regarding the cerebral representations of unilateral and bilateral movements. This hypothesis, in a somewhat modified form, is thus given by Gowers,[2]—"Some muscles of the body, such as the Intercostals and Masseters, are used only with their fellows of the opposite side; others are often used with their fellows, but often also alone, as the zygomatici, the trapezii, and the leg muscles; others are chiefly used alone, as the muscles of the hand. Movements are represented exclusively in the opposite hemisphere in proportion as they are unilateral, in both hemispheres in proportion as they are bilateral. In other words, either hemisphere can excite the bilateral movements, but only the opposite hemisphere can excite the unilateral

[1] *Med. Chir. Trans.*, 1872, vol. iv.

[2] *Diseases of the Nervous System*, vol ii. p. 69.

movements." As the movements of speech are bilateral, they can be excited from either hemisphere.

Broadbent's hypothesis had not long to wait before it received ample confirmation, both from experiment and from clinical observation. Ferrier, in the course of his experiments, observed that "some movements are bilaterally represented in each hemisphere, and are thrown into action conjointly by electrical stimulation of the cortex. This holds good especially of the oro-lingual and trunk movements." Barlow,[1] in 1877, published his interesting and important case of cerebral lesion, first in the left third frontal convolution, and then in the corresponding convolution of the right side. The patient, a boy, was the subject of heart disease, and had first an attack of aphasia due to embolism in the artery supplying the left third frontal convolution. But he speedily regained the power of speech, by training the corresponding *right* third frontal convolution. At a subsequent period, a second embolism plugged the artery of supply of this convolution also, so that the patient again became aphasic; and this time the aphasia was permanent. But not only was there aphasia after the second embolism; there was also true paralysis of the tongue and lips on both sides, as in Glosso-Labio-Laryngeal Paralysis. So long as one of the centres remained sound, these organs were paralyzed only to a very slight extent upon one side, because they are bilaterally represented in the cortex; but their bilateral destruction necessarily resulted in a paralysis of the tongue and lips that was well marked on both sides.

These facts, of great interest in themselves, thoroughly explain the apparent anomaly that, in the complex movements of speech, a store of images amassed on one side only of the brain should be capable of guiding the movements of the articulative muscles on both sides. That one side has alone been efficiently educated is proved, of course, by every case of aphasia. The best explanation of its being so is, I believe, that furnished by the suggestion of Dr Moxon, that in the training of the speech centres it is favourable to the operation of the educating attention, that it should, in the fulfilment of its delicate task, be concentrated upon one hemisphere, rather than divided between two.

[1] *British Medical Journal*, 1877.

The organs of sense that are connected with the reception of incoming speech impressions, viz., those of hearing and of sight, are represented bilaterally in the cerebral cortex, just as are the muscular organs concerned in the production of speech. Thus, each ear, and each eye, is connected with both hemispheres; and each hemisphere is therefore connected with both eyes, and both ears. Destruction of the cortical centre for hearing or vision in one of the hemispheres, will, therefore, not make the patient deaf or blind in one ear or eye;[1] and, on the other hand, total deafness or blindness on one side, from disease of the ear or eye, will not cut off either of the hemispheres from the reception of impressions coming from the remaining ear or eye. But, nevertheless, in regard to speech, the education of the auditory and visual centres is unilateral. In the auditory and visual centres of one hemisphere only are the sense-impressions of speech, audible and visible, carefully noted by the attention, registered, and amassed; and the hemisphere selected is always the same as that for the motor centres of oral articulation and of writing. It is the left hemisphere in right-handed people, the right in left-handed people.

Dr Moxon seems to have been the first to suggest clearly the probable relations of the auditory and visual centres in the cerebral cortex to incoming speech and its memories or images. In the paper of 1866, from which I have just quoted, there occur the following sentences:—"The resolution of the power of language into incoming and outgoing language is a very striking fact, and its bearing upon the inquiry as to the site of the faculties of speaking and understanding the speech of others is, I think, very important, when we notice the significant circumstance that (in ordinary cases of hemiplegia of the right side with motor aphasia) the power of motor language disappears with power of motion, whilst the power of sensory language remains with the power of sensation. . . . Does not this indicate that the memory of movements, combined

[1] To be more exact, it may be said—(1), that destruction of the cortical centre on one side often causes temporary deafness in the opposite ear, but this passes off as the impressions from the deaf ear are more and more easily conveyed to the cortical centre of the same side along pathways previously not much used; and (2), that destruction of the cortical centre for vision on one side causes, not blindness of the opposite eye but blindness in the opposite half of the field of vision in *both* eyes (Homonymous Hemianopsia), and this is usually permanent.

for words, lies in anatomical connexion with the centres which give motion to the tongue, etc., whilst the memories of sounds and sights, combined for words, lies in anatomical connexion with the centres of the nerves of the eye and ear? or, in other words, that the situation of the ideas of *associated motions* which form the faculties of speech is supra-motory, whilst the situation of the ideas of *associated sensations*, which form the faculty of word comprehension, is supra-sensory."

Considering the date at which these sentences were written, I think them very remarkable; they state so clearly the true relationships of speech, not only to the motor centres, but also to the sensory or receptive centres. The very terms "supra-motory" and "supra-sensory" will recall to mind the terms "psycho-motor" and "psycho-sensory" at present used by some of the French authors. The terms seem to indicate that, in the author's opinion, the speech memories or images are registered, not outside of, but within the gateways of the consciousness. But Dr Moxon was not so fortunate as to verify his hypothesis regarding the relationships of the speech memories to the sensory centres, by the observation and record of actual cases. The great service to science of recording actual cases of sensory aphasia, and of pointing out clearly the distinctions between sensory and motor aphasia, was reserved for others, and more especially for Wernicke.

If I were now writing a history of the literature of Aphasia, it would here be necessary for me to give an account of the great number of admirable papers on the subject that were issued during the ten or fifteen years following the publication, in 1861, of Broca's original cases. It would be necessary for me to describe, for example, the stores of accurately observed cases accumulated by Trousseau[1] in France, and by Hughlings-Jackson[2] in this country. But for detailed historical information I must refer the reader to Kussmaul's treatise, or to the learned and valuable work of Sir Frederic Bateman of Norwich.[3] I shall here only, for the reader's convenience, make the briefest note of a few of the leading papers on the subject published in this country during the period referred to.

[1] *Clinique Médicale*, chap. lxii.

[2] *Lond. Hosp. Clin. Lectures and Reports*, 1864, p. 337.

[3] *On Aphasia, and the Localization of the Faculty of Language*, 2nd ed., 1890.

In 1864, soon after the appearance of the treatise by Dr Hughlings-Jackson above alluded to, Dr James Russell of Birmingham published a series of valuable papers on Aphasia in the *British Medical Journal*. In one of those papers (p. 239) he draws a clear distinction between a loss of speech due to a mechanical difficulty in articulation and a loss of speech due to loss of memory of words. [According to Spamer and Lichtheim,[1] Dr Russell was the first to make this distinction; but it had already been made, many years previously, by Lordat,[2] who clearly distinguishes between "*Amnésie verbale*," loss of memory of words, and "*Asynergie verbale*," loss of power of pronouncing words that are remembered; and who uses, moreover, the term "*Paramnésie verbale*" for that emission of *wrong* words which we now term Paraphasia.] In 1866, Dr Sanders recorded an important case of Aphasia in the *Edinburgh Medical Journal*. In commenting on the varieties of aphasia, he invented anew, for aphasia due to loss of memory of words, the adjective Amnesic, using this word in the same sense as Lordat had used it; and, for the condition that Lordat had termed *Asynergie verbale*, he invented the term Ataxic Aphasia. In the following year, 1867, Professor Gairdner read a paper on Aphasia to the Philosophical Society of Glasgow.[3] In this thoughtful and instructive treatise, the author distinguishes between the Ideation and the Innervation of language, and records a number of interesting cases. In 1867, Dr Wm. Ogle published a paper on "Aphasia and Agraphia" in the *St George's Hospital Reports*, vol. ii., p. 83, in which, like the above-mentioned writers, he distinguishes between two forms of Aphasia, suggesting for them the adjectives "Amnemonic" and "Atactic." He is the first to propose the use of the term "Agraphia" for the loss of the power of writing that is often found associated with other forms of Aphasia. The paper includes the records of a number of valuable cases. In 1869, Dr Bastian published in the *Medico-Chirurgical Review*, vol. xliii., pp. 299 and 470, articles on "The Various Forms of Loss of Speech in Cerebral Disease;" in the course of which he clearly shows the possibility of Sensory Aphasia, his main thesis being that "Words are revived in the cerebral hemisphere as

[1] *Brain*, 1884, p. 471.

[2] *Analyse de la Parole*, 1843.

[3] See *Proceedings of the Glasgow Philosophical Society*, 1865–1868, p. 87.

remembered sounds." In 1872, Dr Broadbent published in the *Medico-Chirurgical Transactions*, vol. lv., p. 144, a paper on the "Cerebral Mechanism of Speech and Thought," in which he puts upon record one of the first published cases of what we now term "Word-Blindness," as well as a number of other valuable cases. "In this contribution," Dr Ross remarks, "as well as in all his subsequent writings, Dr Broadbent sees clearly that the disorders of speech which had hitherto been described under the name of Amnesic Aphasia, are caused by lesion in the area of the posterior branches of the Sylvian artery, and that they result from injury of the sensory mechanism." [1]

Thus, even from such a brief summary as the foregoing, it will be seen that, in this country, before the publication of Wernicke's paper, the various forms of Aphasia, sensory and motor, were already gradually being differentiated and recognised. And it would not be difficult to show that similar progress was being made in other countries.

Further, we must not omit to note, that, at this period, a new era in Cerebral Physiology was begun by experiments in electrical stimulation upon the brains of living animals. The era opened with the experiments of Fritsch and Hitzig in 1870, and those of Ferrier in 1873. By this new method of observation, a precision was soon given to the science of Cerebral Physiology that it had never before possessed.

Wernicke published his important treatise[2] in 1874. In it he records several cases of "Sensory Aphasia" that presented the characteristic symptoms now known as Word-Deafness and Word-Blindness. He carefully describes the morbid appearances, and the locality of the lesion, as displayed in one of the cases upon which an autopsy had been made. More clearly and precisely than any previous writer, he describes the differences between Sensory and Motor Aphasia. He also describes the variety of aphasia that results from lesion of the white conducting fibres connecting the sensory with the motor speech-centre. He thus puts the subject of Sensory Aphasia upon a much firmer basis than it had hitherto occupied. Wernicke's name, therefore, will probably always be associated, in a special manner, with the elucidation of Sensory Aphasia.

[1] Dr Ross *On Aphasia*, 1887, p. 114.

[2] *Der Aphasische Symptomencomplex*, 1874.

In 1877, Kussmaul published his great and comprehensive reatise on the "Disturbances of Speech."[1] He adopted the conclu-ions of Wernicke as to Sensory Aphasia, and illustrated the subject y quoting records of additional cases. He also distinguished, nore precisely than Wernicke had done, the two forms of sensory phasia; inventing the term "Word-Blindness" for the form in vhich the patient, though not blind, is unable to read visible words, nd the term "Word-Deafness" for the form in which the patient, hough not deaf, can no longer understand words that are spoken o him.

Thus four primary or elementary forms of aphasia came to be enerally recognised—two motor forms, and two sensory;—each of he four being due to disablement of a particular centre in the ortex,—a disablement involving an obliteration, complete or artial, of the store of memories or images that have been therein tored. The two Motor forms are—(1), Aphemia (Motor Aphasia), mplying the obliteration of the motor memories of oral speech; nd (2), Agraphia, implying the obliteration of the motor memories f written speech. The two Sensory varieties are Word-Deafness nd Word-Blindness, which imply the obliteration of sensory peech-memories, auditory and visual respectively. The cortical entres involved in all four varieties are situated in the cortex of nly one, and the same, hemisphere of the brain. What modifica-ion of this classification, and what additions to it, have been uggested by recent observations, we shall have to consider in uture papers.

The Nature of the Sounds that constitute Speech; and the Grades of Coördination employed in their production.

In the first chapter of this book I tried to illustrate, in simple way, the composite nature of speech-sounds, by likening the two mechanisms that produce them to the two hands of a violinist: the Vocal Mechanism being compared to the bow-hand, and the Oral Articulative Mechanism to the string-hand. That comparison, however, may now be discarded, since, for our present purposes, it will be more convenient for us to look at the speech mechanisms as they are actually constructed.

[1] Ziemssen's *Cycl. of Pract. Med.*, Amer. edition, vol. xiv.

All we have to do in this respect is to realize that the executive organs of the two mechanisms are placed at the upper end of the air-passage, and that one is above the other,—that of the oral articulative mechanism being above, and that of the vocal mechanism below. We should also make note of the fact that below the larynx there is a third mechanism, the Respiratory, which furnishes, by expiratory effort, the blast of air without which no speech-sounds could be produced, either at the larynx or in the oral cavity. Thus three mechanisms co-operate in producing the sounds of speech. But, as the sounds are produced at the two first,—the third only supplying the necessary air,—we may pass over the third very shortly. We need only note about it: (1), That the expiratory pressure of air is furnished continuously for each clause or sentence; (2), that it is made to vary in strength according to the requirements of emphasis and emotional expression; and (3), that as yet the cortical centre in the brain from which the expiratory effort for speech is innervated has not been definitely localized.

Confining our attention, then, to the Laryngeal and the Oral Articulative Mechanisms, we find that each mechanism is capable of being called into action quite independently of the other; although for the purposes of speech the two must be employed together. Thus, with the Larynx, we can hum a tune without words, the oral articulative mechanism being meanwhile quite passive; and, with the Oral Articulative Mechanism, we can cause the tongue, lips, etc., to go through all the movements necessary for the articulation of a sentence, without producing any audible speech, —if, meanwhile, the glottis is kept either widely open, so that passing air will produce no laryngeal sound, or firmly closed (as in straining), so that air will not be allowed to pass at all. These points have been discussed at some length in the second chapter. As each of the mechanisms, Vocal and Oral Articulative, is thus so capable of displaying activities of its own independently of the other, it is not surprising to find, from the latest experimental researches upon animals, that each mechanism has probably its own separate sub-centre in the brain; and that the two cortical sub-centres, though they may lie in juxtaposition, and overlap each other at their margins, are yet probably distinct, as the corresponding centres are in animals. If

they are so, electrical stimulation of the one sub-centre would, as in animals, cause adduction of the vocal cords, and the same stimulation applied to the other would cause movements of the lips and tongue; the movements in both cases being bilateral, though the stimulus be applied only upon one side of the brain.

The accomplishment of articulate speech is acquired by educating the two sub-centres to act together, in perfect coördination with one another. By what nervous arrangements, in the minute structure of the cortex, the two sub-centres are thus brought to act in coördination, we are as yet, I take it, in almost complete ignorance. But if we analyze the sounds, and see in what manner they are combined to form words, the study of the sounds will help us to understand the action of the cortical centres. Fortunately this analysis was made for us, to a great extent, thousands of years ago, by the inventors of the Ordinary Alphabet. In constructing a Physiological Alphabet, we merely try to give a representation of the sounds that is truer to Nature than that of the ordinary alphabet; removing the corruptions that have crept into the latter in the course of long use, and correcting the mistakes that seem originally to have been made in the framing of it.

Turning, then, again for a moment to the Physiological Alphabet, I think we may say that the sounds represented by its letter-symbols constitute the *Sound-Units* of speech; and that all our speech is constructed by the arrangement of these sound-units into the *Sequences* that we call syllables, words, and phrases. The phonograph, faithfully reproducing speech, is able to do so because words previously spoken into it have made on its revolving cylinder impressions of the vibrations of their units or letter-sounds. The phonograph reproduces these vibrations, sounding unit after unit, and marking the breaks in continuity that occur between syllables, words, and sentences. When a word is spoken, the units composing it are not struck off all at once, like a chord of music on the piano; they are played off in sequence, like a musical phrase, note after note.

But the unit, or letter-sound, is a composite thing, requiring, in the case of the vowels, and also in that of the greater number of the consonants, the simultaneous action of both mechanisms; and

involving in each mechanism the coördinate action of many muscles. There is thus not only coördination of the one mechanism with the other, but also coördination of the several muscular movements in each mechanism with one another. Further, in speech, over and above the two forms of coördination thus exhibited in the formation of the sound-units, there is a third form, exhibited in the arrangement of the units into words and phrases. This we may call, if the phrase is allowable, the Coördination of Sequence. These distinctions have, I think, hitherto been too much neglected. In order that the reader may see their real importance, let me here pause for a moment, to recall to his mind the leading speech-disorders that have already been considered, and to see how they are each related to the two Mechanisms and the three Forms of Coördination.

In brief, then, it may be repeated—

1. That Stammering is due to a fault in the coördination of the one mechanism with the other.

2. That in Hysterical Aphonia there is functional paresis of the vocal mechanism only.

3. That in Hysterical Mutism there is functional paralysis,—in most cases, of the vocal mechanism only; in some, probably, of the oral articulative mechanism only; and in a few, probably, of both mechanisms.

4. That in Lalling we have—(*a.*) In bad cases, a "baby speech," in which all three forms of coördination are so defective, from want of education, that words are truncated, scamped, and slurred, so as to be almost or altogether unintelligible; (*b.*) In slight cases, a lingering defect (from imperfect education) in the internal coördination of the oral articulative mechanism, which displays itself in the imperfect pronunciation of certain difficult letter-sounds, such as **r** or **l**, or **k** or **g**.

5. That in Slurring we have an impairment or degeneration in the internal coördination of the oral articulative mechanism, which results in the slovenly articulation of the more difficult of the single letter-sounds, and of their combinations; so that, in some respects, articulation shows a retrogression towards the lalling articulation of children.

6. That in the Syllable-Stumbling of general paralysis we have not only a stumbling repetition of syllables, but also a distinct

disorder in the *Coördination of Sequence*, displaying itself in the occasional placing of units, and even of whole syllables, in wrong places.

The two coördinations involved in the production of the units or letter-sounds, and the one concerned with their arrangement—which last I have called the "coördination of sequence,"—are alike rendered possible by the formation of sensory and motor memories, imprinted within the centres in the process of their education. It is these memories of "associated sounds and movements" that go to form the word-images or pictures of which so much has already been said.

Now, aphasia consists in the obliteration of these memories. Sometimes the obliteration is complete, sometimes only partial. In the slighter cases, only words of certain particular kinds are forgotten, such as proper names, and the names of particular objects. Other words are remembered, and may be pronounced with perfect articulation. Therefore, in these slighter cases, it is only the coördination of sequence that is materially affected. Certain particular sequences or words, not very deeply imprinted, have been wiped out from the memory of the enfeebled centre. In many severe cases, on the other hand, there is complete obliteration of all word-pictures (memories of sequence); and, along with this, there may be an obliteration, equally complete, of the memories of how to produce the units or letter-sounds. In such severe cases, the patient is not only unable to articulate the simplest words, such as *Papa* or *Mama*, when asked to do so; he is even unable to pronounce properly the letter-sounds of single vowels or consonants. The memories of the Units have, in such cases, been wiped out, along with the memories of their Sequences.

It is wonderful to think what a wealth of memories of the sequences of these sound-units must be stored up in the speech-centres of every educated man; or, to put it in another way, what a wealth of words and phrases lie latent in his speech-centres, ready to be revived upon occasions calling for them. His thoughts clothe themselves in these words and phrases; and the wardrobe is so well furnished that the same thought finds in it a choice of garments, and is enabled to select that which appears to be most appropriate for the expression, not only of the intellectual meaning,

but also of the emotional colour or feeling that is associated with it. The very tones of the voice are also, as we have seen, made to contribute their quota to the expressiveness of spoken language.

Professor Bain has remarked upon the adhesiveness of thoughts and of words, in virtue of which they link themselves to each other, thought to thought, and word to word, in chains or trains. The property is exhibited, not only by words, but also by the sound-units of which words are composed. It is exhibited even more strongly in the linking together of the units to form syllables and words, than in the linking of words into familiar phrases. It is the "Coördination of Sequence." How securely it can link word to word, we may realize when we repeat from memory a verse of poetry that has been long familiar to us. Perhaps it is owing to this adhesiveness of words, that he who is a perfect master of several languages does not, in conversation, mix up the words of one language with those of another. Some time ago I had the pleasure of conversing with a physician of note, who, born in Scotland, has lived in France since early boyhood, and now practises there. He is equally master of French and English. I asked him which of the two languages he preferred to think in. He told me he sometimes thought in the one and sometimes in the other; he had no preference, and usually found himself thinking in the language of the last person he had been conversing with. I asked him if he ever, in thought or in speech, mixed up the two languages, more or less. He said, Never; they always kept themselves distinct from each other in his mind.

Here let me add, in concluding this part of the subject, that although, for simplicity's sake, I have, in treating of the grades of coördination in the formation of letters, words, and phrases, made reference specially to the Motor Speech-centre, it must not be forgotten that the very same grades must be represented, in like manner, in the Auditory Speech-centre. Each motor image has its equivalent sensory image; and, as we have seen, the two that form the Primary Couple are welded together in the consciousness into one, so as to form what we have called the primary Word-Percept. In constitution they must of necessity be closely equivalent to each other.

Depth of Imprintation of Speech-Memories in the Speech-Centres; Overflow of Speech-Education into the corresponding Convolutions of the opposite Hemisphere; Recurring Utterances.

DEPTH OF IMPRINTATION.—It is a remarkable fact that the various classes of words are not all imprinted, if we may so express it, in the memories of the speech-centres, with equal depth and permanency. Thus, notoriously, Nouns form the class of words whose memories are the least firmly established, and therefore the most easily obliterated. Further, it is known that the memory of a noun will be lost more easily in proportion as the idea represented by it is special or concrete in character. Proper names being, above all other nouns, representative of special individuality, are the most easily obliterated of all; but names of other concrete things, such as a *watch*, a *chain*, or a *handkerchief*, are also easily obliterated. Abstract nouns and general terms, on the other hand, such as *time*, *thing*, *day*, *night*, are retained comparatively well. In aphasia, Nouns of this latter class are lost to any extent only in cases in which the names of concrete things are lost still more. In such cases, the less common varieties of verb and of the other parts of speech have also generally suffered more or less; so that speech is fragmentary, and requires to be eked out by pantomime. In very severe aphasia, speech may be altogether lost. But even in severe cases a few words in very common use may be retained, such as *yes* and *no*; and these the patient may continue to use quite intelligently.

Now, what is the law underlying this difference in the perishableness of words and phrases? Words and phrases are sequences of sound-units. The memories of the most deeply imprinted will naturally be least easily obliterated. Passing over, for the present, conditions of Brain that are favourable for depth of impression, such as Youth and Intelligence, and looking only to Language, we may reasonably suppose that when speech-memories are being acquired by the centres, the two things most favourable to depth and permanency of impression will be Emphasis in the use of the word, and Frequent Repetition of it in speech. Looking at the nouns, which are known to be the parts of speech most easily obliterated, we find that, as everything, and every class of things, has its name, nouns are almost infinitely numerous; and yet, if we

examine a few sentences of written or spoken speech, we find that only the abstract nouns and the general terms occur individually with any considerable frequency in ordinary speech, and that the specific names of concrete things do so only at long intervals. Nouns of this latter class, therefore, being seldom repeated, can make no very deep impression on the speech-centres. On the other hand, if we look at adjectives, prepositions, verbs, etc., we find that while they are comparatively few in number, they are individually more frequently used, being often repeated. Some of them also, such as adjectives and adverbs, are often used with considerable emphasis. They therefore fulfil the two conditions favourable to depth of imprintation, and are not easily obliterated. Still more distinctly are the two conditions fulfilled by the words *yes* and *no*, which are often retained when all else is lost. If, again, we consider how abundantly the speech of many individuals is garnished with "strong language," we need not be surprised to find that, when such an individual becomes aphasic, an old familiar oath may suddenly be emitted under the strong stimulus of emotion. It had previously been deeply engraved, both by frequency of repetition and by emphasis of expression.

The opinion has often been expressed that the names of concrete things are easily forgotten because we can think of such things so clearly without recalling their names. But this, of course, is only another way of saying that we do not always mentally *repeat* the names of such objects when we think of them. The necessary frequency of repetition is clearly, therefore, in this case, the factor that is wanting for depth of imprintation.

There are, however, rare cases in which *verbs* are lost more than nouns; and of this special loss of verbs no adequate explanation has yet been given. Kussmaul (p. 795) gives a note of such a case. Here, translated, is what the patient, a man who was "suffering from aphasia and paraphasia," remarked, when his eyes were being examined; the missing verbs and other words which he failed to recall being given in italics:—"I cannot *see* at all. Formerly I could *read*, especially *large print;* but, naturally with advancing years, I *was obliged to read* small print *through* spectacles."

Overflow of Education into the opposite Hemisphere.—In some cases, words such as *yes* and *no*, and, occasionally, under

excitement, oaths or other conventional expressions, may be emitted even when it is quite certain that the educated motor centre for articulate speech *has been totally destroyed*, and is therefore wholly incapable of retaining the memories of even the most deeply imprinted words. These cases clearly show that, in the process of educating the Broca's convolution to the production of articulate speech, there must, at least in a great number of individuals, be a slight Overflow[1] of Education into the corresponding convolution of the opposite hemisphere. This latter convolution evidently receives what may be called the crumbs of education that fall from the table of the Broca's convolution. When the Broca's convolution is totally destroyed, these crumbs, acquired by the corresponding convolution of the opposite hemisphere, are all that remain of the motor memories of articulate speech, however great may have been the stock of these accumulated in the Broca's convolution. It was Hughlings-Jackson who first directed attention to the little store of words thus often retained in the uneducated centre of the opposite side, when the educated centre has been destroyed. He holds the opinion that the uneducated centre is in a special way related to conventional, emotional, and other forms of what he aptly terms "degraded" speech,—using this term in contrast to intellectual speech, in which each word retains its proper meaning. But, though it is generally admitted that conventional and emotional expressions may be emitted by the uneducated centre after the educated has been destroyed, I do not think it is generally believed that these expressions have been originally relegated to the uneducated

[1] The term "overflow," though convenient, is no doubt somewhat figurative, like the term "imprintation" already used. Of course neither term must be taken too literally. In our present state of knowledge, however, it will be found very difficult to treat of either the one phenomenon or the other, without using language that is more or less figurative. If we wished to describe what is here called "Overflow of Education" in terms that are not figurative, it would probably be correct to say that when, in process of education, strong impressions are being made upon the Broca's convolution, feeble impressions are at the same time being made upon the convolution of the opposite side; and that when these feeble impressions have been repeated a very great number of times, they leave, at last, a distinct memory or image in the uneducated centre. This law would, of course, apply to the auditory as well as to the motor centre.

centre. The more common opinion certainly favours the explanation that these forms of expression have been imprinted in the educated centre more deeply than any others; and that from the very superabundance of their representation, there has been "overflow" into the centre of the opposite side. In other words, the law which determines the occurrence of overflow of education into the opposite hemisphere seems to be the same that determines the depth of imprintation on the educated side; the two factors that are important for both being Frequency of Repetition and Emphasis of Expression.

A certain slight overflow of education into the opposite hemisphere being thus observable in many cases in connexion with the motor centre for oral articulate speech, it should be here noted that the same phenomenon is also exhibited in connexion with the receptive or auditory centre for incoming speech. In some cases, when this latter centre is totally destroyed on the educated side, none of the words, though heard as sounds, can be interpreted as words. In many cases, however, a certain proportion of words can still be interpreted, probably because of the previous overflow of education into the opposite hemisphere; and the proportion of these seems, on the whole, to be greater than that of the words capable of being produced, in motor aphasia, by the uneducated motor centre. It is not surprising that it should be so, seeing that the education of the auditory centre begins before that of the others, and, throughout, retains the lead.

This possibility of overflow of education into the opposite hemisphere, and the varying degree in which it may occur in different individuals, is a confusing element in the study of aphasia. So is also the possible progress of Further Education in what I have termed the uneducated centre, after disease has destroyed the educated one. In young people, this Further Education may speedily bring about an entire restoration of speech; but when aphasia has occurred after completion of bodily growth and development, this education of the uneducated side is usually very difficult, and is often impossible.

Recurring Utterances.—We have been discussing the fact that, even in cases in which the educated motor centre has been entirely destroyed, the patient, in virtue of overflow of education into the

opposite hemisphere, may yet be able appropriately to use certain words such as *yes* or *no*, or to emit, upon occasion, certain emotional or conventional expressions. These all have more or less meaning. It must now be noted that, in like circumstances, a patient may emit from the uneducated centre, whenever he tries to speak, a word or phrase *without meaning*. Whatever he may wish to say, it may be always the same syllable, word, or phrase that he emits. These words and phrases are therefore termed Recurring Utterances. It may be well here shortly to discuss their nature.

Nothing is more common in cases of severe motor aphasia than to find that the patient can utter nothing but a certain recurring syllable, word, or phrase. One of Broca's very first cases exhibited the phenomenon typically. In reply to all questions, he said *tan, tan, tan;* and, in all ordinary circumstances, the same syllable was repeated if he tried spontaneously to make a remark. Only when he was irritated did he startle his hearers by pronouncing, with perfect articulation, the common French oath, "Sacré nom," etc. Trousseau, Hughlings-Jackson, Gairdner, and many others have reported cases showing many varieties of recurring utterances. In one case the word "cousisi" is always emitted; in another, the word "nurse;" in another the word "yes" is articulated, not with its usual meaning, but as a recurring utterance without any meaning. In other cases, again, a whole phrase is included in the recurring utterance: as in Dr Russell's case of the manufacturer, seized with aphasia when making an inventory of his goods, who replied "list complete" to every question; and in another case of a patient, seized with aphasia when in danger, whose recurring utterance was always "I want protection."

The question regarding the causes which determine the nature of any recurring utterance is one that has excited much interest. Dr Hughlings-Jackson suggests that, in many cases, the recurring utterance is an expression that has either been emitted, or been at the point of emission, at the moment of seizure, and that has, therefore, in all probability been deeply imprinted by the stimulus of emotion; and many recorded cases clearly indicate that this may be the cause determining the nature of the utterance. But it is not suggested that this is invariably the determining cause. In some cases, the effort to speak seems to result, by accident as it were, in the production of some meaningless syllable; and

this syllable, once produced, recurs on all subsequent occasions when the patient tries to speak. In others, the attention of friends to the training of the patient results in his being able to pronounce some single word, such as "nurse;" and this afterwards becomes the recurring utterance. The uneducated speech-centre thus learns a word, or phrase, in one way or another, and, having learned, discharges it, and it alone, whenever the effort to speak is made. As Prof. Gairdner says, it is like a barrel-organ that plays always the same tune when the handle is turned.

Just as the aphasic patient may thus, in trying to speak, show that he is *possessed*, as it were, by a single word, so, in trying to write, he may become possessed, or, to use Prof. Gairdner's expression, "intoxicated," by a single letter. He often is able to write the first and second letters of his name, but, instead of coming to the third, he may repeat the second again and again, as if he could not get the image of it to retire, when it is no longer wanted. In other cases, he may repeat, again and again, some special letter of the name, such as *m* or *n*.

It is a large and curious question, this, about the non-retirement of word-images when they are no longer wanted. The wonder is that, in normal conditions, the images are so easily called up, and that they so promptly retire after being used, when they are no longer wanted. And yet they must not retire too soon. We should not be able to grasp the meaning of a sentence, or even of a long word, if we could not retain it in the memory as a whole, after its completion. There is a curious form of aphasia, described by Grashey, in which the chief phenomenon seems to be the too quick retirement of images from the consciousness. We shall have to consider it by-and-by, in connexion with Aphasia due to Functional Causes. That word-images sometimes fail to retire, and give trouble by continuing to obtrude themselves upon the mind when they are not wanted—in the form of "possessions," hallucinations, or impulsions—we have already seen, in connexion with the study of speech in its relations to Insanity. Something of an analogous failure to retire is, I think, exhibited in these two phenomena of aphasia, the Recurring Utterances in speaking and the Recurring Letters in writing. It is exhibited also, in a very interesting manner, by many aphasic patients who are gradually recovering the power of speech. "What is this gentleman's

name?" I said to such a patient recently. "Dr Anderson," she replied. "And what is your own name?" "Mary *Anderson*," she said; though she had, a short time previously, given her own name correctly.

Amnesia Verbalis and Paraphasia. Articulative Amnesia, and Articulative Ataxia.

Amnesia Verbalis.—As I have already said a good deal about this Amnesia, or forgetfulness of words, and about the law which seems to determine the varying degrees in which different classes of words may be forgotten, it will not be necessary, in this general sketch of leading phenomena, to discuss the subject much further. But I should like to define, as distinctly as I can, the sense in which I mean to use the term Amnesia Verbalis. By different writers, it has been used with a varying width of signification. I mean to use it solely in connexion with the *productive* processes of thought and speech, as signifying a failure to call up in the mind the appropriate word-images for ideas that are seeking embodiment in words, whether for purposes of silent thought or for those of audible speech. For failure in the Interpretation of words that are still heard as sounds, we have the convenient term Word-Deafness. But, for failure to call up words in the memory when they are wanted for purposes of production, we have no term but this of Amnesia Verbalis. I think that we should reserve the term strictly for this failure in the power of calling up words from within, and let the term Word-Deafness stand as the equivalent term for failure in reception and interpretation.

In connexion with Written language, it may be found convenient, in like manner, to use the term Amnesia Literarum as indicative of a failure (on the productive side) to call up the images of letters and words in the mind when the effort to write is being made; in contrast to Word-Blindness, which implies a failure on the side of reception and interpretation.

Without entering into any detail as to the causation of Amnesia Verbalis, we may, I think, here make note of two different conditions which may each produce it:—

(1.) It is met with in conditions of General Enfeeblement of the Brain, such as may be associated with the debility of severe

fever, or be produced by the pressure of effusion on the brain as a whole. In such conditions, the mind as a whole is enfeebled, and its faculty of language shares in the enfeeblement. In the debility of severe fever, forgetfulness of names and other nouns is common; and cases have been recorded in which foreign languages that the patient had been master of have, for the time, been quite forgotten, though the native language, more deeply imprinted, has been retained.

(2.) Local disease in the Speech Centres. That such disease should produce Amnesia Verbalis, when both the auditory and the motor centre are involved, is easily intelligible; but why should this Amnesia be so well marked in most of the cases in which only one of the primary centres has been destroyed? Why should the mind not be able to call up with ease the images of the other centre? I think we can explain this only on the hypothesis that in health the two word-images are habitually revived together as a "Word-Percept." When one of them is destroyed, the word-percept is mutilated and incomplete, and cannot be so easily revived.

It is notorious that amnesia of nouns, etc., results when the Auditory word-centre is destroyed. In such cases, as the patient retains the power of articulation (the motor centre being intact), his speech demonstrates the amnesia of nouns, etc., in the most striking way.

But when it is the Motor centre that is destroyed, and articulation is therefore impossible, Amnesia is not so plainly exhibited. In such cases, Amnesia certainly does not exist if the patient still retains the power of expressing his thoughts in writing; but his loss of the power of writing does not enable us to say with certainty that the patient has Amnesia, and is unable to call up words in his mind. In such cases, some observers, such as Lichtheim, show the patient a common object, and ask him to indicate with his fingers how many syllables its name contains. There can be little doubt that, in most cases at least, destruction of the motor centre, like destruction of the auditory centre, causes serious Amnesia Verbalis.

Paraphasia.—When an aphasic patient, in speaking, uses words which he did not intend to use, and which do not express the

thought that is seeking expression, he is said to display the phenomenon of Paraphasia. In some cases, no sooner is the wrong word uttered than the patient recognises his error, and strives to correct it; but in other cases, owing to Word-Deafness, he does not recognise the error, and may go on talking freely, in the full belief that he is expressing himself intelligently, even although the speech produced is mere "gibberish"—as it may be, in rare cases, when the phenomenon is extremely well marked. It is in the Aphasia produced by lesion of the Auditory Word-centre that Paraphasia is most marked. The retention of the power of articulation, in such cases, makes the recognition of Paraphasia very easy. Some think that Paraphasia never occurs except in these cases of Sensory Aphasia. But this is probably a mistake. Paraphasia is essentially one of the possible consequences of Amnesia Verbalis; and, as such Amnesia probably exists in Motor as well as in Sensory Aphasia, we need not be surprised to find a slight degree of Paraphasia exhibiting itself in connexion with Motor Aphasia, when, by education of the opposite convolution, the patient is in process of recovering his powers of articulation, and can speak well enough to exhibit it. Nevertheless, it is true that a marked degree of Paraphasia is especially characteristic of the Sensory, or Auditory variety of Aphasia. Like Simple Amnesia Verbalis, Paraphasia is exhibited most frequently in connexion with nouns, of which one is substituted for another; but, in marked cases, the other parts of speech suffer in the same way.

Articulative Amnesia.—Instead of a total forgetfulness of a word, such as a noun, the patient may exhibit only a partial forgetfulness of it. He has a general idea of the word, but fails to remember it in detail. In such circumstances, he pronounces a sound that may or may not be sufficiently like the word aimed at to enable the listener to guess what that word really is. I propose to use the term Articulative Amnesia for this forgetfulness of the details of articulation. It will sometimes be found associated with other symptoms, such as marked paraphasia, which point to the existence of lesions in the auditory centre. This is only an illustration of the fact, that words are represented in all their details in the sensory as well as the motor speech-centre.

Articulative Ataxia (*Asynergia Verbalis*).—Here, owing to disease in the Motor centre, or in the white substance of the brain immediately subjacent to it, the power of articulation is destroyed, even if the patient is able to call up the auditory image of the word in his mind. It is not always possible to distinguish between an Articulative Amnesia and an Articulative Ataxy. But in general the faults of articulation in lesions of the motor centre are so strikingly characteristic that there can be no difficulty in diagnosing Articulative Ataxia. Lesions in this locality generally make the patient practically speechless. He can articulate scarcely anything; failing even to repeat simple words that he is asked to repeat. The educated centre being destroyed, he is thrown upon the scanty resources of the uneducated centre of the opposite side. Often, as we have seen, he can emit only some Recurring Utterance, or some very common words, such as "Yes" or "No." It is generally when he is recovering the power of speech, by the Further Education of the previously uneducated centre, that he displays more varied faults in articulation. Gradually acquiring an increasing vocabulary, he continues for a long time to display, in a degree that differs greatly in different cases, the Articulative faults of Slurring, Lalling, Syllable-Stumbling, sometimes a little Stammering, and often an utterance that is slow and laborious. It is in these same circumstances also, as we have seen, that a case of Motor Aphasia may clearly show Amnesia Verbalis, and even a slight degree of Paraphasia.

Mental Impairment. Echolalia.

Mental Impairment.—It is doubtful whether it would be correct to say of any patient affected with Aphasia that his intellect remains altogether unimpaired. Probably there is more or less mental impairment in every case. Usually it is less distinct in purely motor aphasia than in sensory aphasia. A patient with purely motor aphasia is often capable of managing his business affairs. He expresses himself by signs if he cannot either speak or write. He may be able to engage with success in games of skill; and in all respects he may show himself to be intelligent and clear-headed. Yet, to those who knew him previously, there is generally observable a distinct diminution of mental power, or of self-control; and the patient

himself is apt to complain that he experiences fatigue, and headache, and irritability, if he applies himself to mental work requiring prolonged and close attention.

In a large proportion of cases, the loss of mental power and of self-control is obvious. Very often the patient is unable to take any part in managing business affairs, dementia being quite pronounced.[1] As is so often the case in organic disease of the brain, the patient may be also very emotional and easily moved to tears.

In some cases, delusions and hallucinations are developed, so that the patient becomes really Insane. I think there can be no doubt that Dr Bastian is right when he says that destruction of the Sensory speech-centres is much more dangerous to the mind than destruction of the Motor ones. Delusions, and Hallucinations, and Hebetude of mind are certainly more commonly met with in cases of Sensory than of Motor Aphasia. Bastian provisionally formulates the following as a working hypothesis:—"That the tendency to mental impairment with aphasia, and the degree of such impairment, will, other things being equal, increase as lesions of the left Hemisphere which produce aphasia recede in site from the third frontal convolution, and approach the occipital lobe." It seems very probable that growing experience will soon convert this "working hypothesis" into an established law.

Echolalia.—We have seen, in connexion with our study of the Speech of the Insane, that Echolalia is pretty often exhibited by patients who are the subjects of Dementia. As Dementia is not uncommon in connexion with Aphasia, the Echolalia which, in rare cases, is exhibited by patients with right-sided Hemiplegia and more or less Aphasic disturbance of speech, should perhaps be attributed rather to the Dementia than to the Aphasia. But there are some very curious and rare cases of Aphasia without Dementia in which the patient can repeat what he hears, and perhaps copy writing that he sees, and yet be totally unable to understand the words he thus repeats or copies. This is a true Echolalia. The consideration of this phenomenon will probably be resumed in a future chapter. At present, I mention the phenomenon only to show

[1] For a discussion of the Medico-Legal relations of Aphasia, see Bateman, *On Aphasia*, chap. x. See also Bernard, *De l'Aphasie*, chap. x.

that in testing the speech of an aphasic patient we must not be content with merely testing the Reception and the Production of speech, spoken and written, but must also ascertain how the patient Repeats or Echoes. Can he repeat words spoken to him; can he write to dictation; and can he copy from a printed or written page?

Other forms of Loss of the Memories of Signs (Asemia) that are related to Aphasia and sometimes found associated with it. Mind-Blindness. Expression of Emotion. The Musical Faculty.

Loss of other Graphic Symbols.—With the destruction of word-images, in Aphasia, there is often associated destruction of the memories of other symbols, which are allied to those of speech. Thus a Word-blind patient is often also Figure-blind, so that he may fail to recognise the ordinary Numerals when he sees them. Equally unintelligible to him may also be Algebraic signs, and the signs used for Musical Notation; although, previously, these may have been very familiar to him. There are, however, cases in which the understanding of some of these other symbols may be retained, though speech symbols be lost. Thus patients are often able to read figures though they cannot read words. They are able, for example, to read the figure 3, though they cannot read the word *Three*. In explanation of this, it has been suggested that figures are more nearly allied to pictures than to words, and suggest the number to the mind as a picture suggests an object. Perhaps when figures are much used both hemispheres may acquire the images of them.

Amimia and Paramimia.—When intelligence is retained though speech is lost, the patient can in most cases express his thoughts in pantomime (gesture language). He nods his head for "Yes," and shakes it for "No," and indicates numbers with the fingers of the hand that is not paralysed. He also, like an uneducated deaf-mute, imitates actions, and "makes pictures in the air." But some cases of Aphasia show impairment of this gesture language; and there may be impairment also of the power of understanding the gesture language of others. In rare cases, again, the patient has been found to use pantomimic signs *wrongly*, nodding his head,

for example, instead of shaking it, when he meant to say "No." Amimia is the term used for the loss of gesture language, and Paramimia that for mistakes in its use. That a one-sided lesion of the Brain should in some cases cause Amimia and Paramimia seems to show that in some brains, at least, the education in these signs, as in those of speech, is, at least to a considerable extent, unilateral.

Mind-Blindness (*Seelenblindheît, cécité psychique*).—It would be better perhaps to term this condition "Object-blindness" than "mind-blindness," though even that term might be liable to misinterpretation. What is meant by the term "Mind-blindness" is that though a formerly familiar object is clearly seen by the patient, it is no longer *recognised*. Familiar friends are no longer recognised at sight, and familiar objects seem strange at sight, so that their natural uses may be mistaken. Like some of the other phenomena which in this chapter I have been briefly summarizing, this condition will require to be noticed in a future chapter. I shall at present only state that this Object-Blindness or Mind-Blindness is sometimes found associated with word-blindness, and, like it, seems to depend upon the obliteration of formerly acquired visual images or memories. In at least one of the recorded cases of it, disease was found in both sides of the brain; and it seems reasonable to suppose that the images or memories of objects must, in most, if not in all brains, be imprinted equally well in both hemispheres.

Retention of the Power of Emotional Expression.—In Aphasic patients, even when Pantomime is impaired, the power of facial Expression of Emotion may remain intact; so that gladness and sorrow are as vividly depicted on the countenance of the patient as on that of a healthy person,—provided always, of course, that the intelligence is not very seriously impaired. Thus when, as is so often the case, there is loss of self-control, the sudden fits of depression of spirits to which the patient is so liable find expression in tears, and flushings, and facial movements, as vividly as similar emotions in children. Evidently Emotion and its expression are functions that belong to both hemispheres of the Brain.

The Musical Faculty.—There are on record many cases of

Aphasia in which the patient, though speechless, was yet musical, and able to hum correctly tunes without words. In one very curious case, an aphasic patient, though unable to *speak*, could yet *sing songs with the words* correctly,—perhaps by aid of the "uneducated Speech-centres" of the opposite hemisphere. Most of these cases, no doubt, have been cases of motor aphasia. It is still a question for investigation how far the musical faculty is destroyed or diminished by destructive lesion of the left *auditory* centre. One is disposed to think that music must belong to both hemispheres of the brain, at least in so far as it is a natural gift and not merely an acquired art. But in one recorded case, to which I may afterwards have occasion to refer, word-deafness seemed to be associated with a loss of the power of appreciating music. This subject, and many of the others to which I have been briefly referring, are really subjects for future investigation. As yet they have received too little attention.

Having already made a note of some of the earlier contributions to the literature of Aphasia, I may here, in concluding this chapter, supplement the list by adding a note of a few of the more important contributions of a later date.

I have already referred to, and frequently quoted from, Kussmaul's treatise on the *Disturbances of Speech*. It continues to be perhaps the richest mine we have of information upon the subject generally. Bateman's valuable work I have also referred to. A second edition of it was published in 1890. Two other treatises of great value are—(1), That of Bernard, *De l'Aphasie* (1st ed. 1885, 2nd ed. 1889), which incorporates the teaching of Professor Charcot; and (2), that of Dr Ross of Manchester, *On Aphasia*, 1887. Many important contributions to the subject have also been made in the shape of chapters upon it in works on the Nervous System. Among these may be mentioned—(1), The chapters in Dr Bastian's works on *The Brain as an Organ of Mind*, 1880; and on *Paralysis: Cerebral, Bulbar, and Spinal*, 1886; (2), a chapter in Professor Grainger Stewart's work, *An Introduction to the Study of the Diseases of the Nervous System*, 1884; (3), the chapter in Dr Ferrier's work on *The Functions of the Brain*, 1886; (4), the chapter in Dr Gowers's work on *Diseases of the Nervous System*, 1888.

Among the more important of recent German contributions are—(1), Grashey, "Ueber Aphasie und ihre Beziehungen zur Wahrnehmung," *Arch. f. Psych.*, xvi., S. 654; (2), Lichtheim, "Ueber Aphasie," translated by Dr de Watteville, in *Brain*, Jan. 1885; (3), Wernicke, "Die neueren Arbeiten über Aphasie," *Fortschr. der Med.*, 1885, ii., p. 825; also i., 1886, p. 371; also ii., 1886, p. 463.

I shall by-and-by have occasion to refer to various important papers on special parts of the subject. The wealth of literature on the subject of Aphasia is overwhelming. If the reader would form an idea of it, let him consult the *Index Catalogue of the Library of the Surgeon-General's Office, U.S. Army*, edited by Dr Billings, and the *Index Medicus*, edited by Dr Billings and Dr Fletcher.

CHAPTER X.

APHASIA IN RELATION TO ORGANIC DISEASES OF THE BRAIN:—PREFATORY NOTES AS TO THE SPEECH-CENTRES. AUDITORY APHASIA.

IT is hoped that the reader remembers what has been said about the constitution of an Object-percept and of a Word-percept, and about the blending together of these two percepts in the consciousness. Lichtheim has constructed a diagram which is fitted to illustrate the constitution of the two percepts, and the relations of the one to the other; and Wernicke has modified this diagram by adding to it looped connecting-lines between the various centres that furnish the images for the object-percept.

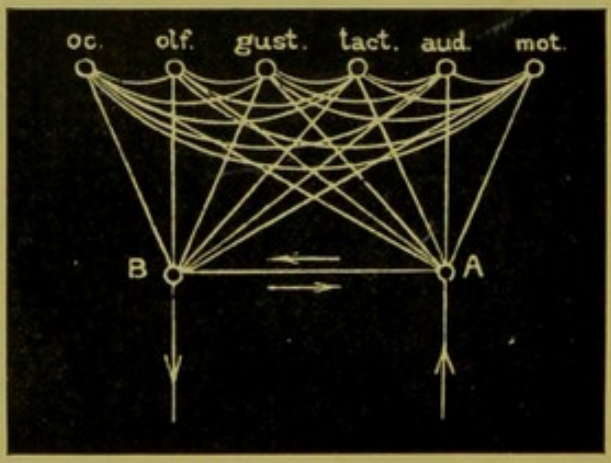


FIG. 1. (After Lichtheim; modified.)

In the diagram as here given, I have adopted Wernicke's addition, and have also slightly increased the number of the image-centres for the object-percept, so as to make them representative of all the centres tested in our series of little experiments with the apples.

In this diagram, the upper row of circles represents the centres for the various images which may go to form the percept or idea

of an object—say, of an apple. The two lower circles, A and B, represent the centres for the two images, auditory and motor, which go to form the percept or idea of a word—say the word "apple." How, in certain circumstances, a word-percept or an object-percept can be entertained separately in the consciousness; and how, when the two percepts represent a familiar object and its name, they are in the consciousness blended together almost inseparably, we have already seen.

An examination of the diagram helps us to understand how, when the word "apple" is heard, its sound revives not only the word-percept, but also the object-percept; and how, on the other hand, when any one of the sensory images of the object-percept, such as that of smell, is revived from without, the revival calls up the other associated images that contribute with it to form the object-percept, and the revival of this, again, calls up, by association, a revival of the word-percept.

The two arrows passing in opposite directions between A and B indicate the close physiological connexion of these two centres—a connexion so close that, in health, it is probably impossible to call up the image at A without reviving that at B along with it, or to call up that at B without also reviving that at A.

But there are also many other points, already discussed, that indeed cannot be illustrated by a diagram and yet may usefully be noted in connexion with the diagram before us. I shall here shortly touch upon a few of them:—

(1.) Though it would make the diagram exceedingly complicated in appearance, I think it would make it more fully expressive of physiological fact, if every connecting line in it (looped and straight) were accompanied, like the line from A to B, with arrows pointing in opposite directions. As to the looped lines, we know already how the revival of any one of the chief images that go to form the object-percept of an apple can call up a revival of the others. This fact of itself shows that the reviving influences can travel in either direction. As to the straight lines between the upper circles and the lower, there can be no doubt that the main direction of current is that of a reflex arc, from A to the upper circles, and from these down to B; and yet it is certain, in the case of A at least, that the currents

may also flow in the opposite direction. Thus, in motor aphasia, in which B is destroyed, the auditory images of words may, to some extent at least, be revived at A, by descending currents from the sense-image centres, so that the patient may be able to call up words in the mind, though unable to utter them. In auditory aphasia, in which A is destroyed, it is not so certain that a motor image formed at B can, by exciting upward currents from B, throw a reflex of itself back into the sense-image centres, so as to keep the mind informed of the meaning of the words that are being uttered. In many cases of auditory aphasia, the patient seems to have little consciousness of the words he is using at B, and often, in fact, uses wrong words without knowing that he is doing so. But it is not improbable that future inquiry will show that there is great variation in this respect. Even now, we can say that in some cases there is evidence of such a reflex being thrown back from B to the mind. These points, in due course, will be illustrated by examples.

(2.) The diagram gives no indication of the fact that, whilst the images which go to form the Object-Percept are probably imprinted equally well, or almost equally well, in both hemispheres of the brain, the images which go to form the Word-Percept are imprinted efficiently in one hemisphere only. This difference, as we have seen, is best explained by the closeness of educative attention required for the efficient imprintation of the intricate word-images.

(3.) The diagram does not indicate the possible juxtaposition in the brain of an object-percept image with one of its word-percept images. Take the object *a bell*, and the word "bell." One of the images or memories which go to form the object-percept of a bell is the sound-memory of its clang. Now, this memory is imprinted in the auditory sense-image centre, possibly in close juxtaposition with the sound memory of the word "bell." But, as indicated above, the memory of the clang is imprinted efficiently in both auditory sense-image centres, and that of the word only in one of them.

(4.) A diagram cannot show how, as pointed out by Charcot, the two word-images at A and B may have a relative importance that differs in different people. It will be remembered that in most people the leading and more important image is apparently that at A, so that most people may be termed *auditifs;* whereas

in a few, the *moteurs*, the leading image is apparently that at B. It is on this hypothesis that we can best account for the fact that the same lesion, occurring in different individuals, may produce aphasia in different degrees of severity.

(5.) The diagram cannot teach anything of the relations of the Intelligence and Attention to the images that go to form the object-percept and the word-percept. Yet the intelligence and attention, as we have seen, are agents of prime importance in effecting the revival of these images; as they were also, originally, in effecting their formation or imprintation.

(6.) Lastly, let it be remarked that the idea represented by the combination of the upper circles of the diagram is the idea of a concrete object, such as an apple. It is a "percept," properly so called. Would it be possible to represent diagrammatically a "concept," such as that indicated by the word "nation"? Evidently it would be impossible. And if it would be impossible to represent diagrammatically any nouns other than those of one particular class, what can we say about adjectives and the other parts of speech? Who could localize in the brain the idea represented by the adjective "beautiful"? The fact is that, by localization and diagrammatic representation, we can, as yet, do no more than merely touch the fringe of the great question as to the nature of ideas, and their relation to speech. But it is something, even to touch the fringe of such a question.

It is now time for us to look at the localization of the various stores of word-images in the cerebral cortex. In indicating these localizations, I shall employ the very useful outline sketches of the cerebral convolutions that are used by most of the recent French authors.

Here, then (Fig. 2), in such an outline sketch, are indicated the positions of the four centres in which are stored the memories or images of speech, audible and visible.

A, the posterior half or three-fourths of the left First Temporal Convolution, is the Auditory Speech-Centre, in which are stored the auditory speech-images. B, the Broca's Convolution, is the centre for the motor memories of speech. C, the Angular and the Supra-Marginal Convolutions, is the centre for the visual images of written and printed speech. D, the posterior extremity of the Second Frontal Convolution, is the graphic-motor centre, in

which are stored the motor memories which guide the right hand in the act of writing.

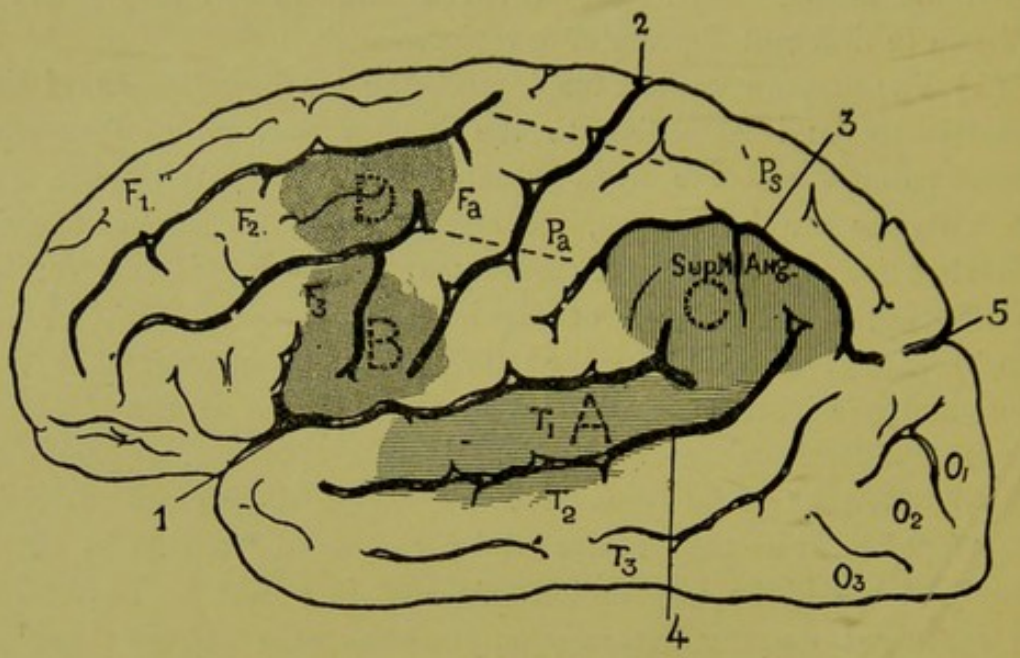


Fig. 2.

If, in the following manner (Fig. 3), we detach the four centres from their connexions, and represent them as circles,

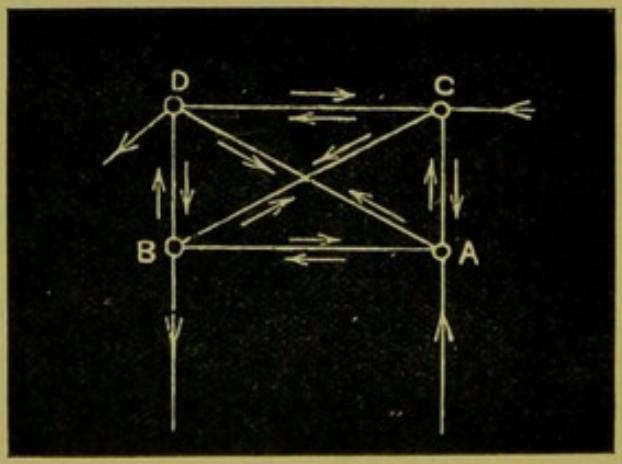


Fig. 3.

we shall be better able to indicate the relations of the four to each other, and also their relations to incoming and outgoing speech.

The exceedingly intimate relations of A and B have already been commented upon: they are indicated by the connecting line and the two arrows. Without detailed discussion of the rela-

tions of A and B with C and D, it may, I think, be said that all the connexions indicated by the lines of the diagram probably exist between them; and that along these lines the influences may travel, as indicated by the arrows, either in the one direction or in the other. What particular images are revived by the acts of Silent Thinking, Speaking, Reading, and Writing, I have already indicated in the last chapter.

With such a diagram as Fig. 3 before us, it is an interesting exercise to consider how the diagram would have to be modified, if we wished to represent the speech-centres—(1), in an educated Blind person, who can read by touch; and (2), in an educated Deaf-Mute, who has been trained by the "lip-reading method" to converse, and who can read and write.

For representation of the centres in the Blind person, we should have to leave out the centre C, and substitute for it another centre in which are stored the Tactile word-images or memories revived by the blind in reading.[1] For representation of the centres in the educated Deaf-Mute, we should have to leave out the centre A, and place alongside of C, in the visual area of the cortex, another centre for the visual memories of lip-reading.

A fact of great practical importance in relation to the speech centres is, that in the brain they are all situated within the territory supplied by the middle cerebral artery. This fact is made evident by Duret's well-known diagram, which I now reproduce (Fig. 4). In this diagram, the fissure of Sylvius is shown opened up, so as to display the Middle Cerebral or Sylvian Artery in all its length, and to show how the various convolutions surrounding the Sylvian fissure are supplied by branches of this artery.

It will be observed that one branch is supplied to the posterior extremity of the third frontal convolution, another to the posterior extremity of the second frontal, another to the posterior half of the first temporal convolution, and others to the supra-marginal and angular convolutions. All four speech-centres are thus within the area supplied by this artery.

