CONGENITAL AUDITORY IMPERCEPTION (CONGENITAL WORD-DEAFNESS): AND ITS RELATION TO IDIOGLOSSIA AND OTHER SPEECH DEFECTS.*

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In a previous communication¹ we described in detail a case of 'Congenital Auditory Imperception' in which word-meaning-deafness was the outstanding and important element. It was then pointed out that the disorganisation of the speech mechanism resulting from the auditory defect had led to a method of vocal expression of the nature of so-called 'idioglossia,' an individual language consisting of an extreme form of mispronounced and ill-expressed conventional language. In a further communication² the results of the examination of the patient by the methods employed by Head³ in the investigation of aphasia were detailed and the findings described. As regards the latter, the conclusion was reached that in spite of the fact that such methods revealed more clearly the fundamental nature of the defect, they were not so helpful in the investigation of cases of congenital origin as in cases of aphasia which occur in adult life. The standpoint from which the findings were to be considered was also discussed and the opinion expressed that in congenital cases it might be more valuable to consider what the patient had acquired in spite of his disability, rather than the functions in which he was deficient on account of the defect.

In the present communication, the condition known as congenital word-deafness is reviewed, the clinical features and consequences of the defect are described, and its relation to speech defects and especially to 'idioglossia' is discussed.

NOMENCLATURE.

It is clear that when the earlier cases of congenital word-deafness were reported the association of the auditory defect with defects in speech was not

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fully understood. The descriptive terms employed were those used to describe the speech defects only and gave no hint of the presence of a defect in the field of audition. Wilbur in 1867 called the condition ‘aphasia,’ and both he and Ireland termed their patients ‘idiotic aphasias.’ Hun, Hall and Crane referred to the condition as ‘atavistic speech’ or ‘a sport in language.’ Sainsbury discussed the defect as a difficulty in speech, Hadden described his cases under defects of articulation in children, and Coen, and also discussing the speech defect in particular, referred to it as ‘Hörstummheit.’ Hale White and Golding Bird introduced the term ‘idioglossia’ to describe the curious form of congenital speech defect described by Hadden and occurring in cases of their own, because the utterances of the patient gave the impression that he was speaking in a language of his own. Guthrie defended the use of the term ‘idioglossia’ to describe the speech defect on the grounds that the speech of the patient at least produced the effect of an individual language, even though its abnormalities were due to the mispronunciation of ordinary English. He recognised that the condition was probably due to a congenital deficiency of audition not amounting to deafness but he still regarded the speech defect as the important feature of the condition and continued to use the term ‘idioglossia’ accordingly. Wylie used the term ‘lalling’ from the German word ‘lallen’ (to speak as a child), but, as Guthrie pointed out, the use of this term was by no means justified.

Kerr described his case as ‘congenital pure word-deafness,’ thus apparently assuming that there were no defects elsewhere. Syme used the term ‘congenital aphasia,’ but thought that the condition was analogous to congenital word-blindness and that the term ‘congenital word-deafness’ would describe it more accurately. Gee, Ormerod, Town, and McCready used the term ‘congenital aphasia.’ McCready believed that this term was applicable equally to congenital word-blindness and congenital word-deafness; he recognised that objections had been raised to the use of all three terms but felt that as they had become sanctioned by usage, they were more likely to survive than other terms introduced to describe the conditions. In recording her cases, McCready used the term ‘congenital aphasia,’ but included under it a case of congenital word-blindness as well as one of congenital word-deafness.

Thomas discussed examples of the defect under the aphasias of childhood as ‘congenital word-deafness’ but regarded idioglossia as a distinct defect due to deficiency of the motor speech centre. Yearsley believed that the term ‘congenital word-deafness’ should be reserved for cases which fulfilled the following definition—‘a case in which the sense of hearing being otherwise normal there is failure to appreciate the significance of sounds.’ In referring to McCall’s case, Rutherford said that a case is not one of aphasia if the term ‘congenital word-deafness’ used in connection with it is correct. He regarded the latter condition as an example of a defect in the receptive centres.
for spoken words and believed that "to such conditions the term 'aphasia' carrying with it the significance of imperfection in some part of the central neuro-motor apparatus for language is quite inapplicable." Tait,28 also, was somewhat dubious concerning the use of the term 'aphasia' in such cases, as it implied the loss of something which had been previously present and for that reason was scarcely applicable to a congenital defect. Burr29 described the condition as 'congenital word-deafness' and criticised the use of the term 'aphasia' in such cases for the same reason. Levy30 referred to the condition as 'alalie idiopathique de Coen' and was apparently unaware of the association between the speech defect and congenital word-deafness.

Brönner31 described one of her cases as an example of "marked deficiency in auditory powers, shown by poor auditory memory and defective discrimination of sound"; but in discussing a second case applied no descriptive term to the condition. Hughlings Jackson32 was of the opinion that there was a defect in auditory appreciation on a lower level than that affected in aphasia and that the term 'imperception' could be suitably applied. Head33 agreed that there were certain clinical manifestations justifiably grouped under the term 'imperception,' in which the patient suffered from more than word-deafness—the disturbance belonging to a lower order of functional disintegration than aphasia or amnesia. Wallin34 discussed the condition under the term 'word-deafness,' 'auditory aphasia' or 'verbal amnesia.'

It will be seen from the opinions expressed above that there has been no agreement among writers as to the most suitable term to describe the condition. Clinically, the speech defect is often the most prominent feature, but the fundamental defect is the inability to appreciate the significance of words (word-meaning deafness) and sometimes even of cruder sounds. Hence it would appear that a term descriptive of the fundamental defect is the most suitable, and for this purpose the terms 'congenital word-meaning-deafness' and even 'congenital word-deafness' seem to be too limited in scope. Certain aspects of the condition suggest that considerably more than a defective appreciation of the significance of words is present, and on this account Hughlings Jackson32 and Head33 were probably right in regarding the defect as upon a lower level than aphasia. Consequently, the term 'congenital auditory imperception' describes the primary condition more completely than 'congenital word-deafness.' The only difficulty in the use of this term is that 'word-deafness' has been sanctioned by usage in adult cases and will probably on that account continue to be used in congenital cases. Its use in congenital cases is justifiable only so long as it is remembered that something more than the auditory appreciation of words is defective, that the defect in perception may extend even to include cruder sounds, and that the term is used in a special sense in such cases. So far, little attention has been paid to the fact that the most obvious clinical feature of the condition is the speech defect. It is perfectly justifiable, however, to apply to the condition a descriptive term which draws attention to the primary defect only, even when,
as we have shown in a previous communication, it is understood that defects are present in speech, in the visual appreciation of symbols, and in writing. There is no more justification for the use of a term descriptive only of the defect in speech than there would be for the use of one describing only the defect in visual appreciation or that in writing. A term descriptive of the primary and fundamental defect should be sufficient and on the whole it is felt that 'congenital auditory imperception' is probably the best for the purpose. On account of the long-established use of 'word-deafness' in adult cases, however, the term 'congenital word-deafness' is used in its special sense in order to prevent confusion.

**HISTORY.**

The history of the subject of congenital word-deafness and its complications is a reflection of the different phases through which the subject has passed since aphasia was first recognised as a clinical abnormality early in the nineteenth century. Hence it follows that references to the subject are to be found under the headings of idiocy in children, speech defects (and especially idioglossia), congenital aphasia, sensory aphasia, congenital word-deafness, the association of congenital word-deafness and congenital aphasia with speech defects, behaviour defects, studies in psychology and educational problems.

In 1828 Gall differentiated the processes of memory into distinct 'faculties' in which he included those of 'word memory' and 'the sense of spoken language.' He described the variations in these functions in diseased conditions, and anticipated both the 'word-blindness' of Kussmaul and the 'motor aphasia' of Broca. In addition he described what McCready24 regards as faulty speech memory in children and not only gave a clear clinical picture of 'congenital aphasia' but also thus early differentiated those who were feebleminded from those who were mentally normal. In 1865 Benedikt (according to Kerr17) described an intelligent boy who heard and apparently understood but could say only 'papa' and 'mama.' In 1867 there appeared from the pen of Wilbur a communication which indicated at least in some measure the attitude which at that time was assumed towards the then unrecognised defect. In a paper upon aphasia in the mentally afflicted he reviewed the speech defects in 443 idiots under his care and with reference to their powers of expression arranged them in nine classes, the most important of which from the point of view of the subject under discussion was that including "those who repeat a sentence after hearing it but have not the power to originate it." That at least some of them were examples of the condition now known as congenital word-deafness is suggested by a study of four of the cases quoted by him in his paper. The first case was a boy of thirteen who attempted to speak only one or two words which his father alone could understand, and "used his eyes more than his ears." He did not attempt to speak until the age of nine and after his education was undertaken he learned to read much more easily.
than to speak. The second case was that of a boy of eight whose condition was described as "idiocy supervening in infancy." Though his mother declared that he spoke, it was found that he merely repeated what he heard, and never originated speech. His lack of spontaneous speech was thought to be due to "the absence of proper volition," but it is significant that the defect was eventually overcome by education through the visual channel. The third case was that of a boy of thirteen whose condition was described as "idiocy resulting from convulsions in infancy." It was noticed that if he were asked to repeat two or three words he would say only the last one—"ball" for "my ball," and "book" for "the book." It was remarked that "his memory would not go back to the last word in his attempt at repetition." The fourth case was that of a boy of eight who made no attempt to speak. It was noted that when shown a printed word he knew what it represented and pointed to the object "but his memory seemed at fault as to the name until it was pronounced in his hearing." It is significant that of the ten cases quoted by Wilbur, four were almost certainly cases of congenital word-deafness as the condition is now defined and that two others, but for the fact that they were described as partially or slightly deaf, might be placed in the same category. It is noteworthy also that all the cases were in an institution for idiots; from this it may be assumed, apart from the descriptions applied to the cases quoted above, that, like deaf mutes, children suffering from this disability were thought to be unable to understand spoken language because they were mentally deficient. In all four cases the descriptions reveal no defects other than those of hearing and speech and in fact stress the point that the children were well-behaved and intelligent in all other respects.

In 1868 Hun described the case of a girl of four and a half, and that of her younger brother who "spoke a language of their own" thought to resemble French; and in 1886 Hall recorded the cases of two twins of German extraction who spoke a language of their own thought to resemble German. These four cases were regarded by Guthrie as cases of idioglossia, a feature of the condition which will be discussed at a later stage.

In 1889, Coen of Vienna described under the name of 'Hörstummheit,' a form of congenital inability to speak, occurring in children and especially in boys who were normal in body and mind and whose speech organs were apparently healthy. In the same year Sainsbury described the case of a boy of five and a half who suffered from difficulty in speech to such an extent as to be unintelligible to strangers; he recorded the alphabet as pronounced by this patient as follows: "sa, p, see, t, c, sa, see, sa, sow, sa, sa, sow, sa, sa, p, two, sa, sa, t, soo, fee, tow-see, sa, wow, sa." He then proceeded: "I may suggest that the speech error may be of the nature of a simple defect, i.e., fault by arrest, the centres in the cortex having failed to develop; or it may be of the nature of an actual perversion. In either case there may be simply an inability to reproduce the sound given, the child being conscious of the
 imperfection of his own copy, or there may be a condition analogous to colour-blindness, a failure to recognise sound differences.” The nature of the speech abnormality in this case suggests that it is the same as the ‘idioglossia’ described by Hadden10 and others, a feature of congenital word-deafness which we have described according to Head’s terminology as ‘verbal aphasia’; the explanation offered is interesting as it is the first suggestion on record that the speech defect is due to an inability to recognise differences in sound.