It is no part of my intention to describe the various forms of

[1] According to the results of recent investigation, tactile sensation seems to have a double representation in the brain, partly in the motor convolutions, and partly in the limbic lobe (gyrus fornicatus). See V. Horsley, in the *Nineteenth Century*, June 1891.

organic disease that, by disabling or destroying one or more of the speech-centres, may give rise to aphasia. But I may say, in few

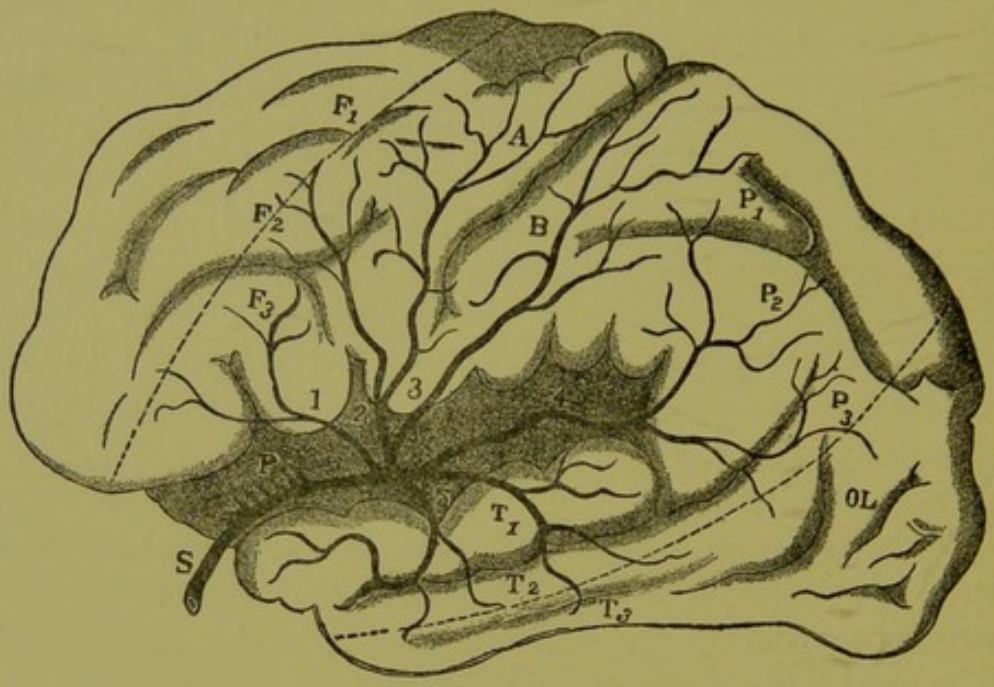


Fig. 4. (After Duret.)

words, that among the more important of such diseases are,—(1.) Necrotic Softening, produced by the occlusion of the Sylvian artery or one of its branches. (2.) Apoplexy; which may either destroy a speech-centre by invading it, or disable it by exercising pressure upon it. (3.) Inflammatory conditions, such as Cerebritis, with or without suppuration; or, more rarely, Meningitis, with involvement of the subjacent grey matter in the inflammation. (4.) Tumours; which may either destroy a speech-centre by invading it, or disable it by producing pressure upon it. (5.) Traumatic conditions, such as fracture of the skull. Occurring over one of the speech-centres, a fracture sometimes causes disablement of it by the compression of depressed bone or extravasated blood, and sometimes destroys it by inciting in it inflammation that leads to abscess or softening.

For the analytical study of aphasia, it is best to take cases in which one speech-centre alone is affected, and in which the functions of the brain as a whole are not impaired, either by general pressure or by general inflammation. Most of the cases that fulfil these conditions are produced either by occlusion of a branch of the Sylvian artery or by a limited traumatism.

I now proceed to take up *seriatim* the consideration of each of the forms of Aphasia. In doing so, I shall follow the same order as was adopted in treating of the Hallucinations of Speech. I shall take first the centre A, in which are stored the auditory memories of speech, and consider what effects are produced by its destruction; then, in like manner, I shall take B, containing the motor memories of spoken speech; and then, successively, C and D, the two centres containing the visual and motor memories of printed and written speech.

Auditory Aphasia.

By the term Auditory Aphasia, is meant the aphasia which results from the destruction or disablement of the auditory word-images at A. The centre for these images is one of the two cortical centres in the brain for hearing. It will be remembered that, though there is a centre for hearing in each hemisphere, and though both centres have probably imprinted in them equally well, or almost equally well, the images of common sounds, only one of them, usually the left, has efficiently imprinted within it the sound-images of words. It is, as shown in the accompanying diagram (Fig. 5), the posterior half or three-fourths of the First

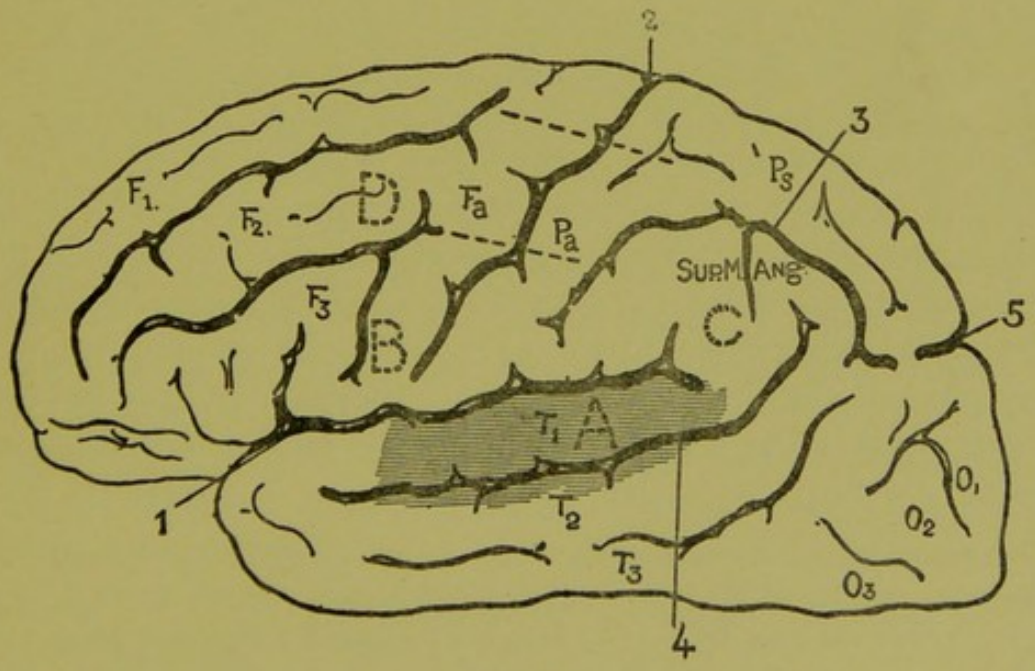


Fig. 5.

Temporal convolution that thus becomes the storehouse of the sound-images of words.

I hope I may be excused for using the term Auditory Aphasia in preference either to the term Sensory Aphasia, proposed by Wernicke, or to the term Word-Deafness, proposed by Kussmaul. "Sensory Aphasia" seems too wide a term, as there are other sensory word-images, viz., the visual, which are not here necessarily involved; and "Word-Deafness" seems too narrow, as this form of aphasia, besides producing Word-Deafness, on the receptive side of speech, produces, on its productive side, the equally important phenomena of Amnesia Verbalis and Paraphasia. Let us look at the two sets of symptoms thus exhibited in Auditory Aphasia, on the receptive and the productive sides of speech.[1]

Effects on Reception and Interpretation of Speech.

1. Reception and Interpretation of Words heard.—When the centre A is destroyed, and its accumulated store of word-images annihilated, it can easily be understood that word-deafness is a necessary consequence. So long as the images were intact, the revival of them from without, by incoming audible speech, sufficed to call up instantly, not only the associated motor image, completing the word-percept, but also the associated meaning. But, the auditory word-images being destroyed, the incoming word-sounds can no longer call up the meaning. The words are still *heard* by the remaining auditory centre of the opposite hemisphere, but they are heard as sounds merely, not as intelligible words: they sound to the patient like words of a foreign language which he does not understand. Therefore, if the patient answer questions, he does so at random; unless, from the gesture or expression of the questioner, he can get some indication of what is being asked of him. As such patients are often remarkably quick in drawing inferences from expression and gesture, it is important that the examiner, in testing a case of word-deafness, should carefully command his countenance and abstain from

[1] Among special treatises upon the Sensory varieties of Aphasia, the following are three of the best:—(1.) Mlle. Nadine Skwortzoff, *De la Cécité et de la Surdité des mots*, 1881. (2.) Seppilli, "La sordita verbale ed afasia sensoriale," *Revist. speriment di freniatria*, 1884, x., pp. 94–125 (a selection from Seppilli's cases is included in Amidon's collection). (3.) Amidon, "On the Pathological Anatomy of Sensory Aphasia," *New York Med. Journ.*, 1885, pp. 113 and 181.

gesture. In cases originally less severe, and in cases in which recovery is advancing, the patient may understand a good deal of what is said to him; but he is apt to exhibit failure in the understanding of nouns, especially of those which are the names of concrete things. It is worth noting that patients unable, from word-deafness, to understand anything else, may yet, in some cases, respond when their own names are called.

In illustration of word-deafness, I think I cannot do better than select some questions and answers from the conversation which is incorporated in Wernicke's record of one of the cases published by him in the paper which did so much to make the phenomena of Sensory Aphasia generally known to the profession. Let it be understood that in this case, and in all the others to be referred to, hearing was intact.

Case I. (Wernicke, *Der Aphasische Symptomencomplex*, 1874).—A widow of a workman, aged 59, became suddenly ill in March 1874, with vertigo and headache, but without loss of consciousness; and spoke confusedly, expressing herself sometimes correctly, but answering questions quite at random. The patient at first understood absolutely nothing that was said to her; but one had to take care not to assist her by gesture. Yet when she spoke spontaneously, she expressed herself with intelligence, though she occasionally mispronounced a word or used a wrong one. She gradually improved; and on the 20th of April 1874, when Wernicke recorded the last note of her progress, the word-deafness had disappeared, and she had also made a great advance in power of expression. Here is a little bit of the conversation held with her, on the 18th of March, when improvement had already begun. It will be observed that she understood the first question, a conventional one.

"Good morning; how are you?" "Thank you; I am very well." "How old are you?" "Thank you; fairly well." "How old are you?" "Do you mean to ask how I hear?" "I wish to know how old you are. How old are you?" "Indeed, that is just what I do not know . . . . as I hear folk say." "Would you please to give me your hand?" "I really do not know how I," etc. (no trace of comprehension). "Where is Richard?" "I do not know what I shall say. My name is Frau Adam." "Where is Richard?" (Considers a long time), "Mein Sodam (Sohn), mein Richard."

In this conversation, the commencing improvement in the condition of the patient is shown by her recognition of the meaning of the first question, a conventional one; and in her being able to recognise, though with difficulty, the name of her son Richard.

From the recorded cases of auditory aphasia, it would be easy to multiply examples of Word-Deafness; but one other brief reference to a case may suffice for special illustration of this symptom.

Case II. (*A patient under the care of* Meynert, *in Vienna; the case being recorded by one of his assistants. It will be found in Mlle. Nadine Skwortzoff's Collection of Cases, Op. cit., p.* 88).—A woman, aged 23. Could not understand even conventional questions. To the question "How do you do?" she replied, "My country is a beautiful one;" and when she was asked to put out her tongue, she remarked, "My brother John," etc.; and yet she replied intelligently to questions if they were accompanied by gestures that enabled her to understand them.

2. Reception and Interpretation of Words seen.—As the auditory word-centre, A, and the visual word centre, C, lie in juxtaposition, they are very apt to be involved together in the same lesion; the patient being then rendered word-blind as well as word-deaf. But in some cases the visual word-centre C is left intact, though the auditory word-centre A is destroyed. In these circumstances, can the patient read visible words? Upon this question there is difference of opinion. It must be remembered that, in the ordinary condition of things, the visual centre C is not directly connected with the meaning. Its connexion with the meaning is only indirect, through A and B. Therefore, when A is destroyed, one of the two links connecting C with the meaning is broken. But there remains the other link, B; and the question has yet to be definitely decided how far, in the absence of A, the visual word-image, revived at C, can call up the meaning, by acting upon B. Lichtheim[1] and Wernicke[2] think that it cannot do so, and that the destruction of A necessarily causes the patient to be unable to understand visible as well as audible speech. They hold, however,

[1] *Brain*, Jan. 1885, p. 439.

[2] *Fortschr. der Med.*, ii. 1885, p. 828. See his diagram.

that there is a form of word-deafness due, not to destruction of the centre A, but to destruction of the subcortical fibres leading from the ears to that centre, and that a lesion of this kind does not interfere with reading, although it renders the patient word-deaf. But this variety of aphasia seems to have been differentiated from clinical observation only, without, as yet, the verification of post-mortem examinations.

According to other authorities, the destruction of the centre A, though it usually damages, does not necessarily destroy the power of reading, because the visual images at C can still call up the meaning by acting upon B, through the connecting fibres represented by the line C B (Fig. 3). Here is a brief note of a case which seems to show that this latter view is the correct one.

Case III. (*This case was originally recorded by* C. Giraudeau, *Rev. de Med.*, ii. 1882, p. 446. *It is given in Amidon's Collection of Cases, New York Med. Journ.*, vol. xli., p. 181).—A widow, aged 46. Had suffered for three months from constant headache, and had become quite word-deaf. To all questions she invariably replied, "What is it you say? I don't understand you. Cure me!" Hearing and sight were intact. *She read well, and answered questions which were written and shown to her.* She died comatose. "On autopsy, there was found a tumour, the size of a walnut, in the posterior part of the left temporal lobe. Above, it reached the fissure of Sylvius; below, it involved three-quarters of the breadth of the second temporal convolution. It reached forward to within three centimetres of the anterior extremity of the temporal lobe, backward to within one centimetre of the posterior extremity of the fissure of Sylvius. It encroached slightly on the white matter, and was easily enucleated."

I think this case affords strong evidence in favour of the view that, at least in some of these cases, the power of understanding printed or written speech is preserved, though the power of understanding words that are heard is destroyed.

I may add here notes of two other cases in which, as in Case III., the patient, though word-deaf, retained the power of reading.

Case IV. (*Recorded by* Dr Abercromby, *in his Inquiry into the Intellectual Powers*, p. 149, *and quoted by Mlle. Skwortzoff, Op. cit.*).—A gentleman had ceased to understand words spoken to

him, but understood very well written names. As he managed a farm, he had in his room a list of the words which he might chance to hear in his conversations with his workmen. When a workman was talking to him on any subject, he listened without at first seizing anything of the words except the sound. He then looked up the words in his written list, and, whenever he saw them, he understood them perfectly.

Case V. (Schmidt, 1887; *quoted by Mlle. Skwortzoff*).—A female, æt. 25. Ten days after parturition, had lost conciousness suddenly, upon making an effort. On recovery, there was no paralysis, but the patient could not understand what was said to her, and had great difficulty in expressing herself spontaneously. "If one wrote down a question upon a slate, she examined the words one after another attentively; tried to pronounce them one by one, and then in more rapid sequence; and then replied."

I think this last case shows pretty plainly that the meaning of the word revived at C was reached only through revival of the motor images at B. Why, it may be asked, should not the meaning be reached directly from C? This question has already been discussed; and we have seen reason to adopt the conclusion that printed and written words are only symbols of symbols, and can therefore call up the meaning only by reviving the primary word-percept or symbol, at A and B, or a part of it, either at A or at B. It is only among those who have read a very great deal that the visible word-symbols may, possibly, at length acquire direct connexions with the meanings; and it is not conclusively proved that such direct connexions may, even in such individuals, be acquired.

Effects upon the Production of Speech.

1. Spoken Speech.—That Word-Deafness should result from the destruction of the auditory word-images at A is only what anyone would *à priori* have expected. Obviously, the auditory word-images must occupy the first place, in point of importance, in relation to incoming speech. But it could not so easily have been anticipated that these auditory word-images are also of very great importance in relation to outgoing speech. Yet it is so. In relation to outgoing speech, they are of importance in every

person; and in those persons who are strongly *auditifs* the importance is probably paramount. In the reception of speech, the word-images are revived from without, by words that are heard or seen; in its production, they are revived from within, by the thoughts that arise in our minds. In most people, the thought that is seeking expression leans towards the motor word-images, but it evidently stimulates also the auditory word-images. It calls up both word-images simultaneously; and it is only when it is able to do so that it can with perfect ease call up the words of all classes required for its expression. In most cases, destruction of the auditory centre does not annihilate the power of expression, it merely damages it; but in persons who are strongly *auditifs*, it may practically destroy it. This interference with the power of expression betrays itself in—

Amnesia Verbalis; Articulative Amnesia; and Paraphasia.—As already indicated, the degree of Amnesia Verbalis exhibited by a case of auditory aphasia seems to differ according to the degree in which the individual is *auditif*. There are cases upon record of what is called "Gibberish Aphasia," in which the word-deaf patient expressed himself in a totally unintelligible jargon, and was yet, owing to his word-deafness, quite unconscious of the fact that he was expressing himself unintelligibly. These may be regarded as extreme instances of Amnesia Verbalis and Paraphasia; and there is reason to believe that destruction of the auditory centre A can furnish such an instance only when the individual affected is very strongly *auditif*. In general, the destruction of the auditory centre leaves the patient in possession of considerable powers of expression. The Amnesia Verbalis in most cases displays itself chiefly or solely in a forgetfulness of nouns, and especially of such nouns as are the names of concrete objects. The patient, when speaking, is from time to time brought to a sudden stop, owing to the forgetting of a noun, and is obliged to explain himself in some roundabout way; or, still more characteristically, he displays Paraphasia in his use of nouns, substituting a wrong noun for a right one, and very often proceeding in his talk without any consciousness of the error. In a few cases the paraphasia takes the form of a recurring utterance. In Auditory Aphasia, Paraphasia is one of the leading and most characteristic of the phenomena,—Word-Deafness on the recep-

tive side of speech, and Amnesia with Paraphasia on its productive being the leading symptoms of auditory aphasia.

Associated with Amnesia Verbalis there is often that partial amnesia of words which I have termed Articulative Amnesia. The word is remembered in a general way, but some of its articulative details are forgotten, so that, when produced, it is barely recognisable. Here and there in a sentence, a patient with auditory aphasia may produce a word which bears the marks of this Articulative Amnesia; and the words thus imperfectly remembered are for the most part Nouns.

2. Effects on Writing.—The same Amnesia Verbalis, Paraphasia, and Articulative Amnesia that are displayed in what the patient says are also displayed in what he writes, and in his spelling. Writing is, of course, a mere representation of internal speech; and the representation naturally exhibits all the faults of the original. In fact, it seems that, in not a few cases, the characteristic faults are exhibited even more strikingly in what is written than in what is spoken. The name Paragraphia is given to the paraphasia thus exhibited in writing.

I now proceed to illustrate these Faults of Outgoing Speech by further brief references to recorded cases.

Case VI. (Dr Broadbent, *The Lancet*, 1878, p. 312.) *Case showing "Gibberish Aphasia."*—A man, aged 49, had had an obscure cerebral seizure which left him aphasic, but not paralysed, except that he had a slight paresis of the right side of his face. His speech was reduced to unintelligible gibberish, in the midst of which one could distinguish a few words from time to time, such as "If you please, Sir." The patient evidently believed, when speaking, that he was expressing himself intelligibly. Requests to make him do things, made it evident that he was word-deaf. For example, when he was asked to give his hand, he invariably put out his tongue. An autopsy showed a very extensive area of softening which involved the left first temporal convolution.

Two other typical cases of Gibberish Aphasia will be found at pp. 200 and 201 of Sir Frederic Bateman's work. In one of these, recorded originally by Dr Osborne, the patient expressed himself in so extraordinary a jargon that he was treated as a foreigner at

the hotel in Dublin where he was living. In this case, Dr Osborne clearly ascertained that when the patient read aloud, "although he employed strange words having no connexion whatever with the text before him, he really understood the sense of what he was purporting to read." When the sentence beginning "It shall be in the power of the College to examine or not to examine any licentiate" was put before him, this is what he made of it, in reading aloud: "An the be what in the temothar of the throthotodoo to majorum," etc. He recovered in course of time. The case is one of great interest, but it is difficult to be sure, from the facts recorded, that the aphasia was due to disablement of the centre A. Possibly it may have been due to fault of conduction between A and B.

It would be easy, from the recorded cases, to give numerous examples of ordinary Amnesia Verbalis and Paraphasia. But it will suffice to give only a few, and I shall try to select cases that will each show some particular feature. I shall begin with a well-known case of extreme Paraphasia, recorded by Trousseau.

Case VII. (Trousseau, *Clin. Méd.*, 4th ed., vol. ii., p. 674).—"Madame B., mother-in-law of a respected medical man, without ever having had any paralytic symptoms, became somewhat rapidly the subject of very singular affections of intelligence. A visitor calls upon her; she rises to receive him with an air of politeness, and pointing to an arm-chair, says, 'Pig, brute, stupid fool' ('Madame invites you to be seated,' says the son-in-law, who interprets the wish of the patient so strangely expressed). Let us note that the acts of this lady appeared otherwise quite sensible, and, what is curious and not common among aphasics, she did not seem to be annoyed about, or to understand, the meaning of the insulting expressions she made use of."

Case VIII. (Dr Ross, *On Aphasia*, p. 30.) *The case shows Paraphasia exhibiting itself in the form of a Recurring Utterance.*—James Lee, æt. 57. First came under Dr Ross's observation about 1880. Five months previously, had had a fit of some kind, which did not produce paralysis, but left him unable to speak correctly. There is no mention of word-deafness having at any time been exhibited. Besides Amnesia of nouns and Paraphasia, the patient presented a Paragraphia that was even more marked than his

paraphasia. His paraphasia exhibited itself as a Recurring Utterance, viz., the utterance "A public house." "He was handed a bunch of keys, and asked to name one of them; he held it between his thumb and index finger and said,—'It is a public house.' 'That is not a public house,' I said. 'I know it quite well,' he replied; 'I have seen it thousands of times;' and, trying again to name it, he continued, 'It is a—it is a public house. Pooh! I know it quite well.'" This patient was under observation for years. He improved greatly under training. If, in this case, the lesion was situated in the auditory centre A, as seems probable, it was perhaps a lesion not sufficiently severe to produce word-deafness, though sufficient to produce amnesia of nouns and paraphasia. The marked Paragraphia in this case rendered the patient's letters quite unintelligible, though the handwriting was remarkably good.

Case IX. (Dr Ross, *On Aphasia*, p. 25.) *This case, besides Amnesia Verbalis, Paraphasia, and Word-Deafness, shows Articulative Amnesia.*—Joseph Lander, æt. 51. A seizure, occurring during sleep, made the patient aphasic, word-blind, word-deaf, markedly amnesic, especially of nouns, and paraphasic. A point of special interest is that he exhibited Articulative Amnesia. When Dr Ross asked him to name things, he often showed that he had a general idea of the name, but failed to remember it in detail. Thus when shown a pencil he said, "It's a pu—; it's a punt—no, that's what bothers me." When asked the day of the week (Wednesday) he said it was Waterday. It is worth noting that this patient was more amnesic than word-deaf. The word-deafness seems to have partly passed off before the patient came under Dr Ross's care.

Case X. (*Treated by* M. Magnan, *in the Asylum of St Anne, Paris. Recorded by Mlle. Skwortzoff, Op. cit.*, p. 71). *The case shows, along with the ordinary symptoms of this form of Aphasia, an Amnesia of Verbs and Prepositions, as well as of Nouns.*—A man, aged 54. His illness had begun gradually five years previously, with Amnesia and Paraphasia. He forgot Nouns, and in a less degree Verbs; and the few verbs retained by him were used in the infinitive. Two years after the first appearance of this amnesia,

marked Word-Deafness was developed; and this continued during the whole period of his residence in hospital. A point of special interest in this case is that, besides Amnesia of Nouns, there seems to have been, during the patient's period of residence in the Asylum, a total Amnesia of Verbs and Prepositions. "During the whole period of nine months, when he resided in the Asylum, he never on any single occasion pronounced a verb or a preposition." Another point of great interest is the fact that, in the gradual advance of the lesion, the Production of speech was interfered with before its Reception and Interpretation,—the amnesia appearing before the word-deafness. This seems to show that an incoming Audible Word is a stronger stimulus to and reviver of the word-image, than is an Idea or Meaning seeking expression from within.

Effects upon the powers of Repeating or Echoing words and Copying written words.

Destruction of the centre A naturally interferes with the power of Repeating or Echoing words. If there were only one auditory centre, its destruction would, of course, annihilate that power, so that anything like Echolalia would be impossible. But, as there is another auditory centre, in the opposite hemisphere, and as this may be educated to assume the speech functions of the centre A, the repetition of words heard is often *possible* in auditory aphasia, though it is always difficult till after much practice. Attention to the word-sounds received by this uneducated centre, and to the reproduction of these sounds by the educated motor centre B, is no doubt the basis of the Further Education which in cases of auditory aphasia frequently leads to the complete restoration of speech. At first, in most cases, this reception and reproduction of speech-sounds is obviously difficult to the patient; but it becomes more and more easy as the word-images are more and more securely acquired. Thus, in the case recorded by Schmidt already alluded to (Case V.), there is this further note about the training of the patient to repeat what was said to her:—"She heard when one pronounced the vowels separately, and she repeated them. If one pronounced a monosyllabic word, she did not understand it; but if one separated the different letters in such a manner as to accentuate

them clearly, she repeated it. For words of two syllables, it was necessary, to begin with, to pronounce distinctly the first syllable, then the next, and then the two together, in order to get her to understand the word. Little by little, she learned to seize words more quickly; but six months elapsed before she could understand, without its being repeated to her, an entire phrase, though short and pronounced slowly, with accent on every word." It may be noted that in this case the word-deafness, as usual, disappeared before the amnesia verbalis.

I think the above quotation affords some valuable hints for the Treatment of auditory aphasia.

As to *the copying of written and printed speech*, it appears that auditory aphasia does not interfere with it. Such is the opinion expressed by Wernicke and Lichtheim, who have paid special attention to the point.

The Musical Faculty in Auditory Aphasia.

I have already, in a former chapter, indicated that this part of the subject requires further investigation. On the one hand, cases of auditory aphasia due to destruction of the centre A are recorded in which the musical faculty was well preserved; but, on the other hand, impairment of the musical faculty has been found associated with the word-deafness in at least two cases. It is noteworthy, however, that in these two cases (recorded by Wernicke[1] and Lichtheim[2]) the lesion was supposed to be situated, not in the centre A, but in the subcortical fibres leading up to it.[3] In Lichtheim's case, the patient, who had formerly been musical, lost the power of recognising even common melodies; and sometimes asked his children to stop singing quartettes, "as they made too much noise." In Wernicke's case, the patient could recognise tunes whistled to him, and could himself repeat them, but displayed a defect in the hearing of the higher tones. Future investigation will, no doubt, show whether the two auditory centres share equally, or unequally, in the faculty of music.

[1] *Fortschr. der Med.*, 1886, xi. p. 474.

[2] *Brain*, Jan. 1885, p. 461.

[3] I shall have occasion to refer specially to this view of Lichtheim and Wernicke in a future chapter.

Why Auditory Aphasia was so much later in being recognised than Motor Aphasia. Its Curability.

It is interesting to consider the question why the first recognition of auditory aphasia was so much later than that of motor aphasia. There seem to be three reasons.

1. That disease or disablement of the left first temporal convolution ("Wernicke's convolution") is not so common as disease or disablement of Broca's convolution.

2. That for a long time, no doubt, many cases of auditory aphasia were mistaken for cases of mental derangement. When a person who obviously could hear, was yet unable to understand what was said to him, and replied to questions in a totally irrelevant manner, it was very natural to suppose that he was suffering from mental derangement. The condition was not well understood until Wernicke, in 1874, clearly defined it, and described its symptoms.

3. That, owing to speedy education of the uneducated right auditory centre, the effects upon speech of a lesion in the educated left auditory centre pass off, in a large proportion of cases, much more quickly than the effects of a lesion of the educated motor centre. Wernicke says that the word-deafness often passes off, and speech is restored, in the course of six or eight weeks. In some cases, however, the symptoms are permanent, or pass away only very slowly. It is important to note that, when recovery takes place, the Word-Deafness generally passes off before the Amnesia Verbalis and Paraphasia.

Perhaps this greater curability of auditory aphasia may be due to the fact that the auditory centre is the first to receive education in speech, and that possibly, in connexion with its education, there is more "overflow" to the other side than is the case in connexion with the education of the motor centre. However it may be explained, the fact remains, that in cases of auditory aphasia due to destruction of the centre A the "Further Education" of the auditory centre of the opposite side is easier and faster than is, in motor aphasia, the further education of the uneducated motor centre. The following is an interesting case which illustrates this point, and which shows, further, that speech may be entirely recovered even after total destruction of both of the educated centres, auditory and motor.

Case XI. (Bernard, *De l'Aphasie*, p. 159).—A woman, aged 49 treated by Charcot in the Salpêtrière Hospital. Six years before coming under observation, she had one morning awoke from sleep hemiplegic and aphasic. Two years after this, she had been able to acquire only the power of saying "yes" and "no." At first, the aphasia had been both sensory and motor, so that the patient had been Word-Deaf as well as Aphemic. She had been able to understand only a few of the words spoken to her, and these only after they had been several times repeated. Words spoken had seemed to her only an indistinct noise, "like conversation in a crowd." She could not say precisely how long this word-deafness had lasted, but it had disappeared much sooner than her motor aphasia. Little by little she had recovered from the motor aphasia also, so that when, in 1883, she came under the care of Prof. Charcot, her speech had for some years been thoroughly restored. She was admitted into the Salpêtrière on account of an intercurrent affection unconnected with the brain or speech, viz., an obliteration, by thrombosis, of the abdominal aorta; and of this she died in a few days. On autopsy, it was found that, on the left side of the brain, both the Broca's convolution and the first temporal convolution had been completely destroyed by old softening.

Besides illustrating the possibility of recovery from an aphasia that is both motor and sensory, this case shows that, in the process of recovery, the education of the uneducated centres is easier and more rapid in the case of the auditory than in that of the motor centre.

Summary of Leading Features.

In now summing up the leading features of auditory aphasia it may be said that—

1. It is rarer than motor aphasia.
2. It is more easily curable.
3. It interferes with both the reception and the production of audible speech,—its leading symptoms being, on the reception side, Word-Deafness, and, on the production side, Amnesia Verbalis, Paraphasia, and Articulative Amnesia.
4. It interferes with the Repetition or Echoing of spoken words. Though the words are heard by the uneducated auditory centre,

their auditory images are at first not well retained, and the patient has therefore at first difficulty in getting the educated motor centre to conform to these imperfect auditory images of the opposite side; but, with practice, this difficulty generally disappears.

5. As to Written or Printed Speech, we have seen that there is difference of opinion upon the question whether or not the power of Reading is retained; but it has been shown above that it is retained in some cases at least. As to Writing, we have seen that the motor act of writing is not interfered with, the handwriting being often good. Nor, apparently, is the power of Copying words in writing interfered with. But when the patient tries to express his thoughts in writing he exhibits faults of expression and faults in spelling equivalent to the faults of his spoken speech, this Paragraphia being, in fact, only a translation into writing of the Paraphasia in the patient's internal speech. And these faults of written speech are often even more marked than are those of spoken speech.

Treatment of Auditory Aphasia.

The best hints for the treatment of Auditory Aphasia that I have been able to find are those furnished by the record of the case by Schmidt (Case V., p. 288), from which an additional note has been given at page 293. In this case, words were slowly and articulately spoken to the patient, and she was asked to repeat them. Printed words were also shown to her, and she was asked to read them. At first she repeated the words slowly and with difficulty, but with practice she acquired increasing facility. Probably the practice was imprinting the word-images efficiently in the uneducated auditory centre, and at the same time establishing connexions, of the requisite intimacy, between these images and those of the other speech-centres. Even when no special training has been given, the mere habit of listening attentively to the speech of others, and trying to understand it, educates in many cases, as we have seen, the uneducated auditory centre, and in due time establishes connexions sufficiently intimate between its images and those of the other speech-centres. When special training is required, the best that can be given is probably such as was used in the case referred to, viz., training of the patient to repeat words

spoken to him, and to read aloud words shown to him. Of course it will be understood that such training should be prescribed only when the condition of the brain and of the general health indicates that such an exercise is not likely to be injurious or too fatiguing to the patient.

CHAPTER XI.

APHASIA IN RELATION TO ORGANIC DISEASES OF THE BRAIN—*Continued*:—MOTOR APHASIA (APHEMIA); CONDUCTION APHASIA.

MOTOR APHASIA (APHEMIA).

THE form of Aphasia now to be considered has, by Wernicke, Charcot and others, been termed Motor Aphasia; but as it was originally described by Broca, and as Broca applied to it the term Aphemia, many writers have, in honour of Broca, wished to retain that term. It was formerly objected to the term Aphemia that the word, in ancient Greek, had a different and an objectionable meaning.[1] On this account, Trousseau proposed as a substitute for it the term Aphasia. But it has been found that this term, too, occurs in ancient Greek with a meaning different from its medical one.[2] The profession, disregarding these original meanings, has decided to retain both terms. Aphasia is now used as the generic title for the whole of this group of Speech Disorders, and Aphemia is used, by many, as the specific term for the motor variety of aphasia.

Before I go on to discuss in some detail the characteristics of aphemia, it may, I think, be of advantage to look for a moment at the work which is now being done by the Experimental Physiologists in connexion with the physiology of the motor speech-centre in the brain.

It will, of course, be borne in mind that monkeys, and the other animals experimented upon, are not endowed with human speech, and that, therefore, the centre in the brains of these animals which anatomically corresponds with the motor speech-centre of the human subject, does not fully correspond with it physiologically. Yet the correspondence is real and close, even physiologically; because, though they cannot speak articulately, these animals have

[1] It meant infamy.

[2] It meant dumbness from fear or perplexity.

an expressional language of their own, for the purposes of which they employ largely the same organs as are employed by man for articulate speech, viz., the organ of voice, and the muscles within and around the mouth. Therefore, in analysing the action of the motor centre in these animals, and in localising the various sub-centres contained within it (such as that for adduction of the vocal cords, and those for movements of the lips and tongue), experimental physiology is fitted to throw much light upon the constitution of the motor centre in the human subject.

At page 478 of Dr Ferrier's work on *The Functions of the Brain*, 2nd ed., the reader will find, in the diagram showing the cortical centres in the human brain, that Dr Ferrier has indicated the motor centre for speech by a circle (9·10), within which he includes (1) the vertical part, or "foot," of the third frontal convolution; (2) the "foot" of the ascending frontal convolution; and (3) part of the "foot" of the ascending parietal. The area thus demarcated is that which is now termed "Broca's convolution." By Broca himself it was termed the "Operculum," because it covers like a lid, and hides from view, the group of short convolutions on the floor of the Fissure of Sylvius known as the Island of Reil. It will be observed that this operculum corresponds, on the surface

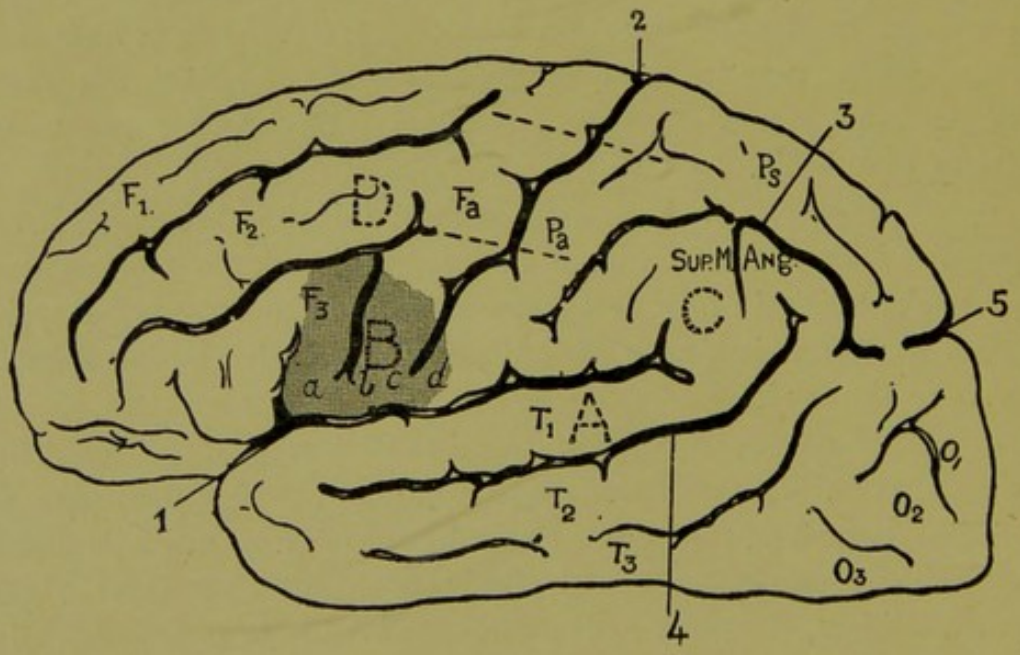


FIG. 6.

of the brain, to the angle between the short ascending and the long horizontal branch of the Fissure of Sylvius. Ferrier (p. 481)

says:—"(9) and (10), included together in one, mark the centres for the movements of the lips and tongue as in articulation. This is the region disease of which, on the left side, causes aphasia, and is generally known as Broca's Convolution." In the diagram on previous page, this area is indicated by shading.

I do not know whether Ferrier, in thus demarcating the centres for the movement of the lips and tongue in the human subject, was guided entirely by the results of experimental observations on the lower animals, or also took into account the results of clinical and pathological observation upon the human subject. But I suppose he must have taken clinical and pathological observation into account, because I find that the later observations by V. Horsley and his colleagues have led to the demarcation of an area for the movements of the lips and tongue that is different from the area given by Ferrier. It is different in this important respect, that *it does not include within it the foot of the third frontal convolution.* It limits the representation of the movements of the lips and tongue to the foot of the ascending frontal and the foot of the ascending parietal convolutions, and leaves the foot of the third frontal convolution out of account altogether. Neither in the macacque monkey, nor in the orang outang (an anthropoid), have these later experimenters found the foot of the third left frontal convolution to be included within the motor area for the movements of the lips and tongue.[1] Now this is a remarkable fact, because, as we shall see by-and-by, clinical and pathological observation has shown that the foot of the third left frontal convolution has relations to the motor production of speech that are apparently even more important than those of the feet of the ascending frontal and ascending parietal convolutions.

How is this apparent discrepancy between the results of experimental and those of clinical observation to be explained? It seems to me that if the foot of the third frontal convolution is not motor in function, and yet has relations of extreme importance to the motor production of speech, we are almost forced to the

[1] For an account of the experiments upon the brain of the orang outang, see V. Horsley and E. Beevor, in the *Phil. Trans. of the Roy. Society* (*B.*) 1890, p. 129. For the application of the results of recent experimental researches upon animals to the human brain, see V. Horsley, in the *International Journal of Science*, vol. xciii. 1887, p. 342.

conclusion that it must be, in a special manner, the storehouse of the guiding psycho-motor pictures or memories, which, in themselves, are so largely sensory in constitution, being made up chiefly from memories of muscular and tactile sensations. Are these psycho-motor pictures, then, stored in the foot of the third frontal convolution, and the executive motor cells contained in the feet of the ascending frontal and ascending parietal convolutions? We cannot as yet answer this question definitely. We must wait for the results of further experiments upon anthropoid monkeys; and, above all, we must wait for the decisive evidence that can be obtained only from the careful observation of cases in which limited lesions have destroyed one small portion or another of the grey matter within the area of Broca's convolution. Some such cases have already been recorded, and I shall give notes of a few of them; but we are greatly in need of additional evidence of this kind.

A very important conclusion arrived at by the experimental physiologists is that, within the area of Broca's convolution, there is a special sub-centre for the motor innervation of the muscles which adduct the vocal cords, and thus place them in position for phonation. This sub-centre is situated, in monkeys, within the foot of the ascending frontal convolution, close behind the precentral sulcus. We owe this advance in the physiology of the motor area to the observations of a number of physiologists, but more especially to those of Krause[1] and of F. Semon and V. Horsley.[2] In this sub-centre, the adductors of the vocal cords have been found to be bilaterally represented,[3] so that stimulation of this sub-centre in one hemisphere is found to be capable of producing equal adduction of both vocal cords. In the human

[1] Krause, *Archiv für Anat. und Phys., Physiol. Abth.*, 1884.

[2] F. Semon and V. Horsley, *Trans. of the Roy. Society* (*B.*) 1890, p. 187.

[3] They have been found to be so in dogs, by Krause; and in monkeys, by F. Semon and V. Horsley. On the other hand, Masini (*Arch. ital. di Laryng. Napoli.*, April 1888) finds that very light stimulation of the centre in one hemisphere produces movement only of the opposite vocal cord, though stronger stimulation produces bilateral movement. Semon and Horsley, however, have repeated their experiments since the publication of Masini's paper, and they adhere to their conclusion that unilateral stimulation of the centre always produces equal movement of both vocal cords. See F. Semon's contribution to Virchow's *Festschrift*, 1890, vol. iii. p. 429.

subject, the probable situation of this sub-centre for phonation is indicated in Fig. 6 by the letter *b*, in the shaded area. The sub-centre for the oral articulative mechanism (lips, tongue, etc.) lies further back, in the ascending frontal convolution, at and about *c*, and seems also to extend backwards to the neighbourhood of *d*, in the ascending parietal convolution.[1] Here, then, at *b* in Fig. 6, we have denoted the probable centre for phonation (the vocal mechanism); and at *c* and *d* the centre for the movements of the lips, tongue, etc. (the oral articulative mechanism). Whether or not the foot of the third frontal convolution, at *a*, is really the store-house of the guiding psycho-motor pictures for spoken speech, we must leave, for the present, an open question; but we may make note of the fact that, although in the lower animals electrical stimulation of this convolution *a* appears to be incapable of exciting muscular movements in the larynx or mouth, yet in the human subject a destructive lesion at *a* is even more disastrous to speech than such a lesion at *b*, *c*, or *d*.

Effects of Motor Aphasia upon the Production of Speech.

1. Spoken Speech.—Destruction of Broca's convolution (B in Fig. 6) renders the production of spoken speech impossible. This would be the law, without exception or modification, were it not for the existence of the "uneducated centre of the opposite hemisphere." When the educated convolution is destroyed, thoughts seeking expression are thrown upon the very scanty resources of this uneducated convolution. We have already seen how much and how little this convolution can do in such circumstances. In some cases, it can do nothing at all, the patient being unable to emit any articulate sound whatever. In other cases, the uneducated centre may suffice for the emission of some recurring utterance, or, under excitement, some old familiar oath or other conventional expression. In other cases, again, the words *yes* and *no*, and perhaps a few others, may be emitted and used appropriately. We have already discussed these capabilities

[1] In the orang outang, this area seems not to extend so far back as to the ascending parietal convolution: it seems to be confined to the ascending frontal. See diagrams of the brain of the macacque monkey and the orang outang, in an article by V. Horsley, *Nineteenth Century*, June 1891.

of the uneducated centre at some length. We have already also seen that, by a process of Further Education, the uneducated centre may, in young people especially, gradually acquire more and more efficiency, until at length it may be able to take the place, and discharge the functions, of the convolution that has been destroyed. In such cases, speech is gradually bettered, and its recovery may be complete.

In trying to illustrate the effects of motor aphasia upon the production of spoken speech, it would be scarcely possible to select more instructive examples than Broca's two original cases—the cases whose publication in 1861 did so much to arouse throughout Europe a great interest in the subject of aphasia. The patients were both inmates of the Bicêtre Hospital in Paris, to which Broca was surgeon.

Case I. (Broca, *Mémoires d'anthropologie*, p. 17).—On the 11th of April 1861, there was admitted into the surgical wards of Bicêtre Asylum a man of 51 years of age, named Leborgne. He was affected with a diffuse gangrenous phlegmon of the whole of the right inferior extremity, and of this he died five days after coming under Broca's care. Leborgne had been an old inmate of the Bicêtre Asylum, having lived in it for a period of about twenty years. His history was that he had since youth been subject to epileptic fits. At the age of 30 he had lost his speech, and, becoming about this time unable to continue at his usual occupation as a lastmaker, he had been admitted into the Bicêtre Asylum. For the first ten years of his residence at the Bicêtre he was active and intelligent, though speechless. He was known in the Asylum by the nickname 'Tan,' because that was the only syllable he could pronounce. In answering questions, or in expressing himself spontaneously, he said merely *Tan, Tan, Tan.* He expressed himself well, however, by pantomime. When his interlocutors did not understand his pantomime, he got easily irritated, and added then to his vocabulary "one great oath, one only—'Sacré nom de Dieu.'" After the first ten years in the Bicêtre, his health began to fail. He began to lose the motor power in his right arm; and the paralysis gradually extended to the right leg. At the same time, sight and intelligence became alike enfeebled. For the last six or seven years of his life he had been constantly

confined to bed. In this condition he was seized with the phlegmonous erysipelas for which he was transferred to the surgical ward and placed under the care of Broca. As already said, he died in about five days after his admission.

At the autopsy, a very extensive softening was found in the left hemisphere. It involved the greater part of the frontal lobe, as well as the corpus striatum, the Island of Reil, and the convolutions lying along the margin of the Sylvian fissure. On careful examination, Broca was able to satisfy himself that, in this vast area of softening, the oldest portion was that at about the middle of the frontal lobe. It appeared evident that in this neighbourhood the softening had first begun, and that it was when the softening was limited to this neighbourhood that the patient had been merely aphasic, and not paralysed. The subsequent hemiplegic paralysis had been caused by the backward extension of the softening. Such was Broca's explanation of the case, and the explanation received striking confirmation from Case II., which I now proceed to make a note of.

Case II. (Broca, *Mémoires d'anthropologie*, p. 34).—The patient, named Lelong, admitted 24th October 1861, was 84 years of age. He had been a labourer. In April 1860, he had had an apoplectic stroke, with temporary loss of consciousness; for which he had been treated in hospital. He had recovered in a few days, without any hemiplegia, though his walk, without being lame, was a little uncertain. The stroke, however, had rendered him aphasic, so that his vocabulary was reduced to the few words to be presently noted. He was in this condition, able to go about, though aphasic, when, on the 27th of October 1861, six months after the stroke, he fell and broke the neck of his femur. It was for this injury that he was admitted to the Bicêtre Hospital under the care of Broca, and it was from the effects of this injury that he died ten days after admission.

Broca's notes about the speech of this patient are very interesting. He says:—"To the questions one addressed to him he replied only in signs, accompanied by one or two syllables articulated energetically and with a certain effort. These syllables had a meaning. They were French words, viz., *oui, non, tois* (for *trois*), and *toujours*. He had a fifth word which he pronounced when

one asked his name. He then replied, 'Lelo,' for Lelong, his real name.

"The three first words of his vocabulary corresponded each to a definite idea. In affirming or approving, he said '*oui*.' In expressing the opposite idea, he said '*non*.' The word *tois* expressed all numbers, all numerical ideas. And, lastly, whenever these three words were not applicable, Lelong helped himself with the word '*toujours*,' which, in consequence, had no definite meaning. I asked him if he knew how to write? '*Oui*.' If he could do it? '*Non*.' 'Try.' He tried, but he could not succeed in directing the pen."

Broca illustrates these points very fully, by giving details of his conversations with the patient. He tells us that the patient expressed himself well in pantomime, when words failed him. For example, when he was asked what had formerly been his occupation, he imitated very well the action of using a shovel.

At the autopsy, a cyst-like cavity filled with serum was found to occupy the room of what is now known as Broca's convolution. It extended far enough upwards to take the place also of the posterior extremity of the second frontal convolution. It was sharply limited and defined in its margin and base, and the hæmatin crystals in its wall showed that the cause of the local destruction of cerebral tissue had been the apoplexy in April 1860.

Even apart from their great historical interest, these two cases are most valuable: they illustrate so well and so fully the characteristic features of motor aphasia. Broca's convolution being in both cases utterly destroyed, there was, in both, the almost complete annihilation of the power of producing speech. In both cases, the patient was thrown upon the scanty resources of the uneducated convolution of the opposite side; and in both it is evident that a few crumbs of speech had been acquired by this convolution, through "overflow of education." Leborgne can swear "one great oath," when he is irritated. Lelong can articulate, and use intelligently, three or four words, including *yes* and *no*. Both patients also exhibit examples of recurring utterances. Leborgne, on all occasions, when he tries to speak, says *Tan, Tan*. Lelong, when the few words of his vocabulary are inapplicable, always uses the recurring utterance *toujours*. Both patients are capable of expressing themselves well in pantomime. Lastly, in both

patients, though the production of speech is almost completely annihilated, its reception and interpretation are little, if at all, interfered with.

It would be exceedingly interesting if we could have before us a series of cases showing the effects of very limited lesions in the various parts of Broca's convolution,—lesions situated, for example, at the positions indicated by *a*, *b*, *c*, and *d*, in Fig. 6. But, from cases recorded, it is not yet possible to bring together such a series. Here are a few of the best cases of this kind that have as yet been published.

Case III. (Rosenstein, *Berliner Klin. Wochenschrift*, 1868, p. 182). *Lesion in the Third Frontal Convolution, presumably in its "foot," at or about a*, Fig. 6.—A woman, aged 22, was admitted into hospital in 1867, suffering from fever of intermittent type, and also from nephritis and uræmia. In the course of her illness, which lasted many months, she had severe headache, vomiting, and convulsions. But she had recovered from these symptoms, and the dropsy and uræmia were also disappearing, when one day she suddenly developed cerebral symptoms of a serious kind. She sat up in bed with dilated pupils and staring eyes. She could understand clearly what was said to her, but, in reply to questions, could only say *yes, yes.* She tried to make her wishes known by gesture. In order to see if she had also lost the power of expressing herself in writing, she was got to make an attempt to write; but, though formerly she had been able to write well, she was now only able to make different kinds of strokes,—no letters. If one of her wishes was guessed, she nodded. She died, a fortnight after the attack, from dropsy in the chest; having remained speechless, though intelligent, till the date of her death. There had been no paralysis. At the autopsy, there was found a clot of the size of a hazel-nut, surrounded by a limited area of secondary softening, in the third frontal convolution. It is to be regretted that its precise situation in the convolution is not given.

Let it be noted that in the foregoing case there was loss of the power of writing. I now proceed to make a note of another case of limited lesion in the same locality in which the power of writing was retained.

Case IV. (Dr Wm. Ogle, *St George's Hospital Reports*, vol. ii. p. 105). *Softening of the foot of the Third Frontal Convolution, a*, Fig. 6.—A man of rheumatic constitution, and the subject of aortic and mitral disease. Three days before admission he had fallen down suddenly, without loss of consciousness, and had found himself hemiplegic and aphasic. On examination, his speech was found to be limited to the two words *yes* and *no*. At first, he had difficulty in deglutition and in putting out his tongue, but these symptoms passed away in a few days. He understood all that was said to him, and expressed himself well by pantomime. "He could write with his left hand, with sufficient distinctness, words which he could not pronounce when asked to do so. In his writing, there was often a tendency to reduplication of letters. For instance, he wrote 'Testatament' for 'Testament.' But I cannot say whether this was more than the result of defective education."

The autopsy showed the brain to be healthy, except at two limited spots, of which the chief "was the posterior part of the third frontal convolution on the left side. Here was a softened and almost diffluent patch, about three-quarters of an inch in breadth, reaching from the highest part of the third convolution, backwards and downwards to the Fissure of Sylvius. The softened part was not actually the most posterior part of the convolution, for there was a narrow unsoftened strip between it and the transverse (ascending) frontal convolution. On cutting into the brain, a second small patch of softening was seen in the centre of the left hemisphere, external to and rather above the corpus striatum, and extending towards the posterior extremity of the Fissure of Sylvius. All the rest of the brain was apparently healthy." The cause of the softening in Broca's convolution was found to be occlusion, by embolism, of a branch of the Sylvian artery.

This, I think, is one of the most valuable cases of the kind on record. I have already drawn attention to the fact that in this case the patient retained the power of writing.

A very interesting case of limited lesion at the bottom of the precentral sulcus (between *a* and *b*, Fig. 6) has recently been put upon record by MM. Balet and Boix, in the *Archiv de Neurologie*, 1892, p. 231. For purposes of illustration, however, the case is unfortunately not a good one, since, along with the limited lesion

in the left hemisphere, there was very extensive disease in the right hemisphere. I therefore merely refer to the case in passing, without quoting it.

It is much to be regretted that we have not as yet records of cases of limited lesion at *b*, *c*, and *d* (Fig. 6), respectively. If we may accept the conclusions of the experimental physiologists, the area at *b* represents the centre for the adduction of the vocal cords in phonation, and, behind this, the area at *c* and *d* represents the centre for the oral articulative mechanism (lips, tongue, etc.). In the second chapter, I have shown that the complete disablement either of the vocal mechanism or of the oral articulative mechanism renders an individual quite speechless. Does it follow that destruction of the phonating centre at *b* would have this effect, and that this effect would also be produced by destruction of the centre for oral articulation at *c* and *d?* It would follow, I think, undoubtedly, were it not for one possibility. If we are to suppose that the foot of the third frontal convolution, *a*, is the centre for the guiding psycho-motor images, and that at *b* and at *c* and *d* lie the motor executive centres of the vocal and oral articulative mechanisms, it is conceivable that even after destruction of *b*, or of *c* and *d*, the psycho-motor pictures at *a* may be capable of having themselves orally exteriorized or executed by establishing new connexions, or rather by availing themselves of connexions previously not much used, with the executive centres of the opposite hemisphere.

But it is not of much advantage to speculate about these possibilities,—we have at present so little real knowledge of the functions that are subserved by each individual part within the area of Broca's convolutions. I have touched upon the subject merely to show how desirable it is that we should have careful records of the effects of limited lesions in this area.

I may here add that though I have not met with any good records of cases of limited lesions at *b*, or at *c* or *d*, I have, in looking for such, found two good cases recorded by Dejerine (*Comptes Rendus des Séances de la Société de Biologie*, March 1891), in which a small area of softening existed internal to *b*, not in the grey matter, but in the white matter subjacent to it. Both patients were the subjects of motor aphasia, but could express themselves freely in writing. The curious and puzzling circum-

stance about these cases is that there was, in both, paralysis (complete in one and incomplete in the other) of the right vocal cord. This, of course, is not at all in harmony with the results obtained by the experimental physiologists. According to these results, the vocal cords are represented bilaterally in the brain, so that stimulation of the phonating centre on one side of the brain causes adduction of both vocal cords, and destruction of the centre on one side does not cause any paralysis of the vocal cords, either on one side or on both. Though Dejerine notes that the bulb was, in each case, carefully examined, and that no lesion was found in it capable of accounting for the paralysis of the right vocal cord, one is inclined to think that there must have been some lesion low down in the motor tract; because destruction of the whole of Broca's convolution is of common occurrence and has not been observed to produce paralysis of the opposite vocal cord,—the patient retaining his voice in such cases, though he has lost his speech.[1]

Recognising that it is at present premature to attempt any very precise analysis of the functions of the different areas in the grey matter of Broca's convolution—although experimental physiology is already affording grounds for the belief that such an analysis will be possible at no distant date,—let us return to the consideration of the characteristic features of motor aphasia, as exhibited in the production of spoken speech.

Ataxia (Asynergia) Verbalis in Motor Aphasia.—The leading feature of motor aphasia, when it is well marked, is that the production of words is rendered impossible, except, it may be, in the case

[1] There are upon record a number of other cases in which paralysis of one vocal cord was attributed to an organic lesion in the opposite hemisphere of the brain, the most important being (1) a case reported by Garel (*Annales des maladies de l'oreille et du larynx*, May 1886), in which a paralysis of the left vocal cord was attributed to softening of the foot of the right Ascending Frontal convolution, and (2) a case by Garel and Dor (*Ibid.*, April 1890), in which a paralysis of one cord was attributed to a small lesion in the Internal Capsule of the opposite hemisphere. Both cases will be found given fully in the Thesis by R. Mongorgé, entitled *Etude sur les Laryngoplégies Unilatéral*, Lyon, 1890. They are criticised by Semon (Virchow's *Festschrift*, vol. iii. p. 432), who holds that some lesion lower down in the motor tract must have been overlooked, and points to the fact that, in the experience of every physician, lesion in the foot of the Ascending Frontal, or in the Internal Capsule, does not produce the loss of voice which would result from paralysis of one vocal cord.

of the words that are retained, such as the recurring utterances, a few words in very common use, such as *yes* and *no*, and emotional utterances, such as oaths. The patient may possibly be able to call up other words in his mind, by revival of their auditory images, but, if so, he cannot utter them. He cannot utter words, even if they are spoken to him and he is asked to repeat them. To this disablement of the power of producing or uttering words, the term Ataxia Verbalis has been applied; and motor aphasia is accordingly often termed Ataxic Aphasia. It cannot be said that the term is a happy one, seeing that, literally, ataxia means want of order, and that, in motor aphasia, the leading feature is not disorder, but is disablement. I think it a pity that the term Asynergia Verbalis, originally proposed by Lordat in 1843, has not been retained, since asynergia (want of the power of working together) would have been a more appropriate term for this disablement of the complex motor mechanisms of speech than ataxia; and the term Asynergic Aphasia would have been more descriptive of the condition than the term ataxic aphasia. Theoretically, it seems reasonable to believe that asynergia verbalis may be due either, on the one hand, to the obliteration of those psycho-motor images which, in the production of words, are essential for the guidance of the executive motor cells; or, on the other hand,—the psycho-motor images being intact,—to the destruction of the executive motor cells. Further, it should be noted that a disablement of utterance of like character, and as complete as in either of these two cases, will result if the conducting fibres leading from the executive cells are cut across by a sub-cortical lesion.

Destruction of the psycho-motor images or memories might, no doubt, be classed as a form of Amnesia Verbalis, if we chose to employ that term in its widest sense, as many have employed it. But, as I have already indicated in the last paper, it is extremely desirable that the term Amnesia Verbalis should be used in a more restricted sense, as the term for one of the most important of the symptoms of aphasia, viz., that Forgetfulness of Words which betrays itself in the loss of the power of calling up words in the mind, when they are wanted for purposes of utterance or of silent thought. We have no other term by which we can designate this most important symptom. Using the term in this sense, let us now look at the relation of amnesia verbalis to motor aphasia.

Amnesia Verbalis in Motor Aphasia.—We have already seen how prominent a symptom Amnesia Verbalis is in Auditory Aphasia; and how, in that condition, it is associated with its companion symptoms, Articulative Amnesia and Paraphasia. In Motor Aphasia, the absence of word-deafness, and the consequent ease with which the patient interprets what is said to him, has led many to think that there can be little or no amnesia verbalis. But this is a mistake. When thought is seeking expression, it leans towards the motor images; and, if these are destroyed, it cannot easily find the words it wants. Possibly it may with difficulty find some of them, by reviving the auditory images; in which case Amnesia Verbalis will not be complete. But there is reason to believe that in every case of severe motor aphasia that is due to destruction of the motor images, Amnesia Verbalis is extremely well marked,—even more so, perhaps, than it is in cases of severe auditory aphasia. Trousseau is evidently right when (p. 721) he says, "There is not only asynergia, there is amnesia verbalis. The patients have forgotten the words." He is also evidently right when he attributes to this amnesia verbalis the striking disablement of the power of expressing thought *in writing* that is exhibited by most of these patients.

When motor aphasia is severe, it is often very difficult to prove that the patient has severe amnesia verbalis, because it is difficult to get behind the obvious and prominent asynergia verbalis. In such cases, the retention of the power of expressing thought in writing would prove the absence of amnesia, in proportion as that power is retained. But the absence of the power of expressing thought in writing does not necessarily prove the presence of amnesia verbalis, because the power of writing may be destroyed by lesion in the visual or motor centres for writing. Therefore, in such cases, one is obliged to have recourse to Lichtheim's plan of trying to ascertain whether the patient can call up words in his mind. He asks the patient to indicate with his fingers the number of syllables in the names of familiar objects shown to him.

It is, as a rule, only when a patient is recovering from his motor asynergia that the amnesia verbalis can be easily demonstrated. He is then regaining the power of uttering the more common words and phrases, but, in accordance with laws which we have

already discussed, he finds himself at a loss when he wishes to use a word of less common occurrence, such as the name of a concrete thing. Here is a case which beautifully illustrates this Amnesia of Nouns, in motor aphasia, which persists even when the patient is in process of recovery.

CASE VI. (*Reported by* Dr J. Batty Tuke *and* Dr John Fraser, *Journal of Mental Science*, 1872, p. 46.) *Shows Amnesia Verbalis. Also illustrates Recovery of Speech after Destruction of Broca's Convolution.*—A female, aged 54, admitted to the Fife and Kinross Lunatic Asylum on December 14th, 1868. Eleven years previously, at the age of 43, she had had an apoplectic seizure. On recovery of consciousness, she had not exhibited any paralysis, but had been found to be quite speechless. Had been weak-minded as well as aphasic from the day of the attack, but, after some years, had gradually regained her speech to a considerable extent. Had become actually insane only four weeks before admission. After her admission, she rapidly improved in mind, and became almost sane.

"During the whole period of her residence, two peculiarities in her speech were observed—a thickness of articulation resembling that of general paralysis, and a hesitancy when about to name anything, the latter increasing very much some months previous to her death." She forgot nouns in a striking way. For example, "she would say, 'Give me a glass of——.' If asked if it was water, she said 'No.' Wine? 'No.' Whisky? 'Yes, whisky.' *Never did she hesitate to articulate the word when she heard it.*" She could read, but was never observed to write. She died from caries of the vertebræ. The autopsy showed that the old apoplectic extravasation that had occurred eleven years before her death had resulted in the complete destruction of the posterior part of the left third frontal convolution, the posterior part of the second left frontal, the foot of the ascending frontal, and part of the foot of the ascending parietal. An admirable plate shows the limits of the lesion.[1]

[1] At the date of the publication of this case, the possibility of "further education" in the convolution of the opposite side was not generally recognised; and the authors of the paper naturally supposed that the case afforded evidence adverse to Broca's views. At the present time, the possibility of such further education is, of course, recognised by every one.

This is a most valuable case, showing not only the complete, or almost complete, loss of speech that is produced in the first instance by such a lesion, but showing also recovery of speech by education of the convolution of the opposite side; and showing, further, some of the peculiarities that are presented by such patients when they are in process of recovery. A forgetfulness of nouns (true amnesia verbalis) and a thickness of articulation resembling that of general paralysis of the insane are the two peculiarities noted. As in such cases of advancing recovery of speech we find amnesia of nouns to be so marked a symptom, we may reasonably conclude that amnesia verbalis exists from the beginning in motor aphasia. It probably exists in a proportion commensurate with the severity of the aphasia. The fact that both in auditory and in motor aphasia the patient may be unable to call up certain words, and especially nouns, in his mind, when he wants them for utterance or for silent thought, proves, I think, conclusively that in order to be called up from within with perfect ease the word-percepts must be complete: they must be possessed of both their auditory and their motor images, and these must be revived simultaneously. The loss of either image renders the percept incomplete, and makes its revival comparatively difficult. Hence the amnesia verbalis of both auditory and motor aphasia.

The Paraphasia which is so characteristic a symptom of auditory aphasia is rarely exhibited in cases of motor aphasia. If exhibited at all, it is only in a very slight degree; and, as there is no word-deafness, the patient is at once aware of any error he may make in the use of a word.

As amnesia verbalis is so marked a feature in motor aphasia, we may suppose that the imperfect development of the symptom which we have termed Articulative Amnesia may be experienced by the patient in relation to certain words. The auditory image of the word may be imperfectly revived, so that the patient has mentally an imperfect image of it. If so, he will not be able to articulate the word correctly. But it will be seen that, in motor aphasia, it would be practically impossible to know whether the patient's imperfect articulation of the word was due to the imperfect revival of it in his mind, or to the impossibility, owing to the motor asynergia, of articulating it when it is revived. Practically, therefore, it is impossible to distinguish between this Articulative

Amnesia and slight Asynergia (Ataxia) Verbalis, though theoretically it is possible to make a distinction between the two.

Lalling and other Faults of Articulation in Motor Aphasia.—When, in recovery from motor aphasia, the uneducated centre of the opposite side is learning to discharge the function of the centre that has been destroyed, the articulation of the patient often exhibits faults which put one in mind of the lalling articulation of children. One of my patients lalled distinctly,—always, for example, using *T*, an easy letter, for a number of others. He said *tage* for *cage, take* for *sake.* He also used *L* for *W*, saying *lee* for *we;* and he scamped his words like a child, saying *'rison* for *prison.* His case was one of well-marked motor aphasia with right hemiplegia. His intelligence was fairly good. Slurring, also, is often met with in these cases of advancing recovery from motor aphasia; and a slight degree of Stuttering is met with occasionally. All these faults in the performance of the previously uneducated centre put one in mind of the imperfect performances of a child who is beginning to speak. The analogy occurred to Trousseau. He says,—"I have asked myself whether it is not simply forgetfulness of the instinctive and harmonious movements that we have all learnt from early childhood and that constitute articulative speech; and whether by this forgetfulness the aphasic patient is not put into the condition of a child whom one teaches to lisp his first words, or of a deaf-mute who, cured suddenly of his deafness, tries to imitate the language of the people whom he now for the first time hears speak. There would, however, be this difference between the aphasic and the deaf-mute, that the one has forgotten what he had learnt, and that the other had never learnt it."

2. Effects upon the Production of Writing.—The striking interference with the power of writing that in most cases of motor aphasia co-exists with the disablement of speech attracted the attention of students of aphasia almost from the first.

Trousseau, in his splendid chapter on Aphasia,[1] expresses himself very clearly on this subject. He says,—"The greater number of aphasics are paralysed in the right hand and cannot write; and if they acquire the habit of writing with the left hand, it is easy to see

[1] *Clinique Médicale*, p. 708.

that they cannot trace, in writing, many more words than they can express in speech." He illustrates this proposition by citing a number of cases; among others that of a patient who had only two words in his vocabulary, viz., *oui* and *maman*, and who could only write one word, viz., his own name. When asked to write any word, he always wrote his own name; and he did so even when he was asked to write *oui* or *maman*.

Gairdner,[1] in 1867, expresses similar views. He says,—"Notwithstanding some noteworthy exceptions (to appearance) in which aphasic individuals are said, on rather good authority, to have been capable of expressing their thoughts in writing, the usual fact is certainly the opposite,—the aphasic writes at least as badly as he speaks; and when he speaks not at all, he writes not at all."

It is in this paper that Gairdner directs attention to that remarkable phenomenon exhibited in the writing of aphasics, the "intoxication" of the brain with a letter. He gives facsimiles of the handwriting of several of his patients, which show admirably how, when the patient tries to write a word—his name, for example —some letter in it is apt to be repeated over and over again, as if the patient could not get the image of it to retire from his mind.

When, at a later period, the centres for the visual and graphic-motor images of words in the brain had been differentiated, it was suggested that the troubles of aphasics in writing might be accounted for by supposing that the lesion in Broca's convolution extended into the posterior extremity of the second frontal convolution, and thus involved the centre for writing. We shall by-and-by have to consider what effect upon writing a lesion so situated may produce. In the meantime it may be remarked that opinion is coming round to the older view of Trousseau and Gairdner, according to which this disablement of the power of writing is one of the common, almost constant, results of motor aphasia. Dejerine thus concludes a recent valuable contribution to the "Study of the Troubles of Writing in Aphasics:"[2]—"Thus in proportion as we advance in the study of agraphia we find that Trousseau was right, when, speaking in his celebrated cliniques upon aphasia, of the troubles of writing in aphasics, he said, having in view certainly only the cortical motor aphasics, the

[1] *Proc. of the Phil. Soc. of Glasgow*, 1865–68, p. 104.

[2] *Comptes Rendus des Séances de la Société de Biologie*, July 1891.

only kind known at his epoch, 'Usually the aphasic is not more able to express his thoughts in speech than in writing; and, although he has retained the movements of his hands and can employ them with as much intelligence as formerly, he is as incapable of composing a word with the pen as he is of composing it for its purpose of speech.'"[1]

Rosenstein's case, already quoted (Case III.), shows conclusively that a lesion strictly limited to the third frontal convolution may be as destructive to the power of writing as it is to that of speech.

It is universally admitted, however, that there are exceptional cases, in which patients, presenting typically the symptoms of motor aphasia in their spoken speech, can yet express themselves correctly in writing,—thus showing that they have mentally little or no amnesia verbalis. It is generally believed that in these cases the lesion is not cortical, but sub-cortical; and that it is so situated as to cut across the pathways leading to the organs of phonation and articulation, whilst it leaves intact the pathways connecting the motor speech-centre with the centres for writing. Gowers (p. 106) gives a diagram illustrating this possibility.

But, granting that the majority of these cases may thus be referred to the category of cases due to sub-cortical lesion, I think it far from certain that this exceptional retention of the power of writing is always to be so explained. There is, for example, Dr Wm. Ogle's case (Case IV.), in which the foot of the third frontal convolution was almost wholly destroyed, and yet the patient could, in writing, express himself pretty correctly, though he was otherwise typically aphasic. Is it not possible that that patient was markedly *auditif*, and that his vivid auditory word-images were in themselves sufficiently potent to call up the equivalent visual and motor images in the writing centres? I do not see how the patient's retention of the power of writing can be otherwise explained. And then, again,—always supposing the guiding psycho-motor images for oral speech to be specially stored in the foot of the third frontal convolution,—is it not possible that, in a case in which this convolution has escaped while the feet of the ascending frontal and ascending parietal have been destroyed, the word-images formed in the foot of the third frontal are capable

[1] *Clin. Méd.*, p. 718.

of acting upon the centres for written speech, while no longer susceptible of being *orally* exteriorised or executed, owing to the destruction of the motor executive cells? I shall presently, in connexion with the treatment of motor aphasia, make a note of a case of my own, in which writing was retained, and in which I was inclined to attribute the destruction of oral speech to a lesion so situated. When future clinical and pathological observation and experimental research have successfully analysed the functions of the various parts of Broca's convolution, we shall have clearer views upon such questions as these two.

Effects upon the Reception and Interpretation of Speech.

1. AUDIBLE SPEECH.—The fact that, in motor aphasia, the reception and interpretation of audible speech are little, if at all, interfered with, has already been abundantly illustrated. The auditory word-images, revived from without by speech that is heard, are quite capable of calling up the meanings of words in the mind without assistance from the companion motor images. There is practically, therefore, no word-deafness in motor aphasia.

Yet it is highly probable that in the healthy brain, when the auditory images are strongly revived from without, the motor images are also, though perhaps faintly, revived along with them.[1] Has this revival of the motor image no value in assisting the auditory image to call up the meaning? I do not think this question has ever been carefully considered by students of aphasia. My own impression is that the motor images have a certain slight value in this respect. To put the matter to proof, patients with motor aphasia should be tested with the words which are known to be the least deeply imprinted, viz., the names of concrete things. My own method is to ask the aphasic patient to touch, in succession, as I name each part, his *nose*, his *ear*, his *chin*, etc.; and my belief is that in a large proportion of cases of motor aphasia the patient fails to interpret some of these names, or

[1] Bain says,—"While intently listening to a speech, we are liable to follow the speaker with a suppressed articulation of our own, whereby we take the train of words into a vocal embrace, as well as receive it passively on the sense of hearing. This is an instance of concurring or compound association."—*Senses and Intellect*, 3rd ed., 1868, p. 353.

has a difficulty in interpreting them, which he shows by hesitating and considering before he touches the part. I have had no autopsy on any one of the cases which exhibited this phenomenon, so that I cannot say for certain that there was in them no element of auditory aphasia; but I may say that I regarded the cases as cases of pure motor aphasia. The point, I think, deserves attention.

2. Visible Speech, Written and Printed.—Although, in motor aphasia, the reception and interpretation of audible speech are little, if at all, interfered with, the reception and interpretation of speech that is written or printed are interfered with, as a rule, in a marked degree. This loss of the power of reading (Alexia) is not so absolute as it is in a case of true word-blindness, due to the destruction of the visual images at C (Fig. 2); nevertheless, as a rule, it is very marked. It early attracted the attention of Trousseau, who quotes many instances in illustration of it. In some of these cases there seems to have been an element of what is now termed sensory aphasia, but others appear to have been cases of aphasia purely motor. Of these latter, perhaps the best is the celebrated case of the patient who could only speak one word, viz., the meaningless recurring utterance *Cousisi*, and who could only write one word, his own name, Paquet. "We ask him his name, 'Cousisi;' we pray him to write it, he writes 'Paquet.' We ask then him to write his address, he writes again 'Paquet;' then, perceiving that he has made a mistake, he turns his head with an air of impatience, saying 'Cousisi.'" This patient, who had been a well-educated man, occupied himself much with reading. "He reads sometimes all day, and I am bound to admit that he follows the lines sufficiently well, that he turns the pages at the right time, and that he *seems* to understand what he reads; but by a little experiment one can prove quite clearly that he really understands much less than he seems to do. I take the book and read aloud the bottom of a page, and I tell him to follow with his eyes, and turn the page when I come to the end of it; he never does it at the right moment." He had in his possession a number of little printed romances, such as one might read and throw aside, as one disposes of a daily newspaper. Trousseau remarks that it would be an intolerable punishment to any ordinary

person to be forced to read these stories over and over again. But this patient did so voluntarily. "He reads; he reads again; he reads always with the same attention." One of the explanations suggested is, that he understands imperfectly, and does not remember well, what he reads.

I think most physicians who have watched cases of motor aphasia with care will agree that, in the vast majority, there is an interference with the power of reading, such as is illustrated by this case of Trousseau's. Sometimes it is greater and sometimes less; in almost all cases it is distinctly present. It is therefore the more surprising to find that Lichtheim[1] thinks that in pure cases of motor aphasia the power of understanding written and printed words is intact. Lichtheim says,—"According to the diagram, the power of reading aloud should be lost, but that of silent reading preserved intact. I am sure that in uncomplicated cases this must be so, but I much regret that I have not had a case to observe during the last few years. . . . . It has been often specified [in literature] that the faculty of reading was intact; on the other hand, Trousseau has shown that many aphasics appear eager in their reading and yet do not understand what they read. . . . . I shall return to this point, and show by personal observations how I think this contradiction may be explained." At page 468 he says,—"These cases appear to me to have been instances of total aphasia [combined sensory and motor aphasia] in which the symptom of word-deafness has already been recovered from," but in which the remains of the lesion on the sensory side are sufficient to interfere with the perfectly free transit of incoming speech to the mind.

But, in motor aphasia, more or less interference with the power of reading is so exceedingly common—almost constant—that I do not think it can be always explained in this way. An explanation that appears more generally applicable may be founded upon—(1), the suggestion of Professor Bain,[2] that the motor images have a certain value in connexion even with the reception and interpretation of speech; and (2), the fact emphasized by Ferrier, that there is in educated people an exceedingly close relationship between the visual images of letters at C and their motor articulative images

[1] *Brain*, Jan. 1885.

[2] See footnote, page 318.

at B,—a relation almost as intimate as is the relation of these motor images at B with the auditory images at A. Ferrier (p. 441) says, "Here the articulatory or motor element is the central point of two sensory cohesions,—the one auditory, the other visual,—which two are regarded as equivalent." If the visual images of letters are more intimately associated with the motor images at B than with the auditory at A, it necessarily results that the destruction of the motor images at B will in every case of motor aphasia cause serious interference with the power of reading; because the visual images at C can only revive the meaning by acting upon it through the images of the primary couple, and the destruction of B breaks one of the connecting links.

Effects upon the power of Repeating or Echoing Spoken Speech, and upon that of Copying Written Speech.

When motor aphasia is complete, the power of repeating or echoing spoken words is of course destroyed as completely as is the power of volitional or spontaneous utterance. In both cases, the power of utterance would be lost permanently were it not for the Further Education of the convolution on the opposite side of the brain, which convolution, as we have seen, may gradually acquire articulative power. I think it is worthy of note, at this point, that the acquisition of articulative power by the previously uneducated centre is furthered if the patient is made to attempt the repetition or echoing of words and letter-sounds spoken to him. But I shall have something to say specially about the education of these cases presently.

As to *copying of written or printed words*, it is not materially interfered with in motor aphasia. If, owing to paralysis, the patient cannot copy with the right hand, he can do so with his left. It is generally found that he has no difficulty in translating printed into written characters. The contrast between what he has written from copy and what he has written spontaneously is often remarkable. Thus a patient of my own, when asked to write, to my dictation, the words "yesterday at Ayr Police Court," wrote "Glamen a dug gu Puegen Tued Gow Mgu," but when shown the words in print he copied them in writing very legibly. This patient was not, in the proper sense of the term, "word-blind."

He could give some account, though an incorrect one, of the meaning of any sentence in a newspaper that I asked him to read.

Other Phenomena occasionally associated with Motor Aphasia.

1. I have already, in a former chapter, made a note of the occasional occurrence of Amimia and of Paramimia in connexion with motor aphasia. In Amimia, the patient has lost the power of using such simple pantomimic signs as nodding the head to indicate the affirmative. In Paramimia, he misuses these signs; shaking the head, perhaps, instead of nodding it, when he wishes to indicate the affirmative. It is usually in severe cases of motor aphasia that amimia and paramimia are found as associated symptoms. They generally pass off quickly when the patient begins to improve. In the great majority of cases of motor aphasia there is no impairment of this power of pantomimic expression; often the patient is, in this way, able to express himself with striking vivacity.

2. Another symptom occasionally exhibited by severe cases of motor aphasia is an *inability to protrude the tongue by effort of the will.* Most aphasic patients are quite able to protrude the tongue, and to move it about freely in all directions. But in a few cases the patient is unable to protrude the tongue by effort of the will; and yet he may be able to protrude it instinctively and involuntarily. Among the recorded cases of patients unable to protrude the tongue voluntarily, there is one in which the patient protruded it involuntarily in the act of licking his lips as a preparation for the effort to protrude it voluntarily; and another in which the patient protruded the tongue instinctively when a sweet lozenge was being carried to his mouth.

Treatment of Motor Aphasia.

In training a patient with motor aphasia to speak, it is often of advantage to him to pronounce simple words in his hearing and ask him to repeat them. It is largely by practice in such repetition of words heard that the patient, in so many cases, re-acquires the power of speech. He educates in this way the previously uneducated centre. But I think the process may be expedited if it is conducted on scientific principles. It should be remembered

that the patient has lost the power of uttering even the simple letter-sounds. If he can be got to master the letter-sounds in the first instance, it will be more possible for him, afterwards, to produce their combinations in the form of words. It happens that I have had lately under treatment a case of motor aphasia in which the education of the patient after this manner was remarkably effective in restoring to him his power of speech. Nowadays it is scarcely worth while to publish any case of aphasia that does not include a record of the morbid changes in the brain. But I make an exception in this case, not only because of its bearings on the treatment of motor aphasia, but also because the case is one of that comparatively rare variety in which the patient, utterly aphasic as to spoken speech, is yet capable of expressing himself well in writing.

Case VII. (Personal Observation.) *Motor Aphasia with Retention of the Power of Writing. Method of Education resorted to in restoring Spoken Speech.*—Patrick Keaney, æt. 25, single, a stoker on the railway, recently returned from America; admitted to Ward 31 on 10th September 1892.

Complaints.—Loss of speech. Loss of power in right arm and leg. Disease of the mitral valve of heart.

History.—The patient, who is a respectable and fairly well educated young man, states that he never had rheumatic fever or any illness attended with pain about the region of his heart. Up to the beginning of his present illness he always enjoyed good health, but for the last five years he has noticed that he has easily got out of breath on exertion, and that on such occasions he has had palpitation of the heart.

In 1889, the patient, in company with a fellow workman, his cousin, emigrated to America. They settled in Pittsburg, where Patrick got employment on the railway as a stoker. He had long hours, and got his meals very irregularly.

On the 13th of May 1892, he came home from work feeling very tired, and went as usual to the restaurant, about fifteen yards from his own lodgings, to get his supper. He was taking a cup of tea, when, on raising his cup for the third or fourth time, he suddenly found that the power was leaving his arm, and that he could not raise the cup to his mouth. Alarmed at this, he rose,

paid his reckoning, said good-night to the landlady, and went to his lodgings. His cousin (who has returned with him from America) states that when Patrick entered the room at the lodgings it was evident that there was something seriously wrong. He did not seem to know what he was doing; he could not speak a word; and he was sweating profusely. Yet he did not appear to be lame in walking. He at once went to bed, and in doing so, was able to undress himself. In a few minutes thereafter he became unconscious, and in this condition he remained all night, tossing about restlessly in his sleep. When, in his sleep, he tried to raise himself in bed, it was noticed that he was powerless on the right side. In the morning, when he awoke, it was found that he was totally paralysed on the right side and totally speechless. He was removed to the Pittsburg hospital, where he was carefully tended for thirteen weeks. The cousin states that for the five first days he did not recognise his friends; but the patient himself says that this is a mistake.

The patient states that in about four weeks after the beginning of his illness he had to some extent recovered power in the right leg, so that he could stand without assistance, and could walk a little, if, in doing so, he supported his right shoulder against a wall. About this time, also, he acquired the power of saying *yes* and *no* in answer to questions, always using these words appropriately. After this time, steady improvement continued in the leg; but it was not till over three months after the date of the seizure, when he was at sea, on his voyage home, that he observed any return of power in the arm. He then began to move his shoulder, and in a less degree to flex and extend his elbow joint; but no power of movement has even yet been restored to his wrist joint, and only very slight power of flexion has returned to the joints of the fingers.

About six weeks after the date of the seizure (two weeks after he first began to say *yes* and *no*), the patient for the first time replied to a question in writing; using his left hand in doing so. He was asked, "How are you?" and replied in writing, "Well, I no feel so bad." After this, he replied to questions in writing almost every day; and he states that he never from the first had any difficulty in calling up in his mind the words that he wished to write, although, naturally, he found it somewhat difficult to write with his left hand.

On 15th August, he sailed from New York, in company with his cousin; and in due time he arrived in this country, and was admitted to the Royal Infirmary.

On his admission (10th September), it was found that only a slight trace of lameness remained in the right leg. The arm, however, was seriously paralysed. He could move his shoulder joint freely, being able to raise the arm over his head. He could also flex and extend the elbow joint, but he did so feebly. The wrist joint he could neither flex nor extend in the slightest degree. In the fingers, which he kept habitually semiflexed, there was very slight power of voluntary flexion, but none whatever of extension. The mouth was drawn very slightly to the left side, and the tongue, when protruded, deviated very slightly to the right.

The heart was much hypertrophied, and there were well-marked bruits of mitral obstruction and regurgitation.

From the notes of the case, which have been taken with great care by my former house-physician, Dr W. F. Robertson, I extract a few of the leading particulars regarding the patient's speech.

On his admission, almost the only words which the patient could articulate correctly were *yes* and *no;* but he made attempts to articulate many other words, and it was strikingly noticeable that he always produced sounds distinctly articulated, never an inarticulate slur. Thus, ten days after admission, when he was already beginning to improve, he said, in reply to questions, "Pittsburd" for Pittsburg, "Cáseno" for Glasgow, "Tunnes" for Stirling, "Skennes" for September, "Toosday" for Tuesday, "Much-a-day" for Wednesday. When asked what he had had for tea, he said "Ped" for bread, "Butter" correctly, and "Tea" correctly.

When he was tested with the Physiological Alphabet, it was found that he had lost the power of producing the greater number of the Consonant sounds. With regard to the vowels, whilst he could always produce the middle vowel-sounds Ah and Oh, he had difficulty with the vowels at the two ends of the list, often converting the vowel-sound *ee* into eh, and *oo* into oh.

Here is a note of his articulation of the various consonant sounds of the Physiological Alphabet.

Labials—*P*, as in Papa, is given correctly. *B* in Baba sometimes correct, sometimes as P, patient saying "Paba." *M* correct. *W* as wh, *wee wee* being given as "whey whey."

Labio-Dentals.—*F* generally given as P. *V* generally as F.

Linguo-Dentals.—*Th*[1] as F or H. *Th*[2] as N, D, V, or F. *S* as F. *Z* as F.

Anterior Linguo-Palatals.—*Sh* as F. *T* correct. *D* as T. *N* correct. *L* sometimes correct, but sometimes as D or T or N. *R* occasionally correct, but generally as N, T, D, or Wh.

Posterior Linguo-Palatals.—*K* sometimes correct, but sometimes as T. *G* always as K. *Ng*—as in aing—sometimes as N, sometimes as S. *H* sometimes correct, sometimes as Y. *Y* sometimes correct, sometimes as Wh.

It should be noted that in testing the patient's power of articulating those various letter-sounds, simple syllables were used, such as in Papa for P, in Mama for M, etc.

In singular contrast with the patient's difficulty of articulation, was his comparative facility of expressing himself in writing. The right hand being paralysed, he used his left. Even in his writing, however, distinct deterioration was observable. We were allowed to inspect several of the letters that he had sent home to his father from America before his illness; and in them, although he makes a misspelling now and then, and writes the first personal pronoun with a small i, he expresses himself with exceptional intelligence and in creditable English. The deterioration was shown most markedly in the written account of himself which, at my request, he gave us a few days after admission. In this account, there are, besides misspellings, frequent omissions of words, and some insertions of superfluous words. He begins the account as follows:—

"Patrick Keaney is was in born in the city Stirly [Stirling] in the year 1867 i worked at varous kinds jobs principally woods i made my mind to go to America i sailed in Ancor-liner Ethopa to youngstown when i went to work in the rolling mills then i went Pittsburg where got work as a fireman to a engine," etc.

Patient could read a book silently, though unable to pronounce the words; but in doing so he easily became fatigued, getting headache and a feeling of confusion in his head. He also easily forgot what he had just read.

One of the chief points of interest in the case was the singularly rapid progress the patient made, under tuition, in the re-acquirement of articulate speech. I think no case could have more clearly demonstrated the utility of the Physiological Alphabet as a means

of tuition. We did not trouble the patient with the *names* of the letters, but taught him from the beginning the *letter-sounds* of the physiological alphabet. In doing so, we adopted what may be called the "Mother's Method." Beginning with the Labials, we taught him to say *papa*, *apap*, *appa*, thus giving him the consonant *P* as an initial, a terminal, and a mid-letter. Then we taught him to say *baba*, *abab*, *abba*; then *mama*, *amam*, *amma*; then *wee wee*; and so on throughout the alphabet. He was shown by "lip-reading" how to place the lips, tongue, etc., for the pronunciation of each letter-sound. Being an intelligent and diligent pupil, he soon was able to go over the whole of the letter-sounds in this triple fashion, from one end of the alphabet to the other, by heart, without looking at the paper. We then supplied him with the children's books known as the "Little Primer" and the "Little Reader;" and often, afterwards, we would find him in the side-room by himself, carefully reading aloud from his primer such little sentences as "I have a cat," "he has a dog," etc. At the beginning of January 1893, when he left the Infirmary, he could say anything he wished to say, almost without a mistake in articulation; although he still spoke carefully, slowly, and word by word,—in *staccato* fashion. His writing and spelling had also greatly improved. When I last saw him—July 26th, 1893—there was still something of this character in his speech, but the patient had made much progress since leaving the Infirmary in January.

I asked the patient whether at any time since the seizure he had ever experienced difficulty in forming words in his mind. I asked him to consider this question carefully, and reply to it in writing. Here is his reply, dated December 3rd, 1892:—"With regard to my forming words in my mind, i could always form them in my mind but trouble was in getting them out i could not get them out at all and after makeing all the signs i could think of to my friends if they could not understand me i would have to take paper and a pencil and write it down for them."

On October 17th, he wrote, "When i came in here i could only say yes and no that was all i could say, but now i could say very neare any thing if i could take time."

It is not my intention to enter into any discussion as to the probable nature of the cerebral lesion in this case. From the facts stated, the reader can form his own theory; but I may say that

my own impression is that the cause of the paralysis and aphasia was probably embolism in a branch of the Sylvian artery. It is one of those exceptional cases of motor aphasia in which the patient retains the power of expressing his thoughts in writing, there being little or none of that amnesia verbalis which is usually associated with motor aphasia. The patient could call up words in his mind quite easily, only he could not articulate them. How was it that the power of calling up words in the mind was retained? We have already seen that the retention of this power may possibly be explained on any one of three hypotheses:—(1.) The lesion in Broca's area may have been a sub-cortical one, leaving the grey matter of the cortex unaffected, and cutting across only the motor tract for spoken speech. (2.) The areas *b* and *c d* may have been destroyed, whilst the area *a*, in the foot of the third frontal, was left intact. (3.) The whole of Broca's area may have been destroyed, but the patient, if strongly *auditif*, may have been able to recall the words by reviving their vivid auditory images. I leave the reader to take his choice of any one of these three hypotheses. For my own part, I am inclined to prefer the second. If the lesion was of embolic origin, it was almost certainly cortical; and if cortical, it evidently extended into the motor regions *b* and *c d*, the centres of the articulative organs, because the face was slightly pulled to one side, and the tongue, when protruded, deviated slightly towards the side paralysed. In the present state of our knowledge of the functions of the various parts of Broca's area, we can form no very distinct opinion; but I am inclined to think that the motor images or pictures, presumably stored at *a*, in the foot of the third frontal, were intact, but could not be exteriorised or executed on account of the destruction of the executive cells at *b* and *c d*. The re-education of the patient perhaps enabled him to execute them by means of the executive area in the convolutions of the opposite side.

It should be noted that, in this case, the absence of amnesia verbalis made the education of the patient exceptionally easy. There is, indeed, every reason to believe that the patient's own efforts at articulation would naturally, in the course of a year or two, have led to restoration of speech. But no one who watched the case from day to day could doubt for a moment that the progress of the patient was greatly accelerated by his use of the

physiological alphabet. By its aid, he learned in a wonderfully short time to master all the articulate sounds of which speech is composed, and to combine them correctly, so as to articulate the words he could so easily call up in his mind. In relation to the Education of cases of motor aphasia, I think the case of interest; and I offer it as a contribution to that subject.

Conduction Aphasia (the Leitungsaphasie of Wernicke).

Auditory aphasia is, as we have seen, produced by lesion at the auditory centre A, and motor aphasia by lesion at the motor centre B. I now propose to say a few words about the variety of aphasia which results when a lesion is so situated as to cut across the conducting fibres which extend between A and B, and keep these two centres in physiological connexion. In crossing from the first temporal to the Broca's convolution, these fibres must necessarily pass under the floor of the Fissure of Sylvius, and under the Island of Reil. A softening or other lesion in the floor of the Sylvian Fissure, or in the Island of Reil, is therefore very apt to cut them across.

The variety of aphasia which results from such a lesion was first described by Wernicke, in his original paper of 1874.[1] Its peculiarity is that, whilst, on the one hand, there is no word-deafness, and, on the other hand, no asynergic difficulty of articulation,—both auditory and motor centres being intact,—there is marked Paraphasia. The patient, in expressing himself, uses wrong words, and especially wrong nouns, because, the connexion between A and B being broken, the motor images are deprived of the important guidance in the choice of words which is normally given to them by the auditory images. Wernicke (*Op. cit.*, p. 26) says, "The patient understands everything, being thus quite unlike a patient suffering from the form of aphasia [the auditory] just described. He can also say everything, but the choice of the right words is disturbed in the same way as it is in the form just described. The sound-image is here indeed intact, and it is also in normal relation with the other sense-images which go to form the percept; but, as the connecting path is interrupted, it cannot throw

[1] *Der Aphasiche Symptomencomplex*, p. 26.

into the scale its important influence in directing the choice of the motor images." In another important paper, published in 1886,[1] the same observer says, "Conduction aphasia is characterised chiefly by its negative symptoms. Where no sensory and no motor aphasia is present, but where, in speaking, there is Paraphasia, the erroneous use of words, we have got to deal with disturbed conduction between the centres A and B."

One of the best cases of conduction aphasia yet published has been put on record by Lichtheim. I may here insert a brief note of it.

Case of Conduction Aphasia (Lichtheim, *Brain*, 1885, p. 445).—A man, aged 46, admitted into hospital at Berne on the 3rd of April 1883. No history of his illness could be obtained. Slight paralysis in right arm and leg and in right side of face. Sensation normal. Understanding of spoken speech and of printed and written speech unaffected. In production of speech, exhibits marked paraphasia. "When asked to relate his history, he strings together, in a fluent manner, numerous words of which scarcely one now and then can be made out. The following were noted: 'Evening, five and twenty, and.' Patient is aware of the incorrectness of his diction, and tries to assist himself with gestures. He succeeds better with short words and answers. Thus in answer to the question, 'What was there for supper?' he answered, 'Bread, meal, potatoes,' with only two mistakes. His own name he mutilates." . . . . "His writing is very imperfect. He mixes up the order of letters in a word; and usually stops after an attempt of short duration."

As to repeating and copying. "When he repeats connected sentences he manifests the same defects as in volitional speech; single words are pretty correctly rendered." . . . . "He can copy what is set before him with absolute correctness."

At the autopsy the chief lesion was a softening with depression in the Island of Reil and the floor of the Sylvian Fissure.

A point brought out in this case is, that besides being present in his volitional speech, the Paraphasia was also present in sentences *repeated* to dictation. The Paragraphia should also be noted;

[1] *Fortschrift der Med.*, 1886, i. p. 377.

but Lichtheim says that volitional writing was not sufficiently tested.

There seems, on the whole, to be little to distinguish this form of aphasia from a case of auditory aphasia in which the word-deafness has already been recovered from, but the amnesia verbalis and paraphasia persist. The absence of word-deafness *from the beginning*, in conduction aphasia, would seem to be the chief point of difference.

CHAPTER XII.

Aphasia in relation to Organic Diseases of the Brain—*Continued.*

Visual Aphasia.[1]

I now come to consider the effects of lesion in the centre C, in which are stored the visual memories of letters and words, written and printed.

The centre C (Fig. 7) includes the Angular Convolution, which

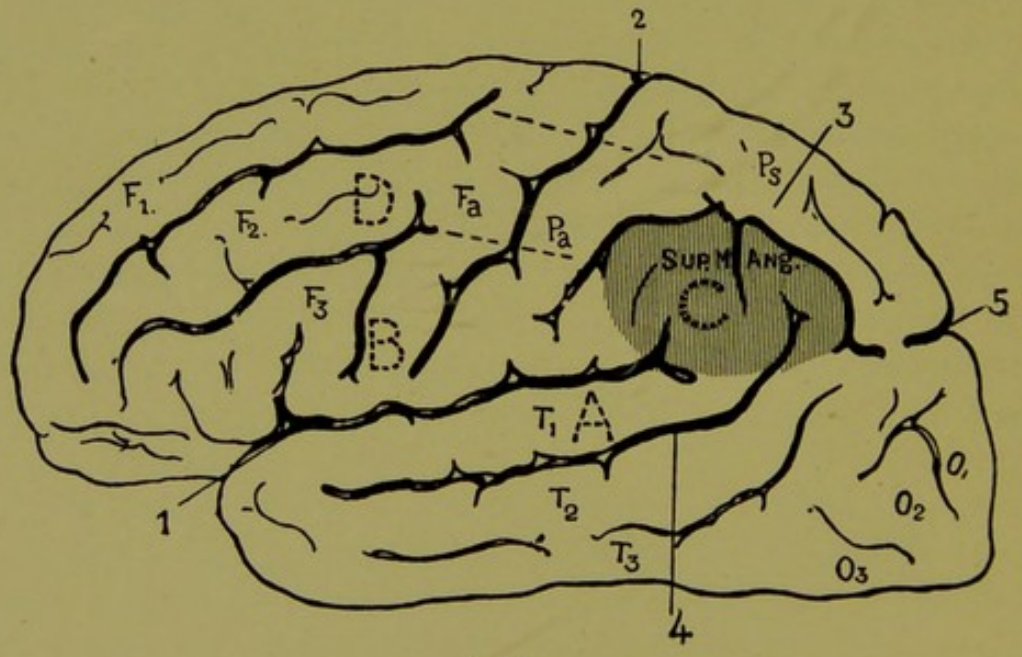


Fig. 7.

curves over the posterior extremity of the First Temporo-Sphenoidal Fissure, and the Supra-Marginal Convolution, which curves over the posterior extremity of the Sylvian Fissure. Of the

[1] I use the term Visual Aphasia in preference to Word-Blindness, because, as we shall see, destruction of the centre C causes not only Word-Blindness but also Agraphia.

two convolutions, the Angular constitutes the more important part of the centre. Both convolutions belong to the inferior part of the Parietal Lobe, and both are supplied with blood by the Sylvian artery.

It is now universally admitted that destruction of the centre C produces Word-Blindness, with consequent annihilation of the power of reading (alexia). This is its well-known effect upon the Reception and Interpretation of written and printed speech. But what is its effect upon the Production of written speech?

There are upon record many cases of word-blindness in which the patient, utterly unable to read—unable to read even his own handwriting,—could yet *write* fluently and correctly. There are, however, other cases in which the word-blind patient was also agraphic, being able to write little or nothing correctly. Until recently, it was supposed that when the word-blind patient could write correctly he could do so because much previous practice in writing had imprinted the motor images of writing so securely upon the graphic-motor centre at D that these motor images sufficed for purposes of writing, though all guidance from the visual images at C had been lost, owing to destruction of this, the visual word-centre; and, on the other hand, when the word-blind patient could *not* write, it was supposed that the graphic-motor images at D had not been sufficiently well imprinted by practice to enable them to act independently.

But recent observation has thrown a new light on the subject. It has recently been shown quite conclusively that the visual images at C are, in all cases, important, not only for the reception and interpretation of written and printed speech, but also for the production of writing. It has been shown, in fact, that when the centre C is destroyed the patient can neither read nor write. As to reading, he is word-blind; as to writing, he has Amnesia Literarum, and therefore cannot call up in his mind the visual images of letters and words required for purposes of writing. It is now considered to be improbable that the graphic-motor images at D can in any single case be so strongly imprinted as to suffice for the act of writing, independently of any guidance from the visual images at C.

How, then, are the cases of pure Word-Blindness without Agraphia—in which the patient can write correctly, though he cannot read even that which he himself has written—to be

accounted for? It is now believed that in these cases the visual word-centre C remains intact, and that so, also, do the pathways for the influences by which it is acted upon *from within* when words, revived in the mind, are being translated into writing; but that, on the other hand, the pathways along which, as we shall see presently, influences pass from the primary visual centres, in the two occipital lobes, to the visual word-centre C, in the angular and supra-marginal convolutions, are cut across, so that the word-images in C, though they can still be revived *from within*, can no longer be reached and revived by impressions coming to them *from without.*

Destruction of the visual word-centre C, therefore, causes both word-blindness and agraphia; but the cutting off of the visual word-centre C from the primary visual centres in the two occipital lobes causes simple word-blindness without agraphia.

The reader may remember the interesting discussion that, some years ago, was carried on by Ferrier and Munk, as to the localization of the cortical centre for vision. Ferrier originally held that it was in the Angular Convolution, and Munk that it was in the convolutions in the posterior part of the Occipital Lobe. Clinical and pathological observation is now leading up to the conclusion that both observers were partly right. The subject cannot yet be said to be fully investigated or made clear in all its relations, but everything tends to show that the occipital lobe, especially its posterior extremity, and its inner surface in the neighbourhood of the Cuneus and Calcarine Fissure (see Fig. 12), is the centre for *primary visual impressions*, and that the Angular Convolution and its neighbourhood form a centre of a higher nature, one of whose functions seems to be the *storage* of the visual images of things and of words.

It is now quite established that the primary visual centre in each occipital lobe is connected with both eyes; and that it is connected, not with the whole, but only with the half of the retina in each eye—the lateral half on the same side of the head as itself. Therefore destruction of the primary visual centre in the occipital lobe causes Homonymous Hemianopsia; that is to say, it renders the patient blind in half of his field of vision, the right or left half as the case may be; this half-blindness being termed "homonymous" because it is on the same side in relation to both eyes.

It will be remembered that, in passing backwards to form images on the retina, rays of light cross within the eyeball. When our eyes are directed straight forward, rays of light coming from an object in the right half of the field of vision cross over and form an image of the object upon the left half of the retina. If this left half of the retina be blind in both eyes, it is thus the objects to the right of the patient that are invisible to him; and, as it is the *left* half of the retina that is blind when the primary visual centre in the *left* occipital lobe is destroyed, the patient, in such a case, has *right* homonymous hemianopsia. In other words, the law is that destruction of the primary visual centre in the occipital lobe causes homonymous hemianopsia in the *opposite* half of the field of vision.

Destruction of the higher visual centre at C, causing, as already said, both word-blindness (alexia) and agraphia, does not, according to recent observations, cause hemianopsia. Concentric contraction of the field of vision in both eyes, but most marked in the eye of the opposite side, seems to be often associated with it; but even this is not proved to be a necessary consequence of it. If, however, the lesion at C penetrates deeply into the subjacent white matter, it will cut across the "Radiation of Gratiolet"—a band of white fibres passing backwards to the primary visual centre in the occipital lobe, and forming part of the pathway between the retina and that centre,—and will produce homonymous hemianopsia as effectually as a lesion of the primary visual centre itself would. In such a case, the symptoms would be word-blindness, agraphia, and homonymous hemianopsia.

The last point of importance to be noted is, that this higher centre at C is in relation not only with the primary occipital centre of its own side, but also with the primary occipital centre of the opposite hemisphere. It follows that a lesion of the primary occipital centre on the same side, causing hemianopsia, does not cut off the higher centre C from incoming impressions, and does not render the patient word-blind. In order that the higher centre be rendered word-blind though itself intact, it must be cut off from its connections with *both* occipital lobes, by a lesion which cuts across the fibres coming to it from each of them.

To sum up these rather complicated conclusions, it may be said, —(1.) That destruction of the higher visual word-centre C causes both word-blindness and agraphia. (2.) That destruction of C,

causing word-blindness and agraphia, does not also cause hemianopsia if the lesion is limited to the grey matter; but that if the lesion penetrates deeply into the subjacent white matter and cuts across the Radiation of Gratiolet it does also cause hemianopsia. (3.) That a lesion in the primary visual centre in the left occipital lobe causes right homonymous hemianopsia, but does not render the patient word-blind, because the higher centre at the angular convolution is still in connexion with the primary visual centre in the right occipital lobe. (4.) That a lesion in the white matter of the occipital lobe so situated as to cut across the fibres passing forwards from both occipital lobes to the left angular convolution renders the patient word-blind but not agraphic. As such a lesion necessarily involves also the Radiation of Gratiolet, the patient has at the same time right homonymous hemianopsia.

There are thus in practice two classes of cases of word-blindness to be met with,—(1.) The cases in which the patient is at the same time agraphic; such cases being due to destruction of the centre C (2.) The cases in which the patient, though word-blind, is not agraphic; such cases being due to a lesion in the white matter of the occipital lobe, which has severed the fibres connecting the centre C with both of the primary visual centres, in the two hemispheres.

It is especially to the recent work of two observers, Dejerine and Sérieux, that we owe this clear distinction between these two classes of cases of word-blindness. They have put upon record a series of cases so complete and convincing that the distinction between the two classes of cases may be regarded as established. In bringing these new observations under the notice of the reader, I cannot do better than insert here the diagram employed by Dejerine to illustrate the connexion of the eyes with the primary visual centres, and, through them, with the higher visual word-centre C.

An examination of this diagram (Fig. 8) will enable the reader to understand quite easily the relation of the eyes to the primary visual centre in the occipital lobe. In the diagram, the left optic tract and its connexions are, for the sake of distinctness, given in deep black. The reader will, on looking at the diagram, at once understand how section of the left optic tract, B O, would produce homonymous hemianopsia in the opposite half of the field of

vision. He will also see that the same effect would be produced by a lesion further back, either in the Optic Thalamus, in the

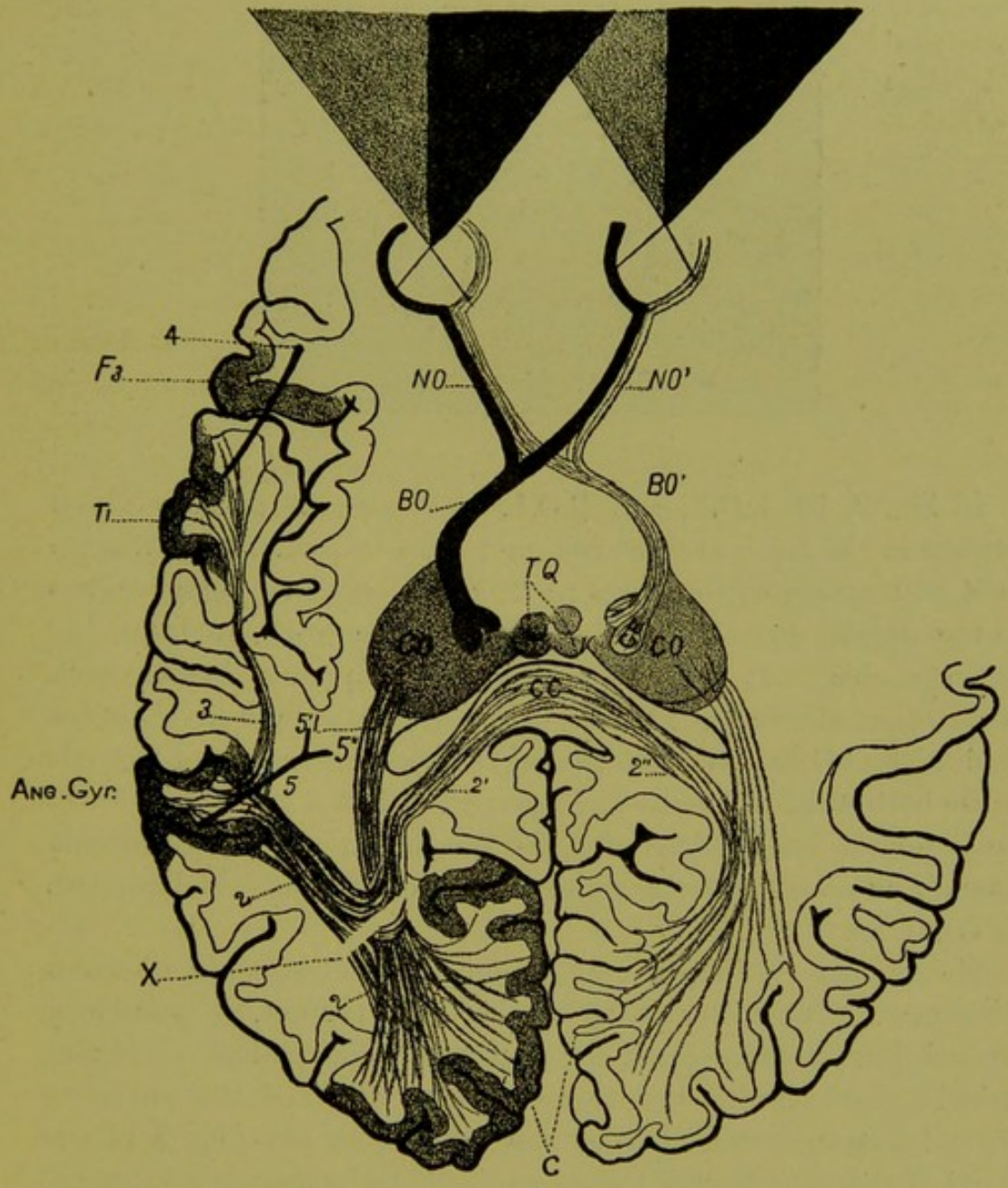


Fig. 8.—(After Dejerine.)

Radiation of Gratiolet, or in the Primary Visual Centre itself. But he will note that word-blindness will not, in any of these cases, be added to the hemianopsia, unless the lesion be situated at about X, and so cut across not only the fibres which connect the angular convolution with the left occipital lobe, but also those which connect it with the right one.

Perhaps additional clearness will be arrived at from the study

of the following diagram, Fig. 9, which is merely Fig. 3 repeated, with the addition of the dotted lines and circles.

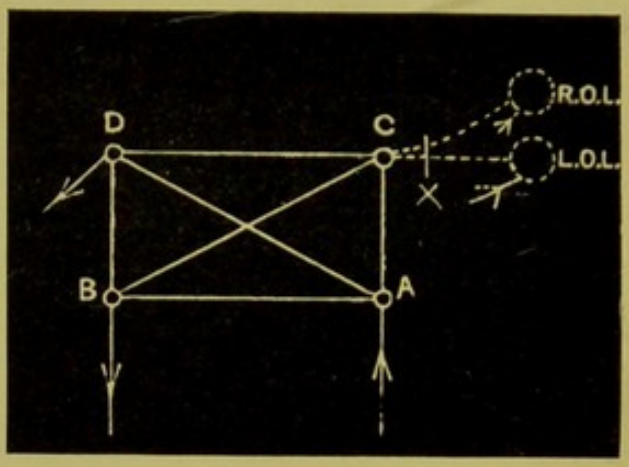


Fig. 9.

In Fig. 9, let L.O.L. and R.O.L. represent the primary visual centres in the left and right occipital lobes respectively. A lesion at X will cut across the fibres passing forward from these centres to the angular convolution C. It will cause word-blindness, but not agraphia. It will also cause homonymous hemianopsia, because, as shown in Fig. 8, such a lesion always involves the Radiation of Gratiolet. On the other hand, destruction of C would cause both word-blindness and agraphia. But it would not cause hemianopsia unless (see Fig. 8) the lesion penetrated deeply enough into the subjacent white matter to cut across the Radiation of Gratiolet.

Hemianopsia is thus a very common accompaniment of word-blindness. Whenever word-blindness is present, it should be looked for. It can easily be detected. The patient should be asked to look steadily into the physician's eye, and the physician should then make a flickering movement with the fingers of one hand at the periphery of the patient's field of vision, and bring the fingers, thus in movement, gradually inwards towards the centre of the field of vision. If there is hemianopsia, the patient will not see the moving fingers on the blind side until they have reached the middle of the field of vision, and are directly in the line between the physician's eye and his own. For the more exact demarcation of the field of vision in such cases, the Perimeter or the Campimeter should be used.

I now proceed to give examples of these two classes of cases, in

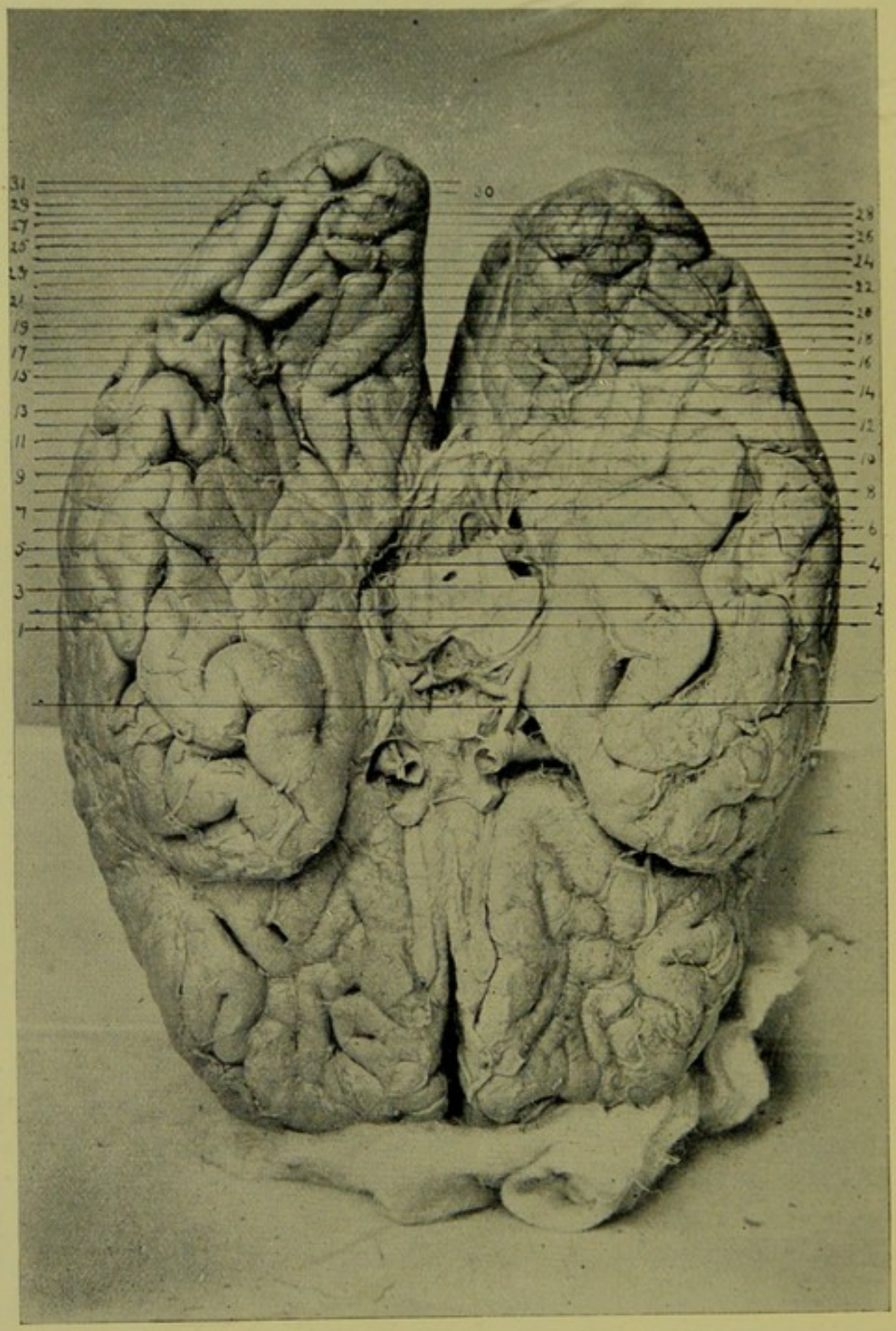


FIG. 10.—Brain of Case II., from a Photograph by Dr Middlemass.

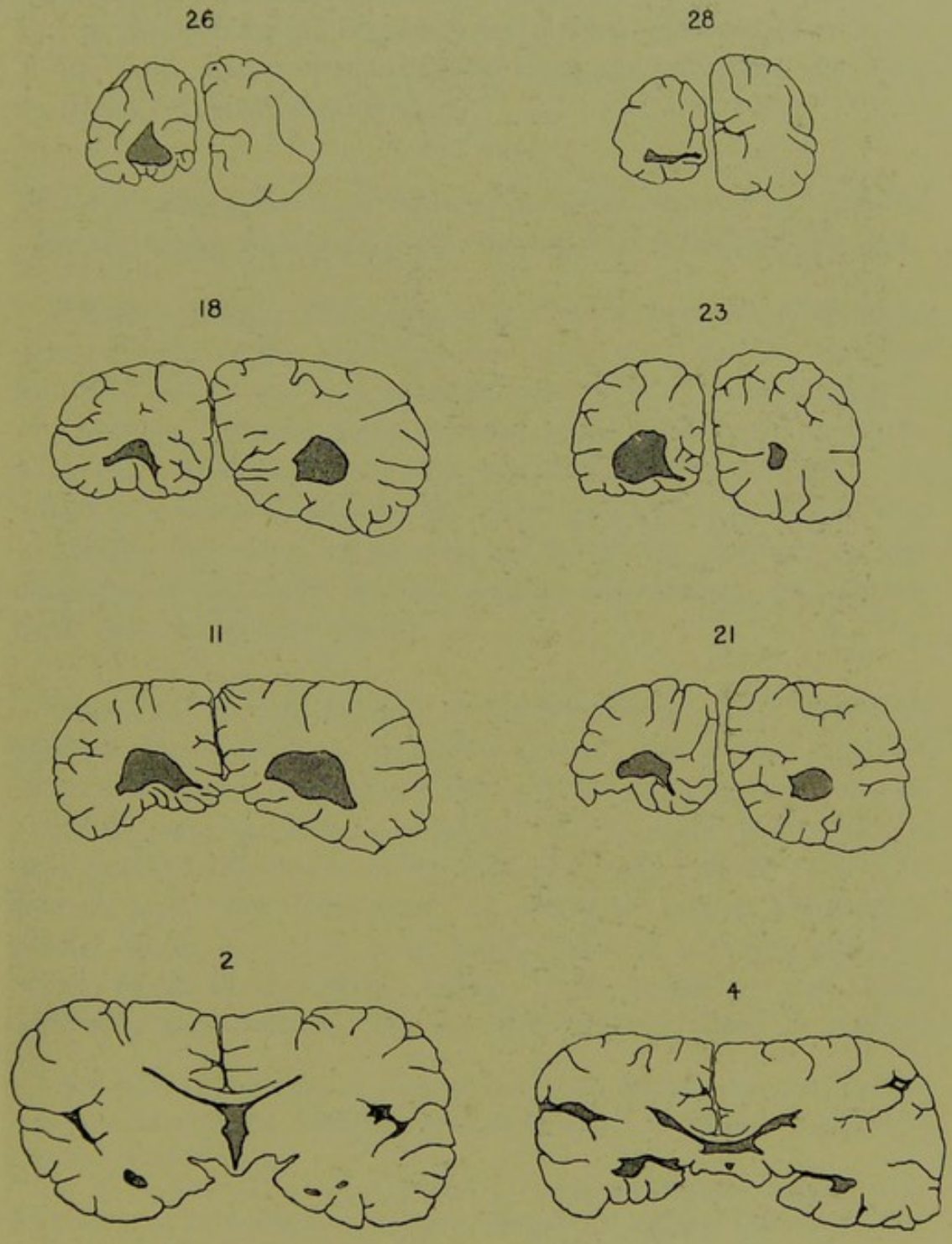


FIG. 11.—Sections of the Brain of Case II., drawn by aid of the camera lucida, showing atrophy of the left occipital lobe, and enlargement of the posterior horn of the lateral ventricle. In the Photograph (Fig. 10), the position at which each section was made is indicated by the corresponding number and line.

which word-blindness is the symptom common to both. First, I shall take the cases in which the visual word-centre C is intact, but is cut off from impressions coming from without, by a lesion in the white matter of the occipital lobe; and, secondly, the cases in which C is itself destroyed.

Word-Blindness from such lesion in the white matter of the occipital lobe (at X, *Fig.* 8) *as cuts off the centre C from incoming influences.*

It will well repay the reader to look up for himself the excellent series of cases of this kind that have been published by Dejerine and Sérieux.[1] I can only afford to insert here a short account of one of them. But the one that I shall select is in itself a very complete one. It shows, in the first part of the patient's history, the effects of a lesion situated in the white matter of the occipital lobe (at X, Fig. 8), and then, afterwards, the effects produced by the extension of that lesion into the angular convolution, and accordingly into the centre C itself.