In 1891 Hale-White and Golding Bird14 described under the name of ‘idioglossia’ a defective condition of speech which gave the impression of an individual language in two brothers aged ten and a half and nine years, respectively. This speech defect is mentioned by Bastian35 as a congenital speech defect. “These children have a certain extent a language of their own so that when asked to repeat phrases they make use of different, though definite, sounds instead of those proper to the words that should be employed. The sounds which they substitute are said to be always the same for the same words.” This last peculiarity McCready34 believed to be due to the fact that the child simply repeated the sounds as he heard them. In 1891 Taylor36 described a case of a similar speech defect in a boy of eight and a half. In the same year Hadden10 gave a full account of three cases in illustration of defects of articulation—all males and aged respectively eleven, seven and four years. In the first case the language used was similar to that described by Sainsbury9 in his case; and “when asked to copy or write at dictation short and simple sentences, he would transcribe the first two or three words correctly, and then he would seem puzzled, the remaining words being represented by unmeaning up and down strokes or by combinations of letters like ve, va, etc., which recalled his spoken language. He soon became hopelessly confused and unable to proceed.” In the second case the language was similar and “many other defects appeared when he attempted to combine sounds into words.” In the third case “the power to combine the elementary sounds in ordinary articulate language was very defective and his speech was accordingly almost unintelligible.” Hadden10 suggested that the condition was almost certainly dependent upon some fault in the central nervous system, and thought it was due to a defect of a part of the brain “which co-ordinates the fifty or so elementary sounds into more complex forms.” He appeared to discuss the defect entirely from the motor aspect and made no reference to any auditory defects. He suggested for such cases methods of education which had met with some success at his hands.

In 1895 Colman37, in the course of a discussion on various speech defects, mentioned ‘idioglossia’ as an inability to pronounce certain letters and the substitution for them of totally dissimilar sounds. He described two cases in detail and mentioned that he had notes of six other cases of the same type. His first case was that of a boy of six who repeated the Lord’s Prayer in the following way: “Oue tabde ne nah e nedde, ann de di na; i dede ta, i du
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de di ou eeth a te e edde. Te ut te da oue dade de, e didde ap tetedde, a ne adiu to tetedde adase us, ne notte tetate, mime, utte enn, to i aiteneve, pore e danle, to edde e edde. Ame.” No mention was made of any defect in the understanding of words. In his second case, a boy of six, the speech was quite unintelligible.

In 1900 Kerr11 published under the title of ‘congenital pure word-deafness’ a case which he subsequently claimed to be the first authoritative case of the condition published. This was a boy of nine who “was very intelligent, without discoverable defect, except that he could not understand words; he had good hearing but did not speak until taught articulation.” Kerr38 mentioned that he had recognised this case because he had seen cases of congenital blindness and expected to find a similar defect in the auditory field. In 1904, Syme18 described the condition of a boy of eight who “when spoken to did not seem to hear” though his hearing was good, “had no idea of the meaning of words” and had never spoken in an intelligible manner. He suggested that in this case there was either a faulty development of the auditory centre or an interference with the afferent path to this centre, and rather inclined to the former view.

In 1907 Guthrie15 reviewed the literature of idioglossia and described two cases of the condition, the first in a girl of seven and the second in a boy of seven and a half. He reproduced the alphabet as pronounced by his cases, drew attention to the familial factor in the condition and pointed out that it was not necessarily associated with mental deficiency. He concluded that there was no defect in the motor apparatus of speech, and that want of attention and mental concentration was largely concerned in perpetuating the faulty articulation. In connection with the case he described in detail, Guthrie was of the opinion that the defect was not in the motor vocal apparatus but in the ear; “it is not that he is deaf, but that he lacks the power of discriminating shades of difference between sounds.” Guthrie defended the use of the term ‘idioglossia’ on the grounds that the speech of those affected produced the effect of a new language though it was actually nothing more than imperfectly pronounced English; he criticised the use of the term ‘lalling’ suggested by Wyllie16 and adduced evidence to dispose of the suggestion that idioglossia was actually an atavistic language as suggested by Hall, Hun and Crane8; also he disproved the theory that it was a baby language. This author expressed the opinion that idioglossia is simply an exaggeration of defective modes of speech which are extremely common in minor degrees without being regarded as in any way morbid; and in discussing the part played by defective audition in producing idioglossia quoted Hadden’s opinion that “the evolution of speech depends upon the integrity of the auditory perceptive centres” and that of Spencer Watson39 and Langdon Brown10 that the condition was due to a defect of hearing short of deafness.

In 1908 Thomas33, in discussing the aphasias of childhood and educational hygiene, pointed out that individuals could be classified into ‘auditives,’
'visuals' and 'motor-minded' according as they remembered and thought chiefly in auditory, visual or kinesthetic terms; he also expressed the opinion that in every 'faculty' there could be found all kinds of variation from extreme facility to entire absence of organisation. Thomas then proceeded: "If this be true, we should find some children who are unable to organise their auditory word centres, although otherwise intelligent, and unable, though they hear, to store up memories of the meaning of words heard"—the congenitally word-deaf. He remarked that some examples of the condition were to be found in almost every class for the deaf, and that the common explanation of the condition was that "they do not understand because they are too lazy to do so." He described two cases in detail. The first was that of a boy of eight who had never attempted to talk. His hearing was normal to all the usual tests but he could not understand words; he repeated sentences after the speaker in an imperfect manner, such as "Det me a pentil" for "Get me a pencil"; and made an obvious attempt to understand a few words by keeping his eyes fixed upon the speaker's lips. His second case was that of a boy of four whose hearing was good, who made an attempt to repeat words heard but could attach no meaning to them, and by lip-reading understood the words seen and repeated them correctly. His voice and intonation were normal. Because of the prevailing theory based upon the work of those whom Head called the 'diagrammists,' Thomas recognised no relationship between congenital word-deafness and idiglossia and expressed the opinion that the latter defect was due to imperfect organisation of the motor speech centre and that most minor speech defects in children were also due to the same cause.

In 1909 Yearsley reported a case of "a peculiar form of (?) word-deafness" in a girl of eleven who had been at a deaf school for three years. This patient had "only vowel hearing and could produce no words"; she repeated words as they were spoken, had normal hearing to ordinary sounds and was normal in every other respect. In this case the defect was thought to be due to "weakness of the auditory word centre." In 1910 McCreary again suggested that idiglossia was due to partial word-deafness, that it resulted from the child's repeating words parrotwise as he heard them, and that the speech of those affected was intelligible only to those in close contact with them and to young children of the same age. In 1911 McCall described a case of congenital word-deafness in a boy of eight who "when spoken to took no notice and might easily have been mistaken for a deaf child," but at once had his attention attracted by a noise. "His speech was markedly defective and the intonation resembled in a slight degree that peculiar to cleft palate. As words, however, meant nothing to such a child, he did not attempt to imitate them unless directly made to do so; he therefore did not learn to talk." In the same year Tait described a case in a boy of five under the title of "congenital deficiency of speech areas (congenital aphasia?)." This boy could not utter a single word, but phonated a sound like "ta" or "ah" suggestive of cleft
palate. His hearing was good and he was said to understand what was said to him, but in this case as in many others whose records we have examined, there was nothing in the report to indicate that any careful investigation had been made to show that there was a distinction between the understanding of words seen and those heard. In 1911 Levy discussed the speech defect previously referred to as idioglossia under the title of ‘entendants-muets’ or ‘alalie idiopathique de Coen.’ He described it as a type of dumbness in children more than three years old, of normal or almost normal appearance, and without any deafness. He provided the following concise definition of the condition as he understood it: a type of speech defect presenting the following positive and negative characteristics—(1) children who are normal physically and mentally; (2) hearing normal; (3) the peripheral organs of speech properly formed and functioning normally; (4) absence of paralysis, atrophy or contracture of the trunk and limbs. He described the sufferers from this condition as children who hear well and have all the appearances of children of their age excepting that they do not speak at all or have a rudimentary language for their age. The cause of the defect he regarded as obscure. Levy mentioned five cases of the condition all of which he had observed for a period of five years, but apart from one who was described as a female of sixteen when first seen no details were given of the abnormalities.

In 1911 Town gave a comprehensive historical review of congenital aphasia and described two cases of congenital word-deafness in her account of the condition. The first case was that of a boy of eight who could not understand or use language normally. He was not deaf, made his wants known by gestures and comprehended directions given by signs. “He could repeat words uttered in an ordinary tone, not correctly, but in a way that approximated to the original.” He could name about thirty-six objects or their pictures and used voluntarily about twenty-four words, so that he had a vocabulary of about sixty words. “He heard other words, as was proved by the fact that he would repeat them, but he did not understand them, as was shown by his failure to comply with requests or point out objects.” She also reported a second case the details of which are not available.

In 1912 Burr discussed congenital aphasia and pointed out that no necropsy of a case of congenital cerebral speech defect leading to motor aphasia had ever been performed. He stressed the fact that all discussions upon aphasia had been based upon adult cases in which the main consideration was the comparison of the condition of the patient with that previous to the onset of the lesion giving rise to the aphasia, and mentioned that of the pathological variations of speech in children only deaf-mutism had been studied in any detail. He discussed the prevailing opinion that when a child was mute and not deaf he must be an imbecile, and sought in his paper to combat this impression. He summarised the arguments against the existence of a developmental aphasia as follows—(1) the absence of necropsies proving it, against
which there were no necropsies disproving it; (2) the fact that acquired aphasias in children are usually recovered from, presumably by education of the opposite cerebral hemisphere even when the lesion is destructive. From the latter, Burr concluded that a bilateral lesion would be necessary in congenital cases and the chances of this were small. He believed nevertheless that (1) there are individuals who, without congenital or early defect, never develop the ability to speak on account of disturbances confined to the speech centres, though hearing and the understanding of heard words are normal; and that (2) "there are still others who are congenitally word-deaf and whose mental deficiency depends upon the speech defect, the verbal amnesia or rather the inability to fix in memory the impressions of heard words, rather than that the speech defect is the result of the imbecility." He stated that, nevertheless, although their mental condition is potentially normal, "these cases without suitable environment will grow up imbeciles from deprivation as deaf-mutes formerly did." He stressed the fact that, in the absence of necropsies, a discussion of morbid anatomy would be of no assistance, and was of the opinion that even with them "it is entirely conceivable that the speech centres may on gross examination show no sign of disease and yet be so poor in well-developed cells as to be unable to perform their functions." Burr then described four cases to show that they were potentially normal in mind and with proper environment would attain to average mentality. His first case was that of a boy of twelve who had suffered from congenital syphilis and was entirely speechless and mute except for a few inarticulate sounds. On examination he showed definite evidence of congenital syphilis; in addition, it was noted that he apparently understood what was said to him but that with education his intelligence, or rather his knowledge, increased a great deal and that apart from speech he learned things quickly and well. The second case was that of a boy of three who had never made an effort to talk though he apparently heard perfectly well. The third case was that of a boy of seven who up to the age of five could repeat words immediately after he heard them, but after that could speak only a few words spontaneously and those never in sentences of more than three words. He could repeat a number of words on hearing them, but no new words could be fixed in his memory though his memory for events was good. Burr's fourth case was that of a girl of seventeen who was for a time in a school for the mute and had never spoken beyond saying the words 'yes' and 'no' which she usually but not always employed correctly. Although it was recorded that she could hear and understand spoken language, it was not stated how complete was the investigation upon which that opinion was based.