Case I. (Dejerine, *Comptes Rendus des Séances de la Société de Biologie*, March 1892, p. 64.)—The patient was a man aged 68. After a number of attacks of tingling in the right leg and arm, he suddenly perceived that he could not read a single word; but he still retained the power of writing, and indeed could write with perfect ease. For four years, he remained in this condition—totally word- and even letter-blind, but able to write correctly whole pages of manuscript, though quite unable to read them after they were written. He had also lost the power of reading

[1] The following is a list of some of the papers by Dejerine and Sérieux, lately published in the *Comptes Rendus de la Société de Biologie* at the dates mentioned below:—

M. J. Dejerine.—(1.) "Contribution à l'étude de l'aphasie motrice sous-corticale et de la localisation cérébrale des centres laryngés (muscles phonateurs)," 6th March 1891. (2.) "Sur un cas d'aphasie sensorielle (surdité et cécité verbales) suivi d'autopsie," 20th March 1891. (3.) "Sur un cas de cécité verbale avec agraphie, suivi d'autopsie," 27th March 1891. (4.) "Contribution à l'étude des troubles de l'écriture chez les aphasiques," July 1891. (5.) "Des différentes variétés de cécité verbale," March 1892.

P. Sérieux.—(1.) "Sur un cas d'agraphie d'origine sensorielle," 11th Dec. 1891. (2.) "Cas de cécité verbale avec agraphie," 16th Jan. 1892.

musical notes, though he could still sing well. He retained the power of reading figures, and could do mental calculations as well as formerly. He had right homonymous hemianopsia.

Ten days before his death, he became suddenly affected with very pronounced paraphasia, and with *total agraphia;* without, however, any paralysis of motion or loss of consciousness. There was no trace of word-deafness; and he retained his intelligence to the end. He died suddenly.

At the autopsy, there was found,—(1.) an old lesion, a softening which had destroyed the cuneus and some of the neighbouring convolutions of the occipital lobe, and had extended deeply into the white matter, so as also to cut across the fibres passing from the right occipital lobe to the angular convolution. This lesion accounted for the long-standing word-blindness without agraphia, and for the hemianopsia. (2.) A recent lesion, viz., a softening of the angular and supra-marginal convolutions, which accounted for the recent appearance of agraphia and paraphasia; the paraphasia being, no doubt, due to a disturbance of the neighbouring auditory word-centre A. The case is thus in every way a most instructive and complete one.

Among the cases of word-blindness which have come under my own observation, I have had two in which the patients were under my observation for years, and in which I had opportunities of examining the brain *post-mortem*. In both cases, there was extensive disease of the occipital lobe. Along with word-blindness, they both presented well-marked hemianopsia. As a contribution to the subject, I now proceed to make a short record of these two cases.

Case II. (Personal observation.)—J. S., æt. 72; clerk of works; appeared as an out-patient at the Royal Infirmary on December 12th, 1889.

The patient, who was a man of fine physique, had enjoyed good health until August 1885. He then, at the age of 68, began to suffer from symptoms referable to his nervous system. These included loss of power in the right hand and the left foot, with some muscular wasting and distinct impairment of sensibility in them. He had at the same time some pain in the back of

the head; and he suffered occasionally from giddiness, being apt to stagger if he turned sharply in walking. On account of these symptoms, he had been a patient in my Wards from November 11th till December 1st, 1885; but, though I have full notes of this illness, I need not here give further details. I shall only say that he recovered the power in the hand and foot. On leaving the Infirmary, however, he found himself unable to resume his former occupation as clerk of works. He felt that he had no longer sufficient mental energy for it. He therefore, after this time, maintained himself by collecting accounts for mercantile men. He found himself quite able to do this, as his powers of reading and writing and of making up accounts were as yet apparently unimpaired.

On the 12th of December 1889, he called at the Infirmary to inform me that about six weeks previously he had had a severe seizure. About midday, when he was walking in the street, he had suddenly felt giddy and inclined to fall, everything appearing to swim before his eyes; but, after supporting himself upon a railing for half an hour, he had begun to feel better, and, though still light in the head, had been able, slowly and with difficulty, to walk home. Ten days after this seizure, he began to feel the whole right side of the body cold and heavy; the difference of sensation in the two sides being so marked that, to use his own expression, he felt as if a plumb line down the middle of the head and trunk had divided him into two halves. The tactile sensation in the right side seemed to himself to be blunted; but objective examination at the Infirmary, some weeks afterwards, did not confirm this impression. It was at this time, ten days after the seizure, *that he discovered that he was word-blind.* He could not read even his own name. At first, he was even letter-blind; but, before coming to the Infirmary on the 12th of December, he had recovered sufficiently to be able to recognise the *letters* individually, though he could read no single word without first spelling it.

Examination of the eyes at this time showed typical right Homonymous Hemianopsia, with marked contraction of the remaining left halves of the fields of vision. The contraction was so marked that the patient saw things as if looking at them through a tube. Though word-blind, the patient was not agraphic. He continued, indeed, to write a remarkably good business hand; and he made very few mistakes in spelling, such as he did make being

evidently due, not to his cerebral condition, but to defective education. Although he expressed himself in writing with ease and fluency, he could read the writing only word by word, after spelling each word letter by letter.

As to spoken speech, the patient expressed himself with great liveliness and volubility, being never at a loss for a word, except in the case of proper names, which he was apt to forget. There was no forgetfulness of the names of things, and no paraphasia. His intelligence seemed very good; but he complained of a sense of confusion in his head, "as if a cloud were over his mind;" and this feeling, together with his word-blindness, had made him quite unable to continue his occupation of collecting accounts.

After the date of this examination (December 12th, 1889) the patient continued to reside at his lodgings for some months, calling occasionally to report himself at the Infirmary. He then became affected with gangrene of the great toe; and, as this deprived him of sleep, he became delirious at night, and so unmanageable that it was necessary for his friends to have him removed to the hospital of St Cuthbert's Workhouse. He was afterwards transferred to the City Workhouse; and there, eventually, he died of hepatic disease with jaundice, on the 23rd of January 1893.

A post-mortem examination was made by me two days after the patient's death, and the brain was committed for examination to Dr Middlemass, Pathologist to the Royal Edinburgh Asylum, whose report I now append.

Pathological Report by Dr Middlemass.—"An examination of the brain showed that there was no gross lesion except on the under surface. When it was turned over, and the cerebellum removed, there was seen to be a considerable amount of atrophy of the convolutions on the under surface of the occipital lobe on the left side. There was some falling in of the convolutions in the centre, and on palpation there was slight fluctuation to be felt, as if the posterior horn of the ventricle were dilated. The arrangement of the convolutions was quite different from that usually described and from that of the other side. They were smaller and appeared to be more numerous, and there was a considerable amount of atrophy. Whether the arrangement of the convolutions was due to the atrophy or not, it was impossible to say absolutely.

"The brain was hardened as a whole, and subsequently transverse sections were made to ascertain the exact nature and extent of the atrophy. As a result of these, it was found that there was a softening of the white matter in the floor of the posterior horn of the left lateral ventricle, due probably to the blocking of one of the branches of the posterior cerebral artery. This softening was not of the usual kind in which both white and grey matter alike suffer, but, as sometimes happens, especially in softenings involving the walls of the ventricles, it affected the white matter only. This had degenerated and become gradually absorbed, and as a consequence the horn of the ventricle had become dilated to compensate for the loss of solid material. The grey matter of the convolutions had been left, though in a somewhat atrophied condition, and their form was reproduced in the floor of the ventricle, but exactly the reverse of their appearance on the external surface. A microscopic examination of these convolutions in the fresh condition it was not possible to make, as it was desired to harden the brain as a whole. But an examination of similar conditions in other cases makes it certain, that, though the convolutions preserved their form in a general way, they were functionally inactive, their central connexions being cut off, and the nerve elements degenerated. An investigation of the sections of the brain showed that the atrophy extended from the tip of the under surface of the occipital lobe, where the dilated posterior horn reached to within an eighth of an inch of the surface, as far forwards as the middle of the crura cerebri. That is to say, the convolutions affected were those designated median and lateral occipito-temporal (Ecker) or lingual and fusiform lobules, together with the posterior half of the gyrus hippocampi. There was no affection of either Broca's convolution or the angular gyrus."

Dr Middlemass photographed the brain, and made a large number of transverse sections of the occipital lobe. Of each section he made an exact drawing by aid of the camera lucida. I am sorry I cannot publish copies of all of these drawings, but I have made a selection of eight of them (see Fig. 11). In each case the exact position at which the section was made is indicated by its number and the corresponding number and line on the photograph, which I also reproduce (Fig. 10). From these sections, the reader will observe how much the posterior horn of the left lateral ventricle

was enlarged, and how markedly the white matter around it, and especially that beneath its floor, was atrophied. In the photograph, the atrophied condition of the convolutions at the tip and along the inferior surface of the occipital lobe is fairly well exhibited; but I may say that in the photograph this appearance is not so striking as it was in the actual brain.

There can be little doubt that in this case the extensive disease of the white matter of the left occipital lobe had involved the fibres connecting the angular convolution with both occipital lobes, thus causing the word-blindness. The lesion also involved both the Radiation of Gratiolet and the primary centre for vision in the cortex of the left occipital lobe, thus causing the hemianopsia.

Case III. (Personal Observation.)—A much-respected professional man, aged 70. Had been engaged in active work in South Africa till thirteen years before the beginning of his illness, when he had retired and settled in Edinburgh. During these last thirteen years, he had continued to enjoy his usual excellent health, except that on ten or twelve occasions he had experienced attacks of giddiness, sufficiently marked to make him stagger, and cause him to support himself with his stick for a moment. It was observed also that, for three or four years before the beginning of his illness, he had, in his walk and carriage, been showing evidence of advancing age.

On Saturday, the 22nd of September 1888, the patient had fatigued himself a good deal with walking; but in the evening he seemed in his usual health. Next morning he awoke with a dull headache; and, feeling ill, he remained in bed nearly all day. On the third day, he seemed a good deal better, and went out for a short time, but still felt unwell. On the fourth day, he was decidedly worse, and kept his bed. It was now observed that when he was taking his food he did not direct the movements of his right hand properly. The expression of his face also showed his friends that he was seriously ill. I was therefore sent for, and saw the patient in the afternoon. I found him suffering from slight motor hemiplegia, with considerable anæsthesia, on the right side, and with well-marked and typical right homonymous hemianopsia. At this time, and for several weeks afterwards, the patient was much confused in his mind, especially during the

night, having delusions about being away from home, etc., and being much troubled with nightmare in his sleep. But he gradually improved, and by about the end of November was able to sit up a little daily.

On the 4th of December, and during succeeding days, I made a pretty full note of his condition, doing it little by little, so as to avoid fatiguing him.

I found that the motor weakness on the right side had diminished notably, the outer circle of the dynamometer showing with the right hand a grasp of 70, as compared with 90 registered by the grasp of the left hand. The weakness in the right leg had also diminished, so that the patient, when out of bed, was able, though lame, to walk a few steps without assistance. The anæsthesia of the right side had almost completely disappeared. In the arm, however, there was still marked impairment of the muscular sense; so that when his eyes were closed he had great difficulty in guiding the movements of the affected right arm, when he was asked to touch, with the right hand, the left hand or the nose. The right homonymous hemianopsia continued to be as complete and typical as before.

Written Speech.—There was total Word-Blindness. The patient was not only word-blind, but also letter-blind. When the name Dugald was placed before him in large print, he could not make it out, but, as is curiously the rule in such cases, he did not hesitate to name each of the letters, though mistaken in every case. This is what he made of Dugald:

D u g a l d
K a n i o i

He was equally at fault with numerals, naming them as letters, thus—

1 2 3 4 5 6
i r e i u e

In like manner he translated the following algebraic symbols thus—

\+ × ÷
n e a

He could, however, interpret the meaning of pictures or drawings quite easily. I made him a sketch of a man's face, and asked him what it was. He could not recall the word "face," but said that it

was "a most determined Highlander;" and the face had a determined expression.

Unfortunately I did not test his power of *writing* sufficiently, as I was afraid of exhausting him. But I got him to write, with his somewhat weak right hand, his own Christian name. He did so in large and tremulous characters that are barely legible.

Spoken Speech.—There was no marked degree of word-deafness; but there was a slight degree of it, which was shown when the patient was tested with the names of concrete things. Thus, when I asked him to touch, as I named each part, his *nose, eyebrows, beard,* etc., he often made mistakes in what he touched. There was marked Amnesia of the names of persons and of concrete things. Thus the patient often failed to recall the names of his nearest relations, and could not name articles of furniture that were pointed out to him. In conversation, he was often arrested by this forgetfulness of nouns. Here is a little bit of my conversation with him. "How did you sleep last night?" "I got a sleeping thing late in the morning. It is making me heavier and useless. It looked very much to me last night as if there was a little modifying of the — Oh! I don't know how I can't name these things." "Have you any pain in your head now?" "No; there is a stupidness, and not so clear. Last night, was very stupid and dull." "Tell me what you feel as regards your speech." "It would be impossible for me to bring up the names of those articles that are used for acting upon speech. Could not name one of them. It is getting worse and worse."

Apart from the amnesia of nouns, there was no hesitancy in the patient's utterance; there was no stammering; and only now and again was there a slight thickness of speech (slurring) in pronouncing a word or syllable. With his total Word-Blindness and consequent inability to read any printed or written word, it was interesting to contrast the readiness with which he recognised words when they were spelt aloud to him. Shown the printed word *cat,* he made a mistake with every letter in spelling it; but when the letters were spelt aloud to him, and he was asked what it was, he said, "cat, of course," with the greatest readiness.

In this condition the patient remained for about four years,

totally word-blind,[1] and never attempting either to read or to write; and presenting some amnesia of nouns, in his conversation. With the exception of two periods of some weeks' duration, during which his mind was a good deal disturbed by delusions, he was perfectly rational; though intellectually he was no longer the man he had been before his illness. He lived quietly at home, and was able to sit up most of the day, and to go out for a drive in good weather. In the evenings, he was in the habit of hearing his sons say their Latin lessons over to him; and he could always correct them if they made a mistake. Throughout his illness, he was carefully attended by my friend Dr R. A. Lundie. He died of a pneumonic attack, on the 15th of October 1892, æt. 74.

The autopsy was conducted by Dr Leith, Pathologist to the Royal Infirmary, Dr Lundie and I being also present. On examination of the brain, it was found that the convolutions forming the speech centres A B C and D were normal in appearance, the angular convolution C being normal, like the others. The chief morbid appearances were found on the under surface of the occipital lobe. In his careful report, Dr Leith notes that they were exhibited chiefly in the Inferior Temporo-Occipital Convolution (4th Temporal), the Hippocampal Convolution, and the Collateral Fissure, and also in the Lingual Convolution, the anterior part of the Cuneus, and the Calcarine Fissure. In these parts, there was thinning of the cortex from atrophy. On section, Dr Leith found that beneath the atrophied cortex there was still greater atrophy of the white matter, this being so marked that at the region of greatest atrophy the remnant of the cortex came into direct connexion with the ependyma of the ventricular horn. At this region of greatest atrophy (the under surface of the occipital lobe, about the middle of the Inferior Temporo-Occipital or 4th Temporal Convolution), there was a marked depression on the surface of the brain about $2\frac{1}{8}$ inches in length, and from $\frac{7}{8}$ of an inch to an inch in breadth. This depression marked the situation of a kind of cyst-like cavity where the grey matter and the subjacent white matter had been almost entirely destroyed, so that the walls of the cavity were chiefly formed of pia mater on the one side and the

[1] His son tells me that the patient, on one occasion, two years after the beginning of his illness, made out a name upon a tombstone, though he was wrong in spelling the other letters of the inscription.

ependyma of the ventricle on the other. The Collateral Fissure was much widened, and its floor was formed, owing to the disappearance of the grey and white matters, by the ependyma of the ventricle. From a sketch made at the autopsy, and from Dr Leith's description, I have indicated in the following diagram (Fig. 12) the area in which the atrophy of the cortex was most

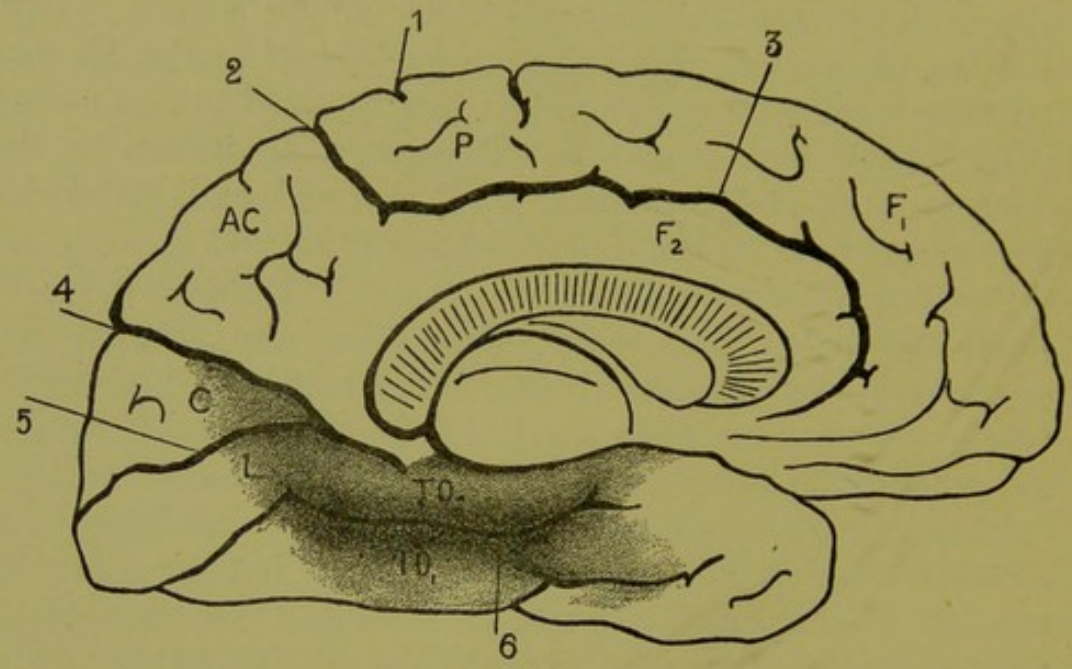


FIG. 12.—The shading shows the region of atrophy of the cortex and subjacent white matter. C, the Cuneus; L, the Lingual Convolution; TO_1, the Inferior Temporo-Occipital Convolution; TO_2, the Hippocampal Convolution; 5, the Calcarine Fissure; 6, the Collateral Fissure.

apparent. The area of deepest shading in the Inferior Temporo-Occipital Convolution indicates the situation of the marked depression where there was a cyst-like cavity beneath the pia mater.

Dr Leith could not detect any hæmatoidin crystals in the walls of the cavity, and he was inclined to think that the cause of the atrophy was not apoplexy but thrombosis of the bloodvessels. He was not, however, able to find any actual thrombus in a bloodvessel, the only morbid appearance observable in the bloodvessels of the brain being a slight thickening of their coats.

Here, then, is a second case of hemianopsia and word-blindness in which, as in the last, the lesion involved both the grey and the white matter of the occipital lobe; the region in which the atrophy was best marked being, as in the other case, the under surface of the occipital and temporal lobes.

In this last case, the lesion, though it did not involve the first temporal convolution, the centre for auditory word-images, had

evidently, by its proximity, disturbed the action of that centre sufficiently to produce the considerable degree of Amnesia Verbalis that was exhibited in the patient's speech, especially during the first months of his illness. The writing, unfortunately, was not sufficiently tested to enable me to say whether the visual word-images at the centre C were also disturbed in like manner; but, as the centre C appeared to be intact, we may reasonably conclude that the word-blindness was due to the cutting off of the centre C from incoming impressions, by the disease in the white matter. The slight motor hemiplegia was no doubt due to the disturbance of the motor centres caused by the proximity of the serious disease in the occipital and temporal lobes of the same hemisphere.

Word-Blindness with Agraphia, produced by Destruction of the Centre C.

In contrast with the three cases which I have already given, I shall now cite a case of word-blindness in which the lesion was situated, not in the occipital lobe, but in the angular convolution, and accordingly in the centre C itself. Several excellent cases of this kind have been put on record by Dejerine and Sérieux. I shall select a very typical one recorded by Sérieux; and I ask the reader to note (1) that in this case the word-blindness was associated with agraphia, and (2) that it was not associated with hemianopsia, because the lesion did not penetrate deeply enough into the subjacent white matter to cut across the Radiation of Gratiolet.

Case IV. (*Reported by* Sérieux *to the Soc. de Biologie*, 16th Jan. 1892. See *Comptes Rendus.*)—A female, aged 63, admitted into the Asylum of Villejuif on the 29th of Sept. 1891. Was intelligent, but had lost the power of reading and writing. Being anxious to regain the power of reading and writing, she practised much with her pen; but her efforts resulted only in such confused collections of letters as the following—these being, moreover, written badly—in a tremulous hand—"*an um aa monon mono muosi.*" The intelligence was normal, and there were no paralytic symptoms whatever. Vision was intact, and it is expressly stated that there was no hemianopsia. It was as impossible for the patient to read as

to write. She could, however, recognise a few of the individual letters [overflow of education into the other hemisphere?]; and when a word was composed of these she could sometimes spell it out and pronounce it.

Two months after her admission, she had an attack of apoplexy, with hæmorrhage into the ventricles, and died. At the autopsy, besides the recent extravasation of blood, there was found in the brain the old lesion which had produced the word-blindness and agraphia. This was a softening exactly circumscribed in the area now recognised as that for visual word-images, viz., the angular and supra-marginal convolutions.

Nothing could be more convincing than this case. It and the other cases of the same kind already on record prove conclusively that not only word-blindness (alexia), but also agraphia, is produced by a destructive lesion in the visual word-centre. And be it remarked that in such cases the patient cannot write with his left hand any more than he can with his right.

The case contrasts with Cases I. and II., in which with lesion in the occipital lobe, and with word-blindness and hemianopsia, the patient was not agraphic, because the visual word-centre, though cut off from the primary word-centres, and therefore word-blind, was still intact, and could, for purposes of writing, have its images revived from within. I hope I have said enough to make perfectly clear the distinction between these two varieties of word-blindness, — the one with, and the other without associated agraphia.

How some word-blind patients may be enabled to read.

It is a well-known fact that some word-blind patients, quite unable to read either words or letters on merely looking at them, can yet spell out words shown to them, if they make with the finger a tracing in the air of each individual letter. Charcot, Westphal, and others, have recorded many cases of this kind. By making such a tracing, these patients no doubt revive the graphic-motor images of the letters that are stored in the centre D. But if the centre C, with its visual images of the letters, is destroyed, it is doubtful if the revival of the graphic-motor images at D can, of itself, suffice to bring about this mental recognition of the letters.

It seems, on the whole, to be probable that the word-blind patients who are able to spell out words on thus making tracings of the letters belong to the category of those whose word-blindness is due, not to the destruction of the centre C, but to the cutting off of that centre from its connexions with the primary visual centres in the occipital lobes. In such patients, the revival of the graphic-motor images at D no doubt excites a revival of the corresponding visual images at C, and thus the mental recognition of the letters is rendered easy. The clear distinction between the two classes of word-blind patients has been made so recently that it is as yet impossible to say if in any case belonging to the class in which word-blindness is due to destruction of the centre C it is possible for the patient to spell out letters on tracing them in the air. It seems very probable, however, that all the patients who can thus spell out letters belong to the other class, whose word-blindness is due to the cutting off of the visual word-centre C from its connexions with the primary visual centres in the occipital lobes.

Mind Blindness (Psychical Blindness) sometimes associated with Word-Blindness.

In a few rare cases of word-blindness, experience has shown that the patient not only fails to recognise words when he sees them, but also fails to recognise familiar objects. He may, for example, mistake a basin for a chamber-pot, or a handkerchief for a towel; and on seeing an intimate friend he may fail to recognise him until he hears him speak. This condition is known as mind-blindness (*Seelenblindheit*, *cécité psychique*). Essentially, it is probably of the same nature as word-blindness. It seems, like word-blindness, to be due to the obliteration of images that have been stored in the higher visual centre. As the imprintation and storage of the images of *things* does not require such close attention as the imprintation and storage of *words*, the images of things are probably stored efficiently in both hemispheres of the brain. There is probably, however, in different brains, some variation in this respect; since a few cases of unilateral lesion have, I believe, been recorded in which a certain degree of mind-blindness (would not it be better to call it object-blindness?) seems to have been

present. We know, as yet, but little of the subject, and I shall therefore not enter into any detail about it; but I should like to make a short note of a very remarkable case of mind-blindness (object-blindness), associated with word-blindness, that has recently been put on record by Sérieux.

Case V. (*Reported by* Sérieux, *Comptes Rendus, Soc. de Biologie*, Dec. 1891, p. 195.)—A female, aged 62. Had a stroke in 1888, followed by temporary paralysis, and lasting troubles of vision. Had another attack in June 1890, with epileptiform convulsions, hallucinations of hearing, delirium, etc. When examined on the morning of the 16th of Dec. 1890, was found to be suffering from word-blindness and agraphia, and also from word-deafness and paraphasia. The intelligence was intact, except that there was marked mind-blindness (object-blindness). This was exhibited in the inability of the patient to recognise her nearest relations when they called upon her. She said the people about her seemed to be wearing masks, and that the nose was changed, etc. The figure of her daughter appeared to her to be "flat as a skate." This object-blindness, best marked in relation to faces, was also exhibited, in a less degree, in relation to other objects. She could recognise some of these, such as her fingers, a penholder, etc.; but she failed to recognise others,—apparently, for example, mistaking a comb for a penholder, and wiping it as such. After a period of some months, during which there was amelioration in all her symptoms, she died of a pneumonia. At the autopsy, a lesion was found in the cortex of each hemisphere. On the left side, there was a softening in the supra-marginal convolution, and also a limited patch of softening in the posterior extremity of the first temporal. On the right side, there was a large patch of softening involving the angular and supra-marginal convolutions, and also the posterior extremities of the first and second temporal convolutions.

This case is of great interest in relation to mind-blindness. It suggests that the visual images of objects are, as I have said they probably are, efficiently imprinted on the higher visual centres of both hemispheres, whereas, owing probably to the greater effort of attention required, the images of words are efficiently imprinted in the higher visual centre of only one of the hemispheres. But the subject has not yet been fully studied.

Visual Hallucinations apt to be associated with Hemianopsia when the Lesion is in the Cortex of the Occipital Lobe.

In concluding this chapter, I should like to say a word about an interesting phenomenon that has recently been found to be frequently associated with homonymous hemianopsia when that symptom is of cortical origin. Professor Henschen of Upsala, in his great work on *The Pathology of the Brain*,[1] directs attention to the fact that in cases of cortical origin of the symptom well-marked visual hallucinations (figures of men, etc.) may trouble the patient in the blind half of the field of vision. He gives in detail a number of cases in which these hallucinations were present. This is a good illustration of the law so strongly insisted upon by Bastian, and so frequently exemplified in practice, that lesions in the posterior parts of the brain are more apt to produce hallucinations and delusions than lesions in the middle or anterior parts.

[1] *Klin. und Anat. Beiträge zur Path. des Gehirns*, 1892.

CHAPTER XIII.

APHASIA IN RELATION TO ORGANIC DISEASES OF THE BRAIN—*Continued.*

GRAPHIC-MOTOR APHASIA. SUMMARY OF THE LEADING FEATURES OF THE DIFFERENT SIMPLE FORMS OF APHASIA. ADDITIONAL SIMPLE FORMS RECOGNISED BY LICHTHEIM AND WERNICKE. COMPOUND FORMS. METHOD OF CASE-TAKING.

GRAPHIC-MOTOR APHASIA.

THE graphic-motor centre D still remains to be considered. This centre is believed to be situated, as shown in the accompanying diagram (Fig. 13), at the posterior extremity of the second left

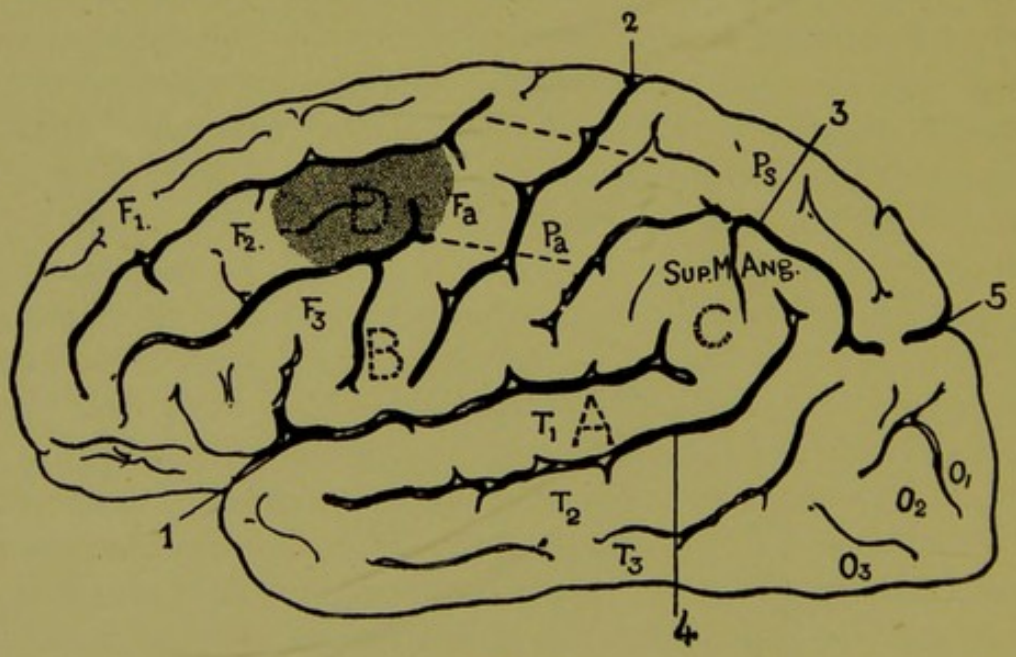


FIG. 13.

frontal convolution, immediately in front of the motor centre for the hand, which extends at the same level across both the ascending frontal and ascending parietal convolutions.

It is interesting to look back upon the gradual evolution of knowledge regarding the various form of aphasia, and to note the views that at different times have been held regarding the causation of agraphia. At first, the possibility of the existence of a special centre for the memories of the movements of writing seems scarcely to have been contemplated. The agraphia which was found to be so common an accompaniment of aphasia was supposed to be simply a necessary consequence of it. It was recognised as unreasonable to expect that words could be written, if, owing to amnesia verbalis, they could not even be remembered. We have already seen that opinion, in the present day, is coming round to this old view; which is now held to be a sufficient explanation of the agraphia in a great number of the cases presenting that symptom, though it is not supposed to be the proper explanation of it in all cases.

The next step in the evolution was the localization by Exner, in 1881,[1] of a special graphic-motor centre in the posterior extremity of the second frontal convolution, at D. It must be confessed that the facts adduced by Exner in favour of this localization are not very convincing; but nevertheless they afford a certain amount of evidence in favour of it. The localization proposed by Exner was accepted by various eminent writers on aphasia; and it thus came to be the fashion, for a time, to refer the symptom agraphia, in most cases, to destruction of this centre D. Lying, as it does, in juxtaposition with Broca's convolution, the centre D is, indeed, in a great number of cases of lesion of that convolution, found to be involved along with it.

But, within the last few years, much has been done to detract from the supposed importance of the centre D. In the first place, Wernicke directed attention to the fact that we can write not only with the right hand—with whose motor centre the centre D is in connexion,—but also with the left hand, with the elbow, with the right or left foot, and even with the teeth. It seemed to Wernicke that in the act of writing the *visual* images were the important ones; because, given a clear and distinct visual image of a word and its component letters, all that any movable part of the body to which a pencil can be attached requires to do, in order to

[1] *Untersuchungen über die Localization der Functionen in der Grosshirnrinde des Menschen*, 1881, p. 57.

produce the word in writing, is to make *a drawing* from that image. There can be no doubt that there is much truth in this doctrine. The fact that, as we have seen, the destruction of the visual centre C is destructive of the power of writing, is corroborative of it. But, though we grant the importance of the visual images at C in relation to writing, I do not think we should on that account imagine that the graphic-motor images at D are of no importance whatever. We should remember that the congenitally blind, who have no visual images at all, can yet be trained to write or print their names in ordinary characters.[1] Having no visual images, these congenitally blind persons must depend exclusively upon the psycho-motor memories of writing—the "kinæsthetic memories" of the act, as Bastian would term them. If, again, we compare, in our own persons, our facility in writing with the right hand with our awkwardness in writing with the left, we shall be able to realize how much more the right hand has learned to do than merely to *draw* the visual images revived within the centre C. When we write with the left hand or with the foot, we do, indeed, carefully and laboriously *draw* these visual images; but when we write with the right hand we utilize also the psycho-motor images that are probably stored at D. These are promptly revived by the visual images at C, and they are exteriorized or executed with the facility which comes of practice.

Nevertheless, it cannot be denied that the centre D has fallen, of late, from the position of high importance in relation to agraphia that it occupied in the opinion of writers on aphasia some years ago. The recent observations by Dejerine and Sérieux with regard to the centre C, and its relations to agraphia, have done much to diminish, in the current estimate, the importance of the centre D. Opinion, moreover, as we have seen, is coming round to recognise again the truth of the old view of Trousseau and others, that in a large number of cases of aphasia in which the patient cannot express himself in writing the agraphia is really due to the amnesia verbalis that attends upon aphasia, whether the lesion be at A or at B.

It would be interesting if we could have before us the record of a case in which a small and isolated lesion had destroyed the

[1] This, by the kindness of W. H. Illingworth, the Head-Teacher, I have been enabled to verify by personal observation at the Edinburgh Blind Asylum.

centre D, and it alone. A single case of this kind would show us definitely in what degree agraphia is produced by such a lesion; and it would show us, moreover, whether the agraphia thus caused is displayed only when the patient attempts to write with the right hand, or also when he attempts to write with the left. But, according to Dejerine,[1] no single case has yet been put upon record in which the lesion was thus strictly limited to the centre D. One case has indeed been put upon record, by Henschen of Upsala,[2] in which such a limited lesion had partly destroyed the centre D; but in that case there was also, in the same hemisphere, another limited lesion, which had destroyed, in like manner, the centre C. In all the other recorded cases in which autopsies have been made, it appears that the lesion destroying the centre D had also affected the centre B, or other neighbouring parts. We are left, therefore, to the doubtful evidence that has been furnished by cases in which there has been no autopsy. From such evidence, it is only permissible for us to guess that, when agraphia exists as an isolated symptom (without alexia or any trouble of spoken speech), the lesion may possibly be situated in the centre D. We shall be the more cautious, however, in coming to any definite conclusion, if we bear in mind what has been pointed out by Lichtheim,—that in motor or sensory aphasia with agraphia, when recovery takes place, the power of speaking is always restored before the power of writing; and that agraphia may thus, in such cases, linger as an isolated remnant of an aphasia due to lesion, not in D at all, but in A or B. Dejerine states that all the cases of apparently pure and uncomplicated agraphia that have hitherto been put on record appear to be really cases of this description. Let us take, for example, two of the best of them, which will be found detailed in a paper on this subject by Pitres;[3] the first being a case that occurred in the practice of Prof. Charcot, and the second a case that occurred in the writer's own practice.

Case I. (Prof. Charcot.) A Russian officer, aged 52. In August 1882, the fingers of his right hand became suddenly enfeebled so that he could not hold a pen; but this paresis soon almost en-

[1] *Compt. Rend. de Soc. de Biologie*, 30th July 1891, p. 99.

[2] *Klin. und Anat. Beiträge zur Path. Gehirns, Erster Teil*, S. 173, Tafel xxxv.

[3] *Revue de Médicine*, 1884, p. 864

tirely disappeared, so that the patient could write again. He could speak Russian, French, and German. Six months after the occurrence of the paresis in the hand, when he was at an evening assembly, he found, to his great surprise, that when addressed in French or German he could not reply in either of these languages; though he understood perfectly what was said to him in them, and could still express himself in Russian with his ordinary facility. Little by little, he improved; regaining the power of speaking French, though that of speaking German still remained lost to him. When at this stage, he found, one day, on attempting to write a letter, that he could not write a single word; the loss of the power of writing being out of all proportion to the slight motor weakness which still lingered in the right hand. He then, on the 10th April 1883, consulted Prof. Charcot. The intelligence was found to be normal, and there was no word-blindness, the patient being able to read aloud French, German, or Russian. But he could not write in any one of these languages. When asked to write, "Je demeure Hotel de Bade," he could only write "Je dem." He could only write the name of Prof. Charcot in French and Russian, but not in German. It was found that there was still a little difficulty in the movements of the right hand, with slight cutaneous anæsthesia, and incomplete loss of the sense of position of the fingers.

Some days after the date of this examination, the patient died suddenly. There was no autopsy.

Although it is probable that, in this case, the centre D was affected, there was evidently serious disease in other parts of the brain, with some involvement of the centre A or B; and it is therefore probable that the agraphia was not due solely to disablement of the centre D. It is not stated how the patient could write with the left hand.

Case II. (M. Pitres). The patient was seen two years after a cerebral seizure, which had occurred in 1882, and had caused lasting paresis and rigidity of the right leg, slight paresis of the right arm and hand, and right homonymous hemianopsia. He was found to have agraphia when he attempted to express his thoughts in writing with the right hand, though with that hand he could copy letters and figures. He had already educated himself

to write with the left hand, and with it could write very legibly. With the right hand, he could not write even numbers, except from copy. When asked to write the number 125 with the right hand, he had first to write it down with the left, and then copy it with the right. There was no word-blindness, and no trouble of spoken speech. This interesting case is very difficult of explanation. It is evidently not, any more than the last, an example of limited and isolated lesion in the centre D. The hemianopsia, indeed, suggests that there may also have been a lesion in the left occipital lobe.

Cases of isolated and limited lesion of the centre D, where the careful clinical records have been supplemented by accurate description of the pathological changes, have not yet been published. They are needed, before the exact importance of the centre D, in relation to the physiology and pathology of written speech, can be said to be fully ascertained.

Mirror Writing.

A point of interest in connexion with the writing of aphasic patients who are not the subjects of true agraphia, is that, in some few cases, when the patient attempts to write with the left hand he is apt to write from right to left, instead of from left to right. This is called *mirror writing.* A good many cases of it have been recorded; some of them being cases of patients with aphasia, and others being cases of patients suffering from diseases other than aphasia. Bernard,[1] for example (p. 237), records a very good case in which this mirror writing was well exhibited by a female patient suffering from locomotor ataxy, who wrote with her left hand because the attempt to write with the right always brought on violent pain in the right arm. This patient does not seem to have been fully aware of the peculiarity of her writing, being much surprised at receiving no replies to the letters she often sent to her friends. Of course such writing can, with the aid of a mirror, be read quite easily by any one.

It seems to be almost natural for the left hand to write from right to left. Bernard (p. 235) says,—"Some have seen in mirror

[1] *De l'Aphasie*, p. 237.

writing a pathological phenomenon, a new manifestation of aphasia ; but this is an opinion which has not been accepted.

"In the Indo-Germanic race, the only race in which writing is centrifugal, mirror writing is the normal form of writing with the left hand."

Of course there must be something pathological in the patient's intelligence, if, when writing in mirror-fashion, he imagines that he is writing in the ordinary way.

Brief Summary of the Leading Features of the various Elementary Forms of Aphasia already considered.

In now reviewing briefly the leading symptoms produced by destructive lesions in each of the speech-centres A, B, C, and D, it may be useful to keep in view the following diagram (Fig. 14). This is merely Fig. 9, with the addition of the circle M—which stands for the idea or meaning to be expressed or to be evoked—and the dotted lines connecting M with A and B, the centres of the primary couple, with which alone, in most persons, the ideas or meanings are in direct connexion.

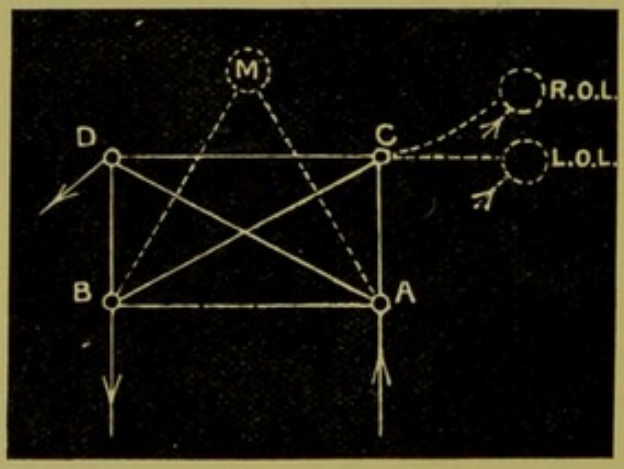


Fig. 14.

Let us begin with the two centres C and D, the centres for the visual and motor images of printed and written speech ; and let us take first of all the centre D.

(1.) *The Centre D, and Graphic-motor Aphasia.*—We have just seen how unsatisfactory is our knowledge of the exact relations of this centre to the production of writing. On the whole, however,

it seems probable that a destructive lesion of D would render the patient agraphic, at least as to the right hand; but it is doubtful whether it would interfere at all with writing by means of the left hand. The left hand would probably still be able to *draw* the visual images of letters revived at C.

(2.) *The Centre C, and Visual Aphasia.*—(*a.*) We have seen that destruction of this centre is now proved to have the double effect of producing word-blindness (alexia) and agraphia. We also know that destruction of the grey matter of the centre does not produce hemianopsia, but that hemianopsia is produced if the lesion extend deeply enough into the subjacent white matter to cut across the Radiation of Gratiolet. (*b.*) We have seen that a lesion in the white matter of the occipital lobe that cuts off the visual word-centre C from impressions coming to it from the primary visual centres of the two occipital lobes renders the patient word-blind, but that such a lesion does not produce agraphia, because the centre C itself remains intact, and its images can still be revived from within, when the effort to write is made. In, apparently, all cases of this last kind, hemianopsia is associated with the word-blindness; because the lesion involves also the Radiation of Gratiolet.

(3.) *The Centre A, and Auditory Aphasia.*—Destruction of the auditory word-centre A causes, on the receptive side, word-deafness, and also marked interference with the power of interpreting visible speech, printed or written. On the productive side, it causes amnesia verbalis, with its companion symptoms, articulative amnesia and paraphasia. This form of aphasia is often rapidly recovered from; and, in the process of recovery, the word-deafness generally disappears before the amnesia verbalis and the paraphasia.

(4.) *The Centre B, and Motor Aphasia.*—Destructive lesion of this centre annihilates, or almost annihilates, the power of producing speech; owing partly to the asynergia (ataxia) verbalis which is its leading effect, and partly to the marked amnesia verbalis which it also produces. Though there is scarcely any interference with the reception and interpretation of audible speech, we have seen that there is some reason to think that there may be slight interference with the reception and interpretation of those words

whose memories are the least deeply imprinted, viz., the names of concrete things. There is usually distinct interference with the reception and interpretation of visible speech, printed or written.

(5.) *The Conducting Fibres between A and B, and Conduction Aphasia.*—We have seen that a lesion which cuts across these fibres produces the form of aphasia known as Conduction Aphasia (Leitungsaphasie), whose characteristic symptom is the single one—paraphasia. In this variety of aphasia, there is neither, on the one hand, any word-deafness, nor, on the other hand, any defect of articulative power; because the centres A and B are themselves both intact.

It may be well to add here a few notes summarizing the causes which may produce Alexia and Agraphia.

Alexia.—(1.) When we remember that, as shown in Fig. 14, the meaning to be evoked by incoming words is in direct relationship only with the images of the primary couple A and B, it is not surprising to find that the destruction either of A or of B interferes more or less markedly with the interpretation of visible words printed or written. It is generally admitted that there is such interference with the interpretation of visible speech when the centre A is destroyed; but a case has been cited which seems to show that there are exceptional cases in which, even in the absence of the centre A, the power of interpreting visible speech is retained, owing to the close relationship existing between the visual images of letters at C and the motor images at B, and the direct connexion of the latter with the equivalent ideas or meanings. (2.) Some suppose that when B is destroyed there is no interference whatever with the power of silent reading, as the visual images at C can still revive the auditory images at A, and thereby call up the meanings; but we have seen reason to believe that this is probably a mistake, since, in motor aphasia, alexia is almost always exhibited, in greater or less degree. (3.) Total alexia, true word-blindness, is exhibited, either when the centre C is itself destroyed, or when, itself remaining intact, it is, by lesion in the white matter of the occipital lobe, cut off from the impressions which normally act upon it from the primary visual centres of the two occipital lobes.

Agraphia.—If we try to summarize the causes which may produce agraphia, I think we may say,—(1), That it may be due to the amnesia verbalis which results from a lesion either in A or in B; (2), that it may be due to the amnesia literarum which results from a lesion in C; and (3), that a partial agraphia, displayed at least in the performance of the right hand, may, probably, be produced by a lesion at D.

Brief Note of certain other Simple Forms of Aphasia that are recognised by Lichtheim and Wernicke.

In the able paper from which I have already quoted (*Brain*, January 1885), Lichtheim, putting aside for the time the centres for written language, C and D, and looking exclusively to the centres of the primary couple A and B, recognises *seven* possible varieties of simple aphasia, due either to lesion in one or other of these two centres or to lesion in one or other of the conducting pathways that lead to and from them. I have already treated of three of these seven, viz., the aphasia resulting from lesion at A, that from lesion at B, and that from lesion in the conducting path between A and B. I now wish to consider very briefly the four additional varieties which are included in Lichtheim's classification. He gets these additional four by supposing the existence of lesion below and above each of the centres A and B, in the positions indicated in the diagram (Fig. 15), by the figures 4, 5, 6, and 7.

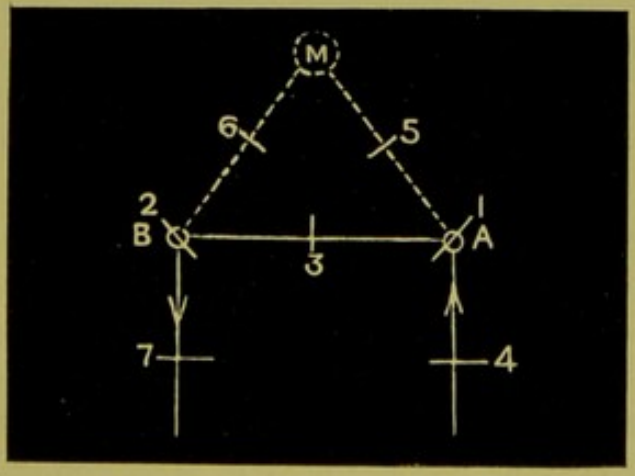


Fig. 15.—After Lichtheim; modified.

Wernicke, who has adopted this classification, proposes for these seven varieties the following names:—Nos. 1 and 2 he terms

respectively Sensory Cortical and Motor Cortical Aphasia; No. 3 Conduction Aphasia (Leitungsaphasie); Nos. 4 and 5 respectively Subcortical and Transcortical Sensory Aphasia; Nos. 6 and 7 respectively Transcortical and Subcortical Motor Aphasia. But some of these proposed terms are unfortunately somewhat ambiguous in meaning. Perhaps there will be less ambiguity, if, for our present purpose, we substitute for "Cortical" the term "Pictorial" (to signify the relation of the lesion to the word-pictures or memories) and designate the varieties as follows:—1 and 2 as respectively Pictorial Auditory and Pictorial Motor Aphasia; 3 as Inter-pictorial Aphasia; 4 and 5 as Infra-pictorial and Supra-pictorial Auditory Aphasia; and 6 and 7 as Supra-pictorial and Infra-pictorial Motor Aphasia.

Passing over Nos. 1, 2, and 3, which have already been fully considered, let us look at the four others that are included in Lichtheim's classification.

No. 4. *Infra-pictorial Auditory Aphasia.*—The distinguishing feature of this variety is the existence of simple word-deafness, without Amnesia Verbalis or other associated symptoms of speech disturbance. Speaking, reading, and writing are intact; but, the auditory centre being, by a lesion in the afferent tract below it, cut off from incoming impressions, the patient is word-deaf, and therefore cannot understand what is said to him, though he hears the words as sounds. The educated centre A is simply cut off from the incoming words that normally reach it from both ears.

In illustration of this form, Lichtheim gives (p. 461) the case of a journalist, aged 55, who, in 1877, had an apoplectic attack, with complicated troubles of speech, including paraphasia. From these he partially recovered. Then, in 1882, he had a second attack, with aggravation of his speech troubles; but again recovered, so that eventually none of the symptoms remained, except a simple but total word-deafness. There was no difficulty in speaking, reading, or writing. He continued, indeed, to write articles for his journal, which were as good as those written before his illness. Though word-deaf, he was not deaf to other sounds. It was noteworthy, however, that he had lost his ear for music, so that he no longer recognised melodies. The case has already been referred to. It was this patient who sometimes asked his children to stop

singing quartettes, as "they made too much noise." There had, of late years, been no improvement in the word-deafness.

Wernicke has recorded a case of the same kind (also already referred to), in which, in like manner, curious to say, there was also an affection of the musical faculty, the patient having lost the power of appreciating certain notes of high pitch. In this case, too, there was no progressive improvement; and Wernicke is inclined to think that this form of word-deafness may not be so curable as that produced by lesion at the centre A itself (pictorial auditory aphasia).

No. 5. *Supra-pictorial Auditory Aphasia.*—Here the path between A and M is cut across, so that auditory word-pictures revived in A fail to call up the ideas or meanings in M. Incoming audible speech, therefore, is not understood; nor, according to Lichtheim and Wernicke, is incoming visual speech—the patient having alexia as well as word-deafness. He can understand neither what he hears nor what he reads; and yet, the word-images in the centre A being intact, and capable of revival from without, he can repeat with ease, though without understanding it, whatever he hears said to him; and, in like manner, can read aloud with ease, though he does not understand what he reads. He can also easily write to dictation, and easily copy from print or from writing. A true Echolalia, with no understanding of what he is saying, is thus the most characteristic symptom. In his written speech, it has its equivalent in the power he retains of writing to dictation or of copying, without understanding the words written or copied. With regard to volitional speaking and writing, as the patient cannot, from M, call up the auditory images at A, which are so important for the guidance of the motor images at B, he exhibits amnesia of nouns, paraphasia, etc., and, in like manner, as a consequence of the paraphasia, he exhibits paragraphia. At page 454, Lichtheim records, in detail, a case which exactly corresponds with this picture.

No. 6. *Supra-pictorial Motor Aphasia.*—The path between M and B being cut across, it is impossible for the patient to express his thoughts in volitional speech. When he tries to speak volitionally, his attempts result in the same kind of failure as is exhibited in an ordinary case of pictorial motor aphasia, due to destruction of B. Nor, according to Lichtheim, can he express his

thoughts any better in writing. Apart from volitional speaking and writing, everything is normal. The patient can understand both what is said to him and what he reads. He can also, with correct articulation, repeat words that are spoken to him (understanding them, in this variety); and can correctly and easily write to dictation and copy writing (understanding, in both cases, what he writes). At page 447, Lichtheim records a case entirely agreeing with this picture.

No. 7. *Infra-pictorial Motor Aphasia.*—To get the symptoms which characterize this variety, we must suppose the lesion to be so situated as to cut across only those fibres which connect the centre B with the lower centres, in the medulla, for the nerves of speech; and to leave intact all the connecting fibres between B and the other speech centres, as well as the fibres between M and B. Given such a lesion, the only disablement that would result from it would be disablement of spoken speech, both volitional and on attempted repetition of words heard. Otherwise everything would be normal: there would be no amnesia verbalis, no difficulty in volitional writing, writing to dictation, or copying, and no word-deafness. If, owing to accompanying paralysis, the patient could not write with the right hand, he would yet be able to do so with his left. Lichtheim, at page 449, refers to numerous cases already on record which present all the features of this type. The case of Patrick Keaney, which I have put on record in a former chapter, might stand as a fairly good example of it.

Wernicke, who has adopted Lichtheim's classification, and who was, in fact, the originator of part of it, holds, with Lichtheim, that the simple forms of aphasia affecting spoken speech are seven in number. But he has pushed the classification still further. He applies it also to Written speech; and differentiates seven equivalent varieties of aphasic disturbance of written speech, which may exist when spoken speech is intact. His seven varieties are—(1.) Cortical Alexia; (2.) Cortical Agraphia; (3.) Conduction Agraphia; (4.) Subcortical Alexia; (5.) Transcortical Alexia; (6.) Transcortical Agraphia; and (7.) Subcortical Agraphia.[1] He illustrates these seven varieties by means of a diagram similar to Fig. 15, but differing from it in having the centres C and D substituted for A

[1] I have arranged both this list and the forgoing one in an order different from that in which they are given by Wernicke and Lichtheim.

and B; and in having, instead of M, which stands, in Fig. 15, for the idea or meaning to be evoked or expressed, another letter, which stands for the word-percept (belonging to A and B) which has to be evoked by reading, or expressed by writing. If the reader desires to do so, he can reconstruct the diagram in this way, and work out these seven varieties of aphasic derangement of written speech for himself. Whilst quite prepared to grant that such speculations are often highly valuable as preparing the way for actual discoveries, I do not think that Nos. 3, 5, 6, and 7 of these aphasic disturbances of written speech are yet so well attested by actual cases as to make it necessary for me here to describe their symptoms. We have already considered Nos. 1, 2, and 4 (the cutting off of the centre C from incoming impressions), in detail. I leave the reader to study Wernicke's treatise[1] for himself; or to construct the diagram on the lines indicated, and imagine for himself the symptoms that would be exhibited in each of the four remaining varieties.

Even as regards Lichtheim's seven varieties of aphasia in relation to spoken speech, it cannot be said that Nos. 4, 5, 6, and 7 have yet established for themselves so firm a position as Nos. 1, 2, and 3 are generally allowed to hold. It has not yet been shown where exactly in the brain the lesion capable of producing each of them must be situated. There is, in fact, an anatomical difficulty in conceiving where a lesion could be situated that would cut across the afferent fibres and leave the efferent intact, or *vice versâ;* because the afferent and efferent fibres belonging to A and to B are joined to the grey matter of these centres on only one and the same side of the cortex, so that a subcortical lesion, unless situated at some distance from the centre, must almost necessarily cut across, not only the efferent or only the afferent fibres, but both together. Cases, however, are now being recorded which lend support to the classification;[2] and Lichtheim's own cases are strongly corroborative of it. As evidence, the latter are defective only in one respect, viz., that none of them include records of pathological changes. Whether or not Nos. 4, 5, 6, and 7 will yet establish for them-

[1] *Fortsch. der Med.*, ii. 1886, p. 463.

[2] See, for example, A. Pick, *Ein fall transcorticaler Sensorischer Aphasie, Neurol. Centrabl.*, Leipzig, 1890, ix. p. 646; and G. Brock, *Ueber einen fall von transcorticaler Motorischer Aphasie* (Graduation Thesis), 1892.

selves as firm a position as that of Nos. 1, 2, and 3, we cannot at present say; but it is nevertheless certain that the study of this classification affords valuable lessons in the analysis of the symptoms of aphasia, and helps to explain combinations of symptoms that, without this classification, would be inexplicable.

The last of Lichtheim's varieties, No. 7, presents, as we have seen, an apparently possible form of *subcortical* motor aphasia, whose characteristics are due to the circumstance that only one set of the fibres in connexion with the motor centre has been cut across, viz., the set whose function is to convey the commands of the motor speech-centre in Broca's convolution—that is, of the centre B—down towards the organs of articulation and phonation. All the other sets of connecting fibres are, in this form, preserved intact. But it should be understood that this is not the only possible form of subcortical motor aphasia. On the contrary, it is quite possible for a lesion in the white matter beneath Broca's convolution to cut across all the various sets of connecting fibres that are related to it. In such a case, the grey matter of Broca's convolution would be cut off from its connexions with all the other speech centres, and also from its connexions with the higher centres for thought. Its disablement, therefore, would be complete, and the resulting symptoms would, in every way, be the same as those that are produced by a lesion destroying the grey matter of the centre B itself. Thus cut off from all its connexions, and rendered functionally inert, the grey matter of the centre B would inevitably undergo atrophy. I shall return to the subject of subcortical aphasia, when, in a future chapter, I take up the consideration of the effects produced by disease in the various parts of the motor speech tract.

I must now ask the reader to make note of the point at which we have arrived. We have considered the varieties of simple aphasia that can be produced by the destruction of a single speech centre, or by the cutting across of connecting fibres passing to or from each of them; and now we are come to the beginning of the efferent motor tract which leads downwards from Broca's convolution to the organs of articulation and phonation. At this point I leave the speech tract for the present, to return to it afterwards.

In the meantime, I wish (1) to say a few words about the Compound Varieties of Aphasia; (2) to treat of the best method of

case-taking; and (3) to take up, in the next chapter, the consideration of the relations of aphasia and other speech-derangements to Functional Disorders of the cerebral cortex. When I have finished this consideration, I shall return to the motor speech tract; and my final task will be to note the various diseases that may cut that tract across, or may more or less interfere with its conducting power, at various levels in its course.

Compound Varieties of Aphasia in connexion with Organic Disease of the Brain.

For the analytical study of aphasia, no cases are so valuable as simple cases of isolated lesion in a single centre or conducting tract, such as we have hitherto been considering. But it should be remembered that such simple cases, representing one or another of the pure types, are comparatively rare. Much more commonly, the lesion is not thus confined to a single centre or tract, but several centres and tracts are involved at the same time. On the one hand, the disease may be so extensive as to destroy several of the centres; and, on the other, even when only one centre is destroyed, the other centres may be functionally disturbed or disabled, owing either to the proximity of the lesion, and the diffusion of irritation from it, or to the pressure which certain lesions, such as apoplexy or tumour, may exercise upon them from a distance. Thus, mixed or compound cases of aphasia are more common than simple or pure ones.

It would, no doubt, be comparatively easy to describe a considerable variety of these complex combinations, by merely adding the symptoms of one pure type to those of another. But the reader can make these combinations for himself. It will be sufficient for me here to note, in the briefest manner, three of the most common of the compound varieties of aphasia.

(1.) There is the type of Compound Sensory Aphasia, in which both sensory centres—viz., the auditory speech-centre A and the visual C—are involved together. That these two speech-centres should be so often involved together becomes easily intelligible, when we remember that they lie in juxtaposition, and that they are supplied by neighbouring branches of the Sylvian Artery.

(2.) The Compound Motor type, which results from the involvement in the same lesion of the centres B and D,—the motor centres for speaking and writing. There is no doubt that these two parts of the brain are very often involved together. Juxtaposition and vascular supply, as in the former case, explain the association. But the reader will remember that the agraphia which so often attends upon motor aphasia is not always due to involvement of the centre D, being often really due to the amnesia verbalis that attends upon lesion at B.

(3.) The type of Total Aphasia. This type is presented when a lesion of the left hemisphere is so extensive as to destroy or disable all four centres, A, B, C, and D. And, indeed, it may be said to be presented whenever the centres A and B are both destroyed, though C and D escape; because without the primary couple A and B, the centres C and D are, in almost all persons, if not quite in all, incapable either of conveying a message to, or of transmitting one from, the mind.