In 1913 Variot described, under the general title of "congenital aphasia without motor or sensory abnormalities and with apparent preservation of normal mentality," the case of a boy of six who could not speak beyond saying a few monosyllables and bisyllables and the words "papa" and "merci,"
which he repeated parrotwise in a somewhat explosive manner and with the
syllables spaced. He could neither read nor write but was recorded as being
able to understand a few spoken words. Variot concluded that the case was
an unusual one of congenital aphasia different from that occurring in imbeciles
and perhaps associated with a defect in the centre for spoken language or with
an undiscovered lesion which had occurred in early childhood. The statement
that the patient "not only heard spoken sounds but also understood them"
is rather against the inclusion of Variot's case as one of congenital word-
deafness, but here again no details of the method of examination employed
are given.

With the steady growth of interest in the psychological reactions to en-
vironment and difficulties, it is not surprising that the next communication
upon the subject should be concerned with the abnormal psychological reactions
which sometimes complicate the defect. In 1919 Brônner31, in a discussion
on the psychology of special abilities and disabilities, defined the term
'congenital word-deafness' as referring to the inability to understand and
use spoken language, and pointed out that though the term was frequently
employed there were few examples of the defect in the literature. She quoted
Town's21 first case and referred to her second case, believing that both could be
explained more satisfactorily than as the result of a congenital defect. She
then proceeded: "An essential peculiarity in regard to this problem is that
tests proving the hearing normal at the time of examination by no means
show that in the past there was no auditory defect such as would be caused
by an inflammatory process, notably otitis media"; and seemed to think
that lack of consideration of the temporary loss of hearing which might result
from this condition lessened the value of the cases described by Thomas22
and McCall23. Though it would appear to be improbable that temporary loss
of hearing from such a condition could result in loss of the understanding of
words spoken after recovery, a case described by Drinkwater44 in 1911 suggested
that there might be some slight reason for such an opinion. This was the case
of a girl of fourteen who had been completely deaf for four years after the onset
of an ordinary 'cold in the head.' When hearing returned after the removal
of adenoids, it was observed that she could not understand what was said though
she could hear a person speaking. Drinkwater suggested that the auditory
word centre had probably become inactive owing to being unexercised for four
years and the patient had forgotten the meaning of spoken words. It was
noted, however, that the patient made no attempt to repeat words and sounds
after the observer, a fact which suggests that the condition was still one of
partial deafness rather than of word-deafness, for from our examination of the
cases in the literature we have concluded that patients suffering from congenital
word-deafness will and do repeat sounds and words after the observer in an
imperfect manner. Brônner's31 criticism of Town's21 cases suffers from the
fact that it is based upon the consideration of the psychological aspects of the
defect and pays little attention to the clinical aspects of the condition as revealed in the history of the patients. Having discussed this aspect of the problem, Brönner then stated that she had never studied a case of congenital word-deafness and immediately afterwards quoted the following two cases which in our opinion were true examples of the condition. The first was that of a boy of fifteen and a half who had been sent for investigation as a behaviour problem. He made errors in the reading of simple words; was certain only of some monosyllabic words; and could not spell correctly. "We found that the boy could not depend upon the sound of words at all; these evidently meant nothing to him. He himself said he had to learn his spelling entirely by 'the looks of words.' . . . He wrote 'gril' for 'girl' and 'print' for 'printer.' . . . He had no sense of the phonetic values. . . . On examination he showed defects in auditory memory. . . . His enunciation was extremely faulty though his vocabulary showed a fairly wide range. . . . It was evident that he did not hear all the sounds, for certain syllables were slurred over in every trial. . . . His auditory perception was exceedingly faulty and his auditory memory was poor." Furthermore, he was described as a case illustrating "marked deficiency in auditory powers, shown by poor auditory memory and defective discrimination of sounds." The second case was that of a boy of sixteen who illustrated a defect in several aspects of language. Although the clinical investigation was imperfect he appears to have been a true example of congenital word-deafness, as the following extracts from Brönner's description show. "We were impressed over and over again with the fact that words seemed to have no significance to the boy. He had the greatest trouble in expressing himself, nor could he control his verbal associations in tests requiring these. . . . He was unable to write a simple sentence from dictation and when he himself wished to write an account of his schooling the result was ludicrous. Even very simple words were misspelled, as is shown in the following—'I neear wast one plaes atsed in Chicago' (I never went any place outside of Chicago)." In addition to these two cases, Brönner described two others which were apparently of a more limited type. The first was that of a boy of fifteen and a half who showed inability in number work based upon a "defect in auditory memory for numbers." The second case was that of a boy of sixteen and a half who, in spite of good educational advantages, showed a defect for number work which was not merely poor auditory memory but this combined with poor powers of forming associations with symbols. In reading he made errors with small words; he made errors in spelling from dictation; his control of verbal associations was not good, and his visual memory was better than the auditory.

In 1926 Head33 pointed out that there were certain clinical manifestations which could be justifiably grouped under the terms 'auditory imperception' or 'agnosia,' and stressed the fact that the patient suffered from much more than word-deafness. The disturbance belonged to a lower order of functional
disintegration than aphasia and amnesia, for at one time or another the patient had difficulty in recognising the meaning of crude sounds. This was of necessity accompanied by some want of verbal appreciation or inability to read and understand printed symbols; but all such lack of comprehension of language was a secondary consequence of the gross imperception.

By 1927 the importance of the subject of congenital word-deafness, in spite of the comparative rarity of the condition, was fully appreciated and it was recognised as a factor to be considered in education. Wallin\(^3\) defined it as a condition in which in severe cases spoken language is heard but not comprehended. "The difficulty, again, is not in the auditory perception of the spoken words, but in the recognition of the acoustic word imagery." He stressed the speech defects associated with and dependent upon the condition and, emphasising the rarity of congenital word-deafness, pointed out that he had met with only one case in an extensive clinical experience. This case was that of a boy of seven and a half who, though quite intelligent in other matters, was unable to do the lowest grade of school work and was most deficient in language and speech. He was two before he used single words and seven before he spoke in short phrases. He always watched the speaker's lips and facial expression though he took care to speak very loud. The words were heard but many of them seemed not to be understood. After studying him for several years, Wallin came to the conclusion that he was subnormal in general intelligence, and that he was subject to "congenital partial auditory aphasia with partial motor aphasia." He also pointed out that with congenital word-deafness there was sometimes associated "psychic or mental deafness" which he defined as "the loss of the ability to understand the meaning of or to recognize sounds and noises. The affected person hears the sound but cannot identify it and not being able to recognize it does not know how to react to it (sensory apraxia)." In addition, in musical persons 'amusia,' or "the loss of ability to apprehend melodies or to recognize musical sounds" was frequently associated.

**INciDENCE.**

Congenital word-deafness is a comparatively rare defect and much more uncommon than the analogous condition, congenital word-blindness. In our review of the literature which has covered a period of approximately sixty years we found records of or references to only fifty cases which could be interpreted as examples of the condition. While in no way assuming that these are all the cases reported, they probably represent the majority of them and of the cases which have been described in sufficient detail for an opinion to be expressed upon them. Of necessity, certain of the cases included have had to be interpreted as such on incomplete evidence, and the difficulties have been increased considerably by the fact that the term 'congenital word-deafness' was apparently not in common use until about 1910. Although Sainsbury\(^*\) and Coen\(^11\) had in 1889 hinted at the nature of the condition, the first case to
be definitely diagnosed as such was that of Kerr\textsuperscript{17} in 1900; but in 1907 Guthrie\textsuperscript{15} described cases under the name of the associated speech defect—′idioglossia′—and in 1911 Levy\textsuperscript{30} referred to cases as ′alalie idiopathique.′ Thus it follows that references to the condition have been found under ′idiocy′ before 1870, under ′speech defects′ from that time till 1907, and after that under discussions of psychological and educational problems, while only a few of the cases quoted have been described under the term ′congenital word-deafness.′ In some records no reference whatever has been made to the receptive functions; in others the method of examination employed has not been mentioned, and in others again the psychological method of approach alone has been employed. Consequently, it has been found necessary to form some conception of the symptomatology and the complications of the defect from our one case and from the more detailed of the descriptions in the literature of the past twenty years; and to consider every other case in the light of this conception. Upon this basis, only fifty cases have been collected from the literature over a period of sixty years, although there are descriptions of others, such as those of Coen\textsuperscript{11} (1889) and Chazal\textsuperscript{45} (1907), to which we have not been able to gain access.

Up till 1870 most of the cases of congenital aphasia reported were of the auditory type, but following the first description of a case of congenital word-blindness by Broadbent\textsuperscript{46} in 1872, the number of cases of congenital word-blindness reported far exceeded those of congenital word-deafness. It is significant of the relative frequency of the two conditions that in McCready’s paper\textsuperscript{24} (1926) on defects in the zone of language (word-deafness and word-blindness) numerous cases of congenital word-blindness are referred to but not a single case of congenital word-deafness is mentioned. The contrast is more apparent if the frequency of congenital word-blindness as found by certain observers is compared with the number of cases of congenital word-deafness reported in the literature. Of the former condition Warburg\textsuperscript{47} found 14 cases among 2,000 ordinary school children in Cologne, and seven cases among 400 children in special schools, while Thomas\textsuperscript{48} estimated that in London schools the frequency of congenital word-blindness was about one in 2,000.

The rarity of congenital word-deafness has been referred to by other writers. When he described his case in 1904 Syme\textsuperscript{19} claimed that no other case of the same type had been described, and that no post-mortem examination had ever been done on such a case. Burr\textsuperscript{29} and Levy\textsuperscript{30} also referred to the rarity of the condition. Burr pointed out that the literature on the subject was very meagre, the number of such children very small and post-mortem evidence of the cause of the condition non-existent; while Levy was unable to consider the cause of the defect because of lack of material. Other authors who have contrasted the relative frequency of congenital word-blindness with the comparative rarity of congenital word-deafness are Rutherford\textsuperscript{27}, Yearsley\textsuperscript{25}, Brönner\textsuperscript{31}, Thomas\textsuperscript{28}, Kerr\textsuperscript{58} and Wallin\textsuperscript{54}. Rutherford pointed out that congenital aphasia, by which he apparently meant congenital word-deafness,
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was distinctly rare and was easily confused with deaf-mutism by the unwary; Yearsley said that all the suspected cases of the condition he had seen had, with one exception, proved to be other conditions; while Wallin had met with only one case in the course of an extensive clinical experience.

It is interesting to speculate upon the reasons for the comparative rarity of the defect and for the decided contrast between its rarity and the relative frequency of congenital word-blindness.

(1) The symptomatology of congenital word-deafness is not so obvious as that of congenital word-blindness. In the latter the child does not and cannot learn to read, whereas in the former the lack of understanding of spoken language may not be so obvious, and 'idiocy,' 'imbecility,' dumbness, speech defects and behaviour defects may be more prominent features of the condition. Cases of congenital word-blindness are more easily recognised, even by teachers, than are cases of congenital word-deafness.

As Thomas showed, there are probably children who can hear and yet not understand in every school for the deaf; while in France deaf-teachers have recognised the existence of a similar class, but have usually explained that the defect was due to the laziness or inattention of the pupil. Hence it follows that, because of the varied nature of the symptomatology and complications of the defect, such cases have often been accepted as examples of their most prominent feature and, in the absence of detailed investigations with the object of finding the underlying defect, have rarely been diagnosed correctly or completely. It is possible therefore that the incidence of congenital word-deafness in the general population is much greater than is appreciated from the small number of cases which has appeared in the literature.