Occlusion of the Sylvian Artery near its origin may have the effect of disabling all four centres. And, again, an apoplexy in the substance of the hemisphere may for a time disable all four centres by compression. It will be readily understood that the intellect, in all such cases of total aphasia, is very seriously impaired.

In connexion with these various types of aphasia, a fact first noted by Lichtheim has already been alluded to. It is that, in the process of recovery from total aphasia, due to lesion at A and B, the faculty of articulate speech is recovered first. Not till long afterwards are the powers of reading and writing restored; and, indeed, these powers may never be completely restored, even though the restoration of articulate speech has long been perfect or almost so. This seems to be a fact, though the explanation of it is not yet very apparent.

Method of Case-Taking.

When we are taking notes of a case of aphasia, it is well that we should have in our minds some definite plan that may help us to record the symptoms in a connected and intelligible manner, and prevent us from omitting any points of real importance. I do not think it a good plan to take each of the centres separately, and

inquire how the functions of each are affected. The functions of the various centres overlap each other too much for this. It is far better, I think, in the first instance, to get all the facts of the case without reference to the centres, and only then to consider what evidence they afford as to the functional condition of each of the centres. To get at the facts of the case, the easiest method is, I think, to take each of the two forms of speech, the spoken and the written, separately; and with regard to them, to inquire (1) how the patient receives and interprets; (2) how he produces volitionally; (3) in the case of spoken speech, how he repeats or echoes; and, in the case of written speech, how he writes to dictation, and writes from copy.

Full information upon these points will cover nearly the whole ground of the symptomatology of aphasia. Let us try to make a more detailed note about how such information is to be brought out, when we are examining a case after this method.

Spoken Speech.—(1.) *How is it received and interpreted?* Is the hearing good? The hearing being good, is there any difficulty in interpreting the meaning of words heard (word-deafness)? The patient's replies to questions, even if these replies are made only by gesture, will show whether or not he understands what is said. Ask him to put out his tongue, to shut his eyes, to give his hand, etc. He should also be tested specially as to his power of interpreting nouns and verbs. Ask him to touch, one by one, as the parts are named, his nose, ear, eye, chin, etc. Ask him to try to whistle, to shut his eyes, to smile, etc. If the examiner carefully refrains from giving the patient hints, by gesture or expression of countenance, of what is wanted, the recorded answers to such questions will indicate whether word-deafness is present, and in what degree.

(2.) *How is it produced?* When there is pronounced motor aphasia, and speech is reduced to a recurring utterance, one or two familiar words, and, upon occasion, an emotional or conventional expression, the whole vocabulary of the patient should be carefully noted down. When, in either motor or auditory aphasia, there is a considerable vocabulary, we should—

(*a.*) Record words or phrases of the patient showing evidence of defective power of articulation. For example, we should note

any specimens of lalling, stammering, syllable-stumbling, or slurring.

(*b.*) Look for evidences of amnesia verbalis, and its companion symptoms, articulative amnesia and paraphasia. In doing so, we should show the patient common objects and ask him to name them; and, in recording his answers, we should make note of difficulties in remembering nouns, etc., as well as of mistakes in the use of them. When the patient is practically dumb, we should test him for amnesia verbalis by asking him to write answers to questions; or, if he cannot write, by asking him, after Lichtheim's method, to indicate with his fingers the number of syllables in the names of common objects shown to him. If there is paraphasia, we should note whether the patient is immediately conscious of the errors he makes in the use of nouns, etc., or, on the other hand, is quite unconscious of them.

(3.) *How is it repeated or echoed?* The patient should be got to attempt the repetition or echoing of words spoken to him. If he is word-deaf, and cannot understand a mere verbal request to attempt this, the examiner must try to get him to understand what is wanted by putting the request in the language of gesture and repeating the word or phrase over and over again. If the patient is able to echo words or phrases, the attempt should be made to ascertain whether, in doing so, he understands what he is saying.

Written Speech.—(1.) *How is it received and interpreted?* Is the sight good? Is hemianopsia present? Is the patient able to understand questions put before him in writing or in print. If he is speechless, and cannot by *speech* indicate how much he understands, show him in writing or in print such requests as, "Put out your tongue," "Give me your left hand," etc.; and note how he complies with them. If there is some power of interpreting written or printed words, try to ascertain how much there is by asking the patient to read silently a sentence in a book or newspaper and then questioning him about it; framing the questions, if the patient is speechless, in such a manner that he will be able to answer them by gesture or pantomime.

(2.) *How is it produced?* Ask the patient to write his name. If he succeeds, put simple questions to him, and ask him to answer them in writing. If he writes with comparative ease, ask him

to write, at his leisure, the history of his illness. Note in his performance evidence of—(1) paragraphia (which is usually only the written translation of paraphasia); (2) intoxication of the mind with a letter or word; and (3) faults of spelling or syntax. If the right hand is paralysed, let the patient try to write with the left. If the right hand is not paralysed but is agraphic, let him furnish examples of the performance in writing of both the right hand and the left.

(3.) *How does the patient write to dictation and from copy?* Try him in both ways; and if he is able to do either or both, try to ascertain if he understands the meaning of what he writes.

Associated Phenomena.—(1.) *Gesture language* (*Pantomime*). Does the patient understand the gesture language of the examiner, and does he himself employ gesture language intelligently? Or, on the other hand, are there evidences of amimia or of paramimia?

(2.) *Extra Graphic Symbols.* How does he understand and employ such graphic symbols as numbers, algebraic signs (if previously known to him), musical notation (if he was previously a musician), etc.

(3.) *Is there any evidence of Mind-blindness* (*Psychical Blindness*), as shown by inability to recognise common objects shown to him, and to indicate their uses; or by inability to recognise intimate friends at sight?

(4.) *The Emotional and Intellectual Faculties.* Are the emotions lively and their expression vivid, or are they dull? Is self-control well maintained, or does the patient frequently exhibit emotional disturbance?

What is the condition of the Intelligence as exhibited in expressive actions, and in capability of engaging in games of skill, of conducting business affairs, etc.

(5.) *The Motor and Sensory Functions.* All symptoms of motor or sensory paralysis should, of course, be carefully described.

These, I think, are the points we should bear in mind when we are making notes of a case of aphasia. The greatest care must, of course, be taken, not to overtask the damaged brain of the patient. If there is risk of doing so, the work should be done gradually,—little by little.

Note on Terminology.

I never use the term "Mind-Blindness" without feeling it to be a very poor term for the symptom it is meant to designate. The term, as already explained, is meant to designate a patient's loss of the power of recognising at sight objects formerly familiar to him; this loss being due to the fact that the old visual images or memories of the objects, imprinted on the brain by efforts of the attention, are now no longer revived by the sight of the objects when they are looked at. That the images are not revived is either because the centre containing them has been destroyed, or because it is now cut off from its normal connexions with the primary visual centres in the occipital lobes. I have, in the text, suggested the term Object-Blindness, as a substitute for Mind-Blindness: but it cannot be said that even that term is altogether appropriate; because the objects are still seen, though they are no longer recognised—the patient having the feeling that he is seeing them for the first time. In this respect, however, the term Object-Blindness would be no worse than are, for allied conditions, the current terms Word-Blindness and Word-Deafness, which are open to precisely the same kind of objection. I remember, some years ago, when I was taking notes of a case of word-blindness in the Infirmary, one of my surgical colleagues, who happened to enter the ward, asked me what was the case I was working at. I told him it was a case of word-blindness. "Can the patient not see the words?" he asked. "She can see them," I said, "but cannot recognise them." "Then why do you call her Word-Blind?" said he. As everyone beginning the study of Aphasia has this difficulty in comprehending the terms Mind-Blindness, Word-Blindness, and Word-Deafness, would not it be well to find improved substitutes for them, and discard them altogether?

The Greek word ἀγνωσία means want of recognition (α privative and γνῶσις recognition). We might therefore use the word Logagnosia (λόγος, a word, and ἀγνωσία) as a general term for loss of the power of recognising words, audible or visible. For its particular varieties, we might use the term Visual Logagnosia, as a substitute for Word-Blindness; Auditory Logagnosia, as a substitute for Word-Deafness; and Motor Logagnosia, as a term for that interference with the reception and interpretation of written or printed speech, and even, to a slight extent, of audible speech, that is caused by the destruction of the motor word-images at B,—a symptom for which we have hitherto had no term of any kind.

The term Agnosia, thus used in the sense of loss of the power of *recognising*, would stand in distinct contrast to the term Amnesia, already in use as the term for loss of the power of *recollecting;* and would designate a failure on the side of reception and interpretation, just as Amnesia designates a failure on the side of production.

In the text, I have used the term Amnesia Verbalis to designate the failure to call up in the memory the images of words when they are needed for purposes of vocal expression or of silent thought; and in like manner I have used the term Amnesia Literarum for the failure to call up the visual images of letters

and words when they are needed for purposes of writing. But, for the sake of uniformity, it might be well to give up using these terms, and to represent the two varieties of amnesia verbalis by the terms Auditory and Motor Logamnesia, and amnesia literarum by Visual Logamnesia.

If this terminology were adopted, then,—(1) in connexion with the Visual word-centre C, we should have for use the term Visual Logagnosia, instead of Word-Blindness, to designate failure on the side of reception and interpretation, and the term Visual Logamnesia, instead of Amnesia Literarum, to designate failure on the side of production ; (2) in connexion with the Auditory word-centre A, we should have the term Auditory Logagnosia, instead of Word-Deafness, and the term Auditory Logamnesia, instead of "Amnesia Verbalis due to disablement of the auditory images ;" (3) and in connexion with the Motor word-centre B, we should have the terms Motor Logagnosia and Motor Logamnesia.

In Word-Blindness pure and simple, the patient fails to recognise only one particular set of objects, viz., words printed or written. In general Object-Blindness (Mind-Blindness), on the other hand, the patient fails to recognise other objects besides words. As explained in the text, the delicate and intricate images of words are imprinted efficiently in the higher visual centre of only one hemisphere, whereas the simpler images of common objects are imprinted efficiently in both hemispheres. When the visual word-images are destroyed, then, almost always, while one of the two sets of common-object images is destroyed along with them, the other set, in the opposite hemisphere, remains ; so that the patient does not become the subject of general object-blindness. He becomes so, in any marked degree, only when the higher visual centre in both hemispheres is destroyed.

If Visual Logagnosia is to be accepted as the term for Word-Blindness, what term will be suitable for general Object-Blindness ? I would suggest the term Visual Pragmatagnosia (*πρᾶγμα*, an object, and *ἀγνωσία*). This term implies loss of the power of recognising a common object at sight. When this power is lost, there is commonly lost along with it also the power of *recollecting* the appearance of the object, that is to say, the power of calling up its visual image from within, when the attempt is made to revive the idea of it in the mind. For this loss, I would suggest the term Visual Pragmatamnesia.

Word-Deafness probably bears to Mind-Deafness the same relation as Word-Blindness bears to Mind-Blindness. In pure word-deafness, it is only words that cannot be recognised ; in general mind-deafness (a condition to which, as yet, but little attention has been directed), common sounds also fail to be recognised. For general Mind-Deafness, what term would be suitable ? I would suggest the term Acousmatagnosia (*ἄκουσμα*, a sound, and *ἀγνωσία*). And so, again, for failure to call up in the memory the image of a common sound, such as the clang of a bell, when one wishes to think of the sound, I would suggest the term Acousmatamnesia.

Thus, in connexion with the obliteration of old Visual images of Objects in general, we should have the two terms Visual Pragmatagnosia and Visual

Pragmatamnesia ; and in connexion with the obliteration of old images of common Sounds, we should have the terms Acousmatagnosia and Acousmatamnesia.

I beg to submit this terminology for consideration. That reform in the terminology of Aphasia is needed, I have long felt ; and I hope that the above terms may be found to be sufficiently clear and precise.

I may add that the selection of the above terms has been kindly supervised by a distinguished Greek scholar.

CHAPTER XIV.

Aphasia and Other Disturbances of Speech in Relation to Evanescent Organic Affections and Functional Disorders of the Cerebral Cortex.

It has often been argued that there can be no such thing as a purely functional affection; because function and structure go together, and there can be no change in the one without corresponding change in the other. But, though we grant the essential soundness of this position, and admit the fact that an advancing pathology is constantly subtracting from the list of functional affections and adding to that of structural diseases, we yet know how convenient, practically, is the distinction between functional disorders and organic diseases. I think it will be well to have regard to the distinction in treating of speech in the relations to be discussed in the present chapter.

In this chapter, I propose to treat of speech in its relations to Functional Disorders of the cerebral cortex. But I wish it to be understood that I mean to use the term "functional" in the usual loose way, so as to include under it various affections which a strict pathology would, no doubt, relegate to the category of organic diseases.

In recognition of the fact that we cannot draw any strict line of demarcation between organic diseases and functional disorders, I shall begin by making brief notes of the relations of speech to certain affections which are confessedly organic in nature,—though they are related to functional disorders in their evanescence and curability.

But I should like first to direct attention to one or two of the general characteristics presented by aphasia due to evanescent organic affections, or to functional disorders, of the cerebral cortex.

In most of the conditions to be reviewed in this chapter, the

fundamental cause of the aphasia is, not a destruction of one or more of the speech-centres, but a general enfeeblement of cerebral energy, betraying itself, in a special way, in connexion with the delicate function of speech. This being so, we cannot expect to meet often with solitary disablement of one of the speech-centres and functional integrity of the others. The centres A and B, which are so closely related to each other in function, seem for the most part, in the cases now to be considered, to be enfeebled together; and as it is this enfeeblement, rather than disablement, that we have to do with, the symptoms presented to us are much more frequently those of failure in *production* of speech than those of failure in its reception and interpretation. In other words, Amnesia Verbalis (Logamnesia) is much more frequent than the failures in the power of recognising words (Logagnosia) which we term word-deafness and word-blindness. I think, indeed, that the very existence of word-deafness or word-blindness, in any case, should suggest an organic rather than a functional cause; because the word-images must be seriously disabled, and not merely enfeebled, if they cannot be revived by the strong stimulus from without which they normally derive from the hearing and seeing of words. In mere enfeeblement of function, the images often continue to respond to this strong stimulus from without, when the weaker stimulus from within that is produced by thoughts seeking expression in words fails to revive them. And thus it is that in the vast majority of cases of functional aphasia the symptoms are those of Logamnesia, and not those of Logagnosia. The aphasia is amnesic, and very seldom also agnostic.

Beginning, then, with evanescent organic affections of the cerebral cortex, let us now consider briefly the relations of speech to such affections; and afterwards consider also its relations to the more important of the functional disorders of the cerebral cortex.

Evanescent Organic Affections.

I think it will sufficiently fulfil the purposes of this chapter if we select from among such affections—(1) conditions of evanescent inflammation; (2) conditions of compression and of concussion; and (3) conditions of congestion.

1. Conditions of Evanescent Inflammation.—The brain is so delicate in texture that it can but seldom be attacked by inflammation without suffering either total destruction of texture at the part inflamed, or at least a degree of textural damage that leaves behind, permanently, more or less change. When the inflammation affects the centres for speech, aphasia, in one or other of its varieties, is, of course, developed. Sometimes it is a meningitis over the speech-centres that causes the aphasia, by spread of inflammatory action from the membranes to the subjacent cortex; sometimes it is a cerebritis, affecting the brain-substance primarily.

I need not say in what a large proportion of cases death results when there is acute inflammation of the brain, or of its membranes. But some cases do recover; and in a very few the inflammatory action is so evanescent as apparently to cause no permanent damage to brain-tissue. I shall now make a short note of such a case of complete recovery, after a cerebritis which had produced complete paralysis of the right side of the body, and also aphasia. I think the case is worth making a note of even independently of its bearings on speech; because it seems to me to be a good example of a condition which ought, I think, to be more familiarly known than it is at present. I mean the condition of acute cerebritis in one hemisphere, causing hemiplegia, and often leaving behind it, when recovered from, mental enfeeblement, or Jacksonian epilepsy, or both of these together. This condition is generally recognised to be pretty common in children,[1] but I do not think it is generally known to occur also, and not very rarely, in adolescents. During the last two years, I have myself had under treatment three cases of it in adolescents,—a girl[2] and a youth, both aged 18, and the girl, aged 15, whose case I am now going to make a note of. In the two former, the acute illness resulted in permanent left hemiplegia; in the latter, as we shall see, there was for a time right hemiplegia and aphasia, but ultimately complete recovery.

[1] The best description of this hemiplegia of children that I know of is that given by Henoch in his *Lectures on Children's Diseases*. See Dr John Thomson's translation, *New Syd. Society*, 1889, vol. i. p. 290.

[2] In this girl's case, the cerebritis was distinctly a sequela of an attack of influenza; but there was no evidence to show that influenza had anything to do with the causation of the other two cases.

Case I. (Personal Observation.) *Case of Evanescent Hemiplegia and Aphasia, due to Unilateral Cerebritis.*—M. R., æt. 15, a girl who had been employed as a clerk in the Register Office, and, more recently, as an assistant in a drysalter's shop. Admitted to Ward 33, on April 14th, 1891.

History.—Had been falling off in health for a year; her chief complaints being headache, failure of eyesight, lassitude, want of appetite, polyuria, and frequent sensations of chilliness. Had sought advice about her eyesight at the Eye Department of the Royal Infirmary, and been told the failure of eyesight was due to the condition of her general health. For eight days before her admission, had been unable to go out to her daily work. For three of these days, had remained indoors at her lodgings, dull and listless; and then, on the 9th of April, five days before her admission, had gone home by train to her mother's house, which was situated in the outskirts of the city. Had vomited in the morning, before starting on her journey. When in the train, she fainted; but was kindly taken home by two strangers who were travelling in the same carriage with her. When she arrived at her mother's house, she was extremely weak and listless, and spoke very little; but she was not paralysed. Next day, however, when she was being lifted out of bed, she fell towards the right side; and it was then noticed that there was very little power of movement in her right leg. Later in the day, loss of power was also noticed in the right arm; and in the evening she had become almost speechless, so that, in trying to speak spontaneously, or in answer to questions, she could only say "Aye." Three days afterwards she was sent to the Royal Infirmary.

State on Admission.—There was total paralysis of the right arm and leg, and also very marked paralysis of the lower half of the right side of the face. For the first three days the temperature was 102°·5 F.; and, so long as the fever lasted, the patient was very dull and listless, passing all evacuations involuntarily. She was very drowsy, and slept a great deal. On being roused and spoken to, she seemed generally to understand what was said to her; but she sometimes failed to do so, putting out her tongue, for example, when asked to close her eyes. Once, when shown a written request to put out her tongue, she interpreted it correctly, and obeyed. The power of producing speech was almost anni-

hilated; speech being reduced to the recurring utterance "Aye," which she emitted on every attempt to speak. There was a slight trace of haziness in the middle of the right cornea.

On the day after that of her admission, her head was shaved, and a blister of considerable size was put over the motor region of the left hemisphere. She was also ordered a mixture containing iodide and bromide of potassium.

On the fourth day after admission, the temperature fell rapidly, and became normal. Afterwards, it remained normal; except during two or three periods of a day or two, when there was a slight rise. After the fall of temperature, rapid inprovement set in both in motor- and in speech-power. On the sixth day after admission, she was able to say "No," and "Nurse." On the seventh day, she could move the paralysed arm and hand slightly; and also the leg slightly, at the hip and knee joints. On the eighth day, when asked when her brother was coming to see her, she said "on Saturday;" when asked how she was, she said "fine" and then "nice;" and when asked what day of the week it was, she said "Thursday," and then, correcting herself, "Wednesday." There was still, however, considerable amnesia of nouns, so that, on the ninth day, when a watch was shown her she could not remember the word "Watch," but said "to know the time." She told the time correctly from the watch. On the eleventh day, it was interesting to observe her searching in her memory for the word "Watch." She began by saying, "Yes, pa, no, um, no, ta, no;" and, finally, it was only after an evident effort that she got out the word "Watch." She also, on this day, named correctly a bunch of keys and a piece of india-rubber.

Although the full notes of the case, which have been taken with great care by the house-physician, Dr A. S. Duncan, are interesting I cannot afford to give them here in detail. I shall further only make note of the fact that in the patient's expressions, when she was thus rapidly regaining her speech-memories, there were some curious examples of old associations of word-sounds,—old memories of sound-sequences. Thus, we were puzzled to know why she called a common pencil a "hair-pencil," and spoke of Nurse Terry as "Nurse Terra-cotta;" but she afterwards explained to us that, in the shop where she had formerly been employed, she had been in the habit of selling hair-pencils and terra-cotta paint.

In the course of her convalescence, there was a period of a few days during which she suffered from headache, dulness of mind, and slight delusions; but, with this exception, she progressed steadily; and she ultimately made a good recovery, her speech and writing becoming quite normal. Slight weakness in the arm and leg lingered for some months; and for some weeks there was slight movement, of the nature of athetosis, in the right hand; but, on the 5th of January 1892, it is noted that scarcely a trace of these symptoms remained; and they soon afterwards disappeared. Two or three months after this date, however, she had a recurrence of headache and dulness of mind; but after rest in the ward for a few days, and the application of a blister to the head as formerly, she was soon restored to good health and spirits.

I have thought this case worthy of record because the hemiplegia and aphasia seem to me to have been due to cerebritis of the left hemisphere. It was certainly not a case of hysterical hemiplegia; and the symptoms pointed, I think, rather to cerebritis than to meningitis. The case is interesting, as showing that complete recovery may take place after such a condition. The recovery of the speech-centres, after their probable involvement in the evanescent inflammation, is the point of special interest in connexion with our present subject.

2. Conditions of Compression and of Concussion.—Temporary compression from extravasated blood is a much commoner cause of temporary aphasia than evanescent inflammation of the brain substance. We see it exemplified in many cases of apoplexy in the left hemisphere, and even in some in the right hemisphere. When, in such cases, the bulk of the extravasation is being diminished by absorption, the patient first recovers consciousness, but is still in many cases aphasic, until further absorption relieves the speech-centres from compression, and then speech is restored. Very often it is only the motor speech-centres that are compressed, because these lie closer than the sensory centres to the commonest seat of extravasation; but in some cases both motor and sensory centres are compressed; and in these it is worthy of note that, in the process of recovery, the difficulty of reception and interpretation is generally got over first, and the difficulty of production afterwards. This is no doubt generally due to the circumstance

that, in most cases, the centre A is relieved from pressure before the centre B; but even if both centres were relieved simultaneously the power of interpretation would be restored before that of production, because the stimulus from without is a stronger reviver of word-images than the stimulus from within. The difficulty in production usually diminishes as the amnesia verbalis gradually disappears; but, even after disappearance of amnesia verbalis, there often lingers for a long time some thickness of speech (slurring). This is sometimes observable, and may be of long duration, even when the seat of lesion is the right hemisphere. It may, apparently, be due to slight damage either of the motor centre or of the motor tract leading therefrom.

Of greater interest than these common cases of compression of the speech-centres from extravasation of blood in the substance of the brain, are the rarer cases, usually of traumatic origin, in which the speech-centres are compressed from without by an extravasation on the surface of the brain. In these cases, as in those of compression from within, the speech-centres are disabled more or less, in proportion to the amount of pressure; and when the pressure is taken off, by absorption of the extravasation, the recovery of speech is usually complete. Often, however, it is difficult to know how much of the temporary disablement has been due to compression by extravasated blood, and how much to the concussion inflicted on the brain by the injury. Here are two cases of this kind, each of which presents points of interest.

Case II. (Professor Gairdner, *Proc. of the Glasgow Phil. Soc.*, 1865–68, p. 102). *The case had been under the care of* Dr Pagan, *who communicated the following note of it to Professor Gairdner.*— "A youth, about 16 years of age, was admitted, under my care, to the surgical wards of the Infirmary, with well-marked symptoms of concussion of the brain. About two hours before admission, he had fallen upon his head on the deck of a vessel at the Broomielaw, from a considerable height, having missed his footing on the rigging. He remained in a state of complete insensibility for nearly forty-eight hours after admission, when he began to speak in a language which could not be interpreted, till he was visited by one of his shipmates, who told us it was Welsh. (It was a Welsh vessel, and the patient was a native of Wales.) He talked

incessantly, and we were told that his words were not incoherent, but rather a narrative of past events—recollections, in short. He continued in this state for between two and three days, when he began to speak most unmistakable English, but every word nearly was an oath, and most horrible imprecations he uttered. During three or four days longer, he may be said to have *spoken* Welsh and *sworn* English. As consciousness gradually returned, he ceased to speak Welsh and to swear English; and when he recovered completely, after an illness of about twenty days, he spoke English and ceased to swear. There was no fracture of the skull, and but little external injury."

This is a good case, showing how the native language, being the most deeply engraved in the memory, was the least easily obliterated; and how in the acquired language, English, the words most easily revived were those that had been best imprinted,—probably by "frequency of repetition and emphasis of expression."

The second case of this kind, which I now proceed to make a note of, has other points of special interest.

Case III. (Professor Grashey, *Archiv für Psych.*, xvi., 1885, p. 654).—The patient was a brewer, aged 27. In November 1883, he sustained a fracture of the base of the skull, for which he was treated in hospital. When he recovered consciousness, it was found that there was almost complete deafness of the right ear, and almost complete blindness of the right eye, whose field of vision was at the same time extremely contracted. In the left eye, the field of vision was considerably contracted, and the visual acuity was lowered to two-thirds of the normal. There was slight motor paresis in the whole of the right side of the body.

As to speech, there was at first marked word-deafness, but this speedily passed off. There was marked and lasting amnesia of nouns, but no paraphasia. Apart from this amnesia of nouns, the patient had no difficulty in expressing himself; nor was there any difficulty in reading aloud from a book, or in repeating words spoken to him. In writing, his only difficulty was due to his amnesia of nouns.

The peculiar feature of the case has yet to be stated. It was a most remarkable *shortness of memory* for objects seen, and for words seen or heard. The sound-image of a word, or the visual-image of

either a word or an object, could easily be revived from without, and its revival called up the corresponding idea or meaning in the normal way; but, as to visual images, immediately when the object or the word was withdrawn from the patient's sight its image vanished, and he forgot totally what object or word he had been looking at; and so also as to sound-images, he heard the word spoken to him and understood it, but immediately forgot it, and could not repeat it, even if only a very short interval was allowed to elapse before he was asked to do so.

Shown a knife, he knew what it was, and, if he could not recall the noun "knife," he said it was something for cutting with; but if the knife was then placed among other objects, and covered from his sight for a moment, he could not, when the collection of objects was again uncovered, tell which of them had been shown to him.

It was the same with the visual images of letters and words. Shown, for example, the letter G cut out in wood, he easily recognised it; but if it was then covered from his sight, and placed among other wooden letters, he immediately forgot what letter he had seen, and failed to pick it out from among the others, unless he kept repeating to himself "G, G, G," and thus artificially retained it in his memory.

And it was, again, the same with the sound-images of words. He could repeat or echo any word spoken to him, but the memory of it immediately vanished, if he did not retain it artificially by repeating it aloud over and over again.

Even more curiously was this evanescence of word-images exhibited, when the images were revived by the weaker stimulus from within. As already said, there was a good deal of amnesia of nouns. But it was an amnesia of a peculiar character. In ordinary logamnesia, the word is either, for the time, totally forgotten, or some of its details are forgotten (articulative amnesia). But this patient, though unable at once to name an object shown to him, could generally remember the initial letter of the name, and work out the rest of it after a peculiar method. His method was to repeat the sound of the first letter aloud, until it suggested that of the second, then to repeat the first two until he could add the third, and so on until he could pronounce the whole word. Shown, for example, a hand, and asked to name it, he said, "H, H, Ha, Ha, Hand, Hand." Sometimes he got the whole word

more readily if he wrote down the letters one after the other, as their sounds occurred to his memory. In doing so, he would look at the object, and then write the first letter of its name; then look again at the object, and get the second letter; and so on, until the name was completed. If, in the course of this process, the object was withdrawn from his sight, further evolution of the name became impossible to him, as he forgot even what object he had been looking at.

Professor Grashey explains these phenomena by suggesting that the faculty of *retaining* the whole sequence of sound-memories that constitutes a word was, in this case, so enfeebled that, unless the initial letter-sound was constantly repeated, or its symbol at once written down, it vanished from the patient's memory before he could produce the other letter-sounds of the sequence. He concludes (p. 684), from the study of the case, that there is a form of aphasia due to "diminished duration of the sense-impressions," which he thinks "in all probability is not rare, and is most likely to occur in a pure form in patients who have become aphasic after concussion of the brain, or during an illness attended with fever." It cannot, however, be said that pure cases of this kind are common; since, so far as I am aware, this case remains unique in the literature of the subject. In ordinary cases of aphasia, instead of comparative ease in the revival of images, and premature vanishing of them after their revival, we much more frequently meet with that difficulty of reviving them from within which is indicated by the term logamnesia; and, in not a few cases of organic aphasia, that marked persistency of them when revived which is exhibited in recurring utterances in speech and recurring letters in writing.

I may add that this patient ultimately made a good recovery from the symptoms described; so that, on the 19th of January 1885, his condition as to remembrance of objects and words seen, and as to speech generally, was practically normal. I have made rather a full note of the case, as it has attracted much attention, especially in Germany.

3. Conditions of Congestion of the Brain.—In concluding these remarks upon disturbances of speech in relation to evanescent organic affections of the brain, I may here note

that temporary aphasia has often been attributed, rightly or wrongly, to *congestion* of the brain. No doubt many of the cases have been produced by other causes, such as toxæmia; but there seems a good deal of ground for the belief that aphasic disturbance of speech may really be due to cerebral congestion. I have had a case in my own practice which lends support to this view. It occurred, a good many years ago, in the person of an old gentleman, of active mind and energetic habits, who for many years had been subject to occasional attacks of hæmaturia, especially after exposure to cold. It was exposure to cold which brought on the attack of aphasia to which I now wish to refer. He had got chilled, when standing in the street without a greatcoat, conversing with a friend, while a piercing east wind was blowing. Feeling himself become suddenly ill, he had taken a cab and driven home, but on arriving he was so weak on his legs that he had to be almost carried into his house. I saw him almost immediately; and, though I cannot now remember any details about his speech, I remember that, though he was conscious, he was almost speechless. I had him placed before a good fire, had his feet put into warm water, and had his limbs well rubbed; and in a few minutes his speech was restored. He was then put to bed, and rapidly recovered. I remember that the first urine he passed after the attack was like porter, from the quantity of blood in it. He lived for a number of years after this attack; dying eventually of aortic regurgitation, which, however, he was not suffering from at the time of the attack. His urine was always normal, except when he had one of these attacks of hæmaturia. The attack of aphasia and paraplegic paresis which I have just described was probably owing to the chill having produced, on this occasion, not merely congestion of the kidneys, as in his other attacks of hæmaturia, but also congestion of the brain and spinal cord.

Dr Ross (page 51) says,—"A transient attack of aphasia may also occur after a paroxysm of rage, or after a severe fright, shock, or sunstroke;" and he gives references to cases illustrating its occurrence in each of these conditions. It is difficult to know whether, in such cases, the aphasia is due to congestion of the brain, or to severe nervous disturbance; perhaps both may contribute to produce it.

Toxæmia.

I do not know of any poison which produces loss of speech, without loss of consciousness, as one of its constant and characteristic effects; but there are many poisons—some that can be introduced into the body from without, and others that, in conditions of disease, are formed within the body itself—which produce loss of speech occasionally or frequently. These are all poisons which act powerfully upon the brain, producing depression of function — as exemplified in mental stupor or unconsciousness, and in motor paresis or paralysis.

Among poisons that may be taken into the body from without, those belonging to the natural order Atropaceæ have the occasional effect of producing aphasia, perhaps more frequently than any others. Thus, excessive Tobacco-smoking has often caused temporary aphasia,[1] and so has a poisonous dose of Belladonna or of Stramonium. Among other poisons, the roots of Œnanthe crocata (which belongs to the hemlock order) have been known to have the same effect; so has Cannabis indica; and so, too, has Opium, which, like the rest, may produce amnesia verbalis, and, in one recorded case, has been known to produce paraphasia.[2] The well-known fact that Alcohol causes thickness of speech (slurring), I have already alluded to. It also causes dulling of the memory, and may produce amnesia of proper names, and even of the names of things.

Two other poisons of this class should be specially noted. I mean Snake-poison and Lead.

Dr William Ogle,[3] in 1868, wrote a very interesting paper on Snake-bite as a cause of loss of the power of speech. I shall not discuss the theory he offers in explanation of the phenomenon,

[1] G. Ballet (*Le Langage intérieur*, 1886 ; and see also Séglas, *op. cit.*, p. 88) has recorded the fact that he has sometimes produced temporary aphasia in himself by excessive tobacco-smoking. He forgot the names even of common objects, such as an umbrella ; and, even when he could recall the visual image of the name, he could not pronounce the word until his mind had dwelt upon its visual image for some time.

[2] For references to cases showing the action of these various drugs in occasionally producing aphasia, and for a fuller discussion of the subject, I beg to refer the reader to Sir Frederic Bateman's work, p. 273 *et seq.*

[3] *St George's Hospital Reports*, vol. iii., 1868, p. 167.

but shall merely say that he conclusively shows that, in cases of snake-bite, loss of the power of articulate utterance often precedes loss of consciousness, and sometimes persists for days or weeks after all danger to life is past. It is worthy of remark, that in snake-bite the loss of the faculty of speech seems to be entirely on its productive side; since the patients whose cases are cited continued, while conscious, to understand what was said to them.

The other poison is Lead. It is in cases of chronic plumbism that temporary aphasia is apt to be exhibited: sometimes in association with other symptoms of severe "cephalopathia saturnina," such as epileptiform or apoplectiform seizures, paralysis, etc.; sometimes in association with the milder manifestations of plumbism, such as colic, etc. Many cases are on record that show the frequent association of temporary aphasia with chronic plumbism.[1]

Among the conditions of toxæmia in which a poison has been formed *within the body itself*, the two most important, as occasional causes of temporary aphasia, are the uræmia of Bright's disease and the acetonæmia of diabetes. So important, indeed, are these two, that in every case in which there is a history of a temporary attack of aphasia the urine should be examined, both for albumen and for sugar. There are now numerous cases on record, both of uræmic and of diabetic aphasia. It is not a permanent symptom; but either passes off speedily, like a temporary attack of uræmic amblyopia, or forms but a prelude to more serious symptoms, such as uræmic or diabetic coma.[2]

I may here refer to an interesting case in which aphasia occurred as a passing symptom in the course of Diabetes Insipidus. It is a case recorded by M. Chouppe.[3] The patient, a man who had recently been in hospital, had been travelling on foot in search of work, without food, and with few opportunities of satisfying his great thirst, and had at length sunk down exhausted on the road, and fallen into a deep sleep or coma. On being roused, he was found to be quite aphasic; but he produced from his

[1] See, for example, Heymann (C.), "Ein fall von Aphasia saturnina," *Berl. Klin. Woch.*, 1865, p. 195.

[2] See Bernard and Féré, "Des troubles nerveux chez les diabétiques," *Archiv. de Neurologie*, tome iv., 1882, p. 340.

[3] *Comptes Rend. de la Soc. de Biologie*, 1892, p. 642.

pocket a ticket from the hospital, with the name of his complaint, "*polyurie simple*," written upon it. This led the doctor to supply him freely with water, of which he immediately drank about two litres. In about ten minutes thereafter, he recovered his speech, and was able to give an account of himself. M. Chouppe attributes the aphasia to "cerebral deshydræmia."

The fact that aphasia may thus occur in diabetes insipidus, from simple dehydration of the blood, suggests the possibility that its occurrence in diabetes mellitus may also sometimes be due to this cause, and not always to acetonæmia.

In Gout, we have another condition of toxæmia, produced by excess of urate of soda in the blood, which sometimes causes temporary aphasia. It seems probable, however, that in some of the cases attributed to Gout there may have been a uræmic element, due to the existence of gouty disease of the kidneys.

Aphasia and other Troubles of Speech in Relation to Infectious Fevers.

It is not surprising to find that conditions of severe fever, which are so potent as causes of disturbance of the whole nervous system, are occasionally attended with special disturbance of the function of speech; the disturbance being sometimes of the nature of aphasia, and sometimes merely a difficulty or thickness in articulation.

The occurrence of aphasia in connexion with fever attracted attention from an early period in the historical literature of aphasia; Trousseau, for example, having recorded some characteristic cases of it.

It is, however, to Albrecht Clarus that we owe the first special treatise on the subject. This was published in 1874,[1] as part of an able monograph on Aphasia in Children. Others have written well on the subject since that date, as, for example, Richard Kühn,[2] and J. R. Longuet.[3]

[1] A. Clarus, "Uber Aphasie bei Kindern," *Jahrbuch für Kinderheilkunde*, 1874, p. 369.

[2] R. Kühn, "Ueber Transitorische Aphasie bei Typhus Abdominalis," *Deut. Archiv für Klin. Med.*, xxxiv., 1884, p. 56.

[3] J. R. Longuet, "De l'Aphasie transitoire de la fièvre Typhoide," *L'Union Méd.*, xxxvii., 1884, p. 717.

Of all the fevers, typhoid seems, on the whole, the one most apt to cause aphasic disturbance of speech; but the symptom has also been met with, occasionally, in connexion with other fevers, such as typhus, small-pox, measles, intermittent fever, yellow fever, etc. In the papers I have referred to, numerous cases will be found recorded; but it may perhaps be sufficient if, instead of quoting any of them, I only try to make a brief statement of the general conclusions which have been arrived at from the study of these cases by Clarus and the other authorities.

In the first place, it is clearly established that aphasia occurring as a complication of typhoid or some other fever may be either of functional or of organic origin.

The Functional cases, which are greatly the more numerous, are those in which the aphasia exists temporarily, as a nervous symptom of the fever. "It appears usually," says Clarus, "in the later period of a severe case, after other severe nervous symptoms." This functional form is not accompanied by hemiplegia. It occurs much more frequently in children than in adults, and seems commoner in boys than in girls. It usually passes off in a few days. Occasionally it is prolonged for weeks, during the patient's convalescence from the fever; but in such cases it is always, ultimately, completely recovered from. Its occurrence in the course of a fever should not be regarded as a symptom of very bad omen; since experience has shown that recovery is the rule, notwithstanding the development of this symptom. When death occurs, nothing material is found in the brain to account for the aphasia. Clarus thinks that the weakness of the heart and the anæmia of the brain may be the causes of it. Probably, however, the exhaustion of nerve-power, produced by the fever, should also be taken into account. The aphasia is essentially, and as a rule purely, amnesic; and in a few carefully observed cases it has been evident that the speech-memories least deeply imprinted have been the first to be wiped out. Take, for example, the following interesting note, which I extract from Sir Frederic Bateman's work (p. 188): "Dr Scandella, an Italian, who died at New York in 1789, was master of the Italian, French, and English languages; in the beginning of an attack of yellow fever, of which he died, he spoke English only; in the middle of his illness he spoke

French only; but on the day of his death, he spoke only the language of his native country."

The cases of Organic Origin are of altogether different nature. Clarus attributes them, I think rightly, to embolism; whereas Kühn thinks they are probably due to hæmorrhagic extravasation. In this form, the aphasia is developed suddenly, *along with hemiplegia;* and, if the patient recovers from the fever, both the hemiplegia and the aphasia are apt to be permanent. It is worthy of remark that it is not so often at the height of the fever that this form occurs, as during the patient's convalescence,—when his heart is daily getting stronger. It seems probable, indeed, that the increasing strength of the heart's contractions leads to the detachment of a clot which has been formed in some recess of the left auricle or ventricle during the heart's period of weakness; and that this clot, swept into the middle cerebral artery, is the cause of the hemiplegia and aphasia. Many cases of this kind have been put upon record; one of the best of them being a case recorded by the late Dr Scoresby Jackson,[1] in which a young man, during convalescence from typhus fever, became suddenly hemiplegic and aphasic. I remember having, a good many years ago, when in charge of fever wards, a young man under my care who suddenly in this way developed, during his convalescence from typhoid fever, a left hemiplegia without aphasia. Had the hemiplegia been on the right side of the body, the patient would probably have been aphasic as well as hemiplegic.

Although Motor Aphasia is the type most commonly presented when embolism is the cause, it will be readily understood that any type may be presented, according to the centre or centres disabled by the cutting off of the blood-supply.

The cases of functional origin are, as we have seen, much commoner in children than in adults. But I do not think we can say the same of the cases of embolic origin. They are probably as common in adults as in children. They also, as has already been indicated, differ from the functional cases in being associated with hemiplegia, and in being developed more frequently during convalescence than at the height of the fever.

There is still a third form of speech-disturbance in connexion

[1] *Edin. Med. Journal*, 1867, vol. xii., part 2, p. 577.

with fever, which deserves to be specially noted. It is a Dysarthria (difficulty of Articulation), a purely motor disturbance, not properly of aphasic nature.

Westphal is the authority who has paid most attention to these articulative defects in fever.[1] He describes particularly a slow *staccato* utterance, like that of multiple sclerosis, as being not unfrequently met with in the course of small-pox. If the attention of physicians generally should be attracted to the effects of fever upon the power of articulation, it would probably, I think, be found that also other defects are common. Slurring, I anticipate, will be found to be the commonest of all; and I am inclined to believe that extreme slurring, so marked as to make the patient's speech unintelligible, or nearly so, will be found to be a symptom of grave significance,—probably much graver than the occurrence of an amnesic aphasia, inasmuch as it is so suggestive of prostration of motor power. I have myself met with one case of such extreme slurring in typhoid fever. The patient, a middle-aged woman, had by accident been admitted into my general ward, on the 9th of Jan. 1892; and was so prostrate that, when I saw her next day, I thought it well not to subject her to the strain of being removed to the fever hospital. She died on the second day after her admission. She had slurred more and more during the last eight days of her life; and when I saw her, her speech was almost totally inarticulate, though she was evidently quite conscious. I think this subject deserves more attention than it has yet received.

Aphasia in Insanity.

It will be remembered that in treating of the troubles of speech in Insanity, I reserved for future consideration the relations of aphasia to insanity, merely remarking that, among the insane, aphasia is met with in two classes of cases, viz., (1), the class in which the insanity and the aphasia are alike due to the presence in the brain of some gross lesion, such as a softening; and (2), the class in which aphasia exists as a functional complication of insanity, often a merely transitory complication, and in which there is no gross lesion in the brain to account for it. In

[1] "Dysarthrische Störungen bei Pocken und Typhus," *Berliner Klin. Wochenschr.*, 1872, ix., No. 1, p. 8.

now making a few notes as to the relations of aphasia to insanity, I shall pass over the first of these two classes altogether, and confine my attention to the second.

It will be readily understood that the varieties of insanity which are most apt to be complicated by the occurrence of functional aphasia are those in which there is obvious depression of the nervous energies of the brain. The depression of energy may be lasting, as in senile dementia and in chronic melancholia, or may be temporary, as after one or other of the numerous forms of nervous seizure which the insane are peculiarly apt to experience from time to time. Let us look for a moment at the effects of each of these two classes of conditions.

1. Conditions of Lasting Depression of Nervous Energy in Insanity.—We have already considered the speech troubles of chronic dementia, and have seen that a true amnesic aphasia from time to time exhibits itself in such dementia, and more especially, perhaps, in one of its varieties—the senile. Indeed, a certain amount of amnesia of proper names is so common in advanced age that it may be said to be almost a normal phenomenon. But when, in the aged, the mental powers become so enfeebled that the patient may be described as being the subject of senile dementia, the amnesic aphasia is often more strikingly exhibited. It may be constantly present, displaying itself, for example, in a forgetfulness of the names of common objects, or it may occur only from time to time, when the brain is temporarily exhausted. Along with the amnesia verbalis, there may, at such times, be a disablement of articulation which shows all the characteristics of motor asynergia.

It is so, also, in connexion with the mental enfeeblement and depression that attend upon melancholia, and more especially upon melancholia with stupor and mutism. Séglas has studied this subject with care, and has recorded a number of interesting cases of melancholia in which various kinds of disturbance of speech were observed.[1] Besides the mutism so common in such cases—due sometimes to inattention to everything but the internal hallucinations and delusions, sometimes to enfeeblement of will

[1] *Les troubles de la parole chez les Aliénés*, Chap. ii.

or of motor power,—he notes the occasional occurrence of troubles in the power of reception and interpretation of speech. (1.) He states that the patient may, as in an ordinary case of word-deafness, be able to hear the sound of the words spoken to him, but not be able to interpret them,—because of functional disablement of the auditory word-centre A. (2.) He states that there may be something more than this: that there may be general mind-deafness. In this condition, the patient is unable to recognise even common sounds. When spoken to, he not only fails to interpret the words spoken, but also to recognise the tones of a voice that at other times is perfectly familiar to him. One of Séglas's patients expressly stated to him that his voice sounded as if it were the voice of a stranger. (3.) He has also noted that in some of these cases of melancholia, there was what he terms a loss of the power of synthesis in interpretation. The patient could interpret the meaning of individual words, but not that of a sentence,—because he could not hold the whole sentence together in his mind. This was apparently due to evanescence of the word-images. It need scarcely be said that all such observations upon the speech of melancholics are necessarily made under circumstances of exceptional difficulty, and are correspondingly liable to fallacy.

2. Conditions of Temporary Depression of Nervous Energy in Insanity.—It is known that the insane as a class are peculiarly apt to suffer from other nervous troubles besides their insanity. A large proportion of them are liable to temporary conditions of great mental excitement; or to seizures of various kinds, such as epileptic or hysterical fits, attacks of megrim, the apoplectiform or epileptiform seizures of general paralysis known as "congestive attacks," cataleptic conditions, and many other such disturbances.

All, or nearly all, such seizures cause exhaustion of cerebral energy for a time, and one of the evidences of such exhaustion may be a temporary development of aphasia. But, as these different kinds of seizure are also of frequent occurrence in persons who are not insane, and in them, too, are apt to produce aphasic disturbances of speech, it will, I think, be better to describe their effects on speech under separate headings, rather than to treat of them all in relation to the speech of the insane.

Before leaving the subject of insanity, however, let us note a variety of seizure that we shall not again have occasion to refer to—I mean the "congestive attacks" of general paralysis. We may say about it, in a word, that, in patients with general paralysis, temporary aphasia is, after a "congestive attack," of very common occurrence. The nervous exhaustion resulting from the attack seems to be the cause of it.

Aphasia in Hysteria.

In the second chapter, the disturbances of speech that may possibly be presented in hysteria have been fully considered. It will be remembered that by far the commonest of these is hysterical Aphonia; that hysterical Mutism is occasionally met with; and that hysteria has important relations to Stammering,—stammering being in some few cases distinctly due to the nervous disturbance produced by an hysterical fit,[1] and being in most cases a developmental defect of speech that occurs with special frequency in children of nervous or hysterical constitution.

We have seen how closely hysterical mutism trenches upon true motor aphasia; the chief points of difference being that in hysterical mutism the voice is, in the great majority of cases, lost, and the power of writing completely retained, whereas in ordinary motor aphasia the voice is retained, and the power of writing lost or greatly impaired.

True aphasia is rare in hysteria; but that it occasionally occurs is now coming to be the accepted view of those who have paid most attention to the subject. There are now, indeed, several cases on record in which a true motor aphasia, of purely functional origin, has been found to be due to hysteria,—being, as a rule, a temporary result of some hysterical seizure. In some of those cases, as in the case originally recorded by Charcot, and quoted by Natier[2] in his collection of cases of hysterical mutism (see second chapter), agraphia was present as one of the symptoms. The best

[1] See the article entitled "Du bégayement hystérique," par M. Gilbert Ballet, *Bull. et Mém. de la Soc. Méd. des Hôpitaux de Paris*, 23rd October 1889; also the article, "A propos du bégayement hystérique," par le Dr Chervius, *Arch. de Neurologie*, 1891, p. 365.

[2] *Contribution à l'étude du Mutisme Hystérique*, 1888, p. 47.

case of this kind that I know of is one that has been published recently; and this case is so instructive that I am tempted to insert here a short note of it.

Case IV. (P. Ladame, *Centralblatt für Nervenheilkunde*, iii., 1892, p. 241). *Case of Aphasia with Agraphia due to Hysteria.*—Mme. F., the wife of an employé on the railway; age not stated. She had formerly, at the age of 20, suffered from hysterical mutism for six months. On the 9th of January 1892, she was brought to Dr Ladame by her husband, on account of a second attack of hysterical mutism; and this attack seems to have been of that variety which disables the oral articulative mechanism (see second chapter), as, though it is asserted that the patient was without voice, it is also stated that she could emit rough sounds like *han, hon, han.* She was quite speechless. She was much excited, and trembled all over the body, the trembling being most marked in the right arm. Her writing was very tremulous and almost totally illegible. There was complete anæsthesia of the whole of the right side of the body; and, as is often the case in hysteria, the pharyngeal reflex was absent. The attack had begun suddenly, three weeks before she was seen, in consequence of a fright she had got in a dream. The fright had caused some kind of fit, with convulsions, especially in the right arm, and unconsciousness. On recovery of consciousness, the patient was found to be in the condition above described.

It is interesting to find that in this case the mutism was cured, as it had been produced, by a fright. This second fright the patient experienced on the day after she had consulted Dr Ladame. Her husband had had some friends with him in the house at the time, and the patient, with her baby of four months, had been seated in the room with the company. One of the friends, happening to reach up to a shelf for a glass, brought down the shelf, and a great many bottles and glasses that had stood upon it, with a great crash. The patient was for the moment much frightened, and tried to cry out, but could emit only inarticulate sounds, somewhat like *can, can.* She, however, composed herself, and was presently able to sit quietly, listening to the conversation, and at the same time caressing her baby. About ten minutes after the fright, when she was looking fondly at her baby, she suddenly heard her own

voice pronounce the words, "est-tu bien, mon petit." From that moment, she could speak perfectly well: she did not even stammer; and her voice was no longer rough. The pain and tingling in her head, and the anæsthesia of the right side of the body, also disappeared; and when Dr Ladame saw her next day he found that the pharyngeal reflex had returned; and that she could now not only speak, but write quite well. "In a word," says Dr Ladame, "she retained none of the stigmata of her hysteria."

In commenting on the case, Dr Ladame recalls the dialogue in Molière's *Le Médecin malgré lui*, in which an hysteric emits, in reply to all questions, the sounds "*han hi hon han han hi hon;*" and he thinks that Molière must, at some time, have met with a real case of hysterical mutism, as the sounds *han hon* were the very sounds that were emitted by his own patient. It should be remembered, however, that this variety of hysterical mutism, in which the oral articulative mechanism is disabled, is rare. Much more common is the other variety, in which the vocal mechanism is disabled,—so completely that the patient cannot even make the laryngeal noise that is required for whispering. The two varieties have already been described in the second chapter. The point of interest in this case is the similarity—almost complete identity—of the symptoms with those of an ordinary case of motor aphasia. There is, for example, the recurring utterance *han han*. There is also a form of agraphia; though the specimen of writing given in the paper does not show the "recurring letters" that are so often exhibited in motor aphasia. It is illegible largely from the tremulousness of the handwriting.

I may here add a remark or two regarding the speech disturbances apt to occur in certain other conditions closely allied to Hysteria, viz., Catalepsy and Ecstasy, and the condition now termed Astasia Abasia.

In reference to Catalepsy and Ecstasy, Kussmaul (p. 801) says, "In catalepsy, the power of speech is lost during the attack, and the same thing may happen in ecstasy." Future investigation will, no doubt, show to what special causes the loss of speech is, in these two conditions, due. Perhaps in catalepsy it is due to temporary disablement of the motor centres; and in ecstasy to the concentration of the attention upon a single fixed and absorbing idea.

As to Astasia Abasia, it is the condition that was first described by Dr Weir Mitchell under the name of Hysterical Ataxia. In this condition, the patient may, from incoördination of muscular action, be unable to walk (abasia), or even to stand (astasia). I find that in one good case, recorded by Charcot,[1] it is noted that there was a curious interference, not with the power of speech, but with that of *writing*. The patient could perform all ordinary movements with his hands perfectly well, without either incoördination or trembling; but when he tried to write, it was found that, after writing some lines quite legibly, he began to make only illegible strokes; and, as he went on, these strokes became closer and closer to each other, until they fused themselves into a single tremulous stroke, repeated over and over again.

Aphasia in Relation to Epilepsy.

It is a well-known fact that temporary aphasia often makes its appearance in connexion with epilepsy, sometimes as a preliminary "aura," sometimes as an after-consequence of the fit. In the latter case, it is no doubt due to the exhaustion of the brain that is brought about by the "motor discharge." Kussmaul (p. 800) says, "After epileptic attacks there is often loss of speech for hours, days, or weeks at a time." Dr Ross (p. 50) says, "The most common functional lesion of the brain that gives rise to aphasia is the condition which precedes or follows an epileptic attack. In some cases, the warning of an epileptic attack consists of a sudden inability to speak; and it is very probable that word-deafness and word-blindness is by no means an uncommon aura, though the presence of these conditions is not so readily recognised by the observers as a motor aphasia, and in subsequent descriptions by the patient they can hardly be distinguished from the mental confusion which attends the onset of unconsciousness. A transient aphasia often succeeds to the unilateral convulsions which are caused by gross lesions of the brain, such as gliomatous and gummatous tumours, and projecting spicula of bone."

In cases of partial epilepsy of the Jacksonian type, without loss of consciousness, the disablement of the power of speech is always exhibited whenever the convulsive disturbance involves the

[1] *Leçons du Mardi*, 1890, p. 355.

muscles of the cheek, tongue, etc. I have notes of two cases of this kind, in which the convulsions were limited to the right side of the face and the right arm; and, in each of these, the patient was speechless, though never unconscious, both during the seizure and for a minute or two after it was over.

It has been suggested—I do not remember by whom—that the loud "epileptic cry," which so often precedes a fit of general convulsions, is due to sudden motor discharge from the centre for phonation, in the foot of the ascending frontal convolution; and I think there is much probability in the suggestion.

Speech Troubles in Chorea and in Spasmodic Tic.

1. In Chorea, a certain degree of mental dulness very often precedes the appearance of the choreic movements in the limbs, and is apt to persist while these movements are present. In severe cases, again, there is often wild delirium. Therefore, the mental functions being so often involved, it is not improbable that an element of amnesic aphasia is common in chorea. But I cannot say that I have met with any distinct records of cases showing the presence of this condition. What we do find very commonly is more or less interference with the motor execution of speech; and this is sure to be exhibited whenever the muscles of the oral articulative, the vocal, or the respiratory mechanisms are seriously involved in the spasmodic disturbance. In not a few cases, the muscles of all these mechanisms are seriously involved together. They may be affected to such a degree, that the patient is, for the time being, rendered practically dumb.[1]

I may here insert a brief note of two cases of my own, in which speech was thus markedly interfered with; one of them being a case of ordinary chorea in a child, and the other a case of chronic chorea in an adult.

Case V. (Personal observation.) *Shows disturbances of speech from involvement in choreic movements of the muscles of oral articulation, phonation, and respiration.*—A boy aged eight, admitted into Ward 31, on 10th of December 1892. The chorea had

[1] Some very instructive cases of chorea with speech disturbances have been recorded by Charcot, *Leçons du Mardi*, 1889, pp. 37 and 103.

developed gradually, after an attack of subacute articular rheumatism, in the preceding August; and had been getting rapidly worse for a fortnight before his admission. Almost from the first appearance of the choreic movements, the mother had noticed that the articulation was interfered with. Along with very marked choreic movements of the upper and lower limbs, and of the face and neck, there was, on admission, so much interference with articulation, that the patient was for a time almost dumb. On the 14th of December, I dictated the following note as to the condition of speech, etc.: "Breathing on the whole is regular, but now and again inspiration is only half-drawn, or it is too fully drawn. Expression of face is dreamy. When asked his name, says 'John' pretty distinctly, but gives his surname 'Adam' in a whisper. When asked his age, says 'ng—nine.' The following is a list of words he was asked to pronounce, and of the sounds he produced instead of them:—For Guardbridge (his home) he said 'Ayab.' For Mother he said 'Moo.' For Yes—only makes the sibilant sound of S. For Father—opens his mouth and protrudes point of tongue. On second attempt says 'Fath' in a whisper, turning up his eyes at the same time. For Papa—merely presses his lips together, and protrudes them. On second attempt, says 'Pap' in a whisper. Mama—is pronounced correctly, but in a whisper. For From—says 'Thumb.' For So—merely hisses the sibilant S."

On the 24th of December, when he was asked his name, his tongue could be heard working within his mouth for some time, until, with evident effort, he got out "on," for John.

From this date, he improved steadily. On the 25th of February, he left the Infirmary quite well, and able to speak with perfect ease.

Case VI. (Personal observation.) *A case of chronic chorea in an adult showing troubles of speech very similar to those of the last case.*—The patient was a man, aged 43, who came to me as an outpatient in January 1892. He is a well-known inhabitant of the Grassmarket, where his extraordinary walk and gesticulations attract general attention. Many years ago, he was a marine in the Royal Navy. In 1872, he was invalided home on account of ague, contracted in the West Indies. In 1884, when still in the Navy, he began to suffer from epileptic fits; and, as these

continued to recur every three months, he was, in 1886, discharged from the service. He then became a baker, and continued at this occupation until October 1887, when he began to suffer from numbness and tingling. These sensations were first felt in the upper limbs, then in the lower, and, finally, also in the muscles of the trunk and of the head and neck. In 1890, he began to suffer from choreic movements, first in the left hand and arm, and then in the right; and the movements gradually extended to his lower limbs and trunk, until they involved his whole body. In January 1892, when I first examined him at the Infirmary, the chorea was exceedingly well marked. Even when he sat upon a chair, all his limbs executed the most grotesque movements. As to the other parts of his body, the trunk was violently arched backwards from time to time, the head was turned suddenly to one side or the other, and the features were perpetually undergoing extraordinary contortions. In walking, the foot was generally lifted high in the air, before being brought down with emphasis on the heel, the knee being meanwhile kept stiff; and at the same time the arms were violently thrown about. Mischievous boys of the street are apt to mimic his extraordinary gait, and he told us that when they do so he is so much annoyed that his excitement often brings on one of his epileptic fits.

After the perpetual motion of the day, he feels thoroughly worn out at night; but in the morning, after a good night's sleep, he is comparatively fresh.

The speech of this patient closely corresponds to the speech of the little boy whose case has just been noted. It is emitted in a most jerky and irregular manner, being sometimes delayed by the involuntary movements of the tongue, lips, etc., and sometimes—suddenly, in the middle of a word—either converted into a whisper by the involuntary movements of the muscles of the larynx, or arrested altogether from sudden stoppage of the expiratory air-pressure, or sudden occurrence of an involuntary inspiration. For example, in telling us that he had lately been taken before the sheriff as an impostor, the poor man said that he had told the sheriff that he was anything but an "impo—" (word arrested by sudden inspiration).

2. Spasmodic Tic.—This is a condition closely allied in its

symptoms to chronic chorea, but differing from it in the more sudden and less coördinated nature of the movements. A chronic and usually incurable malady, it occurs in all degrees of severity, from a mere local and momentary spasm, such as the spasmodic and violent closure of the eyelids, or the sudden and involuntary shrug of a shoulder, up to constant and severe movements of the whole body, closely analogous to the movements of severe chronic chorea. In cases of the latter degree of severity, it will probably be found that speech is often interfered with, in a manner similar to that exhibited in cases of severe chronic chorea.