(2) Though he recognised that children afflicted with congenital word-deafness are potentially normal both mentally and socially, Burr pointed out that, without suitable environment, they are apt to become 'imbeciles from deprivation,' as deaf-mutes formerly did before the true nature of their condition was fully understood. Thomas pointed out that congenital word-deafness was of greater importance in the struggle for existence than congenital word-blindness and that sufferers from the defect were more liable to fail in their economic and social adjustments. Wilbur's cases were in an institution for idiots and constituted a part of his class of idiots 'who could repeat words but not originate them.' Ireland, in writing on the care of mental defectives, said that there was a small class of 'idiotic aphasies' who remain obstinately mute 'though it is clear that they have more intelligence than other children who talk volubly.' Hence it is necessary, in view of the possibility of 'imbecility from deprivation' occurring in such cases, to consider whether the majority of them did not find their way into institutions for the mentally afflicted—and possibly do still—before accepting the apparent rarity of the condition in the literature as a guide to the frequency of the condition among
the general population. It is necessary, also, to reconsider the significance of the cases of 'imbecility' and 'insanity' mentioned in the family histories of such patients in the light of this possibility.

(3) From 1889 onwards many of the cases which we have been able to recognise as examples of congenital word-deafness were described under the name 'idioglossia,' and this was the case even as late as 1908, when Thomas described congenital word-deafness and idioglossia as two distinct conditions, believing that the latter was due to 'defective development of the motor speech centre.' As McCready and other have shown, idioglossia is probably the speech complication of congenital word-deafness and many cases have probably been diagnosed as such and their auditory defect not recognised. Some cases published under the name 'idioglossia' have been collected and included as cases of congenital word-deafness but these probably represent only a fraction of the total number recognised.

(4) Psychological problems and behaviour defects, as will be shown, sometimes arise as the result of the defect under discussion. In the cases of this category investigated the true cause of their condition is often unrecognised. Brönner, for example, in discussing certain behaviour defects, quoted two cases which fulfilled all the conditions for a diagnosis of congenital word-deafness.

(5) Quite apart from the fact that many cases of congenital word-deafness may have been missed because they were incompletely diagnosed under one of the groups mentioned above, the condition still remains much more uncommon than congenital word-blindness. For this Wallin has suggested the interesting explanation that spoken language is phylogenetically a much older form of communication than written language, and therefore much less likely to be affected by biological defects or degenerations.

SEX DISTRIBUTION.

Congenital word-deafness like congenital word-blindness is apparently much more common in males than in females. Of the 50 cases collected by us there are references to the sex of the patient in only 36 cases (including our own case). Of these, 30 were males and six females, a proportion of five cases in males to one case in a female. This greater frequency of the defect in males was referred to by Coen, who pointed out that his condition 'Hörs- tummheit' occurred chiefly in boys. No other writer appears to have stressed this peculiar sex distribution. A similar distribution has, however, been noted in congenital word-blindness. McCready pointed out that that condition occurred more frequently in males, and found that of the 41 cases he collected in 1909, 34 were males and seven were females, a relative frequency which is almost exactly the same as that of the cases of congenital word-deafness we have collected.
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THE FAMILIAL FACTOR.

A familial influence has been noted particularly in connection with congenital word-blindness, but hitherto it has not been emphasized particularly as a factor in the etiology of congenital word-deafness. Since the two defects are somewhat analogous and any discussion of the causation of the one must necessarily include consideration of influences common to both, it is necessary first to refer to the familial factor in congenital word-blindness. McCready\textsuperscript{24} described four cases in two generations, in a father and his three sons; and in connection with a second case mentioned that the father and a paternal uncle could not read until they were ten and that their father and paternal uncle both had difficulty in learning to read until late childhood. The mother of one of Thomas's\textsuperscript{25} cases had never been able to learn to read, and five other children in the same family suffered from the same defect as the patient. A sister of another of Thomas's cases could not read even after she had left a special school. The maternal uncle of Fisher's\textsuperscript{19} case did not read until he was ten; Hinselwood\textsuperscript{19} described cases in four brothers; while both Stephenson\textsuperscript{21} and Plate\textsuperscript{22} described cases occurring in three generations. In Stephenson's group of cases the defect was apparently transmitted from the first to the second generation through an affected female, and from the second to the third generation through an unaffected female.

The familial factor is quite as apparent in connection with cases of congenital word-deafness, and was present in eighteen of the cases quoted and also in our own case. Hun's\textsuperscript{4} two cases occurred in a girl and in her younger brother, while Hall's\textsuperscript{7} two cases occurred in twins. Hale White and Golding Bird's\textsuperscript{14} two cases were in brothers; their father spoke badly until he was twenty-three; their mother died insane and their paternal uncle spoke indistinctly until adult life. A maternal cousin of Taylor's\textsuperscript{26} case was an 'idiot.' Guthrie's\textsuperscript{18} second patient also suffered from pseudohypertrophic muscular dystrophy; his brother suffered from the same speech defect until shortly before his death, and a sister then aged five spoke more indistinctly than her brother. The father of one of Hadden's\textsuperscript{16} patients died insane; two of the paternal uncles of another died insane: and in connection with a third case there was no history of insanity, stammering or defects of speech in the parents or other six children. There was, however, a paternal uncle who did not speak until he was seven and a maternal cousin who stammered slightly. Syme's\textsuperscript{18} case was that of the third child in a family of four: the others were healthy and could hear and speak normally; but the mother was left-handed and "spoke very little." One of Thomas's\textsuperscript{25} patients had a brother who did not speak until he was five, a sister aged five who had never been able to speak, and a paternal uncle who did not speak until he was five. The father in Tait's\textsuperscript{28} case had a slight impediment in speech, saying "mouf" for "mouth," and his brother was an epileptic. Levy\textsuperscript{30} discussed the familial factor in more detail than most other authors and pointed out that psychological troubles
and alcoholism were frequent in families suffering from 'alalie idiopathique de Coen,' as were also speech defects of a similar or different type. Burr, McCall, Town, Brönner, Colman, Kerr, Sainsbury, Variot, Yearsley, Wilbur, Coen and Wallin made no reference to a familial factor in their cases. In our own case a maternal aunt spoke first at the age of four and did not speak at all clearly until the age of ten, another aunt was reputed to suffer from "nerve-deafness" and an uncle on the mother's side was backward in speaking and at three could not pronounce words well enough to be understood.

Thus it is evident that there is a definite familial factor in cases of congenital word-deafness but no definite evidence to show in what manner the defect is transmitted from one generation to another. The presence of this familial factor is a matter of some importance when one considers the causation of the two defects and particularly of congenital word-deafness; and seems to support the presence of a biological defect rather than the results of birth injury as the essential cause of the condition.

**PATHOGENESIS.**

In the absence of autopsies on patients who have suffered from congenital auditory imperception, one can only speculate upon the pathology of the condition. Even if autopsies were available, it is probable that they would reveal little or no direct evidence of focal lesions in the brain to account for the clinical symptoms. In the case of similar conditions affecting the cells of the pre-Rolandic motor cortex and other parts of the brain, a careful microscopical examination has often been necessary to elucidate the anatomical changes associated with a clinical picture which appeared to be due to a lesion in that part. Consequently, we can only consider probable causes and discuss the evidence for and against them.

The probable causes of congenital auditory imperception are (1) trauma, and (2) a biological variation of the nature of aplasia affecting both hemispheres of the brain behind the temporal lobes.

In favour of trauma as a cause there is no evidence apart from the occasional report of a difficult labour during which the patient might have been exposed to injury. Against it is the need for both sides of the brain to be affected by the injury before the condition can be produced. In the event of one side being injured, the opposite side, as a rule, takes over the functions in relation to speech for which it is responsible. If due to trauma, it might be suggested that the comparative rarity of bilateral injury would account for the rarity of congenital auditory imperception.

In support of a biological variation as the cause are the following points: (1) There is a definite familial incidence in one-third of the cases reported in the literature. (2) In order to produce the clinical picture, the lesion must be a bilateral one, and most conditions believed to be due to local aplasia of the cerebral cortex are bilateral in distribution. (3) With education, a certain
degree of recovery results, a feature which has been noted in cases of aplasia affecting the motor cortex and the cerebellum. On the whole, the balance of evidence appears to be in favour of aplasia of the post-temporal cerebral cortex on both sides as the essential pathological condition underlying congenital auditory imperception. It is true that cerebral aplasia affecting the motor cortex and cerebellum rarely shows a familial incidence and on that account it might be preferred to correlate the pathological condition with the abiotrophies, which include the heredo-familial ataxias, rather than with the congenital aplasias. Such a consideration does not, however, invalidate the evidence in support of a biological variation as the essential cause of the condition.

CLINICAL FEATURES.

The clinical features of congenital word-deafness are many and varied. The general clinical picture presented by patients suffering from the defect may be appreciated from the following translation of Levy’s definition of the abnormality (as already mentioned). “This type of mutism is recognised by the following positive and negative characteristics—(1) children who are normal physically and mentally; (2) hearing normal; (3) the peripheral organs of speech properly formed and functioning normally; (4) absence of paralysis, atrophy or contracture of the body or limbs. Usually they are children from four to ten years of age, whose physique and intellect appear to be normal, who in a word have all the appearance of children of their age except that they do not speak at all or have a rudimentary language for their age.” Though this definition draws attention to many of the more important manifestations and is sufficiently complete to serve as a starting-point for a discussion of the clinical features of the condition, it is wanting in several important particulars and needs to be elaborated considerably.

(1) The defect is present from birth. It is rarely observed, however, until the child is old enough for the parents to notice that his acquisition of speech and his understanding of speech and language are defective. Hence in the cases reported in the literature there is rarely any reference to the condition of the child during his first three years of life beyond the statement that he had never been able to learn to speak. We were fortunate enough, however, to obtain a history which emphasized several unusual features of our patient during infancy. In spite of the fact that he was a normal child in all other respects, he had a peculiar cry—low and moaning—quite unlike that of other children of his age. The monotony of the cry and its lack of variation with different affective states were particularly observed by those in attendance upon him. Though he took notice of things about him in the usual way and at the usual time, he did not do so when spoken to. He did not make the responses usual in an infant of his age to those who spoke to him, and in fact pushed them out of the way so that he could see what was going on about him. A child the
subject of this defect does not attempt to say words at the usual time. Although those about him attempt to teach him to speak by getting him to repeat sounds and words after them, they find that he never attempts to say words of his own accord. They notice that, when he must produce some sound to attract the attention of those near him, he usually makes a sound or noise which bears no resemblance to speech. After he has reached the age of eighteen months or two years they complain that he does not learn to talk as other children of his age.