But in connexion with spasmodic tic there is also occasionally exhibited another phenomenon, which seems never to be met with in connexion with chronic chorea. This is Logospasmus Choreiformis, a sudden and involuntary emission of some particular word or phrase; and is the phenomenon to which the name Coprolalia (κόπρος, ordure, and λαλεῖν, to talk) is given, when the word habitually ejaculated is a dirty and disreputable one, as it very often is.

In the chapter on the speech of the Insane, I have already referred to this curious phenomenon, and to the indications of weakness of mental balance that are usually found associated with it in severe cases of spasmodic tic.

Aphasia in relation to Megrim Headache and to Simple Nervous Exhaustion.

In ordinary Megrim, which is so extremely common, aphasic disturbance of speech is very rare. It is less rare, however, in what are called the "accompanied" forms,—the forms in which the headache is accompanied either by ophthalmic phenomena or by paresis of one side of the body. When there is paresis of the right side of the body, there is often also aphasic disturbance of speech; and in cases of "ophthalmic megrim," even when there is no hemiplegic paresis, aphasic disturbance of speech is not uncommon.

In ophthalmic megrim, the disturbance of vision usually precedes the onset of the headache. As is well known, it often takes the form of a temporary attack of homonymous hemianopsia.

This begins with a small blind spot in the centre of the field of vision, which gradually spreads, in both eyes, on one or other side of the field, until the hemianopsia is established,—the spreading margin of the blind area being surrounded by zig-zag lines of silver or coloured light, which are in perpetual dancing movement. When these scintillating lines of light reach the periphery of the field of vision, the centre of the field begins to clear up, and clearness of vision then gradually takes the place of blindness on the affected side, until the whole field is clear. It is when the hemianopsia is clearing away that the second stage of the attack, the stage of pain in the head, sets in. This stage of pain may be succeeded by a third stage, viz., that of vomiting, with which in some cases the attack terminates.

It would seem that aphasic disturbance of speech may appear either in the first or in the second stage. It sometimes takes the form of a simple amnesia of words, especially of nouns, which makes the patient, for the time, unable to produce the words either orally or in writing; but in other cases both word-deafness and word-blindness are present.[1]

I have before me notes of a case of functional aphasia, occurring in the course of an attack of megrim with ophthalmic accompaniments; but, as such cases are now common in medical literature, I need not here give an account of this one.

Megrim headache is one of the commonest causes of temporary aphasia. It is, of course, well to keep this fact in mind; as an attack of aphasia, however temporary, always excites alarm in the mind of the patient and of his friends. If the cause of the aphasia is obviously megrim, it is a great matter that the physician should be able to assure the patient and his friends that there is no need for alarm. This he can generally do. At the same time it should be remembered that "accompanied megrim" is on the whole a graver neurosis than the simple unaccompanied form; and this may be said whether the accompaniment be hemianopsia, or aphasia, or hemiplegic paresis, or all three combined. Ophthalmic megrim, developed, as something new to the patient, in middle life, has sometimes proved to be the precursor of a nervous break-

[1] Charcot has recorded such a case, *Gazette des Hôpitaux*, 17th May 1884. (See also Séglas, *op. cit.*, p. 89.) In this case the aphasia always set in with the second stage of the attack, the stage of pain in the head.

down, which may even take the form of General Paralysis of the Insane.[1]

As the reproductive system has most important relations to the nervous system, it is not surprising to find that some of its conditions and disorders have to be ranked as important causes both of nervous exhaustion and of megrim. In the female, the conditions of menstruation, parturition, and lactation, and the nervous disturbances so commonly developed at the climacteric period, are all recognised as being apt to cause attacks of megrim in persons predisposed to that neurosis. They may thus, in rare cases, be connected with the occurrence of temporary aphasia. In the male, temporary aphasia has, in a few cases, been found to be directly attributable to sexual excesses. Crichton (*op. cit.*, vol. i. p. 371) has recorded an interesting case of this kind.

There are upon record a number of interesting cases of temporary aphasia, occurring in the persons of eminently intellectual men, who have been able, when the attack was over, to give an account of their experiences during it; and there is reason to think that some of these cases have been due to megrim.

The celebrated case of Dr Spalding of Berlin, which has been given by various authors, and will be found detailed in the paper by Professor Gairdner, already quoted from,[2] may perhaps have been due to megrim, or simple cerebral fatigue, or both together. It is a remarkable case, inasmuch as the reception and interpretations of speech, or at least of written speech, were evidently interfered with, as well as its production.

Dr Spalding, in January 1772, after having been rather busily engaged, was asked to draw up a receipt for interest. "He accordingly sat down and wrote the first two words requisite, but in a

[1] Such a case is recorded by Charcot, *Leçons sur les maladies du système nerveux*, t. iii., 1887.

[2] *Proc. of the Phil. Soc. of Glasgow*, 1865–68, p. 110. Dr Gairdner quotes the case from the work of Dr John Cheyne entitled *Essays on Partial Derangement of the Mind in Supposed Connexion with Religion*, Dublin, 1843. The case, I find, is also fully given, in Dr Spalding's own words, by Dr Crichton, in his work entitled *An Inquiry into the Nature and Origin of Mental Derangement*, 1798, vol. i. p. 287. Dr Spalding attributes the attack to the previous straining of his attention. After describing the work he had been engaged in, he says, "My attention, therefore, was constantly kept on the stretch, and was continually shifting from one subject to another."

moment became incapable of finding the rest of the words in his memory, or the strokes of the letters belonging to them." He wrote some words, and knew that they were not right, but could not tell exactly what was wrong with them. He therefore, by signs and monosyllables, quietly ordered away the man who was waiting for the receipt, and proceeded to observe his own condition. He found that he could think quite clearly, in spite of emotional and ideational disturbance, and that he could see and hear "everything about him with its proper shape and sound." But when he tried to speak, he found that he could only pronounce unmeaning syllables. After sad meditation upon his condition for half an hour, he found himself getting clearer and more quiet in his mind. Wishing to summon his family, he first practised the pronunciation of the requisite order, and then rang for the servant. When the members of the family arrived, he was able to speak to them, though slowly and with difficulty; but, by-and-by, his facility of utterance returned; and he found himself only with a trifling headache. He now bethought him of the receipt he had been attempting to write, and—behold!—instead of "Fifty dollars for half a year's interest," as it should have been, he found that he had written, in as clear and straight strokes as ever he had made in his life,—"Fifty dollars through the sanctification of the bri-," with a hyphen, as he had come to the end of a line. He could not in any way account for the extraordinary words he had written.

The case is of special interest, as showing (like Prof. Charcot's case, alluded to in the footnote to p. 404) that in functional aphasia there may, along with simple amnesia verbalis, occasionally be also paragraphia, and failure in reception and interpretation of speech.

The case of Professor Lordat of Montpellier is of still greater interest; because Lordat, who was himself the patient, had long been deeply interested in the subject of speech, and was therefore, on his recovery, able to give a very detailed account of his own experiences. But I refrain from giving this case in detail, partly because it has been so often recorded, and partly because it has always seemed to me probable that the case may have been due to some organic cause, such as thrombosis of a cerebral vein or sinus. I found this opinion upon the facts—(1), that the attack

set in upon the sudden and unexpected retrocedence of an attack of quinsy, which did not go on to suppuration, as the patient's previous attacks had done; (2), that, unlike other supposed examples of aphasia of functional origin, the aphasia here lasted, not merely for a few minutes or hours, but for several months; and (3), that it left behind it a certain slight damage to the power of expression. We are told by Trousseau that before the attack Lordat delivered his eloquent lectures on physiology without notes, but that after it he was obliged to read his lectures. That the damage was not very material will be apparent to any one who reads Lordat's admirable treatise on the *Analysis of Speech*,[1] written subsequently to the attack, and containing his account of it.

The most remarkable point in Lordat's case is his distinct assertion that he could internally think quite well, and could even in his mind arrange the headings of a lecture, though unable to find in his mind the words in which his thoughts could be expressed. For the time, also, he seems to have been totally word-blind, and partially or totally word-deaf; and it is touching to read his description of his delight, when, one day, the title of a work in his library caught his eye, and he found himself able to read once more, and understand, the words "Hippocratis Opera."

Sometimes, in functional aphasia, paraphasia has been observed. Thus, Professor Gairdner records the case of a friend of his own, who had attacks of ophthalmic disturbance and vertigo—evidently of the nature of megrim, though without headache or sickness,—and who, during the attacks, exhibited marked paraphasia. "Whenever he attempted to speak in the midst of this vertigo, the words seemed to come out quite differently from what he intended, and as if he had lost control over them. In fact, he talked nonsense, knowing and feeling that it was nonsense, but without the least power to make sense of it."[2]

A similar case will be found noted in Sir Frederic Bateman's work (p. 203). It occurred in the person of an eminent physician, who, at the time, was suffering from severe fatigue, and possibly also from megrim. When going through his wards at the Infirmary "after a deal of hard professional work, he lost command of

[1] *Analyse de la parole*, 1843.

[2] *Proceedings of the Glasgow Philosoph. Society*, 1865–68, p. 113.

his tongue, and found himself talking nonsense—absolute nonsense. He knew that he was talking nonsense, but he could not help it, and he felt for the time being that he must speak nonsense. At the same time he was attacked with giddiness; but after resting a little, he regained control of himself, and the symptoms never occurred again."

Thus, among the phenomena of functional aphasia may, as of occasional occurrence, be reckoned paraphasia, paragraphia, word-blindness, and word-deafness. But the occurrence of these phenomena is rare. The occurrence, indeed, of word-blindness or of word-deafness ought generally to suggest to the mind of the physician the probability of an organic rather than a functional cause. In common cases of functional aphasia, the leading and often the only phenomenon is amnesia verbalis (logamnesia)—the loss of the power of calling up words in the memory from within. Commonly the aphasia is purely amnesic: only in a few cases is it also agnostic.

Curious are the tricks that may be played upon an individual by a simple amnesia of nouns. The name of some familiar friend, or of some familiar place, may, for the moment, be forgotten. This is so common as to be scarcely pathological. But there is usually something pathological in the case, if the individual, even for a moment, forget his own name, or his own address. The famous case of the ambassador at St Petersburg, originally recorded by Crichton,[1] is referred to by almost all writers on aphasia. The ambassador had occasion to call at a house where he was not known to the servants. Wishing to give his name, he found, to his consternation, that he was not able, for the moment, to remember it. Whereupon he turned to his companion, and said to him, with much earnestness, "For God's sake, tell me who I am."

Aphasia and other Speech Troubles caused reflexly by Irritation of certain Peripheral Nerves.

The form of reflex irritation most familiarly recognised as a possible cause of aphasia is irritation of the intestines by worms, especially tape-worms or round-worms. There are numerous cases of this kind on record. It is in children that

[1] *An Inquiry into the Nature and Origin of Mental Derangement*, 1798.

intestinal worms most frequently produce this effect, just as it is in children that fits or chorea may be due to worms. I need not give details of any of the many reported cases of this kind; but I should like here to make a brief note of a case in which a round worm in the intestine of a child produced, not only fits, but also a temporary change in the child's disposition, making him wayward and unmanageable—almost insane, in fact,—and leading him to indulge, young as he was, in the repetition of bad words, which he had, no doubt, chanced to hear pronounced by his seniors. Indeed, the child's language in his fits of excitement was described as being as foul as it could well be. It was the kind of language to which the term coprolalia has so aptly been applied.

Case VII. (*A child under the care of* Dr Burn Murdoch *at the Royal Hospital for Sick Children*). *An intestinal round-worm causing fits, wayward disposition, and coprolalia.*—The patient was a boy, aged 4. He was originally admitted into my own Ward at the Royal Infirmary, but being too young for us, he was immediately transferred, on the 10th of July 1890, to the Sick Children's Hospital; where he came under the care of my friend Dr Burn Murdoch, who has kindly allowed me to make use of his notes of the case. From the mother's account, it appeared that the boy had had an illness about the beginning of the year, during which he had a fit of some kind, which rendered him unconscious for about twelve hours. But he recovered from this illness, and remained in good health until about three weeks before his admission, when, on returning home to his parents, after a short visit to his grandmother, he was found to be greatly altered in disposition, being noisy and unmanageable, and much given to destroying things,—tearing up books in the room, for example. Twelve days before his admission, he began to suffer almost daily from fits, which occurred in groups,—the fits following each other at short intervals for two hours at a time.

On admission, he was found to be a well-nourished child, but his expression was observed to be at times rather wild and fierce, and at other times rather vacant. He continued to have frequent fits. He was very restless, grimacing, and whistling loudly, and tossing about in his bed. When addressed, he sometimes spoke; but his answers were not always relevant. Occasionally he swore,

using "extremely foul language, especially when interfered with." Even during his very brief stay at the Infirmary, before his transference to the Sick Children's Hospital, his language made a strong impression upon all who heard it.

I need not follow out the case in detail, but shall only say that, after Dr Burn Murdoch had repeatedly given santonine, a round-worm, 10 inches in length, was passed by the child; and that, thereafter, there was rapid improvement in all the symptoms. He left the Hospital on the 2nd of August, much improved. On the 16th, when brought as an out-patient, he had had no fit for twelve days, and was altogether much changed for the better.

The case is interesting, especially as showing how the mental functions may be disturbed, and how a kind of coprolalia may be produced, by an irritation of the intestine acting reflexly upon the brain.

That Aphasia may, in children, be due to the presence of worms in the intestine, is a fact that has long been familiarly known. Cases have also been recorded in which accumulation of scybala in the large intestine had, in children, produced aphasia.[1]

From the facts adduced in this chapter, it is thus evident that aphasia, and other disturbances of speech, may be due to a great variety of causes. As Kussmaul puts it, "It is self-evident that all possible morbid processes in the brain may cause aphasia. They may do this in one of two ways: either they involve directly and permanently the conducting fibres and centres of speech, or they impair their functional vigour more mediately and temporarily, by pressure, ischæmia, or collateral hyperæmia, or perhaps also by simple reflex irritation and radiation."

I have thought it well to devote a separate chapter to the consideration of aphasia and other speech disturbances in relation to functional disorders of the cerebral cortex, because, in practice, these functional disturbances of speech are very common and important. They seem to me, therefore, to be well worthy of separate consideration.

[1] For references to cases of aphasia produced by worms or constipation, see Bateman, pp. 271 and 291.

CHAPTER XV.

Dysarthric and Anarthric Disturbances of Speech due to Lesions affecting the Motor Speech-Tracts.

Brief Sketch of the Anatomy and Physiology of the Motor Tracts for Speaking and Writing.

In the foot of the ascending frontal convolution, as we have seen, there is situated a special centre for the adduction of the vocal cords in phonation—a centre which is the chief cortical representative of the Vocal Mechanism.[1] Behind this centre, are situated various other centres, for the movements of the lips, tongue, pharynx, etc.; which, together, may be taken as the common centre representing the Oral Articulative Mechanism. It is in these centres for phonation and oral articulation that the motor fibres which constitute the motor speech-tract have their origin.

The motor fibres for Writing, as we have also seen, have their origin in the cortical centre for the hand, which lies across the middle of the ascending frontal and ascending parietal convolutions, opposite the posterior extremity of the second frontal convolution.

In experiments upon the brains of living animals, important differences have been observed, it will be remembered, in the effects produced by electrical stimulation of these various centres. In the first place, it has been found that stimulation of the centre for phonation on one side of the brain (either the left or the right side) causes a perfectly equal adduction of both cords; the cortical representation of this movement being perfectly bilateral. On the other hand, the movements caused by stimulation of the various sub-centres representing the oral articulative mechanism,

[1] To produce voice, it will be remembered, there must be, besides adduction of the cords, also expiratory pressure of air. The centre for the expiratory effort, however, has not yet been determined.—It may here be added, that in monkeys, Semon and Horsley have not found a centre for abduction of the cords, though they have found one in cats.

though bilateral, are stronger upon the opposite than upon the same side; the cortical representation of these movements being indeed bilateral, but not being perfectly so. Further, stimulation of the centre for the hand causes movements in the opposite hand only, not in both hands; the cortical representation of the movements of the hand being unilateral, not bilateral. For the explanation of these differences, I must refer the reader to Broadbent's law, which has already been considered in a former chapter.

The motor centres for speaking and writing are portions of the General Motor Area of the cortex. This general motor area occupies the middle third of each hemisphere, in front of and behind the fissure of Rolando; and in it are centres for all the voluntary movements of the trunk and limbs. Throughout the whole of this area, there are, in the cortex, large multipolar cells, known as the cells of Betz, which are supposed to be specially motor in function. It is the opinion of many authorities that the axis-cylinders of the fibres which go to form the General Motor Tract, and which transmit the motor commands of the cortical motor centres to the lower motor centres in the medulla and spinal cord, are really prolongations from the cells of Betz, and are therefore, vitally and physiologically, only parts of these cells.

I think it will help us to understand the course of the motor fibres for speaking and writing, if we consider them in connexion with the general motor tract, of which they form a part.

Converging from the various centres in the general motor area of the cortex, the white conducting fibres of the General Motor Tract pass inwards towards the centre of the hemisphere, among the other white fibres of its centrum ovale; until, on reaching the level of the upper surface of the corpus striatum and optic thalamus, they arrange themselves in a definite order, and constitute a flattened band; which is prolonged downwards towards the crus, as the motor part of the internal capsule.

The exact order in which the bundles of fibres from the various centres in the general motor area are arranged in the motor part of the Internal Capsule has been demonstrated lately by Beevor and Horsley,[1] who have solved the problem by a most elaborate series of experiments upon the brain of the macaque monkey. Of course I do not mean to give the results of these experiments

[1] *Phil. Trans. of the R. Society*, 1890, B., vol. clxxxi., p. 49.

in detail. It will suffice to say that the method adopted was to make a horizontal section of the hemisphere low enough to cut through the middle of the optic thalamus and corpus striatum, and thus cut across, and expose to view in the section, the internal capsule; and then to stimulate the cut ends of the fibres in the motor part of the internal capsule, and note the movements caused by such stimulation. The following diagram, which I copy from Professor Ferrier's recent work on *Cerebral Localisation*, summarises the chief results of the experiments. It represents a section of the brain of a macaque monkey,

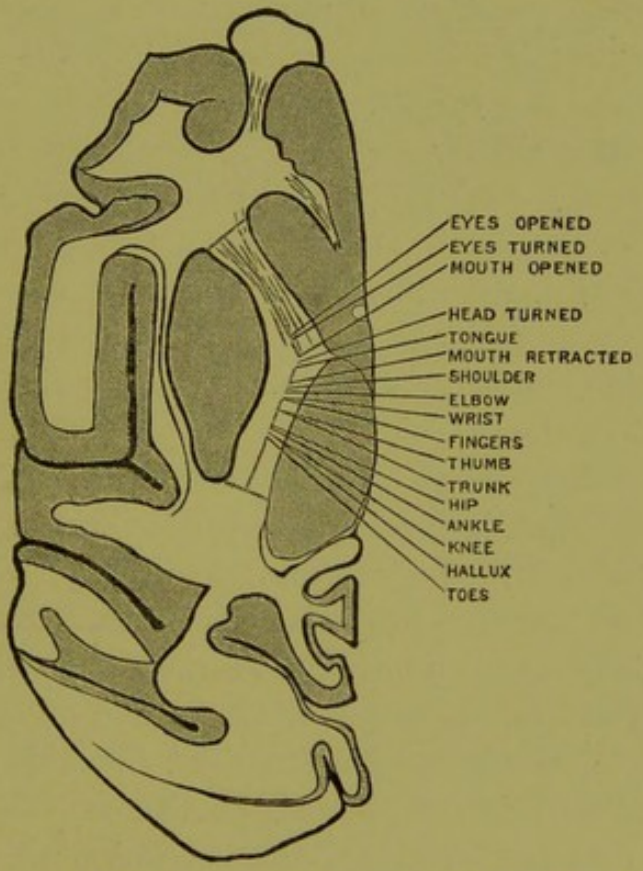


FIG. 16.—(After Ferrier.)—The sketch, which was made for Professor Ferrier's work by Dr Beevor, shows the arrangement of the motor fibres of the internal capsule, according to Beevor and Horsley.

made at the level above mentioned. It exhibits well the position and relations of the internal capsule; showing how the anterior limb of the capsule lies between the lenticular nucleus and the caudate nucleus of the corpus striatum, and the posterior limb between the lenticular nucleus and the optic thalamus; and how, uniting the two limbs, anterior and posterior, there is the "knee" or knee-like bend—an important landmark.

Let the reader note, in the diagram, the portion of the internal

capsule which has been found to be composed of motor fibres belonging to the general motor tract. This portion is the middle third. It begins a little in front of the knee, and extends backwards, so as to include the knee and more than half of the posterior limb of the capsule. The remaining portions of the capsule—roughly, the anterior and the posterior thirds—are not motor in function. The anterior third is derived from the cortex of the præfrontal convolutions, and its functions are unknown. The posterior third is composed of sensory fibres which pass upwards in the capsule, to end ultimately in the gyrus fornicatus and other cortical areas for sensation.

Before leaving this diagram, let us note in it the position of the motor fibres for the tongue, mouth, etc.,—the oral articulative mechanism. It will be observed that they lie far forwards in the motor division of the capsule, at and about its knee. The situation for the fibres of the vocal mechanism is not shown in this diagram; but I may say that, according to the results of a recent elaborate investigation by Semon and Horsley,[1] the fibres for adduction of the vocal cords are situated "in almost exactly the middle of the posterior limb of the capsule."

As we trace the general motor tract onwards to the crus cerebri, we may remark that, in passing downwards, within the capsule, to the base of the brain, the fibres pass on directly, without forming connexions with the cells in the corpus striatum or optic thalamus. It was for a long time supposed that the corpus striatum was a great motor ganglion, interposed in the course of the motor tract, and acting as a centre for coördination; but this has now been disproved, and all that, at present, we can say about the corpus striatum is, that its function is as yet unknown. It is a *terra incognita*, awaiting future exploration.

If we now pass to the crus cerebri, we find that the General Motor Tract occupies the middle third of the crusta,—the part of the crus that is visible to us when we turn over the brain and expose its base to view. The relations of this motor part of the crusta are shown in the following diagram (Fig. 17), in which the general motor tract of the left side is shown by dark shading. It is this part which becomes degenerate and wasted when the general motor tract has been cut across by lesion higher up in the brain.

[1] *Phil. Trans. of the R. Society*, B., 1890, p. 187.

In the Crus, the general motor tract, as shown in the diagram, constitutes about a third—the middle third—of the crusta. The

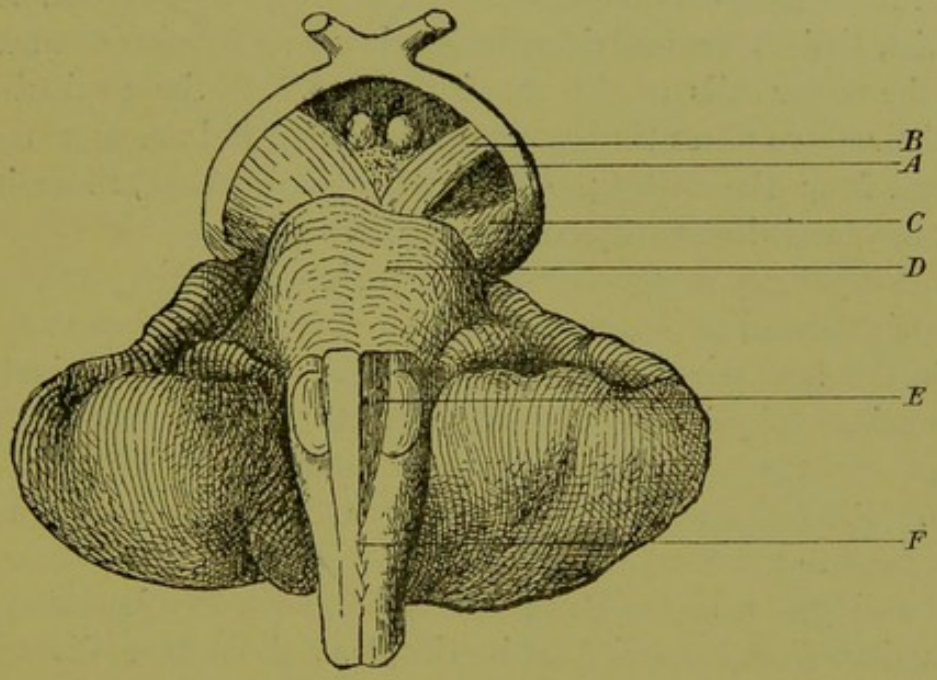


Fig. 17.—(After Charcot.[1])—*A*, the general motor tract (pyramidal tract) degenerated. *B*, the internal fasciculus from the præfrontal convolutions; *C*, the external, sensory, fasciculus; *D*, the pons; *E*, the anterior pyramid degenerated; *F*, the decussation of the pyramids.

inner third is composed of the fibres, above mentioned, which are derived from the præfrontal convolutions; and the outer third is composed of the sensory fibres which are prolonged upwards to form the posterior part of the internal capsule. In the middle or motor third are contained the fibres for phonation and oral articulation, and also the fibres for the movements of the hand, as in writing. The fibres for phonation and oral articulation are believed to lie in the innermost part of the general motor tract, within its inner edge. The fibres for the movements of the hand probably lie close to the outer side of them.

I need not describe the course of the general motor tract through the Pons Varolii; but I should like it to be noted that here, in the Pons, the fibres for phonation and oral articulation diverge, in their course, from the rest of the general motor tract. The rest of the general motor tract, including the fibres for the hand, passes on through the Pons, and emerges at its lower end, as shown in Figure 17, to constitute the Anterior Pyramid of the medulla. At the lower end of the medulla the tracts from the two hemispheres

[1] *Leçons sur les Localisations dans les maladies du Cerveau*, 1887, p. 215.

cross over, in greater part, at the "Decussation of the Pyramids" to the opposite sides.[1] They are afterwards continued downwards within the lateral column of the spinal cord, to the various levels at which their fibres individually terminate by forming connexions with the motor cells of the anterior cornua. To these spinal cells and their nerve fibres they transmit the motor influences conveyed by them from the cortex; and, by the spinal nerves, these influences are carried onwards to the muscles.

Thus the fibres whose function is to innervate the movements of the right hand pass downwards, after crossing at the decussation, within the lateral column of the cervical cord, and terminate by coming into physiological connexion, at the lower part of the cervical enlargement, with the motor cells of the right anterior cornu. From the cornu spring the nerve fibres that are ultimately distributed to the muscles of the hand.

Returning now to the Pons, and to the fibres for phonation and oral articulation, we find that in the Pons these fibres diverge in their course from the rest of the general motor tract. Instead of passing onwards, with the rest of the tract, to the pyramids and their decussation, they decussate, along with other fibres for the face, in the lower part of the pons; and thereafter they soon terminate by coming into anatomical and physiological connexion with various motor nuclei in the floor of the fourth ventricle. From the cells of these nuclei, which are the equivalents of the motor cells in the anterior cornu of the cord, spring the motor nerves for phonation and oral articulation which carry the motor influences onwards to the muscles.

Before I finish these brief notes about the course of the speech tracts, let me say a word about the general plan on which the whole motor tract is formed.

In the motor tract, there are two sets of cells and two sets of fibres. Proceeding from above downwards, we find the first set of cells to be the motor cells (represented, in all probability, by the large cells of Betz) in the motor cortex; and the first set of fibres to be the fibres which are prolonged downwards from these cells, through the hemisphere, crus, and pons, till they terminate, in the

[1] In these brief notes, I have, for the sake of simplicity, omitted mention of those fibres of each pyramid which are continued downwards in the cord without crossing at the decussation of the pyramids.

case of the fibres for the hand, by becoming connected with the large motor cells in the anterior cornu at the lower part of the cervical enlargement, and, in the case of the fibres for phonation and oral articulation, by becoming connected with the motor nuclei in the medulla.

The second set of cells are the large motor cells in the anterior cornua of the spinal cord, and in the motor nuclei of the medulla; and the second set of fibres are the motor fibres proceeding from these cells to be distributed to the various muscles.

In teaching, I have, for a number of years, found it very convenient to designate the first set of cells, together with the fibres prolonged from them, as the "First Trophic Realm in the Motor Tract," and the second set of cells, with the fibres prolonged from them, as the "Second Trophic Realm in the Motor Tract." The terms are convenient, not because they teach anything new, but because they bring into relief the two divisions of the motor tract; and because they keep us in mind of an important function which is subserved by the motor tract in addition to its motor function, —I mean its Trophic function. It is a fact now generally recognised, that the two sets of cells discharge not only motor force, but also trophic force (nourishing nerve force), and that this latter force is as essential for the nutrition of the structures to which it is supplied as is a supply of blood from the bloodvessels. The vitality, both of the two sets of fibres in the motor tract and also of the muscles to which the nerves are distributed, depends upon the supply of this trophic force from the nerve cells.

Take first the nerve fibres:—We find that if the motor cells of the first trophic realm are destroyed, then the fibres of the realm, which are merely prolongations of the cells, become degenerate down to their junctions with the cells of the second trophic realm; and that, in like manner, if the cells of the second trophic realm are destroyed, then the fibres of that realm undergo degeneration and destruction down to their termination in the muscles. So, again, when the fibres of either realm are cut across, the part above the section, being still in connexion with its cells, continues to live, while the part below the section undergoes decay and death. These are but illustrations of the well-known law of Waller, which has taught us that the axis-cylinder of a nerve fibre, however long it may be, is but a part of the cell from which

it springs, and that throughout its length it depends upon the cell for its trophic supply, and therefore for its vitality. It is owing especially to the teaching of Charcot[1] that the full importance of the law of Waller in relation to nervous pathology is now generally recognised.

The accompanying diagram, which I have taken from Dr Gowers's valuable work on *Diseases of the Nervous System*, shows well the constitution of each of the two trophic realms in the motor tract,—the cell *C. C.* with the fibre U. S. representing the first; and the cell *S. C.* with the fibre L. S. the second trophic realm. Dr Gowers terms them, not Trophic Realms, but Upper and Lower Segments, of the motor tract.

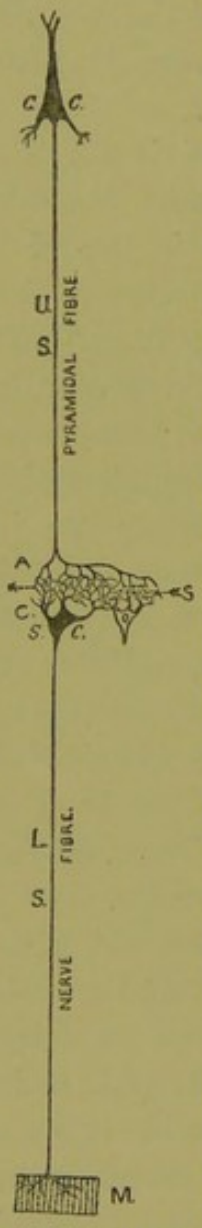


FIG. 18. — (After Gowers.[2])—*C. C.*, a cortical motor cell; *S. C.*, a spinal motor cell; M., a muscle.

If we next take the muscles, we find that for them, too, the nerve cells in the two trophic realms of the motor tract are fountains for the supply of trophic energy. It would appear that this trophic energy for the muscles is derived in part from the cells of the first, and in part from the cells of the second trophic realm. Springing from the cells of the first trophic realm, the trophic energy for the muscles would appear to flow by the fibres of that realm, on into the cells of the second trophic realm. Thence, after getting a tributary supply from the cells of the second trophic realm, the trophic energy flows on in full stream, along the motor nerves, to the muscles.

We can now understand the great difference in the condition of paralyzed muscles that is presented, according as the lesion causing the paralysis is situated in the first or in the second trophic realm of the motor tract. Let the lesion be situated in the first trophic realm,—the motor paralysis may be complete, but the paralyzed muscles do not often waste markedly or rapidly; because

[1] See, for example, his work on *Cerebral Localisations*, 1887, already referred to.

[2] *Diseases of the Nervous System*, vol. i. p. 116.

though cut off from the trophic influences of the cells of the first trophic realm, they are still in full connexion with the cells of the second realm, and continue to be supplied with trophic power from them. On the other hand, let the lesion be situated in the cells or fibres of the second trophic realm, and then not only is there paralysis, as complete as in the other case, but there is also rapid wasting of the paralyzed muscles; because, with the interruption of motor conduction, there is, in this case, also complete cutting off of the trophic supply that had streamed to the muscles from the cells of both trophic realms.

I should have liked to complete the description of the accompaniments of each of these two forms of paralysis,—to have alluded, for example, to the exaggeration of reflexes, and the tendency to spasticity in the muscles, exhibited when paralysis is due to lesion in the first trophic realm; and to the absence of reflexes, the flaccidity of the wasting muscles, and their "reactions of degeneration," when the paralysis is due to disease of the second trophic realm;—but these are matters treated of and explained in every text-book, and I must not make this sketch too long. I content myself with asking the reader's special attention to the *wasting* of muscles that is characteristic of a paralysis due to lesion in the second trophic realm; and with reminding him that in chronic slowly advancing cases, such as are exhibited in the diseases progressive muscular atrophy and progressive bulbar paralysis, this wasting is often attended by fine fibrillar movements in the wasting muscles.

One other matter I should like to allude to before concluding these brief notes upon the anatomy and physiology of the speech-tracts. I have already indicated that, according to the results of experimental investigation by Krause, and by Semon and Horsley, the motor representation of adduction of the vocal cords is bilateral, so that stimulation of the centre for this movement on one side of the brain causes equal adduction of both vocal cords. I would now like to add that Semon and Horsley have also subjected the motor *tract* for adduction of the cords to experimental investigation, and have found that stimulation of any part of the tract in its first trophic realm causes precisely the same bilateral adduction of the cords as is produced by stimulation of the cortical centre from which it springs.

Pathology of the Motor Tracts for Speaking and for Writing.

Before passing to the consideration of the tracts for phonation and oral articulation—the speech-tract proper,—it may, I think, be well to make here a short note about the pathology of the motor tract for writing. This will clear our way for the consideration of the speech-tract proper.

Note on the Pathology of the Motor Tract for Writing.

The tract for writing is, of course, the tract for the movements of the right hand. Its first trophic realm begins in the cortex, as the motor centre for the hand, which is situated about the middle of the left ascending frontal and ascending parietal convolutions, close behind the centre D, as already explained. Its second trophic realm begins in the right anterior cornu of the spinal cord, at the lower end of the cervical enlargement. Apart from what has already been said about the supposed relations of the motor centre for the hand with the centre D, I have little to say about the motor tract for writing that can apply specially to that act, and not also to the other movements of the hand. In common cases of gross cerebral lesion producing right hemiplegia, the tract for the hand is of course very frequently involved, along with the rest of the general motor tract; and, again, in lesions in the upper part of the spinal cord there is often paralysis of one or both hands. But, as we have seen, if the speech centres are intact, and the left hand unaffected, the patient can still write with that hand, though the right be paralyzed.

Of greater interest in relation to the act of writing is the fatigue-neurosis known as Writer's Cramp, which has already been considered in the third chapter of this work. It will be remembered that, in cases of this fatigue-neurosis, it is not always easy to determine which part of the tract for writing has been specially enfeebled by the fatigue; and that in some cases there is ground for the belief that it is the cortical cells of the first trophic realm that are enfeebled, in others the spinal cells of the second trophic realm, in others the nerve-fibres of the second trophic realm, and in others, perhaps, the muscular fibres themselves.

Pathology of the Motor Tract for Speaking.

The task that still remains for us is, to make note of the various lesions that may interfere with or destroy the speech-tract, at one or another level in its course. We shall have to treat first of the lesions that may damage the speech-tract in its first trophic realm; and next, of those that may damage it in its second trophic realm.

The speech-tract, as we have seen, is composed of fibres belonging to the vocal mechanism (such as those whose stimulation causes bilateral adduction of the vocal cords), and of fibres belonging to the oral articulative mechanism. In treating of the pathology of the tract in its first trophic realm, it will, I think, be well to take these two sets of fibres together, and to regard them as constituting a common tract; because, throughout their course in the first trophic realm, the two sets of fibres lie so close together that it is scarcely possible for a lesion to damage one set without also damaging the other. When, however, we come to consider the second trophic realm of the speech-tract, it will be best to take each set of fibres separately; because the two sets are, in the second trophic realm, represented by different nerve trunks, and are therefore, in conditions of disease, often damaged or destroyed separately.

Lesions in the First Trophic Realm.

1. *Unilateral Lesions in the Cerebrum.*—Speech, as we have seen, is a function which is discharged essentially by one hemisphere of the brain, viz., the hemisphere that has been educated to it—this being the left hemisphere in right-handed people, and the right in left-handed people. We have already studied in detail the complete or almost complete destruction of the faculty of producing speech which results when the motor centre B, in the educated hemisphere, is destroyed. We have also seen that if a sub-cortical lesion entirely destroy the white matter immediately beneath the centre B, the centre will be rendered functionally inert, and there will result an aphasia in every way identical with that produced by destruction of the centre itself. Further, we have seen that a sub-cortical lesion at a little distance from the centre B may be

so situated as to cut across only the fibres proceeding downwards from B towards the medulla, and leave intact all the fibres connecting B with the other speech-centres. In this case, the type of aphasia produced is that which has been termed the sub-cortical or infra-pictorial motor type. It is characterised by the absence of amnesia verbalis, and by the retention of the power of writing —with the left, if not with the right hand. Patrick Keaney's case may be taken as a fair example of it.

Here, now, comes a question of some difficulty. If only one common strand of motor fibres (for the vocal and the oral articulative mechanisms) passed downwards from Broca's convolution to the cells of the second trophic realm in the medulla, then, clearly, the cutting across of that single strand by disease would always produce the same effect—complete motor disablement of speech,—at whatever level in the tract the lesion might be situated. In other words, motor aphasia of the infra-pictorial type would be produced, whether the tract were cut across at a little distance from Broca's convolution or at a great distance from it—say, in the crus cerebri. But we know that this is not the case: we know that the infra-pictorial type of motor aphasia is typically produced only when the motor tract has been damaged in the upper part of its course, somewhere between Broca's convolution and the upper part of the internal capsule. Lesions in the internal capsule involving the speech-tract, it is generally believed, do not produce aphasia (except indirectly by pressure, etc.); nor do lesions lower down, in the crus or pons. Such lesions may for a time seriously interfere with articulation, producing a dysarthric disturbance of speech that commonly takes the form of slurring; but the words attempted are evidently the right ones, though, from the slurred and slovenly articulation, it may be difficult to recognise them. After a time, even this dysarthria may pass away, though the break in the motor tract that originally caused it remains. Two problems, therefore, present themselves for solution. (1.) Why does a lesion in the speech-tract at or below the internal capsule not produce infra-pictorial motor aphasia? and (2.) Why, in the majority of cases, is the dysarthria produced by such a lesion recovered from, after a time?

These two problems can be solved only by our adopting the view that the speech-tract which leaves Broca's convolution is

not a single, but a double tract. In other words, there is not only the tract which passes downwards in the same hemisphere directly towards the medulla, but also a second tract which, passing across from Broca's convolution, by the corpus callosum, to the corresponding convolution of the opposite side, establishes connexions between the two convolutions, and enables them to act in motor unison under the guidance of the psycho-motor pictures stored in Broca's convolution. After forming this connexion with the motor convolution of the right side, this tract, it is believed, passes to the internal capsule of that side, and then downwards towards the medulla, in a course similar to that of the direct tract in the left hemisphere. This second tract from Broca's convolution has, conveniently, been termed the "callosal speech-tract." Wernicke[1] suggests that in the normal condition of the brain three-fourths or four-fifths of the energy requisite for the innervation of speech may be furnished by the left hemisphere, and the remaining fraction by the right hemisphere. There seems every reason to believe that, between Broca's convolution and the upper part of the left internal capsule, the two parts of the double speech-tract —the direct for the left hemisphere, and the callosal for the right —lie close together or very near each other; and that in this part of their course they are often cut across together by the same lesion. It would appear, for example, that a lesion in the upper and anterior part of the Island of Reil may, by penetrating into the subjacent white matter, cut them both across, and so produce the infra-pictorial variety of motor aphasia. At and below the upper part of the internal capsule, on the other hand, they increasingly diverge from each other, and are less and less likely to be cut across by the same lesion, until, on reaching the base of the brain, they come near each other again in the Pons; and therefore lesions at and below the upper part of the internal capsule usually produce merely a dysarthria or difficulty of articulation, and not an aphasia of the infra-pictorial motor type. The dysarthria is usually most marked, and most apt to be permanent, when the tract belonging to the left hemisphere is cut across; but dysarthria is also of pretty common occurrence when the lesion is in the right hemisphere; and Wernicke is in such cases inclined

[1] "Ueber die motorische Sprachbahn, und das Verhältniss der Aphasie zur Anarthrie," *Fortschr. der Medicin*, ii. 1884, p. 412.

to attribute it to the cutting across of the tract in that hemisphere. In either case, the dysarthria often, after a time, passes away; and it does so most speedily when the lesion is in the right hemisphere, —because the remaining division of the speech-tract may soon acquire the power of discharging perfectly the function that in health is discharged by the two divisions together.

I shall not attempt here to describe the gross lesions of the brain that are capable of destroying or temporarily disabling the speech-tract in one or other of the cerebral hemispheres. It will be sufficient to remind the reader that the chief of them are apoplexy, softening, and tumour; and that by any one of these conditions the speech-tract may, in some part of its course, either be directly involved and destroyed, or, lying in the neighbourhood of the lesion, be merely disabled without being destroyed.

2. *Bilateral Lesions in the Cerebrum.*—A gross cerebral lesion is, in the vast majority of cases, unilateral; one single focus of disease being developed in one or other hemisphere. But it occasionally happens that two foci are developed, either simultaneously or in succession; and even that the two occupy corresponding positions in the hemispheres. Such symmetrical lesions may involve the speech-tracts on both sides.

I have already, in a former chapter, illustrated the effects produced by symmetrical destruction of the motor speech *centres*, by reference to a well-known case reported by Dr Barlow. In that case, it will be remembered, there was, first, motor aphasia from destruction of Broca's convolution. But this was recovered from, by the convolution of the opposite side being educated to assume the function of speech. Then there occurred a second lesion, which destroyed the convolution of the opposite side. The result was not only a return of motor aphasia—which now remained permanent,—but also the establishment of paralysis in both sides of the mouth and tongue—a form of paralysis so similar in its symptoms to the paralysis caused by disease of the bulbar nuclei that it has been termed Pseudo-Bulbar Paralysis. The chief difference between the two is the absence of wasting of the tongue and other affected muscles in the pseudo-bulbar paralysis, and the marked wasting that attends upon true bulbar paralysis—a difference due to the fact that in the one case it is the first, and in the other the second trophic realm, that is the seat of the disease.

Pseudo-bulbar paralysis being thus the well-known effect of bilateral destruction of the motor *centres* for phonation and oral articulation, it will be readily understood that the very same effect may be produced by bilateral lesion of the motor *tracts* leading from these centres. But in this case there would, almost certainly, be other paralytic accompaniments. There might, for example, be paraplegia in arms and legs—a pseudo-spinal along with the pseudo-bulbar paralysis;—because the various motor strands in the general motor tract lie closer together than the various cortical motor centres from which they spring, and are therefore far less liable to be singled out by a gross lesion and destroyed separately.

These symmetrical gross lesions are rare, and are therefore not very important. Of far greater interest and importance, in relation to speech, are the *fine* lesions—of the nature of sclerosis of the connective tissue—which affect both hemispheres simultaneously, and often seriously interfere with the conduction of motor power along both speech-tracts. As a typical example of such bilateral sclerosis, I shall select the disease known as Multiple or Insular Sclerosis. It is the most commonly met with of the group, and it produces well-marked effects upon the production of speech.

Without attempting to describe the symptoms and pathology of *Multiple Sclerosis,* I may remind the reader that it is a disease most common between the ages of 20 and 35; that among its most characteristic symptoms are:—the embarrassment of speech, to be presently noted; nystagmus; coarse trembling or jactitation of the arms and hands, during performance of voluntary movements; weakness, incoördination, and sometimes spasticity of the legs; enfeeblement of the intellect; and, in the later stages, the occurrence of apoplectiform attacks, the development of symptoms pointing to involvement of the bulb—such as loss of the power of swallowing,—and a general failure of nutrition which betrays itself in a tendency to the formation of bed-sores. Dr Gowers states that the duration of the disease is from two to fifteen years, the average duration being from two to six years.

Pathologically, the disease consists in an overgrowth of the connective tissue of the brain and spinal cord—an overgrowth that is not diffuse or general, but is limited to scattered spots or patches in the white matter of the brain and cord, and also in the white matter of the crura, pons, medulla, and cerebellum. As

microscopic examination of the sclerosed patches shows that the axis-cylinders of the nerve fibres are often partly preserved in the midst of the overgrown connective tissue, it is supposed that the disease primarily consists in an overgrowth of the connective tissue, and that the atrophy of the nerve fibres is a secondary consequence of the pressure put upon them.

In the speech of Multiple Sclerosis, the most striking characteristic is the well-known slow and laborious utterance, in which, with evident effort, each syllable is enunciated separately and deliberately. This is the "*staccato* speech" of multiple sclerosis. Sometimes it is termed "scanning speech," because the effect of it on the ear of the listener is not unlike that produced when someone is heard scanning deliberately a line of Latin poetry. When the *staccato* character is extremely well marked, some individual syllables may, now and again, be shot out with explosive violence.

The slow *staccato* utterance of multiple sclerosis is believed to be due to the interference with conduction in the motor speech-tracts that is produced by the compression of the nerve fibres at points where they are passing through patches of sclerosis.

Along with the *staccato* utterance, there is often drawling of the syllables. As the disease advances, the *staccato* element is apt to become less striking, and the drawling and slurring more and more marked, until speech is at last reduced to an inarticulate drawl. I have in my ward, at the present time, a patient with multiple sclerosis, whom I have had under observation for about eight years. At first his speech was markedly of the *staccato* type; but, for the last two years, it has become more and more slurred and inarticulate. When, for example, he now tries to say "good morning," the words are produced as a monotonous drawl, in which only traces of the m and n and something of the vowel sounds are recognisable. He is in the last stage of the disease: totally paralyzed in the legs, and almost totally so in the arms; and requiring to be fed with the stomach-tube, as he has lost the power of swallowing.

Though *staccato* utterance is most typically exhibited in multiple sclerosis, it would be a mistake to suppose that it occurs only in that disease. We have already seen that an element of *staccato* utterance is often present in the speech of general paralysis of the

insane; and is met with also in the speech of some aphasic patients, when they are beginning to regain the power of speech by training the convolutions of the opposite hemisphere. Charcot emphasizes the resemblance between the speech of multiple sclerosis and that of general paralysis of the insane. He says,[1] "I even believe that, in a good many cases, apart from the help obtained from the consideration of accompanying phenomena, the distinction would be almost impossible. And that the resemblance may be still closer owing to the circumstance, that in multiple sclerosis, as in general paralysis of the insane, emission of words is sometimes preceded or accompanied—as you may remark in our patient—by a slight, as it were convulsive, contraction of the lips." Kussmaul, however (p. 664), holds that Syllable Stumbling, the most characteristic of all the features in the speech of general paralysis, never occurs in multiple sclerosis. In general paralysis, he says,—"Both articulate sounds and syllables are misplaced and thrown into confusion. To borrow Westphal's admirable illustration, the general paralytic, in trying to say 'artillery,' calls it 'artrallerary'; the patient with insular sclerosis, on the other hand, pronounces it 'ar-til-ler-y.'"

Alongside of the above notes about the speech of multiple sclerosis, I shall now insert a brief note about the speech of *Friedreich's disease;* as there is a pretty close resemblance between this speech and the speech of multiple sclerosis. Yet I would first state that we have no right to regard Friedreich's disease as a condition that causes its peculiar speech by interfering with conduction in the first trophic realm of the motor speech-tract. Friedreich's disease is essentially not a disease of the brain, but one of the spinal cord. Like tabes dorsalis, it is a sclerosis of the posterior columns of the cord; and, in its general symptoms, it resembles ordinary tabes dorsalis. But it differs from ordinary tabes in many particulars, some of the distinguishing features of Friedreich's disease being—(1), That it is very markedly a family disease, and often affects brothers and sisters in the same family—one after another acquiring it as they grow up to manhood or womanhood;—and (2), that, like multiple sclerosis, but not like tabes, it causes both nystagmus and a peculiar affection of speech.

[1] *Leçons sur les maladies du système nerveux*, 1875, p. 236.

From the study of the cases of this disease published by Friedreich[1] and others, it may be seen that the characteristic disturbance of speech has in it, almost always, more or less of that *staccato* element which is so markedly present in the speech of multiple sclerosis. But this element may not be very striking. Often the utterance is merely slow and drawling, with that thickness or imperfection of articulation which is, I think, best described as "slurring," but which Friedreich in his description terms "lalling." It is a thick slurring articulation like that of inebriation, but differing from it in being slower and more laborious, and in having often in it a more or less pronounced element of *staccato* enunciation. Friedreich tells that some of his patients had sometimes to attempt difficult words over and over again, before succeeding in their enunciation.

In the very chronic course of Friedreich's disease, the derangement of speech is not one of the first symptoms to be developed. Its appearance is often delayed for a year or several years after the characteristic ataxia has shown itself in the limbs. Friedreich attributes the derangement of speech to changes in the medulla, and especially to a descending neuritis in the roots and trunks of the hypoglossal nerves; but this conclusion does not seem to have been confirmed by other observers, as Gowers remarks that—"The precise origin of the affection of articulation and of the nystagmus has not yet been traced."[2]

In tracing down the speech-tract, I may now pass over the Crura Cerebri with a very brief note. There is, indeed, scarcely anything to be said about the effects of lesions in one or other of the crura, further than that they closely resemble the effects of unilateral lesions of the tract in the internal capsule. A dysarthric disturbance of speech, of the nature of slurring, and usually of temporary duration, is apt to be produced when the speech-tract is cut across in either the right or the left crus. As in the case of lesion in the internal capsule, it is generally most pronounced when the lesion involves the left crus; but it may be more or less distinctly present, for a time at least, when it is the right crus that is involved.

[1] *Virchow's Archiv*, 1863, Bd. xxvi. and xxvii.; also *ibid.*, 1876, Bd. lxviii. and lxx.

[2] *Diseases of the Nervous System*, vol. ii., p. 355.

3. *Lesions in the Pons.*—Leyden was right when, in 1867,[1] he pointed out that in relation to dysarthric and anarthric disturbances of speech lesions of the pons are of special importance. It must be remembered that the speech-tracts from the two hemispheres are here no longer widely separated from each other. They are brought near together, even in the upper part of the pons, in which they lie parallel with each other. In the lower part of the pons, again, they actually cross each other in the middle line, on their way backwards to the nuclei of the medulla. This disposition of the two tracts in the pons renders them liable to be affected together; and when they are destroyed together, total anarthria—utter speechlessness and voicelessness—results. It will be readily understood that in such cases there is also, as a rule, total paraplegia of both arms and legs; as the general motor tracts from both hemispheres are, like the two speech-tracts, apt to be involved together, owing to their juxtaposition. Coarse lesions in the pons, such as apoplexy, softening, and tumour, are the common causes of such total paralysis of speech and of voluntary motion; and such effects are most apt to be produced when the coarse lesion in the pons is central in its situation. On the other hand, unilateral lesion, in the upper part of the pons, may involve only one of the general motor tracts, including the portion of it that forms the tract for speech; and the result will then be, not a paraplegia, but a hemiplegia, and not an anarthria of speech, but a dysarthria. Even in such cases of unilateral lesion, however, the dysarthria is apt to be more than usually severe; because, along with destruction of one of the speech-tracts, there is apt to be also more or less disablement of the other, owing to pressure or to collateral disturbance. The two lie so near each other in the pons that one can scarcely be destroyed without such disturbance of the other.

In cases of central lesion of the pons, with total paraplegia, and total paralysis, it may be, of the face and eyes, as well as total speechlessness, it is, I think, well for us to remember, when in the presence of the patient, that though he may appear to be profoundly comatose he may really, for aught we know, be conscious. I remember one case of this kind in which the son of the aged patient, sitting

[1] *Berliner Klin. Wochenschr.*, 1867, Nos. 7, 8, and 9.

by the bedside with his left hand in the right hand of his father, was startled by feeling his father press his hand repeatedly. The son may have been mistaken in thinking that the pressure was a message to him, communicated through the only channel that remained open,—the pressure may have been automatic and involuntary;—but I think it within the limits of possibility that the son was right in his opinion. The case was one of rapidly spreading lesion in the pons, which, after causing severe neuralgia in the right side of the face, caused left hemiplegia, and then ophthalmoplegia and partial right hemiplegia, with, ultimately, apparent coma. Some voluntary motor power may have lingered in the right hand, even when the patient was, to all appearance, in a condition of deep coma. I mention the case because it made a very strong impression upon me. Since knowing of it, I have always, each session, been careful to ask my students to bear in mind the possibility that a patient with severe lesion of the pons may really be conscious, though apparently comatose.

Lesions in the Second Trophic Realm.

In the foregoing notes upon lesions in the first trophic realm of the speech-tract, I have taken the part of the tract for the vocal mechanism and the part for the oral articulative mechanism together; because they lie in juxtaposition throughout their course, and when affected by disease are almost necessarily involved together. But in now treating of the second trophic realm, it will be best for us to take the two parts of the tract separately; because each part, springing from its own root-cells in the medulla, is continued to its muscular distribution in the form of separate and distinct motor nerves, which can easily be affected by disease independently of each other. I shall first consider the lesions of the nerve trunks, and then the lesions of the medullary nuclei from which they spring; and I shall begin with the motor nerves of the Vocal Mechanism.

1. *Lesions in the Second Trophic Realm of the Motor Tract for the Vocal Mechanism.*—The reader will remember that the motor nerves for the larynx take their origin in the medulla from the nerve-cells of the spinal-accessory nucleus; that the root-fibres

proceeding from this nucleus soon join themselves to the trunk of the vagus; and that, after joining the vagus, they are continued down in the neck as part of its trunk, until—(1), a small number of them leave the vagus to form the motor portion of the superior laryngeal nerve; and (2), the bulk of them leave the vagus at a much lower level, to constitute the great motor nerve of the larynx, viz., the recurrent laryngeal.

As to the Superior Laryngeal nerves, it will be remembered that the muscles of the larynx deriving their motor innervation from them are the crico-thyroid muscles and the small muscles which depress the epiglottis during deglutition. According to some authorities, filaments from them are also supplied to the inter-arytenoid muscle, and to the lateral crico-arytenoid muscles; but this is doubted by others, and seems to be contradicted by the evidence obtained from the study of paralysis due to lesions of the recurrent nerve. The crico-thyroid muscles, undoubtedly supplied by the superior laryngeal nerves, help to fix the thyroid cartilage during phonation, and to tighten the cords during the production of high notes. They act by approximating the cricoid cartilage to the thyroid, in front. Bilateral paralysis of the superior laryngeal nerves is said to be of not uncommon occurrence as an accompaniment or a sequela of Diphtheria, and Sir Morell Mackenzie states that in such cases the chink of the glottis, in phonation, instead of being straight, is bent in zigzag or sinuous fashion, owing to the undue slackening of the cords. The patient, it would appear, may be either voiceless or merely husky. But the chief symptom of paralysis of the superior laryngeal nerve is paralysis of *sensation* within the larynx. It will be remembered that, besides containing the motor fibres above mentioned, the superior laryngeal is also the *sensory* nerve for the larynx. Within the nerve, and within the trunk of the vagus, its sensory fibres course along with the motor; but in the medulla the two sets of fibres are separated from each other, the sensory fibres being connected with the nucleus of the vagus, and the motor with the nucleus of the spinal-accessory. It will be readily understood that the sensory and motor symptoms characteristic of paralysis of the superior laryngeal nerve may be produced either by a lesion of the nerve itself or by a lesion of the trunk of the vagus above the point at which the nerve branches from it.

The Recurrent Laryngeal nerve is, of course, the great motor nerve of the larynx. With the exception of the crico-thyroid muscles above mentioned, it supplies all the muscles which act upon the vocal cords. It thus supplies both the adductors which close and the abductor which opens the glottis.

Careful observation within recent years has brought out some interesting facts about the two sets of fibres—adductor and abductor—that go to make up the recurrent laryngeal nerve. On the one hand, it has been found that when the whole nerve is stimulated with electricity, the effect is not an equally balanced contraction of adductor and abductor muscles, resulting in absence of movement in either one direction or the other, but is a movement of *adduction*, which closes the glottis. And, on the other hand, it has been found that when the whole nerve is gradually compressed from without by a tumour, the result is not a slowly increasing paresis equally marked in adductors and abductor, but is a paresis which shows itself first in the abductor movement, and goes on to paralysis of that movement before there is any distinct paresis in the movement of adduction. How are these two facts to be explained? There has been much controversy about their explanation, and it would take a great deal of space to make a statement of all the hypotheses that have been advanced. I shall content myself with making a brief note of two different explanations, which are each supported by high authority.

Dr Gowers[1] holds that there may be no inherent difference in the properties of the two sets of fibres, and that both of the phenomena above noted may be explained if the bulk and strength of the adductor muscles are—as they seem to be—greater than those of the abductor; or if, as he thinks is the case, the weaker abductor acts at a disadvantage as compared with its opponents, owing to the nature of its attachment to the arytenoid cartilages, and the angle at which it pulls. If we grant that, in the muscular and mechanical arrangements within the larynx, it is thus provided that adduction has a distinct preponderance of power over abduction, then we can understand how it is that stimulation of the whole nerve trunk may cause closure of the glottis, owing to this preponderance of the adductor power; and

[1] *Diseases of the Nervous System*, vol. ii. p. 262.

how, again, when the whole nerve trunk is being slowly weakened by pressure, paresis may show itself first in the movement that is originally the weaker.

Dr Semon,[1] however, explains the phenomena in a very different manner. He holds that, in the two sets of fibres composing the nerve trunk, there are inherent physiological differences. To the adductor fibres, he attributes a greater inherent *excitability;* and to this, he thinks, is due the closure of the glottis which occurs when the whole trunk is stimulated. To the abductor fibres, on the other hand, he attributes a greater *vulnerability;* and in this he finds the explanation of the fact that paralysis of abduction precedes paralysis of adduction, when the whole trunk is being slowly disabled by pressure from without. If, hereafter, it should be thoroughly established that, in these cases of pressure on the nerve, there is distinctly greater *wasting* in the abductor muscle than in the adductors, then Dr Semon's explanation must be accepted; but if, on the other hand, the degree of wasting is equal in abductor and adductors, then Dr Gowers's explanation will have the advantage.

A third explanation of the early appearance of paresis of abduction in these cases of pressure on the nerve trunk was offered by Sir Morell Mackenzie, in his work on *Diseases of the Larynx.* He suggested that, in the trunk of the nerve, the abductor fibres might be arranged peripherally in the outer zone of the nerve-trunk; whereas the adductor fibres might be collected in the centre. This would account, he thought, for the earlier appearance of abductor paresis. But experimental stimulation of the nerve fibres in the trunk has not confirmed this suggestion. Dr Risien Russell,[2] especially, has made a series of conclusive experiments upon the nerves of living animals. Dissecting out the nerve bundles from each other, and stimulating them individually with electricity, he has been able to distinguish the adductor from the abductor bundles, and has found them not to be arranged as suggested by Mackenzie, but to be mixed up indifferently throughout the thickness of the trunk.

[1] "Geschichte der Lehre von den motorischen Kehlkopflähmungen," a contribution to *Virchow's Festschrift*, vol. iii. p. 407.

[2] *Proceedings of the Royal Society*, vol. li. p. 102.

Let us now, from a more strictly clinical and practical point of view, consider, for a moment, the effects of pressure upon the trunk of the recurrent nerve. As a typical example, let us take a case of Aneurism of the Arch of the Aorta, with pressure upon the left recurrent nerve. In the course of such a case, there is apparently always a first stage, during which the paralysis betrays itself by no symptom whatever, except, it may be, a very slight alteration of the voice. This is the stage at which, as yet, there is only paralysis of the abductor muscle, without paralysis of the adductors. If the patient be examined with the laryngoscope at this stage, the left cord is found fixed near the median line—in the position it ought, normally, to occupy only during phonation. It remains there even when, on the patient taking a long breath, the opposite cord is abducted to its full extent. It seems to be the tone of the unopposed adductor muscles that thus keeps the cord of the affected side fixed permanently in the position for phonation. In this stage, the voice is normal, or only very slightly altered; and there is no difficulty of breathing, because the other "gate of the glottis" is open during respiration, and can be swung open to the fullest extent when a long breath is taken. In fact, this stage of recurrent paralysis can only be diagnosed with the aid of the laryngoscope.

With continued and increasing pressure upon the nerve trunk, there is, by-and-by, developed the second stage, characterized by the addition of adductor paralysis to the already existing paralysis of abduction. In this stage, the cord of the affected side is no longer stretched near the median line—in the position for phonation,—as it was in the first stage. The tone of the adductor muscles which kept it there being now lost, the cord falls back from the middle line into the "cadaveric position"—a position midway between that of adduction and that of abduction; —and there it lies immobile, both during attempted phonation and during deep inspiration. When the patient attempts to phonate, the cord of the opposite side is strongly adducted; and, in its effort to meet its paralyzed neighbour, it even crosses the middle line, so as to leave but a narrow interval between itself and the paralyzed cord. The interval is sufficiently narrow to enable the patient to whisper; and, in the whisper, there is generally a feeble vocal element due to the vocal vibration of the

sound cord. The symptoms and the laryngoscopic appearances of this, the second stage of recurrent paralysis due to aneurism, are familiar to every physician ; but the first stage is not so familiarly known, as there may be no symptoms betraying its presence, and as it can only be diagnosed with the aid of the laryngoscope.

Unilateral paralysis of the recurrent nerve, such as is thus so often due to aneurism of the aorta, may also be due to other causes, and occur in connexion either with the left or with the right recurrent. Thus the pressure from a tumour in the mediastinum, or from a glandular tumour in the neck, or from the enlarged lateral lobe of a goitrous thyroid body, or, again, the involvement of the nerve in cancerous disease of the œsophagus, or its compression, on the right side, by the newly-formed connective tissue of a pleuritic thickening at the apex of the right lung,—all of these conditions may produce paralysis of the recurrent nerve on one or other side; and the paralysis may present a first and a second stage, as when it is due to the pressure of an aortic aneurism.

Further, it should be remembered that recurrent paralysis is sometimes due to pressure upon the trunk of the vagus, at some point above the level at which the recurrent nerve is given off. If the point pressed against be so high in the neck as to be above even the point at which the superior laryngeal is given off, then, along with recurrent paralysis, there will be also paralysis of the superior laryngeal nerve, with its characteristic anæsthesia of the larynx.

In some rare cases, Bilateral Paralysis of the recurrent nerves has been found to be due to pressure, either upon the two recurrent nerves or upon the two pneumogastrics. This bilateral paralysis presents the same two stages in its progress as have already been described as occurring in unilateral recurrent paralysis. First, in the stage of simple abductor paralysis, the cords lie in the position of adduction, close to each other in the middle line; and then, in the stage of combined abductor and adductor paralysis, the cords have retired from the middle line, and lie in the cadaveric position, at some distance from each other. It will be readily understood that in the first stage there is great danger of suffocation. The cords lie so close to each other that there results that crowing stridulous inspiration so characteristic

of bilateral abductor paralysis. The noise is loudest when the patient makes any exertion, and when he is asleep; and during sleep a paroxysm of laryngeal dyspnœa may set in, and may end fatally. Tracheotomy is thus often advisable, in bilateral paralysis of the abductors. Though inspiration is noisy and difficult, expiration is easy; and the voice, in speech, may, in this stage, be natural. When, in the second stage, the cords retire into the cadaveric position, breathing becomes easy, all stridor disappearing; but, in this stage, the voice is lost, because the adductors are now paralyzed, as well as the abductors.

Before leaving the laryngeal nerves, I may refer, in a word, to the occasional occurrence of neuritis in one or other of their branches of distribution, and to the resulting paralysis of one or other of the individual muscles of the larynx. I have already, in the second chapter of this work, made some brief reference to the loss of voice which may be caused in this way, by the paralysis of some single adductor muscle.

It still remains for us to consider the Nuclear Cells in the Medulla, from which the motor nerves of the larynx spring. As already indicated, these cells form part of the nucleus of the spinal-accessory division of the eighth cranial nerve. It has been asserted that some of them are also contained within the nucleus of the vagus, but this opinion still requires confirmation.

There are many lesions, coarse and fine, which may affect the motor and sensory nuclei in the medulla; but, as some of these affect, indifferently, the cells of either the oral articulative mechanism or the vocal mechanism, or affect both sets of cells simultaneously, and as others, such as the lesion in glosso-labio-laryngeal paralysis, are primarily developed in the cells of the oral articulative mechanism, I think it will be well to reserve any enumeration of them until we come to look at the nuclear origins of the nerves for the oral articulative mechanism. But there is one lesion which is of special interest in the present connexion, as, on invading the nuclei of the medulla, it seems to have a special proclivity to affect the motor cells of the vocal mechanism,—I mean the spread of degeneration into the medulla in cases of tabes dorsalis (locomotor ataxy).

It is now well ascertained that, in the course of ordinary tabes dorsalis, two forms of laryngeal complication may be developed,

in consequence of this invasion of the spinal-accessory nucleus. These are—(1), Temporary paroxysms of laryngeal dyspnœa ("laryngeal crises"), which by some authorities are attributed to temporary spasm of the adductor muscles, and by others to temporary paralysis of the abductors; (2), permanent paralysis of laryngeal muscles. This paralysis seems always to affect the abductors in the first instance. It may be confined to these throughout, or, in course of time, may involve also the adductors.

Often, especially at first, the paralysis is unilateral; and then, so long as it is purely a unilateral abductor paralysis, it can only be detected with the laryngoscope,—there being no symptoms, such as loss of voice, or laryngeal dyspnœa. When, however, the adductors are also affected, and the cord has fallen back from the median into the cadaveric position, then there is loss of voice, as in the advanced stage of unilateral recurrent paralysis in cases of aneurism.

If there is bilateral paralysis of the abductor muscles alone—as, in tabes dorsalis, there often is,—then the patient suffers from the marked and dangerous laryngeal dyspnœa which has been already noted as characteristic of that condition. This will disappear, but the voice will be lost, if the paralysis ultimately involves also the adductors.

These laryngeal complications of tabes dorsalis must be commoner than is usually imagined. Dr Semon says that in the first twelve cases of tabes examined by him in the "National Hospital for Epilepsy and Paralysis," he found no fewer than seven to be affected either with unilateral paralysis of the abductor, or with unilateral paralysis of both the abductor and the adductors, or with severe bilateral paresis of the abductors. But he adds that in the next fifty or sixty cases not a single case presented any symptom of laryngeal paralysis.[1]

Seeing that in so many of these cases the abductor is affected alone, or is affected first, before the adductors are also involved, Dr Semon has been naturally led to the conclusion that in the medullary nuclei of the laryngeal nerves there is the same comparative vulnerability in the abductor nerve-cells that he believes to exist in the abductor nerve-fibres of the recurrent nerve. And

[1] *Op. cit.*, p. 444.

this conclusion would be irresistible, if it were proved that all degenerative conditions invading the medullary nuclei singled out the abductor cells in similar fashion. But this is not proved. The leading degenerative disease of the medullary nuclei is Progressive Bulbar Paralysis (glosso-labio-laryngeal paralysis); and when that disease, in its latter stage, spreads from the nuclear cells of the oral articulative mechanism into those of the vocal mechanism, it attacks first the adductor cells,—not the cells for abduction. It does not, however, often cause complete paralysis of the adductors. "The laryngeal palsy," says Dr Gowers, "rarely becomes complete, and it is still rarer for the power of abduction to be specially lost, common as abductor palsy is in some other forms of central degeneration."

Some explanation other than that offered by Dr Semon may yet be found—possibly one connected with the anatomical position of the abductor cells,—to account for the frequent occurrence of abductor paralysis as a complication of tabes dorsalis.

In dealing with any case of laryngeal paresis or paralysis, a very important question for us to determine is, whether the paralysis is of functional or of organic origin. As recent investigation has thrown considerable light on this question, perhaps it may be well for us to devote here a little attention to it.

If we take first the Bilateral forms of paresis or paralysis, we may make note of the following general conclusions:—

1. That a bilateral paresis of the Adductor muscles, without any affection of the abductors, is almost always of functional origin, and is commonly due to hysteria. When it is slightly pronounced, it causes "hysterical aphonia." When it is better marked, it causes the common variety of hysterical mutism. This subject has already been fully discussed in the second chapter.

We must, however, admit that in a few cases this paresis of the adductors may be of organic origin, — if it is true that when progressive bulbar paralysis invades the nuclear cells of the vocal mechanism the adductor cells are the first to be affected.

2. That a bilateral paresis or paralysis of the Abductors, without apparent affection of the adductors, is very generally of organic origin,—being most commonly the result of lesion in the bulbar

nuclei, and, in rare cases, the first effect of pressure upon both recurrent nerves or both pneumogastrics.

It is believed by some authorities, however, that this paralysis may in a few cases be of functional causation. Gowers, for example, states that temporary attacks of it, attended with the characteristic dyspnœa, have been known to follow an ordinary laryngeal catarrh; and he expresses his belief that the laryngeal paroxysms of dyspnœa which occur occasionally in some cases of hysteria may sometimes be due to temporary paralysis of the abductors, and not always to spasm of the adductors, as is usually supposed.

3. That a bilateral paralysis involving both Abductor and Adductor muscles is always of organic origin. There seems to be no exception to this rule.

If we now pass to the Unilateral forms of paralysis, we can say in brief about them, that whether they affect adductors or abductor, they are practically all of organic origin.

Possibly, however, it may yet be found that there are rare cases of Hysteria in which there is adductor paresis of one cord only. This possibility I shall discuss presently.

As to the Situation of the lesions accountable for these various forms of paralysis when they are of organic origin, we can say that in the vast majority of cases, if not in every case, it is somewhere in the second trophic realm of the motor tract. It is either in the medullary nuclei, or in the trunks of the nerves, or in their branches of distribution. Being due to lesion in the second trophic realm, these paralyses are attended with the characteristic wasting of the paralyzed muscles.

The rare exceptions to this law—that the organic lesions capable of producing paralysis in the larynx are situated in some part of the second trophic realm of the motor tract—are furnished by bilateral lesions involving the first trophic realm, in both hemispheres or in both crura; and by central lesions in the pons which disable both tracts. In such cases, as we have seen, there is pseudo-bulbar paralysis—a paralysis always bilateral;—and all voluntary control over the larynx, as well as over the muscles of the tongue and lips, is lost.

If the motor representation of the vocal cords in the cerebral

cortex is *perfectly* bilateral (as Semon and Horsley believe it to be), then it is not possible for any unilateral lesion in the first trophic realm—whether in the cortical centre or in the tract—to produce paralysis of one vocal cord (unilateral paralysis in the larynx); because the cortical centre and tract of the other side would continue to innervate both cords. Nor, *à fortiori*, is it possible for any disablement there from functional causes, such as hysteria, to produce unilateral laryngeal paralysis.

But if further investigation should show that Masini is right in stating that the motor representation of the vocal cords in the cortex is not perfectly, but is only imperfectly, bilateral—just as is the motor representation of the tongue, lips, etc.,—it would then appear that it *is* possible for a unilateral lesion in the first trophic realm (either in the cortical centre or the motor tract) to produce paresis of the opposite cord,—just as a unilateral lesion in the first trophic realm of the tract for the oral articulative mechanism produces a slight paresis in the opposite side of the mouth and of the tongue, as is seen in ordinary hemiplegia. And if an organic lesion on one side can thus produce a unilateral paresis in the opposite cord, so perhaps may a functional disablement on one side, due to hysteria.

As we saw in a former chapter, cases of cerebral lesion in one or other of the hemispheres attended with motor paralysis in the opposite cord have already been published. It is, however, suggested by Dr Semon and others, that in these cases some other lesion, in what I have termed the second trophic realm of the tract, must have been present, though overlooked. We must wait for further evidence, before we can be quite sure which party in this controversy is right. If cases of hysterical hemiplegia should be met with in which there is loss of voice from adductor paresis of the vocal cord on the same side as the hemiplegia, they would lend support to the opinion of Masini that the motor representation of the vocal cords is only imperfectly bilateral; since they would tend to show that even a functional unilateral disturbance of the cerebral cortex is capable of producing a unilateral paresis of the opposite cord. The weight of evidence, however, at the present time, is strongly in favour of the conclusion of Semon and Horsley, that the representation of the vocal cords *is* perfectly bilateral, and that it is, therefore, impossible for any organic lesion or

functional disturbance in the first trophic realm to produce unilateral paralysis or paresis in the larynx.

The common bilateral paresis of the adductors in hysteria is commonly believed to be due to functional paresis of motor power, or, shall we say, the power of will, in both hemispheres.[1]

2. *Lesions in the Second Trophic Realm of the Motor Tract for the Oral Articulative Mechanism.*—This realm begins in the motor nuclei of the medulla, and extends, in the form of various motor nerves, to the muscles of oral articulation. The nuclei from which the nerves spring are the motor nuclei of the seventh pair, the hypoglossal nuclei, and portions of the nuclei of the spinal accessory. The nerves are the portio dura of the seventh, the hypoglossal, and the nerves from the spinal-accessory nucleus which supply the soft palate and the muscular wall of the pharynx.

As I do not think it would be of much advantage to attempt here an elaborate description of the lesions of the nerve trunks, I shall content myself with reminding the reader of a few leading facts about these lesions.

First, about the portio dura of the Seventh, I need scarcely say that unilateral paralysis, due to neuritis of the nerve trunk (Bell's paralysis), is one of the commonest of all the forms of local paralysis. Though the mouth is pulled towards the opposite side, and the lips on the paralyzed side are flaccid, the articulation of the labials and the labio-dentals is only slightly interfered with. In rare cases, both nerves are paralyzed; and then the whole face is expressionless, and the lips are flaccid on both sides. Commonly, these cases are due to the pressure of a tumour at the base of the brain upon the nerve roots. But, some years ago, I had, in my wards, a case in which this bilateral paralysis had been caused by injury of the nerve trunks, at or about their exit from the stylo-mastoid foramina. In the bilateral cases, the enunciation of the labials

[1] For fuller information regarding the Paralyses of the Larynx, see the chapter on the subject by Dr Gowers in his work on *Diseases of the Nervous System*, vol. ii. p. 256; or the article by Dr Semon referred to in the footnote to p. 433; or the chapter by Dr M'Bride in his work on *Diseases of the Throat, Nose, and Ear*, and an article by the same author in the *Edinburgh Medical Journal*, July 1885.

and labio-dentals is impossible; but, as the other parts of the articulative mechanism are intact, speech is not very seriously damaged, and is always easily intelligible. It is most striking to hear and see a patient with double facial paralysis laugh: there is something so incongruous between the sad, flaccid, and immobile countenance, and the merry sounds that come, as it were, from behind it. The patient just referred to, whose double paralysis was due to injury, used sometimes to laugh heartily; and she always produced a strong impression on her hearers when she did so.

Paralysis of the Hypoglossal nerve from lesion of the nerve trunk is so rare, that I think we may pass it over. It would, of course, produce paralysis of the tongue on the same side, with very marked wasting; but would probably not interfere very seriously with articulation.

Paralysis of the fibres from the Spinal-accessory nucleus which supply the soft palate is of importance, because it is a frequent complication or sequela of diphtheria. In such cases, it is usually bilateral. It causes the soft palate to droop, and to remain drooping even when the patient takes a long breath or sings a high note. During deglutition, it permits the escape of fluid through the nose. In speech, it produces the peculiar and characteristic nasal snuffle. One of the advantages of studying the function of speech with close attention is that such an alteration of speech as is produced by the presence of even a slight nasal snuffle is at once detected by the trained ear. I can recall, at the present moment, a case in which the presence of a slight nasal snuffle in speech led to the immediate detection of a diphtheria, though the patient was making no complaint about the throat; and another case—one of suppression of urine from blocking of both ureters—in which it led to the examination of the throat, and the detection of an œdema of the soft palate and uvula,—the beginning, as it proved to be, of an acutely advancing dropsy, which caused death in a few hours, by invasion of the lungs. Many other conditions besides paralysis of the soft palate, and œdema of it, may produce a nasal snuffle in speech—as, for example, perforating ulcer of the soft palate, and split palate;—and some people snuffle in speech either from habit and carelessness, or from not having learned in childhood how to manage the soft palate in speaking.

More important than the lesions of the nerve trunks, are lesions of the medullary nuclei from which they spring. Affections of these nuclei produce the type of paralysis known as Bulbar Paralysis.

There are a few cases in which this type of paralysis is suddenly or rapidly produced by such gross lesions as apoplexy, or acute inflammatory softening, in the medulla; but such cases are comparatively rare, and usually prove rapidly fatal. More common and important are those in which disease is of the degenerative and sclerotic type. Such disease slowly involves the nuclei more and more, until there is total paralysis of the muscles supplied from them. This slow degeneration of the bulbar nuclei is sometimes a complication of certain diseases of the spinal cord, such as chronic progressive poliomyelitis (progressive muscular atrophy), or tabes dorsalis, or multiple sclerosis. Sometimes it is a disease *per se*, being, throughout its course, confined to the nuclei of the medulla. It is then known as Progressive Bulbar Paralysis, or Glosso-Labio-Laryngeal Paralysis. This is the most important of the varieties of Bulbar Paralysis; and I think it will suffice for the purposes of this chapter if I make a very few notes about it.

Progressive bulbar paralysis is always bilateral; and the nuclei first affected are usually those for the innervation of the tongue. Thence the disease spreads to the nuclear cells for the lips, and to those for the soft palate and the pharynx. It is only, as a rule, when all these parts have, in course of time, become totally, or almost totally, paralyzed, that the disease overflows, as it were, into the nuclei for the innervation of the larynx.

I need not, in detail, describe the well-known symptoms of progressive bulbar paralysis, but I may remind the reader that, in the advanced stage of the disease, the lower part of the face becomes expressionless as a mask, the lips being entirely paralyzed and remaining helplessly apart so that the patient cannot prevent the dribbling of saliva from the open mouth; that the tongue not only lies paralyzed in the mouth, but generally presents a wrinkled and shrunken or shrivelled appearance, due to marked wasting of its muscular substance, and often in its wasting fibres presents fine fibrillar movements like those in the wasting muscles of a patient with progressive muscular atrophy; that the palate hangs drooping

and paralyzed; and that the paralysis of the pharynx renders deglutition impossible.

It will be readily understood that as the paralysis extends from tongue to lips, and from lips to soft palate and pharynx, corresponding deteriorations of articulation appear in the patient's speech. These, however, need not be described; as the best key to them is to be obtained from the study of the Physiological Alphabet. Sometimes the lips are affected before the tongue; and then it is the labials and the labio-dentals that first suffer. When the palate becomes affected, the characteristic nasal snuffle appears. In the advanced stage of the disease, if the larynx be yet unparalyzed, the patient, though totally unable to articulate, may still, when he tries to speak, be able to emit monotonous vocal sounds of a grunting character.

As to the final invasion of the larynx by the paralysis, it seems certain that, in the great majority of cases of this disease, the first muscles affected are the adductors,—not, as in tabes dorsalis, the abductors. It is rare for the patient to exhibit that laryngeal dyspnœa which is so characteristic of bilateral abductor paralysis. Usually he first exhibits a want of explosiveness in his cough; and afterwards the voice becomes enfeebled, though it is rarely altogether lost. Anæsthesia of the mucous membrane, from involvement of the sensory nuclei, is sometimes added to the motor paralysis. Owing to the combined motor and sensory paralysis of the larynx, the air-passages are imperfectly protected from the entrance of food or fluid, if the patient attempts to swallow; and it therefore becomes necessary to feed him with the stomach-tube.

I would here make a special note regarding this loss of explosiveness in the patient's cough, which often forms the first indication that, in the spread of bulbar paralysis, the larynx is beginning to be invaded. Some years ago, I noticed it in two cases of my own; and I made a note of it in a paper on "Extra-auscultation," recently contributed to the first volume of the *Edinburgh Hospital Reports*. I now find, however, that Dr Gowers had already made careful note of it, in his work on *Diseases of the Nervous System*. But I should like to direct attention to the explanation I have suggested for this want of explosive-

ness in the cough, as it is different from the explanation offered by Dr Gowers. Dr Gowers evidently holds the common opinion that in the closure of the glottis which is preliminary to the act of coughing, and which attends upon the act of straining, the glottis is closed efficiently against the exit of air by the co-aptation of the true vocal cords,—that, in short, it is closed in the same manner as it is for phonation, only with greater strength and firmness. He therefore regards the loss of explosiveness in the cough as simply a first indication of adductor paresis. But, as I have already explained in a former chapter, the closure of the glottis for coughing or straining is a very different thing from its closure for phonation; because in phonation only the true cords are co-aptated, whereas in the preliminary stage of coughing and in straining the false cords are co-aptated as well as the true; and it is, I believe, the false cords, with the Ventricles of Morgagni, which, in valve-like fashion, hold in the imprisoned air during the preliminary or compressive stage of a cough. I do not know that the innervation of this important closure of the false cords has ever yet been adequately investigated. It may be that the muscular fibres which effect the movement are innervated, like those which depress the epiglottis, by the superior laryngeal nerve. But whether this be so or not, I think it highly probable that the nuclear cells for the movement are, in the course of progressive bulbar paralysis, invaded before the nerve-cells for the ordinary adductors of the larynx, and that thence results the early loss of explosiveness in the cough.

In my paper in the *Edinburgh Hospital Reports* I have termed the unexplosive cough above mentioned the "Bovine Cough," because an ox has no Ventricles of Morgagni or false cords, and its cough is therefore an unexplosive grunt or wheeze.

In a normal cough, there are both an explosive element, due to the action of the false cords, and a vocal element, due to the action of the true cords. In the Bovine cough, the explosive element is lost, but the vocal may be retained. In severe cases of hysterical aphonia, on the other hand, the vocal element is often lost, while the explosive is retained; though in mild cases both elements are retained. I have at present, in my wards, a severe case of this kind, in which the aphonia amounts almost to complete mutism, and has hitherto resisted treatment, even by our skilled

specialists; and in this case the absence of the vocal element of the cough and retention of the explosive element are well exhibited. I think this condition of things shows that there may be adductor paresis of the true without adductor paresis of the false cords. Further, we can, each of us, in our own persons, cough at will, either—(1), in the normal way, with both elements in the cough; or (2), like the patient in the above-mentioned case of hysterical aphonia, with the initial explosive element, but without the accompanying vocal element; or (3), after the manner of the ox, with the accompanying vocal element, but without the initial explosive element. Does not all this show that there are two laryngeal mechanisms employed in the act of coughing, viz., that of the false cords and that of the true? It is now close upon thirty years since I first demonstrated the valvular action of the false cords and ventricles of Morgagni during the act of straining, and at the initial stage of coughing; and it is eleven years since my conclusions were confirmed by the joint investigations of Dr Lauder Brunton and Dr Cash, which I have already referred to. When will physiologists and physicians recognise that the subject is worthy of attention?

Alongside of these notes regarding the probable spread of degeneration, in the *second* trophic realm, from the nuclear cells of the oral articulation mechanism into the nuclear cells for the closure of the false cords, I should like to put a note reminding the reader of a point discussed in the first chapter of this work, viz., the occurrence, in a rather rare variety of stammering, of an overflow of energy, from the over-stimulated centres of the oral articulative mechanism into the centre for the closure of the false cords. There results, it will be remembered, when the patient attempts to speak, that closure of the "upper glottis," which gives its special feature to the "gutturo-tetanic" variety of stammering. I think it probable that this overflow occurs in the cortical cells of the *first* trophic realm.

In concluding this chapter, it may be well for us to ask ourselves what general conclusion it tends to lead up to regarding the diagnostic value of the dysarthric disturbances of speech that are produced by lesions of the motor speech-tracts.

I think, on the whole, it should teach us that in diagnosing

the seat of any lesion involving the tract, either in its first or in its second realm, we should not rely exclusively, or even mainly, upon the specific speech-disturbances present. There is too much sameness in the alterations of speech, whatever may be the part of the tract involved, to warrant an exclusive reliance upon them. A thick, slurring, and more or less laborious articulation is the leading characteristic in nearly all such cases.

Yet there are varieties in the degree of the dysarthria which may sometimes help us to diagnose the seat of lesion. A total anarthria is more common in lesions of the pons or of the medulla than in lesions of the hemispheres or of the crura. A special slurring upon linguals or labials may suggest the early stage of bulbar paralysis; and a nasal snuffling may suggest a paralysis of the soft palate, perhaps of diphtheritic origin. Again, predominance of the *staccato* element in the speech ought to suggest multiple sclerosis, though something of the *staccato* element may, as we have seen, be present in other conditions.

On the whole, however, we shall do well, in trying to diagnose the nature and locality of disease in any case of dysarthria or anarthria, not to trust too much to the specific alterations of the speech, but, whilst giving these their due weight, to arrive at our conclusions only after having taken fully into account the associated symptoms of paralysis, and all the other symptoms of the case.

My task is now finished. I began this work by considering the nature of Stammering, a disorder which, by the disruption it exhibits in the harmonious action of the vocal and oral articulative mechanisms, is admirably fitted to illustrate the semi-independence of each of these mechanisms, and to enable us to realize the beautiful coördination with which, in normal speech, they work together. I have now finished by tracing down the motor tracts of the two mechanisms to their terminations in the executive muscles, and by noting the leading conditions of disease that may interfere with motor conduction in them. In the course of the work, we have been led to consider many matters of great interest and importance; for it is a great subject we have been discussing,—a subject full of interest in all its relations. I hope that this work, as a contribution to the study of the subject, will

be found practically useful. There are few studies, I think, so well calculated to give material help in the diagnosis of nervous diseases as the careful study of the Disorders of Speech. I trust that this work will prove of practical value as an aid in the prosecution of this important study.

APPENDIX.

A.—Notes of Three Cases of Speech-Disturbance.

Two of these (Nos. 1 and 2) have been under observation too recently to be available for the Text of this Work. The third Case is referred to in the Text, but only very briefly.

1. *Case of Infra-pictorial Auditory Aphasia (the Subcortical Sensory Aphasia of Lichtheim and Wernicke).*

David Brown, æt. 40, carter, married, born at Strathmiglo. Formerly resident in Glasgow, but has recently been living in Fife with his half-brother. Admitted into Ward 31, 7th Jan. 1894.

Summary of Symptoms.—Some deafness; very marked word-deafness; some logamnesia; occasional paraphasia; suffers from aortic regurgitation.

History.—The history of this case has been very difficult to obtain, owing to the patient's word-deafness and impaired utterance. Some information, however, has been obtained from the half-brother, who has lately seen a good deal of the patient, and still more from the patient himself, by means of questions put to him in writing, or rather in print. He can read and understand questions put to him in this way, though he cannot understand them when they are put to him by word of mouth. The house-physician, Dr Bell, has accordingly been at great pains to obtain a history of the case from the patient in this way.

At the age of ten, the patient had an attack of rheumatic fever, with cardiac complication; and it is probably from this attack that the present incompetency of the aortic valve dates. He seems, however, to have enjoyed fairly good health after this attack, and to have been quite able for his work, until the beginning of his present troubles in July 1892.

Early in July 1892, when driving his cart in the streets of Glasgow, he had a sudden attack of giddiness or faintness. When it came upon him, he was sitting on a cross bench in the cart. It made him fall back into the body of the cart. He says his head was not hurt by the fall, and he does not appear to have lost consciousness. When the attack passed off, which it did almost immediately, he was able to seat himself on the bench again, and go on driving. Although it is not to this first attack that the patient attributes his troubles of speech, it seems nevertheless clear that it was immediately after this attack that his friends began to notice in his speech some word-deafness

and some paraphasia. His brother, who saw him about the end of July, states that already there was a difficulty in understanding what was said to him, and also a difficulty in expressing himself. For example, he remembers the patient saying "twenty miles ago," instead of "twenty years ago." It is also known that the patient from this time gave up going to church, because he no longer understood what was said by the preacher. Otherwise, he continued to be in pretty fair health, and to be quite able for work, until he had a second seizure, about five months after the date of the first.

This second seizure occurred in December 1892. Like the first, it occurred when he was driving his cart. On this occasion, however, he fell, not into, but out of his cart. He thereby sustained an injury of his head, with a cut over the right eyebrow, which has left a scar. He states that he did not lose consciousness, and that immediately after the fall he was able to remount his cart and go on driving. After this seizure, which occurred on a Tuesday, the patient continued at his daily work until the Saturday of the same week, when he had a third seizure.

This third seizure occurred on the Saturday evening, when he was sitting by the fire at home, after having washed himself. It set in suddenly with severe giddiness, which caused him to fall on the floor. There was no loss of consciousness, and he was able to get up immediately after his fall; but the giddiness did not speedily pass off as in the previous attacks,—the patient finding, on getting up, that he staggered much in walking. Immediately, also, he became aware that the attack had rendered him, for the time, completely word-deaf. He states that he recognised quite well such sounds as those caused by the shutting of the door, footsteps on the floor, etc.; but that he could not understand one word his wife said to him, though he heard the sound of her voice. As he was suffering severely from headache, and was feeling chilly and ill, he at once went to bed. Next day, the medical man who was called in ordered that his head should be blistered. The patient remained in bed, at this time, for about six weeks, suffering much from the pain in his head. He then began to get up daily. Presently, he tried to resume work; but, finding himself quite unable for it, he continued to live quietly at home until July 1893. We are informed that while thus living at home he was often greatly depressed in spirits, and that on one occasion he was detected in the act of attempting to commit suicide.

In July 1893, he had a fourth seizure. It occurred when he was taking a walk in the street; and it seems to have taken the form, simply, of severe headache. It made him become, for the time, not merely word-deaf, but absolutely deaf; so that he could not even hear sounds or noises. It also made him become completely aphasic as to production of speech; so that, on arriving at his house, he could not speak a word to his wife. As he was thus evidently getting worse, it was thought best to send him to the Western Infirmary of Glasgow; to which Institution he was accordingly admitted on the 8th of July.

Shortly after this date, while the patient was still in the Infirmary, he was visited by his half-brother; who reports that he could not get him to understand a single word, and that his power of utterance was almost completely disabled. He could, however, understand questions put to him in writing; so that when his brother told him in writing that he was going to

Strathmiglo to see their mother, and asked him if he would like to go too, he indicated his willingness by nodding. At the same time, however, he took hold of his brother's coat and said "awa." From this word and gesture, the brother understood that the patient's clothes had been pawned,—a surmise which, on inquiry, turned out to be correct.

The patient left the Western Infirmary at the end of August 1893, to go to the Convalescent House in connexion with that Institution. Here he remained till the end of September, when he returned to his own home much improved in health.

In October, it came to the knowledge of his half-brother that the patient was in destitute circumstances, and very unhappy at home. He therefore visited him in Glasgow, and induced him to accompany him to his own house in Fife. Here the patient remained till his admission to the Royal Infirmary of Edinburgh. Though, on his first arrival in Fife, he was so weak that he could scarcely walk, he soon began to improve; and before long he became quite active. He also improved as to his understanding of speech and his power of utterance. It was, in particular, noticed that questions that were often asked him became more and more intelligible to him, though other words and questions remained unintelligible to him. As before, he could read and understand written or printed matter. It happened that while he was living in Fife the well-known Monson trial was going on in Edinburgh. He took a great interest in it, and daily read about it in the newspaper. From his remarks it was evident that he followed the various incidents of the trial quite intelligently.

State on Admission.—The patient is a small man—height 4 ft. 10 ins., weight 8 st. 11½ lbs.—but has a good figure, and is lively and active. He has an intelligent expression of countenance, and is bright and cheerful.

Examination of the heart reveals a double bruit at the base; but there is no distinct hypertrophy of the heart, and the pulse, which is rather weak and occasionally intermittent, has little in it of the water-hammer character. He states that he has often, for a few minutes, a pain in the region of the heart, which is apt to radiate upwards towards the neck. He is never troubled with palpitation, but is apt to be breathless on going up a hill. He complains of frequent and severe headaches, which, he says, often keep him awake at night, and are apt to be especially severe in the morning.

There is no motor paralysis or lameness, the patient being quite active on his legs. His grasp, however, is not very strong, and it is noticeable that it is weaker in the right than in the left hand, the right hand giving 40 and the left 45 on the inner circle of the dynamometer. Taste, smell, and eyesight are normal, and the eyes are lively in expression, and do not show any difference in the pupils, or any sluggishness in their movements on exposure to light. During periods of headache, however, the eyes look rather congested and heavy. Examination with the ophthalmoscope shows the fundus to be normal.

Hearing.—In the left ear, the patient is very deaf, being unable to hear the ticking of a watch until it is pressed against the pinna. With the right ear he can hear the ticking of a watch held 8 or 10 inches from the pinna. Dr M'Bride, who kindly examined the patient's ears for me, reports as follows:—

"Left ear—membrane thickened posteriorly and inferiorly, indrawn atrophied patch anteriorly. Right ear—membrane thickened posteriorly, with an atrophic patch in centre of thickening, and also a distinct atrophic patch in front. The tuning-fork gives such uncertain results in this case that we can hardly draw any conclusions."

The following is an abstract of the notes regarding the condition of the patient's speech :—

1. Spoken Speech.

(*a.*) *Reception and Interpretation.*—It is very difficult to get the patient to understand questions put to him, and this difficulty is far greater than can be accounted for by his partial deafness. It is always greatest when he is asked a question which is new to him, however simple the question may be. Old questions which we have asked him often and taught him the meaning of, he replies to readily enough ; and it is noticeable that he hears and understands these old questions quite readily though they be not put to him in a loud voice. When, on the other hand, he is asked a new question, it is interesting to watch the close attention and wistful expression with which he watches the movements of the questioner's lips, and at the same time listens, in trying, without success, to make out the meaning of what is said. Perhaps these observations will best be illustrated by a few specimens of the patient's replies —(1) to old familiar questions, and (2) to new and unfamiliar questions.

(1.) Old familiar Questions.

"Did you sleep last night?" "Yes."
"Did you sleep well?" "Yes, the forepart" (of the night).
"Have you any headache?" "Yes, last night was sair" (sore).
"Where?" Indicated, with his hands, both sides of his forehead.
"Had you a horse at one time?" "Yes, once, a good one."
"How old was he?" "Seven years."
"How many hands high?" "Seventeen."
"Did he bite?" "No me, no me."
"Whom did he bite?" "Anybody going pats, pats" (past).
"What did you do?" "The chain."
"Where did you fix the chain?" "From the haims to the bit."

From the above, it might be supposed that the patient had no difficulty whatever in understanding what was said to him. But it must be remembered that every one of these questions had already been very often put to him during the previous six weeks of his residence in hospital, gesture-language and printing having been used by the questioner to help the patient in interpreting them. He had thus at length become familiar with every one of them, so that he could interpret them without extraneous aid.

In contrast with the above performance of the patient when asked familiar questions, I now proceed to give a few specimens of his performance when asked, on the same day, questions that were not familiar to him.

(2.) New and unfamiliar Questions.

"Are you going out to-day?" In reply, patient merely shook his head. Thrice the question was put to him, and thrice he shook his head. On its being put for the fourth time, he said, in tones of interrogation, "Up the day, up the door?" (trying to repeat the words spoken to him). On the question being again twice repeated to him, he said "Key." During all this time he watched the questioner's lips very closely, and looked very wistful and attentive.

I now indicated to him by gesture that I wished him to repeat the words of the question one by one after me. He did so as follows :—

"Going"	patient said	"Goin."
"Out"	,,	"Oot."
"To-"	,,	"You, to."
"Day"	,,	"Gee, jay, sing."

Although the word "Day" was repeated to him twelve times, he could not be got to pronounce it. He only said "Sing," etc., instead of it; and no better result was got even when the word was shouted to him close to his right ear.

I now put the question to him in gesture-language, by pointing out of the window, and making with two fingers the gesture for walking that is used by deaf-mutes. He understood me at once, and said in reply, "Yes, walk, fine."

With other unfamiliar questions the patient's performance is seldom better than the above. We asked him, for example, the question, "How is Lilly?"—referring to another patient with speech-trouble in the ward. He repeated without difficulty the words "How is," but he could not be got to repeat the word "Lilly," or to understand the question. Instead of "Lilly," he merely said "Sing," etc., experimentally.

It should here be noted, that if the patient succeeded in repeating correctly any word or sentence spoken to him he usually at once understood its meaning.

(*b.*) *Production of Spoken Speech.*—The patient can express his thoughts in speech without much difficulty, but frequently mispronounces words, and sometimes uses wrong words (paraphasia). He evidently has no special amnesia of nouns, as he readily enough names objects shown to him. He was, one day, shown about fifty different objects, and, as a rule, named them correctly. For example, he named correctly a number of coins shown to him. In other cases, he mispronounced certain names that were difficult of pronunciation,—converting the word "scissors," for example, into "skisserits," and the word "moustache" into "muisaret clache." In like manner, he converted "wall" into "walt," and "pocket" into "pock pock."

He often talks pleasantly to the other patients in the ward, though he cannot understand what they say to him. In talking he expresses himself in single words, broken sentences, and gestures. In this way, he on one occasion made the patients quite understand that, when he lived in Glasgow before his illness, he used greatly to enjoy the singing of a street-singer who had lost both legs. He told them that he always gave this man a penny when he heard him sing.

(*c.*) *Echoing of Spoken Speech.*—As already indicated, the power of echoing or repeating words is very greatly impaired. It is impaired, evidently, because of the difficulty the patient has in getting a good auditory image of the word,—and not because of difficulty in articulative production. To the examples already given, may be added the following:—

For "Thinkest," he says "Thickest."
„ "Thou," „ "Now."
„ "So" „ "Snows."

2. Written Speech.

(*a.*) *Reception and Interpretation of Written Speech.*—The patient's eyesight is good, and there is no hemianopsia.

It may here be remarked that the patient has been educated sufficiently at school to enable him to read, with ease, any ordinarily easy words when they are in print. For example, he can read the newspaper, and can understand it fairly well. Any simple question put to him in print, he reads at once, and replies to intelligently. For example, when the request "Put out your tongue" was put before him in print, he obeyed. When asked "How old are you?" he answered, "76, 77, 40 years,"—the last being correct. When asked in print "How long have you been ill?" he answered correctly, "Fifteen months.' When requested to "shut the door," he did so. And when asked "How often did you fall (from attacks of giddiness) when driving your cart?" he answered correctly, "Twice, two times." It was in this way—by printed questions and getting the patient's oral replies to them—that Dr Bell, with much labour, elicited the facts of his history.

(*b.*) *Production of Writing.*—Though the patient can read written easy words and sentences, he has, unfortunately, not been sufficiently well educated to enable him to express himself in writing. He can write his name in fairly legible characters, but when asked to write anything else he shakes his head sadly, and says—"Canna do it, doctor; canna spell."

(*c.*) *Copying of Printed Characters.*—He copies a printed word fairly well, but if the word is withdrawn from his sight, and he is asked to print it again, he makes misspellings in doing so.

3. Gesture Language.

The patient both interprets the gesture language of others and expresses his own thoughts in gesture language with great readiness and intelligence.

4. Music.

A feature of great interest in this case is that the patient's illness has entirely deprived him of his musical sense. Before his illness he was fond of music; and his half-brother informs us that he could himself sing well,—his favourite song being "Down in the trade winds fourteen days." But now when asked, in print, to sing this song, he smiles, shakes his head, and says, "No, canna do it now; yes, could do it before." When asked, "When could you sing?" he said,

"Before my speech, before this." When we got him to attempt the repetition of a note sung to him, he was always much out of tune; and when we played to him upon the piano the notes of "Auld lang syne," he said, "Hear the noise, canna hear the tune now." He made use of the very same words when he spoke of listening to the hymns he had heard sung in the Infirmary chapel.

Commentary.—The element in this case, which makes exact diagnosis rather difficult, is the existence of a considerable degree of actual deafness, and the presence in the ears of the abnormalities mentioned in Dr M'Bride's report. But no one studying the case with care can have the slightest difficulty in concluding that the defect of hearing is little more than an accident in the case, being in itself not at all capable of explaining the patient's difficulty in interpreting speech, to say nothing of the defects in its production. The patient can hear the ticking of a watch held at the distance of eight or ten inches from his right ear. It will be remembered that a deafness even twice as marked as this does not materially interfere with the reception and interpretation of speech, if the person addressed be loudly spoken to. Therefore, in looking for an explanation of the Word-Deafness (auditory logamnesia), and the other symptoms of this case, we must look beyond the mere partial deafness of the patient.

I think it will help the reader to understand the theory of the case I am about to offer, if he will refer to Fig. 15 (Lichtheim's diagram), in Chapter XIII.

The patient's difficulties being chiefly those of reception and interpretation, we must ask ourselves—with the diagram before us—whether the case is one of Pictorial Auditory Aphasia (No. 1), or Infra-pictorial Auditory Aphasia (No. 4), or of Supra-pictorial Auditory Aphasia (No. 5). My own belief is that, essentially, the case is one of Infra-pictorial Auditory Aphasia (No. 4); but that it also contains a slight element of Pictorial Auditory Aphasia (No. 1). I think the centre A itself must be slightly damaged, because there is in the case occasional Paraphasia, as well as a considerable degree of articulative amnesia. I do not think there can be any element of Supra-pictorial Auditory Aphasia (No. 5), because the interpretation of printed speech is well preserved.

I believe, then, that the lesion is so situated as to cut across the tracts connecting the centre A with both ears, and to encroach upon and slightly damage the centre A itself. We do not yet know enough about the pathology of Infra-pictorial Auditory Aphasia to be able to say precisely where in the brain a lesion producing it must be situated. Probably, however, it must be situated in the white matter beneath the centre A. If it is so situated, we can understand how, at the same time, the centre A itself may also be more or less involved.

That the case is essentially one of Infra-pictorial Auditory Aphasia, I think we must conclude, because along with the very striking difficulty in the reception of spoken words, which is the leading symptom, there is only *slight* paraphasia, showing that the centre A cannot be much involved;—and because the interpretation of printed speech, which is easy to the patient, would have been impossible to him had his case been essentially one either of Pictorial or Supra-pictorial Auditory Aphasia.

With regard to the loss of the Musical Sense which has been inflicted on this patient by his ailment, it is interesting to find that in the two cases of

Infra-pictorial Auditory Aphasia (Subcortical Sensory Aphasia) recorded by Wernicke and Lichtheim (and referred to in the text) there was similar loss of the musical sense; and it is worthy of remark that in this case, as in these two, the loss was not only on the receptive side, but also on the productive,—the patient being not only incapable of recognising tunes, but also incapable of himself whistling or singing them.

When the cerebral centres for music are intact, old memories can be revived within them; and by virtue of these an individual may be able to produce music even though he be stone-deaf, and therefore utterly incapable of appreciating music produced by others. This was indeed the very condition of Beethoven in his latter days. Stone-deaf as he was, he yet at this time produced some of his very best compositions. In the case under consideration, the patient is not very deaf, but he has lost all internal sense of music. Though in memory he can still recall the pleasure he formerly had in listening to the Glasgow street-singer, his musical faculty is gone. He cannot now recall the songs that he himself used to sing, any more than he can recognise them when he hears them played or sung by others.

2. *Case of Aphasia after "Congestive Attacks." The case also presents an example of Syllable-Stumbling; and illustrates the difficulty of distinguishing between "General Paralysis of the Insane" and one of the forms of Syphilitic affection of the Cerebral Cortex.*

J. L., æt. 33, warehouseman, recommended by Dr Sloan, admitted Feb. 15th, 1894.

History.—The patient states that he contracted syphilis about eight years ago. Although no secondary symptoms followed the primary sore, he became the subject of "syphilophobia,"—the fear of constitutional syphilis preying so much upon his mind as to drive him, from time to time, almost insane. He remained, however, steadily at work and physically in fairly good health, until June 1893, when he began to be troubled with sore throat and dyspepsia. These complaints he took to be symptoms of constitutional syphilis; the consequence being that he became more than ever disturbed in mind by the fear of syphilis, and that he had recourse to stimulants for the relief of his mental distress.

Early in October, on a Saturday, he took so large a quantity of stimulants that he had to remain in bed all Sunday. On Monday, when he went out to his work, he was still suffering from headache. He continued at work till breakfast time, and then left the warehouse to walk home for breakfast. On his way home he entered a public-house to get a glass of spirits for the relief of his headache. His hand, however, was so weak and unsteady that he dropped the glass when he was in the act of carrying it to his mouth. The weakness of the hand was so marked that he had even great difficulty in extracting from his pocket the money to pay for the liquor. Along with this weakness and unsteadiness of the hand, the patient presently found that there

was loss of speech. When asked by the man in the shop what was the matter with him, he found that he could not say a word in reply. Feeling alarmed, and being much excited, he walked home so rapidly that a fellow-workman, who saw him in the street and wished to speak with him, found he could not overtake him. His wife states that when he reached home his face was extremely congested, and his expression wild and confused. He was speechless, and his wife thought that the right hand and arm were paralyzed. For two days he remained in bed so confused and stupid that on one occasion he micturated involuntarily. On the third day (Wednesday) he spoke for the first time, asking his wife what o'clock it was. His pronunciation, however, was imperfect. For "clock" he said "clo"; and he called a potato a "cap." On Thursday he spoke better, but still slowly and with difficulty. On Thursday night he was somewhat delirious in his sleep. After this time he steadily improved, so that on Friday the paralysis of the hand and arm had disappeared; and next week he was able to read the newspaper, to express himself pretty freely in speech, and to walk to his doctor's house to report himself. He was off work at this time for about six weeks. Though gradually improving, he remained dull and listless, and much inclined to sit and mope at home by the fireside. This condition persisted even after he had returned to work; and from this time his health remained, on the whole, so indifferent, that he was never able to work more than two or three days in the week. His syphilophobia continued to trouble him as severely as ever.

A second congestive attack occurred about four months after the first. It began on the day before that of the patient's admission to the Infirmary; setting in during the evening with pain in the head, increasing difficulty of speech, dulness of mind, and difficulty in micturition. Next morning, on the advice of Dr Sloan, he was removed to the Royal Infirmary, where he was admitted to Ward 31.

State on Admission.—The patient was a tall and well-built man. All the various systems were apparently free from disease except the nervous system. He was confined to bed, and his expression was extremely dull and stupid. As to production of speech, the patient was almost totally aphasic; his reply to almost all questions being "Yes." When asked what he complained of, he pointed to the left side of his head and said, "A nasty, nasty, nasty, well nasty." As to reception and interpretation of speech, though he understood *most* of the remarks made to him, he evidently failed to understand *some* of them. For example, he failed to understand the requests to put out his tongue and to touch his nose. He was so stupid on the day of admission that his urine had to be taken off with the catheter. Next day he was considerably brighter, being able to name correctly a number of objects shown to him, such as a watch, a chain, etc., though failing to name others, such as a pair of scissors. In trying to write he misspelt even his own name, but he evidently knew that he had made mistakes and endeavoured to correct them. After this he continued to improve steadily, so that in a few days he was able to get up and walk about the ward. His speech also improved rapidly, and he was soon able to express himself pretty freely. In his pronunciation, however, there remained marked thickness or Slurring, and there was also very decided Syllable-Stumbling. The employment of the test-word "Hippopotamus" brought out the Syllable-

Stumbling in a most striking manner—the patient's renderings of it being "Hatitopotamus, Hatipotibumus, Tahippotopossimus," and the like. When he was talking it was very noticeable that his upper lip quivered on one or other side in the manner so commonly observed in General Paralysis of the Insane.

During the remainder of the patient's residence in hospital, his improvement was progressive. His speech gradually lost all its peculiarities except a trace of the Syllable-Stumbling, and an occasional trace of the labial shiver. He practised the pronunciation of "Hippopotamus" diligently, and before his discharge he was able to pronounce it correctly, though it evidently still cost him a little effort, which showed itself in a staccato enunciation of the syllables.

As to mind, at the date of his discharge, March 27, 1894, the only peculiarities noticeable were the persistence of the syphilophobia, which was still occasionally very distressing to him, and a certain emotional facility of mind, which betrayed itself especially in irritability of temper and in risibility.

The patient was treated at first with mercurial inunction and administration of iodide of potassium, and afterwards with iodide of potassium alone.

Commentary.—The case is one of a type not unfrequently met with in medical practice. On the whole it conforms in its symptoms to the type of General Paralysis of the Insane; but it does not in all respects reproduce the picture presented by typical examples of that disease. There was here none of the primary mental exaltation so often exhibited by typical examples of General Paralysis; nor did the patient present the characteristic difference of the pupils, nor the fibrillar movements of the tongue. But, on the other hand, there was evident deterioration of the mental faculty; as was shown by the patient's emotionalism, by his syphilophobia, and by his diminished power of work. There was also in the speech marked slurring, pronounced syllable-stumbling, and the accompanying quivering of the upper lip so common in General Paralysis. Lastly, there was the history of two distinct congestive attacks like those of General Paralysis; and after each of these there was the aphasia which in that disease so often follows upon such attacks.

Is this case one of General Paralysis of the Insane, or is it one of syphilis affecting the cerebral cortex? In reality it is often impossible to distinguish the one condition from the other. My own impression is that it is one of General Paralysis. If it is, the patient will have other congestive attacks, and will gradually get worse. It is, however, possible enough that the case may be one of cortical syphilis; and it is in view of this possibility that the patient has been recommended to continue the use of iodide of potassium.

Chronic alcoholism is also known occasionally to produce a group of symptoms exactly corresponding to those of General Paralysis; and it is possible that the patient's over-indulgence in alcohol may have been at least one of the causes in operation.

The case is, I think, illustrative of the difficulty of diagnosis in many such cases. It presents a group of symptoms presumably more familiar to the ordinary physician than to the alienist, viz., the symptoms of General Paralysis without the common mental exaltation of the first stage of that disease.

Alongside this case I could, from my hospital notes, place a number of others in which the same group of symptoms was presented; but this one case will

perhaps suffice to illustrate the difficulty of diagnosis, and also to illustrate the occurrence of aphasia after "Congestive Attacks."

3. *Case of Multiple Sclerosis.*

This is the case to which I have briefly referred in the fifteenth chapter, when treating of the speech disturbances produced by Multiple Sclerosis.

The patient, D. R., was first admitted to my wards on July 16th, 1885, when he was 23 years of age. His history was as follows:—

Until he received the injury to be presently described, he had always enjoyed fairly good health; although he had occasionally been irregular in his habits, as to the use of stimulants. He stated that he had never had syphilis, but had once had gonorrhœa.

At the time of the injury he was in the service of the tramway company; his duty being to wash, during the night, the cars that had been running during the day. He received the injury in the following manner:—

Eight months before admission, when engaged, one night, in washing the cars, he carelessly undid the fastening of the brake of a car which was standing upon an incline. The handle of the brake thereupon flew round with great force, and struck him on the forehead so violently as to drive him back about five yards. He was somewhat stunned; but he retained consciousness, and was able, immediately, to fasten the brake, and so to prevent the car from running down the incline. He felt sick, however, and had to rest from work for a time; though in about an hour he recovered sufficiently to resume work. He continued at work for about five hours, till his usual time of going home in the morning. In walking home, he was so giddy that he staggered several times. After this, he continued nightly at work for about two months; but his giddiness gradually increased, so that he sometimes fell when walking, and then sometimes had difficulty in getting up again. It was on account of this giddiness that he first sought admission to the Royal Infirmary.

Admitted on the 16th of July 1885, he was a patient in my ward till the 10th of September. His chief complaints were marked staggering, and a feeling of giddiness, in walking. His gait, indeed, was so like that of a person somewhat inebriated, that on one occasion he was supposed by an Infirmary official to be in that condition, and was reported accordingly. His tendency was to stagger to the right side and somewhat forwards. At this time there was no distinct alteration of speech, but there was already occasional nystagmus, as well as slight impairment of vision and hearing. As to mind, he was fairly intelligent; and he was cheerful and happy in disposition. Indeed, there was something suggestive of mental weakness in his remarkable cheerfulness, which seemed so little warranted by the circumstances of his case. As yet there was no distinct loss of muscular power in the limbs, and the knee-jerks were only slightly exaggerated. His residence in the Infirmary, and subsequently in the Convalescent House, led to an increase of weight, and to improvement in his general appearance, but to no improvement in the symptoms for which he had sought admission.

From the copious notes taken of this case, from time to time up to the date of the patient's death on the 31st of March 1894, I extract the following

particulars,—premising merely that, after he left the Infirmary, he was for years seen at it, from time to time, as an out-patient, and that, finally, he was re-admitted as an in-patient some months before his death. I shall first give a few extracts from the notes taken while he was an out-patient, and then a brief account of his condition when he was, for the second and last time, an in-patient.

Under the date October 26th, 1885, it is noted that of late he has begun to experience a good deal of confusion of mind every morning on awaking; and also that his sight is becoming impaired.

In June, 1886, it is noted that the difficulty of walking has greatly increased. So marked was now the incoördination, that he could not even stand without help. He now, also, was troubled with ringing in the ears, occasional headaches, occasional shiverings, and various disturbances of sensation, such as itchiness of the nose, etc. He had recently been living in the workhouse for some weeks.

July, 1886.—From this date, the patient made a living by selling cheap books in the streets; some charitable persons having provided him with a supply of books, and with a bath chair to sit in when selling them.

October, 1887.—It is now for the first time noted that the upper extremities are becoming affected in a manner characteristic of Multiple Sclerosis. They presented coarse trembling and jactatory movement, whenever the patient attempted to perform any voluntary act with them. When, for example, he attempted to carry a tumbler full of water to his mouth, the involuntary jerking of his arm caused him to throw the water about in a manner most characteristic.

March, 1889.—Inability to walk or stand without help, and the trembling and jactatory movements of the arms persist; and it is noted that the patient has become sillier in his manner. Several new symptoms are now noted,—viz., (1) the staccato speech so frequently found in Multiple Sclerosis, and (2) marked divergent strabismus of both eyes. The Nystagmus formerly noted had now disappeared.

July, 1891.—He is reported to be worse in every respect. As a new symptom, there is now noted marked failure of vision,—the patient, though still able to count fingers, being unable to describe the pictures on the walls. Examination of the eyes showed the visual acuity to be one-fifteenth of the normal. In his Speech, there is noted, besides the well-marked Staccato element, an element of Slurring, also very distinct. It was typically exhibited in the pronunciation of the test-words "British Constitution," etc. It is also noted that the patient has begun to speak in a bleating monotone.

April, 1893.—At this date, I found the patient, one day, at his accustomed place in the street, sitting in his bath chair with books upon his knee for sale. He was scarcely able to respond to my greeting, his speech being now almost totally inarticulate, though the voice was well preserved. He was now almost quite blind; but he recognised my voice at once, and tried to shake hands with me, though scarcely able to do so, as his upper extremities were now almost completely paralyzed. His wife, who, at my request, came to the Infirmary next day to report as to his condition, stated that of late he had been getting much worse. Even she could now scarcely make out what he wished to say.

Several times of late, he had micturated in bed. As great heat completely overpowered him, she feared much that he would not survive the heat of the approaching summer.

October 19th, 1893.—At this date, the patient was, for the second time, admitted into Ward 31 as an in-patient. His wife stated that two months before the date of his admission he had, one day, a seizure of some kind, during which his head fell over to one side. It was after this seizure, on the same day, that the act of swallowing was first observed to be difficult. A second seizure had occurred a few days before his admission. In the morning, he had been taken out in his bath chair to sell books in the street as usual; but in the afternoon he had been seized with an attack of giddiness. After this seizure, he had gradually lost the power of swallowing; and for two days before admission he had not been able to swallow anything. During these two days, he had been sweating a great deal, and passing his urine involuntarily in bed.

On admission, the patient was in a helpless condition. He was extremely emaciated, and had a bed-sore over the middle of the sacrum. He was feverish, the temperature being 102° F. His legs were drawn up, both knee- and hip-joints being strongly flexed. His arms were semi-flexed at the elbow-joints; and his fingers were also flexed, the hands being almost clenched. He was quite unable to swallow; and on the day of admission was so weak that we thought him dying. But he rallied considerably on being fed with the stomach-tube; and he continued in life, though extremely feeble, for about five months after admission. Throughout the whole of this period, he was fed systematically with the stomach-tube. Though he was, on admission, at once put upon a water-bed, and was throughout nursed with the greatest care and attention—every effort being made to protect his skin,—it was yet found impossible to prevent the development of several other bed-sores. For some weeks before his death, there was almost total paralysis of movement in both lower extremities, and of the left upper extremity. In the right upper extremity, there was a little more power of movement than in the left. Besides the flexure of the limbs already noted, there was marked arching of the back, with retraction of the head. The mouth was kept habitually open, owing to the flaccidity of the lips, whose motor power was evidently much impaired, though not entirely paralyzed. Movement of the tongue was also greatly impaired, the patient being able to protrude the point only about one-eighth of an inch beyond the margins of the teeth. There was considerable wasting of its substance, but its surface was not wrinkled, and there were no fibrillar movements. Throughout the period of the patient's stay in hospital, there was involuntary evacuation of both bladder and rectum.

In the text of this work I have already described the speech of this patient as it was during this second period of residence in the Infirmary. When he tried to speak, he produced only a monotonous vocal drawl, which was so inarticulate that when he tried to say "good morning" only something of the M and N, and something of the vowel-sounds, could be distinguished in it.

The patient lost strength very gradually, and died, eventually, by simple asthenia, on the 31st of March, 1894. On the following day, an autopsy was made by Dr Muir, Pathologist to the Royal Infirmary, who found the case to

be a typical one of Multiple Sclerosis. Dr Muir has worked out, with great care, the microscopic anatomy of the lesions, and I hope will, at an early date, put the results of his examination on record. He has, in the meantime, kindly furnished me with the following brief note of the general results of the examination :—

"The central nervous system showed a very extensive and widespread disseminated sclerosis. The highest-up patch was a small grey area, with ill-defined margin, above the posterior horn of the left ventricle. All the basal ganglia on both sides contained numerous irregular areas of degeneration and sclerosis, which gave a remarkable patchy appearance. These encroached upon, and somewhat narrowed, the internal capsule. The cerebrum, in addition, showed general atrophy. The convolutions were narrow, the sulci widened ; and there was an excess of subarachnoid fluid, as well as milkiness of the arachnoid. The ventricles, also, were dilated.