(2) Hearing is normal. This is often appreciated by the parents of the child long before he is brought for advice. It is also appreciated by teachers of the deaf who recognise that there are sometimes children in classes for deaf-mutes who can hear and yet cannot speak. This is an aspect of the condition which has been stressed not only by Levy but also by other writers who have reported cases. In fact, it is often thought by those who are associated with the child that he must understand language as it is obvious that he can hear; and this error is not absent from the descriptions of the earlier cases reported in the literature. One of Wilbur’s patients was said to “understand simple language spoken to him or in his hearing”; another could hear perfectly well; a third was said to understand ordinary commands; while the fourth knew his name and understood some simple language addressed to him. One of Burr’s patients was said to understand all that was said to him; another was thought to understand spoken language as well as an average child of his age; while a third heard perfectly well as was shown by the fact that he repeated what was said in his hearing. McCall’s patient took no notice when spoken to and might easily have been mistaken for a deaf child, but a noise attracted his attention. His teachers were sure he was not deaf. Tait’s patient could hear; both Thomas’s patients could hear perfectly well; Kerr’s had good hearing; and Sainsbury’s showed no deafness. In our case the auditory apparatus was normal in every respect. In many of the cases reported as idioglossia or a similar speech defect, no direct reference was made to the hearing beyond the statement that, apart from speech, the patient was normal in every way. Guthrie was of the opinion that in some of the cases referred to by him, the hearing was anything but acute as far as mere audition of sounds was concerned. Some writers, including SpencerWatson and Langdon Brown, believed that the speech defect was due to a defect of hearing short of actual deafness, and others, including Levy, believed that impairment of hearing as the result of nasopharyngeal growths and adenoids was sometimes associated with the defect. As Guthrie pointed out, however, the effect of these conditions in producing defective utterance would not alone account for the abnormality of speech described as idioglossia. In some cases, if care is not taken to test the hearing systematically, the impression may be produced that the patient is partially deaf owing to the fact that he cannot distinguish variations in sounds. This source of error was referred to by McCall, and may
have been responsible for the opinions expressed by Spencer Watson, Langdon Brown and others, that adenoids and defect of hearing short of deafness were responsible for the speech defect associated with congenital word-deafness. In addition to the four cases quoted from Wilbur’s series, there were two other patients in the same series who were described as partially or slightly deaf, but otherwise showed a clinical picture very suggestive of congenital word-deafness. It is possible that these two cases were actually examples of the condition and that the patients were thought to be partially deaf because they had difficulty in appreciating variations in sounds. Hence it is necessary to emphasise the need for a careful and detailed examination of the hearing before arriving at a definite conclusion concerning a suspected case, for not only may patients suffering from the defect be thought to be partially deaf when they are not, but those suffering from a minor degree of deafness, such as in the case reported by Drinkwater, may have their deafness unrecognised and be diagnosed in error as cases of congenital word-deafness.

(3) **Spoken language is not understood when spoken in the patient’s hearing and out of his sight.** This is the essential feature of the condition, and the basis of the varied symptomatology which has grown up around it. Two precautions are necessary in testing this aspect. In the first place, it is essential to examine the patient separately for the comprehension of spoken language which he *hears* and for that which he *sees*, especially when the patient has, as many of them have, been in a school for the deaf and has been taught lip-reading. Neglect of this precaution has probably been responsible for the varied descriptions in the literature of the patients’ ability to understand spoken language and for the fact that in many cases the true nature of the defect has not been recognised. Even in a patient who has been taught lip-reading a careful examination in two stages as indicated above will reveal a very obvious difference between the ability to comprehend spoken language ‘heard’ and that ‘seen.’ In many of the cases included in our series on other evidence this precaution was apparently not observed. For example, one of Burr’s patients was recorded as being able to understand all that was said to him and another was thought to understand spoken language. The second precaution is even more important. Tests which depend upon the patient’s repeating what he hears should not be employed, for, as will be shown later, these patients can often repeat parrotwise the sounds they hear though they do not understand their meaning. Only those tests which demand that the patient should understand the meaning of the sounds and words he hears should be employed. The descriptions of many of the earlier cases investigated were also deficient in this respect. Guthrie, for example, wrote of his first case as follows: “Whilst her attention was engaged she could repeat most words correctly at dictation, but she soon looked vacantly round the room and her speech became gibberish although she still continued mechanically to utter words after me.” Frequently, it is only when care is taken to eliminate the two sources of error.
mentioned that the true nature of the defect is appreciated. As Wallin pointed out, spoken language is heard but not comprehended. "The difficulty is not in the auditory perception of the spoken sounds, but in the recognition of the acoustic word imagery. Speech sounds to the word-deaf like a foreign language, a meaningless jargon of sounds." In his case, the patient, although aged seven and a half, was rated only 2–4 years in the Binet-Simon test, in which success is intimately dependent upon the understanding of spoken instructions. In Syme's case it was recorded that "he has no idea of the meaning of sounds. A book is touched and the word 'book' is spoken to him and repeated in a manner by him several times. If now the book is pointed to and he is asked by speech and signs what it is, he never attempts to say 'book.'" Thomas described a patient who heard a watch at a distance from either ear, and heard words readily but understood none. His second patient heard a bell, a whistle and all musical notes readily and responded by raising his hand; he made an attempt to repeat words heard but could attach no meaning to them. Town's patient did not understand the words he heard "as was shown by his failure to comply with requests or point out objects."

(4) In many cases the patient can repeat sounds and words he hears, but he cannot repeat a long series of sounds or words. This feature has been demonstrated in a previous communication in the results of those tests which depend upon the repetition of a phrase of five words. This ability to repeat sounds heard varies considerably. In some cases the imitation is almost perfect, in others only the fact that the same number of syllables is repeated can be appreciated by the observer, and in some there is no attempt at all at repetition. This feature of the condition is often apparent at once when the patient is asked a question, for he may repeat it parrotwise but make no attempt to supply an answer. Syme's patient attempted to repeat the words said in his hearing when the eyes were covered—he was right as regards the number of syllables but not in the words themselves. In one of Wilbur's cases it was found that, though his mother said he could speak, he repeated what he heard or the question but made no attempt at spontaneous speech. Yearsley's patient simply repeated the speech she heard in the following manner:

"Q.—What is the time? (By ear alone.)

A.—What is the time? (Mumbled without intelligence.)"

One of Thomas's patients repeated the command "Get me a pencil" as "Det me a pentil" but made no attempt to carry out the command, and his second patient made an attempt to repeat the words he heard but could attach no meaning to them. One of Burr's patients could repeat words immediately after he heard them, but no new words could be fixed in his memory, although his memory for events was good. Variot's patient could be persuaded to repeat a few syllables parrotwise but in doing so he spoke in a somewhat explosive manner and with the syllables spaced.
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In carrying out the examination of our patient it was difficult to persuade him to obey a command in silence. For example, in performing Head's 'The naming and recognition of common objects' test by getting him to point to an object named verbally by the observer out of his sight, in most of the tests he repeated the name of the object imperfectly after the observer. The inability to repeat correctly more than one or two syllables was shown most clearly in 'The man, the cat and the dog' test. In the first test, when asked to repeat the words 'The cat and the dog' after the observer he repeated them more or less successfully as 'Ge kahnt ahn ge doee,' but with later tests he was unable to repeat more than the first word in his own way. For 'The dog and the cat' he repeated 'Ge dog ge ahn aich' in which only the first two words corresponded to the original. Finally, after a series of tests, the words repeated bore no resemblance to the original words and, though the fact that the phrase consisted of five words was still remembered, there appeared to be complete confusion concerning the relative position of the words. In the last test he repeated 'The man and the cat' as 'Ge doee doee ge taht.' It seemed as if in the earlier tests the words of the phrase were remembered for a short period, but after that only the fact that there were five words in the phrase was appreciated.

This ability to repeat a limited series of words after the observer is liable to cause some confusion in the examination of such patients. Our patient was reported to have been able to say his name and 'Cockadoodle-doo' at the age of three years, but on closer investigation of the circumstances it was found that on each occasion he simply repeated the word after someone who was trying to teach him. In all the tests applied to him depending upon the repetition of sounds heard there was an obvious element of perseveration. In 'The man, the cat and the dog' test, his version of the word 'dog' persisted through all the repetitions after the first one; while, on asking him questions either by ear alone or by lip-reading, his reply was often his name whatever the subject of the question.

It is apparent therefore that such patients often have a limited ability to repeat the sounds they hear in an imperfect manner, and sometimes reply with a stock word or phrase to any questions which may be put to them. It is equally obvious that any method of examination which does not depend primarily upon the appreciation of the words heard may not reveal the true nature of the defect from which the patient is suffering.

(5) Sometimes the patient fails to understand and appreciate musical sounds, and sometimes even cruder sounds. The ability to recognise musical sounds and more particularly crude sounds may, however, be perfectly normal. Our patient could not recognise discords produced by himself on the piano when his eyes were covered, and failed to appreciate the difference between an unmusical noise and the sound of a tuning-fork. In the latter test he indicated in each case by signs that it was a tuning-fork he heard. When asked to repeat a
series of notes sung in his hearing, he changed the inflection of his voice from one note to another but failed to reproduce the notes correctly. Some crude sounds he was able to recognise at times, for the noise made by the wind sometimes made him afraid. He was also able to associate the sounds of the footsteps on a pathway or the noise produced by opening a door with the arrival of his father. His ability to recognise crude sounds apparently varied from time to time; and an examination of the cases reported in the literature leads us to believe that the recognition of crude sounds and of musical sounds varies considerably in cases of congenital word-deafness, the variation probably depending in some degree upon the severity of the defect and upon such a general factor as fatigue. In one of Guthrie's patients the 'musical sense' was singularly wanting, and he apparently rendered pieces by rhythm rather than by melody. The same method was apparent in the attempts made by our patient to play short pieces on the piano. One of Thomas's patients could hear a bell, a whistle and all musical sounds with ease and responded by raising his hand, but it is not at all clear whether he appreciated the differences in the various sounds. Syme's patient was fond of music, heard at once if a street organ began to play nearby and could hum part of a tune. Our patient was fond of listening to organ music, but sometimes he would listen to it for only a few minutes and then his attention would wander.

(6) When lip-reading has been learned, as it has been by many who suffer from the defect, the patient may be able to understand language easily by sight. Although our patient had had only a limited education in lip-reading, it was obvious in the tests applied to him that he could understand a fair proportion of the speech which he saw, which was in decided contrast with his entire lack of ability to understand speech which he heard. Such words as 'match,' 'card,' 'florin' and 'penny' were repeated imperfectly by the patient when spoken by the observer where he could see, and the command to point out the object was obeyed correctly. In the earlier cases recorded this ability of the patient to understand language by sight frequently produced the impression that the patient could understand spoken language.

(7) Speech is absent or exceedingly defective. If the patient learns to speak at all, speech is acquired late and often not before five to twelve years of age. Speech is rarely used spontaneously, and, if it is, phrases of only two or three syllables are employed; it lacks stress and intonation. When communication by signs or pantomime fails, speech is sometimes fluent and of the nature of jargon—a series of unrelated sounds without grammatical structure or sequence; and it cannot be understood by those who are unaccustomed to the patient. Even after attempts have been made at special education in articulation speech may be permanently defective, or it may be of the nature of an individual language based upon the misunderstanding and mispronunciation of the sounds and words heard, one in which special sounds and groups of sounds are used constantly to indicate certain objects and affective states. The
characteristics of the speech defect and its relationship to the original defect are discussed in detail under a separate heading.

(8) There is some difficulty in appreciating the meaning of written and printed symbols, even when the patient has been brought up in a good environment and has received such education, apart from special education, as it is possible for him to receive. In many cases, of course, education has not proceeded sufficiently for the observer to discover whether this defect is present or not. In tests depending upon pointing to objects named in print, our patient was able to obey the command correctly in the majority of tests, but in a number of them he failed to appreciate the meaning of the printed symbols and carried out the command incorrectly. This defect was found to be a handicap in his school work, for when given directions in writing or print he would often simply copy the writing or print and fail to obey the directions contained therein. This defect in the visual field renders the education of patients suffering from congenital word-deafness much more difficult than it would appear to be at first sight. The ability to appreciate and remember pictures and the qualities of form and shape is as a rule perfectly normal. Games can be indulged in with zest and mechanical toys and machinery arouse the full interest of the patient. The ability to appreciate arithmetical symbols is as a rule fairly good, but at times there is some inability to understand the significance and details of the arithmetical processes involved in simple exercises and certain bizarre effects are produced as a result. These were illustrated fully in a previous communication. As will be shown later, this defective appreciation of the meaning of written and printed symbols is merely a part of the 'aphasia' which complicates the original defect.

(9) Attempts at writing reveal certain errors which correspond in general to the errors found in oral speech in those patients who have received some education. These again are evidences of the 'aphasia' which complicates the original defect. In the absence of detailed methods of investigation this feature of the condition has not been referred to in many of the cases reported in the literature. One of Brönné's patients (already alluded to) wrote "I never went any place outside of Chicago" as "I neer wast eate atsed in Chicago." Attempts at spontaneous writing, when they can be made by the patient, often produce ludicrous results. Spelling is defective, and even simple words are misspelled. It is noticeable, however, that words to which the patient has become thoroughly accustomed, such as the name of the town in which he lives and his own name, are rarely misspelled. As far as could be gathered from the investigation of our patient, though the spelling of the names of objects pointed to was apparently quite incorrect, certain groupings of symbols were used more or less constantly for the same objects. In this way the language expressed in writing corresponded with that expressed in oral speech. By our patient a match was constantly named 'mat,' but was expressed in writing at different times as MTLLA and MTLLD. 'Hand' was written at
different times as HTND, HLMD, HLED and HSND. This defect in writing or spelling may be noticed by the patient's teacher as a constant tendency to make such mistakes as GRIL for GIRL. Although rather overshadowed by the more serious symptoms of the condition and thus of little importance in diagnosis, this inability to spell even the simplest of words correctly may be found to be a serious handicap when attempts are made to educate the patient through channels other than the auditory.

(10) Writing from dictation is impossible when the speaker is out of the patient's sight, but may be possible to a limited extent when the patient can see the speaker and has become fairly proficient in lip-reading. Here again, however, if each word is not dictated separately, the same errors of spelling appear as in spontaneous writing. Copying can be performed accurately and, in fact, is often done with much greater attention to detail than is shown by a normal child of the same age.

The patient can express himself in pantomime and by signs, and appreciates the use of pantomime and signs by others. As a rule, physically, he is perfectly normal. There are no defects in the organs of articulation, and physical examination of the nervous system reveals no abnormalities whatever. Some writers have suggested that other congenital defects are sometimes associated with congenital word-deafness, but an examination of the case-reports which have appeared in the literature has revealed only one case in which another congenital defect was present.

(11) The mental condition of children who are the subjects of congenital word-deafness, and the special psychological and educational problems associated with the defect, are considered in detail at a later stage. The child is backward at school, if indeed he has ever reached a stage which would justify sending him to an ordinary school. He is unable to obtain information as quickly and as easily as other children of his age, mainly because the channels of communication are limited. Because of his difficulty in understanding speech and his lack of spontaneous speech he is often thought to be mentally deficient, but, as a rule, his mental condition is normal if he has been brought up in a good environment and treated by his parents and teachers with sympathetic understanding. If neglected, he may perhaps become an 'imbecile from deprivation' in the sense that his lack of speech and difficulty in obtaining information have rendered him incapable of competing economically with his fellows. If not handled with understanding, he may become mentally isolated and develop abnormal psychological reactions to his defect, to his environment and to society. Such abnormal psychological reactions may be aggravated if he is eventually placed in some occupation which is unsuitable because of his personal handicap. His behaviour may then be in some degree antisocial, and may lead him into the courts for offences against the person or society. Because of the much more severe economic handicap entailed in the absence of speech and the lack of understanding of spoken language, such evidences of
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delinquency are even more likely to occur in sufferers from congenital word-deafness than in those who suffer from the corresponding visual defect. A correct diagnosis of the patient’s defect, special education adapted to his particular needs and the choice of an occupation which calls into play his special abilities and places as little stress as possible upon his personal defect, produce in the majority of cases a normal adjustment to society and ensure the normal mental development of the individual.

THE SPEECH DEFECT.

Since the evolution of speech depends upon the integrity of auditory perception the subjects of congenital word-deafness have difficulty in learning to speak. Other causes of delay in acquiring speech are a physiological slow rate of development and deafness resulting from a peripheral lesion; these must be excluded before the condition can be diagnosed definitely as congenital word-deafness. According to McCready, children with such a speech defect are of three types—(1) those in whom all inclination to speech is lacking; (2) those who are dumb without being deaf for ordinary sounds; and (3) those who sometimes enunciate a few definite sounds which they use in connection with definite objects and affective states. Those of the first and second type are fairly common; and in fact all the children suffering from congenital word-deafness might be included in one of these types before they have acquired the few words or sounds which serve them as speech. A few of them acquire some form of speech by the age of three years; more often they have acquired no such means of communicating with their fellows by the age of five years; and cases are on record in which speech has not been acquired before twelve years of age. One of Wilbur’s patients did not attempt to speak until he was nine, and at thirteen could say only a few words which his father alone could understand. Another patient had made no attempt to speak by the time he was eight; while a third began to use only a few single words uttered rapidly at the age of twelve years. One of Hadden’s patients was four before he could make a few sounds; Syme’s patient had not begun to talk or to make use of the usual childish expressions at eighteen months; Kerr’s patient did not speak at all until he was taught articulation; and one of Thomas’s patients did not speak until he was seven. Tait’s patient could not utter a single word at the age of five; some of Levy’s patients did not speak at all; one of Burr’s had never made an effort to talk at three, another was unable to speak at twelve, and a third could say only ‘yes’ and ‘no’ at seventeen. Such children as these, for all practical purposes, are dumb and are able to communicate with their fellows only by signs and pantomime. They may find their way into schools for the deaf but sooner or later they are found to be able to hear and yet lack the power of spontaneous speech. They are often misunderstood and are thought to be mentally defective or merely lazy and inattentive.

It is more common, however, for children suffering from congenital word-deafness to acquire a few sounds and words with which they are able to make
their wants known to those in constant association with them. Their success in expressing themselves in this way varies considerably. Some can make only a few sounds, while others have a fairly large vocabulary which includes sounds and expressions for most of the objects and affective states which come within their experience. In the earlier cases reported, the details of this method of expression were not referred to with any minuteness. One of Wilbur’s patients uttered sounds which only his father could understand, and even after a long period of education in articulation produced his words deliberately and imperfectly. Another expressed himself chiefly by pantomime and at the age of twelve supplemented this method of communication by a few single words imperfectly pronounced. Sainsbury described the speech defect in detail and mentioned that the sounds used by the patients were not as a rule intelligible to strangers. In naming the alphabet, his patient could name correctly only the letters C, P and T; and rendered B and D as P and T. For the remaining letters of the alphabet there was apparently no relation between the normal and the abnormal sounds, the pronunciation of Q being an exception. There was a frequent repetition of the S sound in the naming of the letters. One of Hadden’s patients could pronounce all the vowel sounds, and in repeating the letters of the alphabet mispronounced the names of the letters C, H, I, Q, R, S and Z. Many other defects appeared when he attempted to combine sounds into words, and it was noted that he was slovenly in ending words. He repeated the Lord’s Prayer in the following way: ‘Ane Fave, which art in en-en, Annow be ma name, Ney in-dom um, Vy will be done in ear va it e in ennung, E uh vith day a dai-y be, A fogee uh for cheh-c-ay, A we foh-eev vem vat cheh-futh a ain uh, And ee uh not va tentay-ung, Buh deuce uh fon evil, Foh ine in e ingdom, E power and i o-wy, Foh ee an ee, Amen.’ Hale-White and Golding-Bird termed the defective condition of speech ‘idioglossia’ because it gave the impression of an individual language. One of Guthrie’s patients was described as talking gibberish when her attention wandered; and the vocabulary of his second case consisted almost entirely of the consonant sounds B, P, D, T, K and of various vowel sounds. One of Colman’s patients pronounced the vowels correctly except ‘o’ in ‘not’ which he pronounced as ‘naht.’ His version of the Lord’s prayer (already quoted) was as follows: ‘Oue tabde ne nah e nedde, anne de di na : i tede ta, i du de di on eeth a te e edde. Te ut te da oue dade de, e didde ap tetedde, a ne adin to tetedde adase us, ne notte toate, mine, utte enu, to i aitevene, pore e dande, to edde a edde. Ame.’ He sang fairly well but his singing showed the same defects in articulation. After six weeks’ training he improved very much and rapidly picked up the sounds for the clear pronunciation of the different letters and words except K and G. A second patient could pronounce the vowels well, but used T, D and N for most of the consonants; he could not pronounce the letters F, V, TH, SH, R, K, and G. His speech was quite unintelligible to those unaccustomed to him. Syme’s patient had never spoken in an intelligible
manner at the age of eight, though he occasionally used non-intelligible sounds such as "ow" and "bow" especially when he was angry. Yearsley's patient could pronounce no words properly even after three years at a deaf and dumb school. Her spontaneous speech was slipshod and indistinct, and showed a tendency to replace SH by S; D, G, Z, and T often being mistaken as well. When asked a question she mumbled the question itself without intelligence. Burr described the speech of one of his patients as simply a series of "inaudible sounds." McCall's patient had "markedly defective speech" and its intonation resembled in a slight degree that peculiar to cleft palate. Tait's patient phonated a sound like 'ta' or 'ah' suggestive of cleft palate and made these sounds do duty for everything. One of Brônner's patients showed numerous verbal inaccuracies in his speech and "the English he employed was exceedingly poor." His enunciation was exceedingly faulty though his vocabulary showed a fairly wide range. Certain syllables were slurried over. Wallin described the speech defect associated with congenital word-deafness as follows: "He expresses himself through speech with difficulty. His speech may even be reduced to a jargon of gibberish or reiterated words or letters without grammatical structure."

The speech of our patient has been described in detail in the previous communications referred to. Its general characteristics were as follows: (1) it sounded like gibberish when one was unaccustomed to him and seemed to have no semblance of grammatical formation; (2) speech was rarely used spontaneously and on the rare occasions on which it was, it was confined to single sounds or words; (3) single words or sounds were as a rule used alone in reply to questions, but when these or communication by signs were thought to have failed, there was produced a succession of sounds which seemed to be jargon and not true speech; (4) upon closer observation, certain sounds or series of sounds were found to be used constantly for the same objects or affective states; (5) words such as those for the days of the week were begun with a sound which in some cases resembled the correct one and then trailed off into a long or short vowel sound; (6) there was an element of perseveration in producing a number of words usually pronounced in series, e.g., in counting, the sound "iki" was used to end the name of most of the numbers after sixteen; (7) individual expressions were used constantly for definite objects, e.g., "pickapek" for "pocket"; (8) the speech was monotonous, toneless, indistinct and lacked stress and obvious division into syllables; (9) upon continued observation, the patient's method of expression could be learned and his meaning more easily understood, as in learning a foreign language by associating with one who spoke it; (10) the speech could be readily understood by those in close contact with the patient and by other children of the same age.