"The crura, pons, and medulla showed numerous whitish and grey patches, which gave the sections so irregular an appearance that it was practically impossible to recognise many of the normal structures. In the medulla, the posterior part was most affected.

"The spinal cord was also extensively involved, and irregularly so ; but the posterior columns had suffered most. At many places the outline of the grey matter, especially of the posterior horns, was quite lost, owing to the encroachment of the sclerosis. All the columns showed scattered patches here and there, at different levels. The cord as a whole appeared distinctly atrophied.

"There appeared to be distinct muscular atrophy of the limbs in addition to the general wasting present. The right lower limb was rather more wasted than the left, especially in the calf muscles. The nerves in relation to these parts were considerably attenuated. These were kept for microscopic examination."

Commentary.—This case of Multiple Sclerosis affords a consecutive history of the development of the disease from its beginning to its termination, during a chronic course of nearly ten years. As is well known, the disease differs in its course according as it first affects one part of the nervous system or another. In this case, I think there is ground for the belief that the part first affected was the Cerebellum. Probably the initial blow on the forehead injured the Cerebellum by *contre-coup*, and lit up within it the pathological changes of multiple sclerosis some time before the disease spread to other parts. This would account for the fact that staggering and giddiness in walking were the first symptoms to show themselves. The early Nystagmus may also have been of cerebellar origin. On the other hand, the Staccato Speech that appeared later in the course of the case was probably due to the invasion of the Cerebrum by the disease, and the paralysis of the limbs to the invasion of the Spinal Cord. Lastly, the inarticulate drawling in speech, and the final loss of the power of swallowing, may be explained by the invasion of the bulbar nuclei and nerves.

B.—Reprint of Graduation Thesis.

(*From the Edinburgh Medical Journal of September* 1866.)

Observations on the Physiology of the Larynx. By John Wyllie, M.D., M.R.C.S., Senior President of the Royal Medical Society, and lately one of the Resident Physicians in the Royal Infirmary. (An Inaugural Dissertation, for which a Gold Medal was awarded by the University of Edinburgh at the Medical Graduation of August 1865.)

This paper is intended as a contribution to the Physiology of the Larynx, and not as an exhaustive treatise on the subject. It embodies the results of a somewhat lengthened series of experiments and observations on the following topics:—

1*st*, On the descent of the epiglottis during deglutition.
2*nd*, On the valvular action of the glottis.
3*rd*, On the production of voice.

I.—*On the Descent of the Epiglottis.*

In former times the epiglottis was thought to be the only safeguard against the entrance of food into the windpipe, and its integrity was therefore regarded as of almost vital consequence. But more recently, cases were recorded in which it had been entirely removed by accident or destroyed by disease, and yet in these the bolus did not find its way into the larynx, for this was still effectually prevented by the closure of the *glottis*, so that the act of deglutition continued to be performed with safety, and even with ease. Magendie, also, in his experiments, repeatedly removed the epiglottis of the dog without apparently putting the animal to much inconvenience.[1] Many physiologists were therefore led to regard this valve as only of secondary importance, and merely accessory to the glottis in the performance of its function. In our own time, however, another class of cases is being observed with the aid of the laryngoscope, in which the *glottis* is permanently incapable of closure, owing in some to paralysis of the intrinsic muscles of the larynx, and in others to the presence of tumours upon the vocal cords; and yet, in the majority of these, the larynx seems, by the epiglottis alone, to be as securely guarded as it was when the parts were healthy. There are, then, at the opening of the windpipe, two protecting valves, either of which is in itself capable of closing it when food is passing; but a double security is obtained by their simultaneous action. Of the two, perhaps the epiglottis is the more important in performing this function, for by its shape and position it seems specially fitted to roof in the larynx; and, in ordinary circumstances, it alone is actually of service, for no food comes in contact with the glottis, which nevertheless is closed as an additional protection.

What, then, is the mechanism by which the depression of the epiglottis is accomplished? On this subject various theories have been propounded. For example, it has been maintained that "the larynx is closed, or rather is covered,

[1] Magendie's *Compendium of Physiology*, p. 240.

by the epiglottis depressed mechanically by the alimentary bolus,"[1]—an explanation which must have appeared improbable to any one who thought of such an arrangement protecting the larynx from fluids as well as solids. A second and much more currently accepted theory is, that during deglutition the root of the tongue is pushed downwards upon the epiglottis, which is thus in its turn depressed upon the larynx. This view is modified by some, who suppose that when the larynx is elevated, the epiglottis must be pressed upwards against the base of the tongue, which in thus effecting its closure acts the part only of a passive agent, as it were. Thirdly, it is maintained that the action in question is accomplished solely by the special depressor muscles of the epiglottis, and that after the passage of the bolus the valve is raised again "by its own elasticity and that of its ligaments." This view, which was formerly promulgated by Santorini, has lately been supported by Czermak, who concludes, from his experiments with the auto-laryngoscope, that "the epiglottis is not passively depressed, for example by the base of the tongue, but this depression is actually caused by the proper muscles of the epiglottis itself."[2] A tactile examination of the epiglottis during deglutition fully confirms this statement in so far as it refers to the base of the tongue. The theory, however, that the action of its special depressor muscles is the sole agency which effects the descent of the valve, is met by a serious objection. For, the epiglottis being raised after the passage of the bolus—"by its own elasticity and that of its ligaments"—it naturally follows, if we accept this statement, that, in accomplishing its depression, the muscles must have overcome some resistance from these ligaments. One would, therefore, expect to find a development of muscle commensurate with such resistance; but a dissection of the parts shows us that these depressors of the epiglottis are mere thin bands of muscular fibre, which, if the larynx be not well-developed, are too apt to escape observation altogether. Again, if we turn to the lower animals, we find in certain of the ruminantia, a strong muscle attached to the front of the epiglottis and stretching forwards, in some, into the substance of the tongue, and in others, the sheep for example, dividing in front into two processes, each of which becomes attached to one of the stylo-hyal bones, just above their articulation to the front of the os hyoides. With the existence of this strong elevator muscle we find no corresponding development of the depressors, they are here as weak and thin as in the human subject. It is, then, very improbable that, in depressing the epiglottis, they alone should be the agents employed. Let us see if, in the phenomena of deglutition, we can find anything which may render them assistance.

When the parts concerned in the act of swallowing are carefully dissected, two ligaments are found which are specially adapted to support the epiglottis when the larynx is at rest.[3]

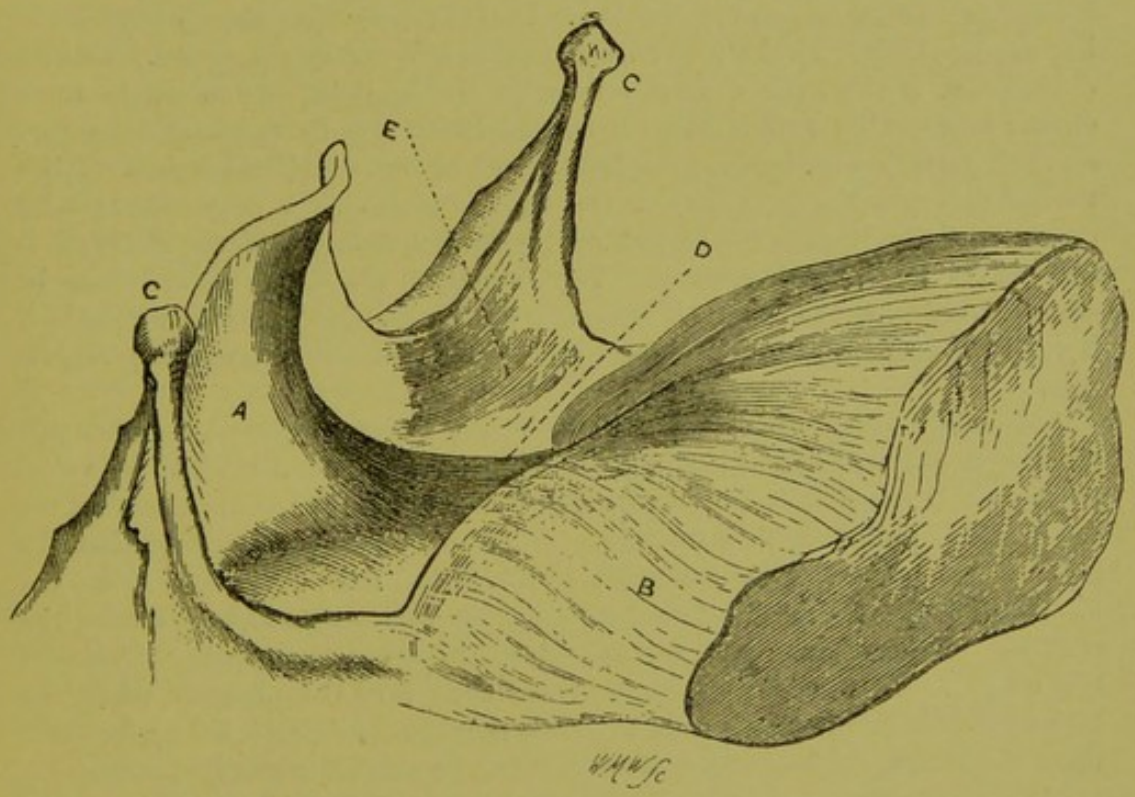
First, there is the *glosso-epiglottic* ligament. This has been called by some anatomists the *frænum epiglottidis*. It seems to be the prolongation backwards of the fibrous septum of the tongue, and at its origin many of the muscular

[1] M. Meyer. [2] Czermak's *Monograph*, translated by the Sydm. Society.

[3] These ligaments have been carefully described by Bishop in his article on the Larynx, in Todd's *Cyclopædia of Anatomy and Physiology*, and by other special writers on the larynx; but they are overlooked by the author of an ordinary text-book.

fibres of the cortex are inserted into it. Posteriorly, it crosses the hyoid bone, and becomes attached to the epiglottis about its middle. It stands out prominently in the mesial line, its sharp edge being enclosed in the middle glosso-epiglottic fold of the mucous membrane. The microscope shows it to be chiefly composed of elastic fibres, but notwithstanding this fact, it is by no means easily stretched when it is isolated. This ligament is the representative, as Magendie pointed out, of the elevator muscle of the epiglottis in the ruminantia, to which I have already referred. I have, in several cases, observed muscular fibres clustering around it even at the epiglottic attachment.

The Epiglottis and its Ligaments.



A, The epiglottis. B, The base of the tongue. C C, The cornua of the hyoid bone. D, The glosso-epiglottic ligament. E, The hyo-epiglottic ligament.

The second ligament is the *hyo-epiglottic* (E), one of equal importance. This is a well-marked membranous expansion stretching from the concave edge of the hyoid bone downwards to the anterior surface of the epiglottis. Its line of origin extends in many cases backwards almost to the point of the great cornu on either side, but often this attachment is not so extensive, the fibres taking their rise almost exclusively from the body of the bone. Its insertion is beneath that of the glosso-epiglottic ligament upon the lower thickened half of the valve. The direction of its fibres varies according to the point of origin, those arising near the points of the great cornua being directed forwards, downwards, and inwards, whilst the central fibres from the body of the bone are directed simply downwards and backwards.

When the larynx is at rest, and the hyoid bone is separated by an interval

from the thyroid cartilage, these two ligaments dip downwards to their insertion, and hold the epiglottis suspended in a semi-erect position above the opening of the windpipe. But, in the act of deglutition, the box of the larynx is elevated, and the base of the tongue is at the same time carried backwards in the pharynx. If we imitate these movements with the dead parts, we find *that both ligaments become relaxed;* for, when the larynx is raised, the thyroid cartilage is made to impinge upon the hyoid bone, and the epiglottis being attached by its apex to the former, the broad ligament that stretches between it and the *os hyoidis* is necessarily slackened. In a similar manner, by the backward movement of the base of the tongue, the glosso-epiglottic ligament is relaxed. The epiglottis has thus lost the support of both its sustaining ligaments, and by its own gravity it tends to droop towards the opening of the larynx,—if touched by the finger its closure is very easily completed. During deglutition, if the little depressor muscles are brought into action in these circumstances, they will meet with no resistance, and by very slight traction on their part, the roofing in of the larynx will be rendered quite secure. After the act of deglutition, the larynx once more descends, the depressor muscles cease to act, the ligaments are put gently on the stretch, and the epiglottis is restored to its original position. The return of the valve, it will thus be observed, is due, not to its elastic ligaments having recoiled after being stretched, but, on the contrary, to their being gently tightened after a temporary relaxation.

A concluding experiment may illustrate the action of these two ligaments when they are in a state of extreme tension. In the highest notes of the voice, the larynx is raised as it is in deglutition ; but there is this difference, that the os hyoides is pulled further forwards by the genio-hyoid muscles, so that the point of the pomum Adami engages itself behind the hyoid bone, instead of merely impinging upon it. The hyo-epiglottic ligament is thus put upon the stretch. In like manner the glosso-epiglottic is pulled upon by the muscles of the tongue. If, now, the finger be introduced into the pharynx when the highest note is being sung, it will be found that the epiglottis is drawn forwards upon the base of the tongue, so that its anterior surface actually touches the mucous membrane of that organ ; the only part of the valve which can be pushed backwards is its free upper border, which may be bent in that direction by the finger,—its middle portion is almost immovable. If, in the same circumstances, the throat be examined with the laryngoscope, these observations will be confirmed ; and it will be further seen that the natural concavity of the posterior surface of the epiglottis is considerably increased, owing to its centre being pulled forwards, whilst its lateral edges are retained somewhat in position by the aryteno-epiglottic folds. These observations, however, are more strictly concerned with the function of voice. I mention them here only to illustrate the importance of the glosso-epiglottic and hyo-epiglottic ligaments in regulating the position of the epiglottis.

II.—*The Valvular Action of the Glottis.*

The circumstances in which shutting of the glottis is observed to take place may be classed under three heads :—

1*st*, Partial closure takes place during phonation, the vocal ligaments being

then approximated, so that only a narrow chink is left, through which the air escapes.

2*d*, In the act of deglutition, complete closure occurs simultaneously with the descent of the epiglottis, as we have already seen.

3*d*, Perfect closure also takes place whenever the air is compressed within the lungs and trachea, whether by a voluntary effort, as in holding the breath, or involuntarily, as before each act of coughing.

I shall, in the meantime, confine my remarks to the second and third of these conditions, reserving the first for that part of the paper which treats of the production of voice.

That the glottis is shut during the act of deglutition is proved by the experiments of Magendie on dogs, and by the observation of such cases as one recorded by Mayo. A man, in an attempt to destroy himself, made a deep gash in the upper part of his throat which extended into the pharynx. "The wound," says the narrator, "was horizontal, and passed backwards over the upper border of the thyroid cartilage, severing the epiglottis near its attachment to the latter, yet the patient, in two or three days after the injury, swallowed easily, and without the least irritation of the larynx, although so free was the opening in the throat that some of the fluid swallowed always ran out at the wound."[1] Observations such as these leave us in no doubt that the glottis is shut during the act of deglutition ; but, even under the most favourable circumstances, it must be extremely difficult to observe the exact manner of its closure, and accordingly we are left very much to infer that the order of phenomena is the same in deglutition as we observe it to be in voluntary shutting of the glottis.

The mechanism of this voluntary closure has been of late years beautifully demonstrated by Czermak. "During complete and hermetic closure," says that author, "I have observed the following phenomena :—

"1*st*, The arytenoid cartilages intimately meet at their internal surfaces and processes, and bring the edges of the vocal cords in contact.

"2*nd*, The superior vocal cords approach the inferior so as to obliterate the ventricles of Morgagni, at the same time they also meet in the median line.

"3*rd*, The epiglottis being lowered and its cushion made more prominent still, it presses against the closed glottis, the contact taking place from before backwards. All these changes take place with such rapidity that great attention is necessary to examine them in detail."[2]

The mode of performing these experiments is, first to shut the glottis gently, and then to compress the air within the chest and trachea, by putting the muscles of expiration more and more powerfully into action.

With the second statement in Czermak's account of the phenomena, viz., that the superior cords approach the inferior so as to obliterate the ventricles of Morgagni, my own observations, as will be seen presently, do not concur. Any observation with the laryngoscope, regarding the condition of these ventricles, is extremely liable to fallacy, for their oblong orifices are situated in the lateral walls of the larynx and look inwards, so that, observing them from above, it is almost impossible to tell whether they are open or closed.

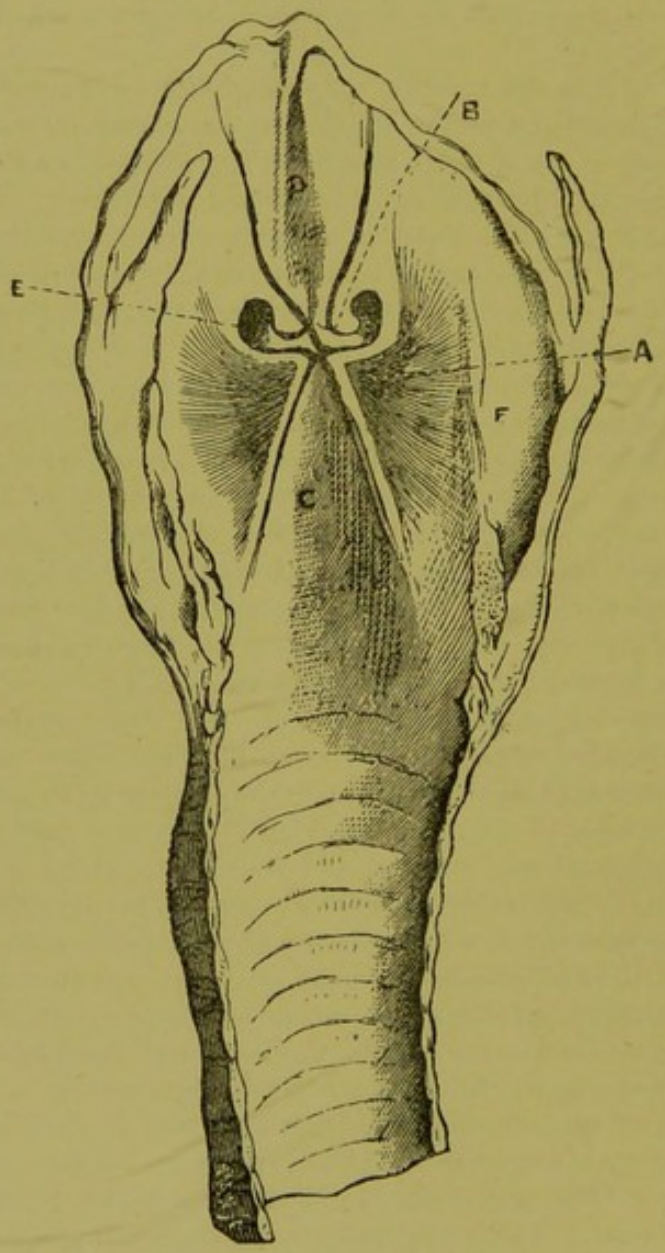
The question now to be considered is, What is the use of this complexity in

[1] Mayo's *Physiology*, pp. 371 and 382.

[2] Czermak's *Monograph*.

the shutting of the glottis? "No doubt," as Czermak remarks, "these threefold occurrences in the hermetic closure of the larynx explain the resistance which the glottis successfully opposes to the pressure of the air without the development of much force during the effort." But what is the exact importance of the false and of the true vocal cords,—what is the physiological purpose of the ventricles of Morgagni? These are problems which remain unsolved.

View of the Glottis from behind.



A, True vocal cord. B, False vocal cord. C, Wedge-shaped space below true cords. D, Wedge-shaped space above false cords. E, Ventricle of Morgagni. F, Ala of thyroid cartilage.

The difficulty in deciding these questions has, it appears to me, arisen in some measure from an anatomical misconception. The vocal cords are considered by many as the free edges of membranes which are flattened both above

and below. But if a vertical section be made through the larynx so as to divide both false and true cords transversely, it will be found, that when these are approximated, the cavity of the larynx above the false cords, as well as that of the trachea below the true, is wedge-shaped (D and C). When thus in apposition, the upper surfaces of the true vocal ligaments present a broad flattened plane slightly hollowed out on each side, but on their tracheal aspect the mucous membrane is observed to fall away obliquely downwards and outwards, thus leaving an angle of considerable size, which forms the margin of each vocal ligament. The same obliquity is observed in the mucous membrane above the false vocal cords, whilst their lower margins are defined by the openings of the ventricles of Morgagni, well-marked pouches which extend upwards behind them about half an inch. These appearances are represented in the accompanying drawing, for which, as also for that showing the ligaments of the epiglottis, I am indebted to the kindness of my friend Mr Ramsay, one of my fellow-residents in the Royal Infirmary. This sketch was taken from a recent dissection, the posterior wall of the trachea being removed, as also that of the cricoid cartilage with the attached arytenoids. The vocal cords are cut through about their middle, so as to exhibit in the section the ventricles of Morgagni (E).

Now it is to be borne in mind that by closure of the glottis complete stoppage is effected, not only of inspiration, but also of expiration, the most powerful efforts at either being rendered quite ineffectual. This is, no doubt, in a sense due to the action of those intrinsic muscles of the larynx which close the rima, but the strength of these comparatively minute structures is surely in itself inadequate to resist the enormous power which the air may be made to exert upon the glottis from within, during a forcible attempt at expiration, as well as its pressure from without, when we try to inspire.[1] From this consideration one is naturally led to suspect the existence in the glottis of some well-adapted valvular arrangements, suited to control both the entrance and exit of the air. With the view of ascertaining whether such arrangements exist, and, if so, what is their precise nature, I made the following experiments upon the dead larynx:—

Having brought together the true cords (A) in the vocalizing position, by transfixing the arytenoid cartilages with a needle, and applying over it a figure-of-eight ligature in a manner which I shall afterwards describe (see experiments on voice), I blew upwards through the trachea, and at the same time attempted to stop the current of air by bringing the true vocal cords accurately into contact; this being done by pressing the arytenoids firmly between the finger and thumb. After repeated trial I found that no manner of adjusting the cartilages could completely obstruct the passage of the air, for as I have already said the space in the trachea below the vocal cords is wedge-shaped (see drawing, C), and the air was thus enabled to wedge itself between the vocal ligaments, producing in its escape a sound which more or less resembled the voice. Feeling satisfied that the true cords could not present

[1] "We may wonder that muscular fasciculi so slight as those of the larynx, however advantageously placed, should be capable of counteracting the efforts of the diaphragm and other muscles of inspiration. But they are found to be no less efficient against the muscles of expiration."—Mayo's *Physiology*.

any serious obstacle to the *exit* of air when the glottis is closed, I now drew air backwards through the larynx, in order to test their value as opposing its *entrance* during attempted inspiration. I found that by a very slight and easy adjustment of the arytenoid cartilages I could prevent its entrance entirely. The cords did not require to be forcibly pressed together; the circumstances most favourable for obtaining their perfect valvular action were that they should be accurately approximated but not stretched, so that when air was blown upwards through the trachea a low note was produced. In this condition by gently pressing forward the apices of the arytenoid cartilages the air was completely obstructed.

I next proceeded to ascertain the effect of bringing together the *false* vocal cords (B). These are not so easily brought into contact as the true, and the means adopted were therefore rather more complicated. Still keeping the arytenoid cartilages fixed together as before, with a needle and ligature, I passed, in addition, two other needles through the anterior surface of the thyroid cartilage, one on each side of the middle line, just opposite the anterior attachments of the cords, and carefully guided their points backwards to their arytenoid extremities, so that each needle was contained within the free edge of a false ligament. The posterior attachments of the cords were then approximated by pressure between the finger and thumb, and at the same time in their whole length they were brought into close apposition by separating the heads of the needles in front of the thyroid cartilage. On attempting to blow upwards through the trachea, when the parts were so arranged, the closure of the glottis was found to be complete. The simple coaptation of the free edges of the false cords proved itself sufficient to obstruct entirely even a powerful current of air from below.

The conclusion to be derived from these experiments is obvious. There is within the larynx a double valve which is capable of controlling both the exit and entrance of air. The plan found so commonly throughout the body in such structures, in the aortic and ileo-cæcal orifices, and in the course of the veins, holds good here likewise. In the upper half the resemblance is most obvious. Comparing it with the aortic valve, we find the representatives of the sinuses of Valsalva in the well-marked ventricles of Morgagni, whilst the cusps are reproduced in the two folds of mucous membrane, whose free edges are known as the false vocal cords.

The same design may be traced in the lower half of the valve. When the true vocal ligaments are brought into apposition, no deep sinus is found on either side, but their upper surfaces form together a broad flattened plane slightly hollowed out exterior to the margins of the rima glottidis, and this arrangement, owing to the greater density and mobility of the parts, is found to act as efficiently as the well-marked ventricles and cusps of the upper valve.

A laryngoscopic examination fully confirms the view which I have just stated. The following phenomena may then be observed :—

1*st*, When the glottis is simply closed, and no effort is made either to take in breath or to expire, the false cords are separated by a very narrow interval through which the edges of the true vocal ligaments may be seen in close apposition.

2*d*, When an effort is made to *inspire*, the superior cords meet in the middle

line so as to leave only a very small triangular opening posteriorly, through which there still may be caught a glimmering of the pale surface of the true ligaments.

3*d*, When expiration is attempted, the false cords are immediately coaptated throughout their whole length, and if the effort made be powerful, the parts above are observed "to arch or curve outwards without allowing the air to escape" (Czermak). This swelling out of the mucous membrane at the upper part of the larynx can be due to nothing but the inflation of the ventricles of Morgagni beneath.

The physiology of these ventricles and of the superior ligaments of the larynx is thus after all so beautifully simple as to render it very surprising that their action was not long since recognised. Formerly, the difficulty no doubt lay in the impossibility of displaying the parts in the living body. Even before the days of the laryngoscope, however, I find, on looking over the various treatises on the larynx, that among the numerous conjectures regarding their use, one shrewd guess has been made, which very nearly approaches the whole truth. In Mayo's *Physiology* there occurs the following passage :— "Mr Willis has very ingeniously conjectured that the closure of the glottis takes place through the inflation of the ventricles from below, when the ligaments have been approximated and an expiration has been attempted. An objection," he continues, "was suggested to me by Mr Wheatstone, which of itself appears fatal to Mr Willis's hypothesis ;—we can close the larynx as well during inspiration as during expiration."[1] I have not yet discovered this suggestion in Mr Willis's own writings, but it is evident that he has never thought of the *true* cords as preventing the entrance of air, otherwise Mayo's criticism would not have been offered.

The characters of that peculiar brassy cough which exists so often in cases of aneurism of the aorta where the recurrent laryngeal nerve is involved, may, I think, be explained in the following manner. Each normal act of coughing may be divided into two stages. 1*st*, The complete closure of the glottis, false and true cords together, so as to enable the air to be compressed within the chest and trachea ; its escape being prevented by the false cords and ventricles of Morgagni as just explained. 2*d*, The sudden and complete opening of the glottis, allowing at once the explosive escape of the compressed air. Both of these movements are performed by muscular action. But in the typical aneurismal cough the glottis is neither closed nor opened perfectly, for the pressure upon the recurrent nerve has impaired its power of transmitting a normal stimulus to the muscles, so that whilst the true cords are brought closely enough together to produce voice, the false cords—not so easily approximated—remain somewhat apart, and the air is therefore allowed to escape, so that the cough is imperfect at its commencement. Again, it is brassy or voicy, because in the second stage the opening of the glottis is not so sudden and perfect as it ought to be, the muscles being kept in a state of spasmodic contraction by the direct irritation of the nerve where it is pressed upon by the aneurismal tumour, so that in the muscles there may be said to exist a tendency to spasm, associated with a partial loss of voluntary motion, a combination not

[1] Mayo's *Physiology*, p. 381.

unfrequent in other nervous affections. Sometimes the spasm is so great as to give rise to crowing on inspiration, and, in a degree greater still, it is the frequent cause of death by asphyxia, for the true cords remaining in apposition shut off by their valvular action the entrance of the air.[1]

In order to understand the action of the muscles by which the glottis is closed, one must have a correct conception of the arytenoid cartilages. Each of these small complicated bodies has somewhat the appearance of a miniature horn, very much flattened from before backwards in its upper two-thirds, so as to present an anterior and a posterior surface with an inner and an outer edge. The *posterior surface* is markedly concave from above downwards, and on it are inserted the fibres of the arytenoid muscle. On the convex *anterior surface*, about its middle, there is a well-marked pit, which gives attachment to the greater part of the fibres of the false vocal cord, and on the lower part of this surface there are also inserted some of the fibres of the thyro-arytenoid muscle. The *inner edge* is the part of the cartilage which is brought into apposition with the corresponding line of the opposite side when the vocal cords are approximated ; it is quite smooth, and is covered only by the mucous membrane. Inferiorly, this border spreads out into a small flattened triangular surface, the anterior angle of which projects forwards in the shape of a pointed process, to which the true vocal ligament is attached. The *outer edge* terminates inferiorly in the posterior external angle, and, together with it, forms the chief line of insertion for the muscles. To the angle are attached the tendons of the posterior and lateral crico-arytenoids, whilst the fibres of the thyro-arytenoid are inserted along the edge, almost as high as the apex of the cartilage. On the *base*, the chief points to be observed are the two angles already mentioned, namely, the *processus vocalis*, and the posterior external angle. The latter projects considerably backwards and outwards, and, scooped out on its inferior surface, is the articular facet of the arytenoid cartilage, which looks downwards and inwards, and is so formed as to fit upon the corresponding saddle-shaped surface of the cricoid. This joint is so oblique, that when the arytenoids are rotated upon it, they naturally approach each other in the middle line, so that their internal edges and vocal processes are brought into apposition. Owing to the articular surface being situated on the inferior aspect of the projecting posterior angle, the whole body of the cartilage extends forwards and assists in covering the opening of the larynx. The concave posterior surfaces being anterior to the articulations, it necessarily follows that the arytenoid muscle, to which they give attachment, must of itself be sufficient to pull the cartilages with their processus vocales together in the middle line.

The mechanism by which the true cords are approximated is thus comparatively simple. Three muscles are said to take part in the action. The arytenoid pulls the cartilages together, bringing their internal edges in contact, so as to close the so-called respiratory portion of the glottis ; the thyro- and crico-arytenoids, whilst they assist the other, act more particularly by rotating the cartilages inwards, so as to bring their anterior processes into still closer apposition, and also to lower them in the cavity of the larynx. This last

[1] In a paper on "Extra-Auscultation," contributed in 1893 to the first volume of the *Edinburgh Hospital Reports*, I have offered another explanation of the Brassy Cough of Aneurism.—J. W., August 1894.

action must especially be accomplished by the fibres of the thyro-arytenoid, which, as already mentioned, are attached along the outer edge, almost as high as the apex of each cartilage.

It is not so easy to determine by what means the false cords are brought together. We have already seen that the point to which most of their fibres are attached posteriorly, is a pit about the middle of the anterior convex surface of each arytenoid cartilage, and, therefore, to the outer side of, and superior to, the insertion of the true ligaments. But this is not their only posterior connexion; another strong band of their fibres becomes attached to the apex of the cartilage of Wrisberg, a body which is too much overlooked by anatomists. Anteriorly, besides their thyroid attachments, they send upwards and forwards several processes to the edge of the lower thickened portion of the epiglottis. There is also to be observed, stretching between the margin of that valve and the superior border of each false ligament, in its whole length, a thin layer of muscular fibre connected with the aryteno-epiglottic muscle.

The cartilages of Wrisberg are contained within the aryteno-epiglottic folds of the mucous membrane, lying immediately in front of, and parallel to, the inner edge of the arytenoid cartilage on each side. They are very slender, except at their upper end, where they form in the free edge of the aryteno-epiglottic fold, a rounded eminence, which is often mistaken for the apex of the arytenoid cartilage. "It," says Ecker, "is surrounded by mucous glands; from it along the false cords a horizontal process runs forwards, which one sees radiate between the elastic fibres of these cords."[1] In front of the inner edge of each arytenoid, the position of this cartilage is marked by a slightly prominent line on the mucous membrane, which extends downwards nearly to the level of the false ligament.

As to the means by which the false cords are approximated, the thyro- and crico-arytenoids which lie parallel with them may, when they contract, tend to bring their free edges in contact; possibly also the cartilages of Wrisberg may bear to the false cords something of the same relation which exists between the arytenoids and the true vocal ligaments, the cartilages forming movable bodies, which can be approximated by muscular action. Our knowledge of these points is very unsatisfactory; the subject requires further investigation. But be that as it may, it is evident that if the muscles which bring together the false vocal cords act also during the production of the higher notes of the voice, their influence as closers of the upper part of the glottis must then be counteracted by the fibres, ligamentous and muscular, which stretch between these cords and the margin of the epiglottis. For that valve being then, as we have seen, pulled strongly forwards, these fibres will draw the false ligaments upwards and outwards, and thus keep patent the interval between them.

III.—*The Mechanism of Voice.*

The great fact that the vibrations produced at the free edges of the inferior ligaments of the larynx are the primary source of the vocal tones, has been long since recognised by physiologists. Many of the minor questions, however, which the subject includes, such as the determination of all the different

[1] Ecker's *Icones Physiologicæ.*

agencies which may tend to raise or lower the pitch of the notes, the special action of each of the muscles, the mechanism of the falsetto voice, are still involved in a great degree of doubt and obscurity. In the following remarks I shall first note shortly a number of phenomena bearing upon these questions, which may be observed in the living body; and, secondly, I shall adduce such evidence as may be afforded by a series of experiments performed upon the dead larynx.

1*st*, When the laryngoscopic mirror is placed at the back of the throat, and the individual examined is desired to sound a vocal note, "the cords are seen to come together with surprising mobility,"[1] and their edges are thrown into a state of rapid vibration. In these circumstances it is to be observed,—(*a.*) That the vibrations during a low note are distinctly visible, but as the pitch of the voice is raised they become more and more rapid and consequently less distinct, until, in the high notes, the cords appear quite motionless. (*b.*) In no part of their posterior half are the vocal cords ever seen to come into actual contact. Even the points of the vocal processes of the arytenoid cartilages are separated by a narrow interval, which continues of the same size in the high notes of the true voice as in the low; but when the sound is made to pass from the true voice into the same note of the falsetto, the vocal processes distinctly approach each other, so that the chink between them is diminished. The epiglottis overshadows the anterior ends of the cords so much that it is impossible with the laryngoscope to tell whether they ever come into actual contact so as to cause the vibration to cease in that part of their extent. (*c.*) As the voice rises in the scale, both false and true cords are evidently more and more stretched; the epiglottis at the same time is seen to be drawn forwards and upwards towards the tongue, as already described.

2*d*, If now an examination of the throat be made with the finger, it will be found that during the production of base notes the cavity of the pharynx is large and capacious, but in the higher treble tones its muscular walls are contracted more and more as the voice ascends, till the finger is felt to be actually grasped within them. This narrowing of the cavity may be observed to be slightly greater in the false voice than in the true, the pitch of the note remaining the same.

3*d*, The condition of the soft palate varies very much during phonation. In the production of low notes, it is raised so as to form a vaulted arch, the isthmus of the fauces is widely open, and the uvula is of its natural size; the levator palati seems the only muscle in action. In the high notes, on the other hand, the whole of the muscles seem to be violently contracted, the interval between the posterior pillars of the fauces is reduced to one-fourth of its natural size, the uvula disappears almost entirely, and the posterior edge of the palate may be felt with the finger to be quite hard and tense. The velum altogether presents an appearance somewhat like the roof of a house, its central line being much elevated, whilst its sides slope obliquely downwards, owing to the contraction of the palato-glossus and palato-pharyngeus. The elevated palate thus constitutes a fixed point from which the palato-pharyngeus may pull upon its other attachments to the wall of the pharynx and the alæ of the thyroid cartilage.

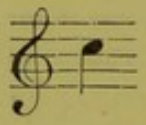
[1] Czermak.

4th, The position of the box of the larynx varies with every note. If the finger be applied over the pomum Adami, it will be found that, during the treble tones, the hyoid bone is pulled upwards and forwards, carrying the larynx along with it; and that finally, when the voice approaches its highest pitch, the thyroid cartilage becomes still further elevated, so that its sharp projecting angle engages itself behind the body of the os hyoides. In the production of the base notes, on the other hand, the box of the larynx is pulled downwards from its position of rest, and during the lowest tones the inferior edge of the hyoid bone becomes applied to the upper border of the thyroid cartilage. The distance between the highest and the lowest point to which the pomum Adami is thus capable of reaching amounts to about one inch. As the larynx rises, the width of the interval between the cricoid and thyroid cartilages becomes perceptibly diminished. At the moment of transition between the true and the false voice, this interval, according to some observers, opens slightly, and the thyroid cartilage at the same time is somewhat lowered; these observations were first made by Mr Bishop, who regards them as affording very weighty evidence in support of his own theory of the falsetto, but I cannot say that I have been able to verify them. Another important observation to be made is, that *during the highest notes the thyroid cartilage is constricted so that its width from side to side is less than it is when the larynx is at rest.* Any one may satisfy himself of this by measuring the box of the larynx between the finger and thumb. The following little experiments may illustrate the effects which this constriction must have upon the voice.

(*a.*) When the alæ of the cartilage are pressed between the finger and thumb, and a high note at the same time is sounded, it will be found that on suddenly removing the pressure, the voice involuntarily falls several notes in the musical scale. In myself, I find that this pressure renders falsetto singing easier, so that with its aid I am able to take several notes higher than I can otherwise reach. (*b.*) An opposite experiment consists in pressing backwards with the finger the point of the pomum Adami when a low note is being produced. In this case, on suddenly removing the pressure, the voice at once rises several notes. (*c.*) When, during the very lowest note of my voice, I compress the upper part of the thyroid cartilage in the manner of the first experiment, I find that, whilst the pressure continues, the voice involuntarily alternates between the natural bass tone and a high treble of a somewhat falsetto character. The only explanation of this phenomenon which I can think of is, that the vocal cords have come in contact at opposite points, so that the glottis acquires the same pitch as if it were half closed. I may state, however, that I have succeeded with this experiment only as yet upon my own larynx.

In performing experiments upon the dead larynx, I have adopted very much the plan employed by Professor Müller. The first thing to be done is to fix the arytenoid cartilages, which may be accomplished by passing a needle transversely through their bases, and pulling them together by applying, on their posterior surface, around the projecting ends of the needle, a figure-of-eight ligature. When this is done with care, the vocal cords are found to be brought accurately together in the middle line, so as to be on the same level and to possess an equal degree of tension. I found it of great advantage to

use the small semicircular suture needle, since its employment obviates the necessity of notching the alæ of the thyroid cartilage, which must be done when the arytenoids are transfixed by a pin or awl, as recommended by Professor Müller. In so notching the posterior borders of the thyroid, one is very apt to detach altogether their inferior cornua, and after such an accident any experiments in imitation of the action of the muscles are of no value. I have generally preserved attached, in the following experiments, the epiglottis and the hyoid bone, since I have found that voice is more easily produced when they are present, owing probably to the support given to the vocal cords by the mucous membrane of the upper part of the larynx, which is then comparatively tense.

For convenience, the different musical notes will be indicated thus:—The note  will be marked C, and those above it up to  will be indicated like it, simply by the letters;  however, and its octave will be marked C^1, D^1, etc., whilst the octave below C will be marked B_1, A_1, etc., and that lower still as B_2, A_2, etc.

Experiment 1.—The larynx was that of a woman aged about fifty years. The cartilages were very little ossified. Attached were the hyoid bone, the epiglottis, and about three inches of the trachea. The arytenoids were fixed with a needle and a ligature in the manner just described, and a leather tube about five inches long was inserted into the opening of the windpipe. On supporting the larynx by the cricoid cartilage alone in a horizontal position, the note produced by blowing very gently through the tube was G. No difference in pitch was produced when the short tube was taken out and replaced by another a foot in length. By pressing backwards the thyroid cartilage, the note could be lowered to G_2; on the other hand, by pulling the thyroid forwards, the arytenoids being fixed, the pitch could be raised to G, so that the compass of the voice embraced two octaves. I could occasionally produce the note A, but it was of a screaming imperfect character. The effect of gently depressing the epiglottis, so as to have only a narrow opening between its margin and the arytenoid cartilages, was to lower the pitch one full tone.[1]

I next proceeded to test the effects of weights attached to the thyroid cartilage so as to stretch the vocal cords. With this object in view, I tied the free ends of the figure-of-eight ligature to a projecting piece of wood, thus suspending the larynx by its arytenoid cartilages. I then passed another strong needle through the angle of the thyroid cartilage, just opposite the attachment of the vocal cords, and to this, the larynx being held in a horizontal position, I suspended the weights with the following effects. The fundamental note being G_1, the addition of

[1] Müller found this to produce a difference of only half a tone.

1 oz.	raised pitch to	G_1	sharp.
2 ,,	,,	A_1	
3 ,,	,,	B_1	
4 ,,	,,	B_1	
5 ,,	,,	C	
6 ,,	,,	C	
7 ,,	,,	D	
8 ,,	,,	D	
9 ,,	,,	D	
10 oz.	raised pitch to	D	
11 ,,	,,	E	
12 ,,	,,	E	
13 ,,	,,	E	
14 ,,	,,	E	
15 ,,	,,	E	
1 lb.	,,	G	
2 ,,	,,	A	
No further note produced.			

It will be observed that, as the voice rose in the scale, a greater and greater weight was required to produce each successive note. I was obliged also to increase the force in blowing almost in a similar proportion, for the gentle blast which produced the fundamental note and those near it, caused no vocal sound at all when a few additional ounces were suspended. At any time during the lower notes, the pitch could be raised by simply increasing the current of air independently of the increase of weight; but in each case, following Müller, I have marked the note produced by the gentlest possible current. With the view of showing how much the elevation in pitch is due to the weights alone, and how much to the increased force of the blast of air, I next made the following observations. Observing the note produced when a weight, for example one pound, was used, I suddenly removed it altogether, and marked the pitch to which the voice fell, the current of air remaining the same. The result was as follows :—

1 lb.	=	G	:	removed	=	C
8 oz.	=	D	:	,,	=	A_1
4 ,,	=	C	:	,,	=	A_1 flat.

2. Keeping the parts in the same position, I next suspended the weights from the hyoid bone, with results identical with those of last table, except that after passing 11 oz., which produced E as before, a greater weight was required to obtain each successive note; 25 oz. being required to produce G, instead of one pound.

3. The larynx was that of a powerful man, aged about forty. The lowest note which I could produce with it by pressing backwards the thyroid cartilage was E_2. The arytenoids being fixed with a needle as before, I now attempted to imitate by weights the action of the *crico-thyroid muscle*. This was done by passing a string through the lower border of the thyroid cartilage on each side at the middle of that muscle's line of attachment. Tying each end of the string in this position, I suspended the weights from the intervening loop, whilst the cricoid cartilage was fixed, and the larynx was held in an oblique position, so that the direction of the string was the same as that of the fibres of the muscle. The following were the results :—

Fundamental note,		E_1	
½ oz.	raised pitch to	F_1	
1 ,,	,,	F_1	
2 ,,	,,	F_1	sharp.
3 ,,	,,	G_1	
4 ,,	,,	G_1	sharp.
5 ,,	,,	B_1	
6 ,,	,,	C	
7 ,,	,,	D	
8 ,,	,,	D	
9 ,,	,,	D	sharp.
10 oz.	raised pitch to	E	
11 ,,	,,	F	
12 ,,	,,	F	
13 ,,	,,	G	
17 ,,	,,		still G
18 ,,	,,	A	
22 ,,	,,		still A
23 ,,	,,	B	
24 ,,	,,	B	
2 lb. or 32 ,,	,,	C^1	
No further note produced.			

The notes from G upwards were of a screaming imperfect character. The following are examples, as before, of the effects of increased force in the current of air :—

1 lb.	=	G	: removed	=	G
8 oz.	=	D	: ,,	=	F_1
4 ,,	=	A_1	: ,,	=	E = fundamental note.

4. With the same larynx I again applied the weight so as to imitate the action of the crico-thyroid, as in last experiment, but in this case the string suspending the larynx was attached, not to the needle transfixing the arytenoids, but to another passed for this purpose transversely through the posterior surface of the cricoid cartilage. The cricoid, therefore, and not the arytenoids, was the fixed point. Owing to the larynx having already been considerably used, the fundamental note produced on blowing very gently was now C_1, instead of E_1, as formerly.

Fundamental note, C_1	2 oz. raised pitch to D_1
1 oz. raised pitch to D_1	3 ,, ,, E_1

Here I was much puzzled to find that whilst when I blew with moderate force the note was E_1, the pitch rose to G_1 when I diminished the current of air, and this transition sometimes occurred even whilst the force which I employed in blowing remained the same. On examining the vocal cords, I found that the space between them became perceptibly wider and of greater length at the moment the lower note was produced. To continue the experiment :—

4 oz. raised pitch to G_1	6 oz. raised pitch to F (weak).
5 ,, ,, C	8 ,, No note produced.

These results are very different from those of last experiment. The curious alternation in the pitch which occurred when three ounces were suspended, and also to a less extent during the other notes, I attributed to the apices of the arytenoids being pulled forwards by the tightening of the false vocal cords, and of the mucous membrane. The slight traction of these parts, I supposed, might imitate to some extent the action of the thyro-arytenoid muscles, to be afterwards described, rotating the cartilages slightly inwards, and at the same time depressing the points of the vocal processes so that the cords were tightened as well as approximated ; on the current of air being increased, these effects were undone, the vocal processes were raised from below, and the cords were separated to the same extent as before. This is the only example of sudden and unexpected alternation between two perfect notes that I met with in all my experiments upon the dead larynx. Müller, who seems to have met with it frequently, speaks of it thus :—"If a slight tension of the ligaments is maintained, it depends upon the manner of blowing whether the note be of the ordinary tone or falsetto (the falsetto note being most easily produced by blowing very gently), and the two different notes thus produced may be very distant from each other in the musical scale, even so much as an octave."[1] In his experiments, Müller always fixed the arytenoid cartilages to a wooden board.

[1] Müller, *Physiology*, vol. ii. p. 1013.

5. In examining the living larynx, we found that during the highest notes of the voice the hyoid bone was pulled strongly forwards by the genio-hyoid muscles, and the thyroid cartilage at the same time was drawn upwards and forwards behind it by the thyro-hyoid muscles. The object of the following experiment is to ascertain what effects the traction of these muscles, exercised in this direction, will have upon the voice. The larynx being once more suspended by the arytenoid cartilages, as in all the experiments except the last, it was held in an oblique position with its superior opening looking downwards. A string was then fixed to each side of the thyroid cartilage about the middle of the oblique line. To this the weights were suspended, the obliquity of the cartilage being such that the string, depending vertically, crossed its superior margin several lines posterior to the point of the *pomum Adami*. This I conceive to be the general direction of the muscular fibres when they are thus strongly contracted :—

Fundamental note = D_1	8 oz. raised pitch to B_1 flat.
½ oz. raised pitch to E_1 flat.	9 ,, ,, C
2 ,, ,, E_1	10 ,, ,, D
3 ,, ,, F_1	13 ,, ,, E flat
4 ,, ,, G_1	19 ,, ,, F
6 ,, ,, G_1 sharp.	24 ,, ,, G
7 ,, ,, A_1	2 lb. ,, G

It must always be borne in mind that in this experiment the arytenoid and cricoid cartilages were fixed and immovable, so that the weights exercised their whole force in pulling forward the thyroid cartilage, whereas in the living body the muscles raise the larynx *en masse*. But making due allowance for this difference, it will still be admitted that the thyro-hyoid muscles in thus acting upon the larynx must tend in some degree to separate the upper part of the thyroid from the arytenoid cartilages, thus stretching the vocal ligaments, and consequently raising the pitch of the voice.

6. In any larynx prepared for vocalization when the apices of the arytenoid cartilages are simply pressed forward with the point of the finger, the effect is to raise the voice in a very remarkable manner. By this simple means I could frequently produce the note G, the highest in last table ; and it may be remarked that the vocal sounds thus obtained were always very powerful, though of a somewhat *punchinello* character. By resting weights upon the posterior surface of the cartilages, I attempted to estimate the amount of force required in this experiment, and found that—

Fundamental note being C_1	4 oz. raised pitch to E_1
1 oz. raised pitch to D_1	8 ,, ,, F_1

There was, however, great difficulty experienced in applying these weights accurately ; and it was found that, by properly directed pressure with the finger, more striking results could be obtained, even when much less force was employed. The cartilages on being pressed forward were observed to rotate slightly inwards upon their articulations, so that the vocal processes became more closely applied to each other, whilst at the same time they were slightly depressed within the cavity of the larynx. The vocal cords were thus actually stretched from before backwards as well as approximated, and owing

to their being brought into actual contact posteriorly, the length of the chink through which the air passed was diminished.

7. Exactly the same effects were produced upon the voice by pressing the arytenoids together between the finger and thumb.

8. Simple lateral compression of the thyroid cartilage was also productive of the same effects, but the notes in this case were soft and weak, instead of being loud and shrill as in the last two experiments. In one larynx I could by this means elevate the pitch to C^1. In this experiment, as in the two preceding, the glottis was observed to be constricted, so that the cords vibrated only in part of their extent. The space between the alæ of the thyroid being wedge-shaped, another effect of their compression was to force backwards the cricoid cartilage, so that the vocal ligaments were tightened.

9. The larynx was that of a man aged about thirty years. In this case the hyoid bone and epiglottis were removed. I also dissected away those muscular fibres of the thyro-arytenoid which lie parallel to the direction of the vocal cord, and within the angle of its free edge, my object being to observe the effect of isolating the cords as much as possible. The result was that extreme difficulty was experienced in producing any vocal sounds at all. When, however, I supplied the place of the muscular fibres just mentioned by small soft rolls of wet paper, the musical tones were produced with almost as much ease as in the other experiments. This observation points out, I think, one function of the thyro-arytenoid muscle, namely, that of supporting the vocal ligaments when their free edges are in a state of vibration.

10. A tube about fifteen inches long, furnished with perforation like that of a clarionet, was affixed to the upper part of the larynx in such a manner that the connexion between them was air-tight. On producing the voice in these circumstances a difference only of one full tone was observed between the note sounded when all the perforations on the side of the tube were left open, and that obtained when they were all closed with the fingers. This is in accordance with the experience of Müller, and in opposition to the theory of Bishop—the vocal-tube theory.

11. The effect of simply increasing the current of air from the gentlest to the strongest blast that could produce a note was to elevate the pitch generally one-fifth, rarely one-sixth, and sometimes only one-fourth. This also accords with Müller's observations.

12. Before concluding the experiments from which I have thus given a selection, I had acquired a command over the dead larynx sufficient to enable me to perform upon it a variety of slow airs, not very correctly, but still in such a manner that they could easily be recognised by my audience. In doing this I could employ at pleasure one of four different methods of raising the pitch:—

1*st*, By pulling forward the thyroid cartilage, as in the first experiment;

2*d*, By pushing forwards with the point of the finger the arytenoid cartilages, as in the sixth experiment;

3*d*, By pressing the arytenoids together between the finger and thumb, as in the seventh experiment;

4*th*, By compressing the thyroid cartilage laterally, as in the eighth experiment.

I always at the same time regulated the current of air so as to blow gently in the low notes, and more powerfully when I required to rise in the scale. The lowest base tones were invariably produced by pressing gently backwards the thyroid cartilage.

I now proceed to inquire if from these experiments any light is thrown on the many difficult problems connected with the production of voice. We have seen that in the dead parts there are three distinct methods by which the pitch of the voice may be elevated :—

1*st*, By tightening the cords ;

2*d*, By increasing the current of air ;

3*d*, By bringing the vocal ligaments partially into contact, so that they vibrate only in a portion of their extent.

In the living body it is universally admitted that the first of these is the chief means employed in raising the pitch of the notes. It is exceedingly probable that the second acts as an assisting agent, for we are conscious of using a greater effort in singing the high notes than the low, just as in the dead larynx we required to increase the current of air as the notes rose in the scale. As to the third method we are left in greater doubt. On the one hand the laryngoscope shows us that during phonation the vocal cords never come into actual contact in the posterior half or three-fourths of their extent, but owing to the projection of the epiglottis we are as yet uncertain of what may take place at their anterior extremities. On the other hand we find among Magendie's observations the following :—"I laid bare the glottis of a noisy dog by cutting between the thyroid cartilage and the os hyoides, and I saw that when the sounds are grave the ligaments of the glottis vibrate in their whole extent, and that the expired air passes out in the whole length of the glottis. In acute sounds the ligaments do not vibrate in their anterior part, but only in their posterior; the opening is therefore diminished."[1] Moreover, we found that of the three means by which this constriction of the glottis may be artificially produced in the dead larynx (Experiments 6, 7, and 8), the only one which we could also employ in the living was the lateral compression of the thyroid cartilage, and in both cases this was observed to produce the same effect upon the voice. This lateral compression occurs naturally during the highest treble tones. It is therefore very probable, though it cannot be said to be absolutely proved, that in certain conditions the pitch of the voice is raised by a shortening of the vibrating portion of the vocal cords, owing to their anterior extremities having come in contact.

When compression of the thyroid cartilage occurs during the production of high notes, it must, I think, be due to the action of the palato-pharyngeus and the middle constrictor of the pharynx, the attachments of which are such that both of them, when contracted as they are in these circumstances, must pull the upper parts of the alæ towards the middle line ; this action is favoured by the box of the larynx at the same time being carried forwards along with the hyoid bone.

The *falsetto voice* has been explained by supposing that during its production the vibrating portion of the cords is shortened in the manner just alluded to.

[1] Magendie's *Compendium of Physiology*, p. 137.

This is the opinion of Bishop, Willis, and others; and the supposition seems a very feasible one. It is also favoured by some of the facts which I have observed. It was noticed, for example, that during the transition from the true voice to the same note of the false, the vocal processes became somewhat more closely approximated.[1] In the same circumstances the muscles of the pharynx were more strongly contracted. If this contraction be really the cause of the lateral constriction of the thyroid cartilage, as just explained, we see at once the means by which the vocal cords are thus partially brought into contact. I hesitate, however, to conclude from these limited data that the cause of the falsetto voice is the lateral constriction of the thyroid cartilage, the more especially as I find Müller ascribing to it in his experiments upon the dead larynx exactly an opposite effect. "The deepest note," he says, "which I could produce in one of my experiments by relaxing the vocal cords was the middle C of the base clef; by exercising slight tension on the cords, and blowing with greater force, I could produce the octave above this (C^1), but I could in that way raise the notes no higher. By compressing the larynx laterally, however, about the situation of the vocal cords and below them, I was able to produce a series of higher notes to the extent of another octave (C^2), without any falsetto tone, although under other conditions falsetto notes could be produced from the A sharp, below the second C (C). The prevention of the falsetto notes, which was here attained by the lateral compression of the larynx, seems during life to be effected by the action of the thyro-arytenoid muscles."[2]

It astonishes me to find Müller speaking so confidently of distinguishing the true and false tones in the voice of the dead larynx. In my own experiments I never succeeded in doing so; I even found that very little difference could be observed between the sound of the male and of the female larynx, further than the fact that the voice of the former was set several notes lower than that of the latter. The absence of the peculiar characteristics in both cases I ascribed to the removal of the pharynx and the other parts of the "vocal-tube." From the observations which I have just mentioned, and from the fact that by artificially compressing my own larynx, I am enabled to add to my falsetto register several notes which I cannot otherwise reach, I have been led to adopt the opinion of Bishop and Willis, namely, that the falsetto voice is produced by a shortening of the vibrating edges of the vocal cords, owing to their having come into actual contact anteriorly; and this I believe to be due in part at least to the constriction of the thyroid cartilage by the palato-pharyngeus and the middle constrictor of the pharynx. This theory accounts for the height of the notes which we are able to produce in the falsetto voice without any great muscular effort, whereas their soft throat character is probably due to the sounds having been made to pass through the greatly contracted pharyngeal cavity.

With reference to *the action of the thyro-arytenoid muscle*, this is a question much disputed by physiologists. On the one hand it is maintained by Mr Willis, and most other English writers, that by its agency the low notes are

[1] In the thesis as originally printed, the words *false* and *true* in this sentence were, by a slip of the pen, transposed.—J. W., August 1894.

[2] Müller's *Physiology*, page 1015.

produced, whilst, on the other, the opposite action has been ascribed to it by some of the German authors, namely, that of elevating the pitch of the voice. Now, in my experiments upon the dead larynx, it was remarked that,

1*st*, Pressing forward the arytenoid cartilages has always a most marked influence in raising the pitch. Exper. 6.

2*d*, Pressing backward the thyroid operates with equal certainty in lowering the notes.

As the muscle therefore stretches between the thyroid and arytenoid cartilages, the effect of its contraction upon the voice will depend entirely upon which of these is the fixed point. A little experiment upon one's own larynx will show at once that it is an easy matter to press back the thyroid cartilage during the production of low notes, so that if the muscle acts in these circumstances it can have little difficulty in approximating the upper part of the thyroid cartilage to the arytenoids. Its action, however, cannot be altogether favourable to the lowering of the vocal pitch, for, in their contraction, those fibres contained within the fold of the vocal ligament near its free margin must render somewhat tense the edges of the cords, thus destroying the laxity which is necessary for the production of bass notes; at the same time, the forward traction of the arytenoids with the consequent depression of their vocal processes must tend, so far as they go, to raise the pitch of the voice. It is therefore evident that if the thyro-arytenoid muscle is intended to produce low notes, it must act under most unfavourable circumstances.

On the other hand, let us suppose that its agency is employed in elevating the pitch of the voice. As the vocal tones rise in the scale we observe that the larynx is pulled upwards and forwards by the thyro-hyoid muscle, and at the same time the lower border of the thyroid cartilage is pulled upon in a downward direction by the crico-thyroid. *Between these two muscles the thyroid cartilage is thoroughly fixed*, and the thyro-arytenoid must, therefore, in contracting, produce its effects solely upon its arytenoid attachments; pulling them forwards, it must exercise the same powerful influence in raising the notes, as we observed was produced by pushing the cartilages from behind in the sixth experiment. Those of its fibres also contained within the folds of the vocal ligament will act by rendering the edges of these cords more tense, and at the same time by supporting them during their vibration.

There can be no doubt, then, that the thyro-arytenoid is one of the muscles which tighten the cords and raise the pitch of the voice. Ecker has thus expressed the German view regarding it: "When these muscles contract, their fibres lose their slightly wavy direction, thereby the free margins of the vocal cords approach each other; seeing that the *processus vocales* are drawn forwards, inwards, and downwards, even to touching, so that only a small linear split remains. As the thyro-arytenoid muscles fill the fold of the vocal ligament nearly to its free margin, necessarily, on the contraction of the muscle, the free margin of the fold becomes sharpened. In this position the vocal cords are drawn as much as possible into the lumen of the air passage. Probably they vibrate in their whole extent, and the chest-notes are produced."

We have as yet, I believe, no satisfactory explanation of the manner in

which the lowest notes are produced. We know that the vocal cords are relaxed by the upper part of the thyroid cartilage moving backwards, but we are still in doubt as to the cause upon which this movement depends.

I cannot bring this paper to a conclusion without expressing my sincere thanks to Dr Grainger Stewart, and also to Dr Sanders, for their kind advice and assistance, and for the interest they have all along taken in the investigation of these very complex questions.

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