Since the speech defect is the most obvious symptom of congenital word-deafness and the one which most often draws attention to the condition, it is necessary to discuss in detail the nature of the defect and its relation to the
original condition. For long it was regarded as an independent condition and its relationship with the defect in the auditory field was unsuspected. In the earlier cases described, the speech defect was thought to be the result of imbecility, idiocy or defective mental development. Wilbur described his cases illustrating the defect as examples of 'aphasia' supervening in mentally defective children, but made it perfectly clear that they belonged to a class of their own—one including mentally defective children who could repeat words after the observer but could not originate them. Arguing from the mental deficiency which he believed was present in all his cases, he stated that in the majority the absence or defect of speech was due to 'lack of volition' on the part of the patient. That his argument was fundamentally wrong is shown by the fact that the descriptions of his cases contained references to no defects, other than those of speech and 'hearing,' which might suggest the presence of mental deficiency. This aspect of the condition was discussed as late as 1912 by Burr who showed that the speech defect in such cases was in no way dependent upon mental deficiency but that such children might become 'imbeciles from deprivation' just as deaf-mutes did formerly. A cursory examination of the patient might have suggested that the speech defect was the result of mental deficiency rather than that the mental deficiency and the speech defect were due to a common cause—congenital word-deafness.

Later it was suggested that the speech defect was a species of 'atavism' or 'a sport in language,' the suggestion being that such children used words of their own invention and in doing so harked back to the speech of their ancestors. Hall's two twins of German extraction were said to speak a language of their own thought to resemble German, while the speech of Hun's two patients was thought to resemble French. Crane reported instances of what he believed to be 'atavism in speech,' but it was noticed by Guthrie that the terms employed by his patients were simply misapplied and mispronounced words which the children had actually heard and had understood only imperfectly. Romanes pointed out that the examples quoted were not striking and that the apparent resemblance to the language of their forebears could be easily explained otherwise. As Guthrie pointed out, the strongest argument against the spontaneous evolution of speech in such cases was the fact that deaf-mutes never talked at all unless they were taught to do so.

In 1891, Hale White and Golding Bird introduced the term 'idioglossia' to describe the defective speech, because it gave the impression that the children were speaking a purely individual language. Though Guthrie defended the use of the term on the grounds that the language used produced the same effect as if a new language were heard, he made it perfectly clear that the defective speech was nothing more than imperfectly pronounced English due to defective audition in the sense that the distinctions between sounds were not understood or not heard. Thus he recognised some connection between the speech defect and a defect of auditory perception, but appeared to think that it was simply an
exaggeration of defective modes of speech which were fairly common in minor degrees without being regarded as in any way morbid. The same attitude was adopted by Wyllie who grouped the defect among all classes of defective utterances and thought that it was due in some measure at least to imbecility. As late as 1908, Thomas regarded the defect in the same light, included it with other types of defective speech and believed that they were all due to defective organisation of the motor centre for speech.

Sainsbury had, however, in 1889 suggested a relationship between a speech defect which bore all the characteristics of idioglossia and a congenital defect in the auditory field analogous with that in the visual field known as congenital word-blindness. Though Kerr had in 1900 described a case of congenital word-deafness in detail and pointed out that children suffering from the defect did not talk properly until taught articulation, the separation of idioglossia and congenital word-deafness into two distinct entities persisted until 1910 when McCready suggested that idioglossia was due to partial word-deafness. In his opinion the speech defect was due to the child repeating sounds as he heard them. This view of the defect served the purpose of drawing attention to the speech defect as the important complication of congenital word-deafness, but failed to account for all the features of the defective speech.

As a result of Marie’s conception of speech as a function which acted as a whole and in which each part was dependent upon the others, and to Head’s detailed method of investigating aphasia and his revival of Hughlings Jackson’s view that the function of speech was on a much higher level than it had been regarded for the previous fifty years, it became apparent that the relationship of the speech defect to congenital word-deafness could not be explained fully in the simple manner suggested by McCready. Head regarded the disturbance in the auditory field as belonging to a lower order of functional disintegration than aphasia and grouped it under the heading of auditory imperception. He pointed out that in addition to the difficulty in appreciating the meaning of words the patient had at some time or other difficulty in recognising the meaning of crude sounds. Wallin also referred to the fact that in addition to inability to recognise the meaning of words, the patient sometimes suffered not only from amusia, or the loss of the ability to appreciate melodies or to recognize musical sounds, but also from what he termed “acoustic aphasia” or inability to recognize sounds and noises. Referring to the latter defect, he said that “it is invariably accompanied by word-deafness, and, in the case of musical persons, by amusia, and frequently by paraphasia, so that their speech resembles that of confused lunatics.”

The investigation of a patient by Head’s methods shows also that the speech defect is due to something more than the child’s repeating words as he hears them. It is true that when asked to repeat sounds and words after the observer, he does so in a manner approximating to the original but differing from it in
the monotony of tone and the lack of stress, but this method of repetition, parrotwise after the observer draws attention to a very minor part of the speech defect and fails to reveal the errors which are evident in spontaneous speech. The results of the examination of our patient by Head's method have been given in detail elsewhere. From them it is evident at once that in such a case there is present a much more widespread defect than can be explained by congenital word-deafness alone and a complicating speech defect which has arisen as a result of the child's repeating sounds as he heard them. The defect in speech is obviously due to something more than the mispronunciation of imperfectly heard and misunderstood words; defects in a similar form appear in the expression of speech in writing, and in addition to the original defect in the auditory field there is an obvious though less apparent defect in the understanding of written and printed language. Consideration of the detailed results of this examination shows that:—(1) there is complete absence of auditory perception for words, musical sounds and certain crude sounds, though at times such crude sounds as those made by the wind are understood and appreciated; (2) there is present a type of ‘aphasia’ involving chiefly the oral expression of language, and to a lesser extent the expression of language in writing and the visual appreciation of written and printed characters—in short, a type which is the same as Head's 'verbal aphasia.' Thus it would appear that the fundamental defect—congenital word-deafness—might be more correctly described as a defect in auditory perception, and that the clinical picture of the condition as revealed in oral, spontaneous speech depends upon a complicating 'verbal aphasia,' the defective speech associated with which is the same as the 'individual language,' 'idioglossia' and 'defect of articulation' of various writers. The explanations of the nature of the speech defect given in the literature, in which it is variously described as the result of imbecility, due to lack of volition, 'a sport in language,' an individual language or simply mispronounced English due to the child repeating words as he hears them, are obviously at fault. In support of all the views but the last there is no satisfactory evidence at all, and against the last view is the fact that there is some defect in all aspects of speech and not in the oral expression of language alone.

There remains one point to be discussed—whether the term 'aphasia' correctly describes the condition which is present. In its strict sense the term means the loss or absence of speech which has already been present, and is used to describe the disturbance of speech in those in whom the function has previously been perfect. It has been suggested by Tait, Burr and others that the term is not strictly applicable to those cases which depend on a congenital defect. In default of a better term, however, the term 'aphasia' will no doubt continue to be employed since it has already been applied for many years to the condition under discussion. It should, however, be understood that it is used in a sense somewhat different from that in which it is employed in adult cases.
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It is apparent, therefore, that although there is a certain speech defect due to the mispronunciation of words heard when the patient repeats them after the observer, the chief speech defect is due to a 'verbal aphasia' which complicates the original auditory defect. When, however, the patient has learned to speak by education through the visual channel and particularly by means of lip-reading as taught to deaf mutes he pronounces his words as he sees and hears them pronounced, but as he is still unable to appreciate the differences between sounds his speech is somewhat different from that of the normal individual. Depending upon the success of his education, his speech may vary from a collection of gibberish with an occasional normal word imperfectly pronounced to words and sentences which are readily understood even by those unaccustomed to him, but is still deliberate and lacking the intonation of the speech of a normal individual.

THE MENTAL CONDITION.

Opinions as to the mental condition of patients suffering from congenital word-deafness have varied considerably; for a time they were thought to be always mentally deficient; but at present the general tendency is to regard them as at least of potentially normal mentality. All Wilbur's cases were found in an institution for idiots, but it is interesting to note that the clinical descriptions of the cases quoted by him revealed no evidences of idiocy other than the defect of speech and the difficulty in understanding speech, and no features which could not be explained as the results of these defects. Coen insisted that such patients were normal physically and mentally. Sainsbury's patient—a girl five and a half years old—was a bright-looking, good child, was useful in the house, could run errands and amused herself with her doll. Hadden did not think that any of his patients were deficient in intelligence; Taylor's patient was intelligent; while, of Hale White and Golding Bird's two one was "sharp and able" and the other was intelligent. Colman attempted to explain why such children were thought to be mentally defective. He pointed out that "although the children are often intelligent and quick, the difficulty of making themselves understood gives other people the impression that they are idiots." Kerr's patient was very intelligent, his only defects being that he could not understand words or speak. Syme's patient—a child of eight—was bright and cheerful; clean in his habits; and showed more intelligence than the average. He could dress and feed himself, played with other children, drew well and copied the names of shops he had visited. The patient described by Guthrie was quite intelligent but his education had been neglected on account of his physical infirmity. He could not, however, concentrate his attention for more than a short time. From this patient and a number of others he reviewed, Guthrie concluded that the subjects of idiossia were not actually unintelligent but had some inherent inability to make use of the faculties of attention and observation which are necessary for the acquisition of correct speech.
The patients described by Thomas, Yearsley and Variot were apparently quite normal mentally. Town found no evidence of general mental defect in her patient, who made his wants known by gestures, understood signs, showed evidence of a retentive memory, and was very interested in finding the causes of events. Tait’s patient was no different from other children except for the inability to talk. He was obedient, could run messages, played with other children, and recognised people he had seen before. McCall thought that her patient was somewhat less intelligent than a patient suffering from congenital word-blindness, but more intelligent than an ordinary mental defective. Levy followed five cases of ‘alalie idiopathique de Coen’ for a long period, and stated that, of these, two became normal individuals and three were still backward, one of them then aged twenty-one not having yet developed a comprehensible language or developed in accordance with her age. He enumerated the changes associated with the defect as memory defects, poor attention, and ill-developed intelligence. Levy thought that the two patients who had become normal might have been better mentally if they had not suffered from the defect, and he concluded that the existence of dumbness in children with normal intelligence remained to be proved.

In spite of the fact that many of the patients described were intelligent, the idea was fairly common until 1912 that when mutism occurred without deafness it was due to imbecility. Because of this idea some institutions for the education of mutes would not admit or even examine children who could hear and were mute, as it was thought that they were imbecile and unsuitable for such institutions. It is not always easy to determine the true mental state of such children especially when they have received little or no training. According to Burr, it is possible to judge their mental development only by their general conduct and behaviour, the kind of things they take an interest in, whether they show normal inquisitiveness, their powers of emotional inhibition and how they respond to attempts to teach them not only speech but knowledge of any kind. On this basis, Burr concluded that some mental deficiency was present in some cases of congenital word-deafness, that it was the result of the speech defect and not the cause of it: in fact, that such children became ‘imbeciles from deprivation’ when they were exposed to a poor environment, but were potentially normal and would become intelligent as other children if treated in the proper manner. He certainly believed that disease or lack of development of the auditory speech centre always produced some and usually marked mental deficiency, but was careful to point out that such mental weakness was due to an unavoidable accident of environment and was not a necessary result of the disease. His first patient was good-natured and intelligent considering that he had had no education. With education “his intelligence or rather his knowledge increased a great deal.” He learned things quickly and well, his memory was excellent and his moral sense good. A second patient was normal mentally, and a third had fair
intelligence, was obedient and good-natured and was able to take care of
himself.

Brönner discussed the defect chiefly from the point of view of the behaviour
and educational problems involved. Judging by the descriptions given her
patients were mentally quite normal apart from the tendency to delinquency.
After long observation of his case, Wallin concluded that the patient was
somewhat subnormal intellectually. Discussing the mentality of individuals
suffering from congenital aphasia, in which he included both word-deafness and
word-blindness, McCready believed that the high degree of intelligence reported
in some cases was not borne out by detailed tests, but nevertheless insisted
that the defects were not incompatible with normal or even superior intelligence.
In a series of fifteen cases of congenital word-blindness, Orton54 reported superior
intelligence in one, average intelligence in nine, mental dulness in one and
marginal defectiveness in four. McCready emphasized the fact that the recogni-
tion of the congenital word-deafness would save a diagnosis of feeble-minded-
ness in many cases, and in those already feeble-minded would indicate the
method of training to be employed.

Our own patient was perfectly normal mentally: and the investigation
of his condition and the study of the cases described in the literature have led
us to the following conclusions concerning the mental state of children who
suffer from congenital word-deafness.

(1) The mental condition of such children is potentially normal. (2) The
fact that they cannot speak or speak only imperfectly, and in addition fail to
understand spoken language, often gives the impression to the uninitiated that
they are mentally defective. (3) With suitable environment and even in the
absence of special education adapted to their particular disability, they have
normal intelligence. (4) With a poor environment and education which pays
no attention to their disability, they are backward and fail to acquire the
knowledge necessary for them to take a normal position in life. (5) Under such
conditions they may become imbeciles from deprivation as did deaf-mutes
before their condition was fully understood, but such ‘imbecility’ is entirely
due to the fact that their defect has not been recognised and is not the result of
the defect itself. (6) In some cases, poor environment and lack of sympathetic
understanding may lead to antisocial tendencies and delinquencies. (7) The
mental condition in cases of congenital word-deafness depends entirely upon
the recognition of the defect, the accident of environment, the presence or
absence of training suited to the individual’s needs and the placing of him in
an occupation which makes use of his abilities and puts as little stress as possible
upon his defective functions. It is entirely a matter of diagnosis and suitable
education.

**THE PSYCHOLOGICAL REACTION AND THE EFFECT ON BEHAVIOUR.**

In some cases of congenital word-deafness the psychological reaction of the
patient to his defect and to its consequences is of paramount importance.
The psychology of this defect and of associated defects has so far been investigated by very few workers, but in the few contributions in which references have been made to the condition certain important features have been emphasised.

The psychological reactions of 'congenital aphasics' have been discussed chiefly by Orton, who recognised certain definite types. Some of the patients are contented, show an apathetic disregard of their handicap and its results, and are apparently quite happy in the condition in which they find themselves. It is possible, however, that this contentment and apathy are due as much to ignorance of the nature of the defect and of its influence upon their future as to an actual adaptation to the situation, which Orton believed to be the case. Our own patient was perfectly happy and contented, and it was only when he was told that when he grew up he would have to work like his father that he revealed the only reaction he had to his defect by saying that he would not be able to do so as he could not speak. Other patients develop a mild paranoid reaction to their teachers, to those whose duty it is to guide or discipline them, and also to society in general. According to Orton, from this reaction there arose behaviour defects, playing truant, petty stealing, the damaging of school property and other delinquencies. Others again feel their situation keenly, realise that they cannot do as well as their fellows, develop a sense of inferiority and show disorders in behaviour. Others again develop what Orton calls "emotional blocking"—a blocking of output when anything is demanded of them. In short, congenital aphasics are apt, especially if emotionally unstable, to fail in their social adjustments if their condition is incorrectly diagnosed, or if they are imperfectly understood and forced into occupations which are unsuitable for them because of their defect.

Brönner has investigated the psychology of special abilities and disabilities in detail. One of her patients, who suffered from a limited memory defect for numbers, had been in court several times for sex delinquencies, was obsessed by sex ideas and had written obscene letters. "It cannot be definitely stated that his lack of ability for certain mental tasks had any direct relation to his misconduct, but, on the other hand, it is a fair assumption that had his school progress been altogether normal, he might have developed good mental interests which could have been sufficiently strong to prevent the growth of the delinquent tendencies which he showed." Another patient, who suffered from a defect for number work and poor powers of forming associations with symbols, had, in spite of good educational advantages, shown a strong tendency to delinquency. The important factor in the development of delinquency in his case was believed to be the choice of an occupation which placed undue stress upon the powers in which he was most defective. A third patient, a case of congenital word-deafness, first came under notice as a problem in behaviour. He was mischievous and was guilty of petty stealing, annoying girls and running away. Brönner was of the opinion that in his case the educational failure due to his
defect had a distinct relationship to his delinquency. Another patient, suffering from congenital word-deafness, frequently ran away from school and had long periods of idleness during which he stole and otherwise got into mischief.

The tendency to delinquency which undoubtedly appears in some congenital aphasics would appear to be due to a number of factors. It is not the defect itself, but rather its consequence in the form of the patient’s relation to his environment, which is directly responsible for the misbehaviour. A good home environment and sympathetic training, even in the absence of recognition of the defect, would appear to save many subjects of the defect from the consequences of antisocial reactions. Conversely, the absence of these advantages would be likely to initiate such reactions at an early age. The effect of attempts at education with other children probably depends upon the patient’s reaction to the defect and its consequences. Antagonism towards teachers who fail to understand him, dissatisfaction with his own progress, a sense of inferiority when he compares himself with his fellows, would appear to be the exciting factors in the development of truancy and other delinquencies. Lack of interest in school work and a feeling of discouragement and inefficiency probably lie at the root of the delinquency which occurs in a small proportion of congenital aphasics. “The step from this to truancy is easily made, and from that to more serious delinquency. Educational dissatisfaction is a very frequent beginning of what may develop into a long career of misdeeds.” The reaction to a vocation may be equally important. The choice of an occupation which demands the use of faculties in which the individual is deficient and fails to encourage those in which he is proficient leads to discouragement, the inability to hold a situation, the frequent changing from one place to another, and a final drifting into delinquency. A poor and unsympathetic home environment, attempts at education ill-adapted to the individual’s needs and the choice of an unsuitable vocation would then appear to be factors of importance midway between congenital deficiency of the type described and antisocial behaviour. Their importance lies in the fact that they can all be corrected in some measure at least. Early appreciation of the presence of a real defect, early recognition of the true nature of the defect, education adapted to the defect and the special abilities of the patient, and finally the choice of a suitable occupation would tend to eliminate the tendency to delinquency which is present in that proportion of congenital aphasics who are emotionally unstable. Although in more stable individuals such tendencies are much less apparent, their reaction to their defect and to society would certainly be improved by the early recognition of their defect and suitable education.

**TREATMENT AND EDUCATION.**

The treatment of congenital word-deafness consists entirely of appropriate education which in turn depends upon the early recognition not only of the defect which is the obstruction to the individual’s career, but also of the abilities
that may be used with advantage in his education. The general aim of all
such education must be the socialization of the individual and, to achieve that
end, it must be remembered that different individuals, even those sufferin9
from the same defect, need different methods of treatment. Measuring the
intelligence of the individual according to a scale such as the Binet-Simon is a
beginning to the study of the individual but fails completely to give a correct
picture, for as a rule the success of such a method depends upon the correct
understanding of oral instructions and it is in the appreciation of these that
the subjects of the defect invariably fail. It is necessary to mention this fact
because many individuals who present problems in education are studied in
the first instance by such methods and are seldom, at such an early stage,
investigated completely by ordinary clinical methods. If such methods are used
they must always be supplemented by a thorough clinical examination of the
patient, a careful analysis of the speech defect and a complete examination of
the defects in the other zones of language before recommendations can be made
for practical guidance in education. It is well, therefore, to consider what are
the chief difficulties the average sufferer from congenital word-deafness has to
face in education, and what are the most suitable methods of approach.
Education by the auditory route as applied in conventional methods of edu-
cation is not possible: by the visual route, when applied in the conventional
manner by the use of reading, education is very difficult as there is usually
present some lack of appreciation of the significance of written and printed
symbols. However, when applied by lip-reading and by the use of the patient’s
power to appreciate form and shape not only by touch but with the eye edu-
cation will as a rule produce good results. Nevertheless, there remains to
contend with some impairment of ‘internal speech,’ as we have shown in
Head’s ‘Hand, eye and ear test.’ Thus it is obvious, however much the
defect may appear to be limited to the auditory field and however easy education
through the visual and other channels may appear to be, that there are usually
complicating defects in these other channels of approach which render education
through them much more difficult than would appear at first sight.

The education of the subject of congenital word-deafness has received
little attention. By Wilbur it was attempted on the assumption that the
defect in language was due to mental deficiency and that the imperfect volition
responsible for the defect could be remedied in some cases by patient training;
by Hadden and Guthrie in the belief that the defect was almost entirely one
of speech; but by no one has it been applied with a full appreciation of all the
difficulties involved. The educational problem in all such defects has been
emphasized by Brönner in the following manner. The problem is not that of
segregation, as in the case of the feeble-minded and the mentally deficient; it is rather adjustment to the social organism. The first step in developing
each individual in relation to his potentialitics is to recognise that he needs
individual adjustment. The second step is to realise the need for educational
diagnosis. Early investigation is essential. "The first and most obvious advantage of early investigation is the saving of time that would otherwise be wasted. The second is the prevention of discouragement and loss of interest. With the consciousness of failure, there is, all too frequently, emotional disturbance leading to the development of a bad attitude either towards the difficult subject or towards school in general. Frequently, the child is subjected to teasing by his comrades or to scolding by his teachers; sometimes friction arises at home as well as at school, and as a consequence of these irritations, antisocial grudges are formed. Because of these conditions, leading to lack of self-confidence and sometimes to excessive mental disturbances, we find that it is often extremely difficult to induce the elder child or adolescent to make any effort under systematic guidance to overcome the defects. Again and again we have seen that, in spite of desire to master the difficulty, emotions may be stronger than ambition."

The education of the patient must be so arranged as to produce the following results.

1. To secure for him normal relationships with those with whom he comes into contact in his home, at school and in society.

2. To provide him with the means of communicating with and understanding his fellows.

3. To enable him to qualify by training for some occupation in which he can engage in a manner commensurate with his abilities.

The methods employed have varied considerably in their details, but as a rule have followed the same general principles.

The child may be treated as a deaf-mute and taught as such. Thomas thought that this was the only rational method of educating the subjects of congenital word-deafness. The advantages of this method are that the patient acquires some means of understanding his fellows and can communicate with them more or less successfully. He is, however, made to associate almost entirely with those who are deaf and thus fails to learn much that he would otherwise acquire by association with those who hear and can speak if he were placed among them as soon as his elementary education had reached a stage which would permit him to do so with advantage.

Hadden adopted a method of education almost identical with that used for deaf-mutes, but employed certain important modifications which added much to the success of his treatment. The patient was made to watch and then imitate the actions of the lips, tongue and teeth required for the production of the various elementary sounds, but it was often necessary actually to adjust the parts by the fingers or forceps. After a time he succeeded in saying most of the alphabet correctly; but he had great difficulty in joining consonants and vowels to make even simple words. Although he had made distinct progress during the seven weeks he was under instruction and could produce with an effort nearly all the sounds necessary for articulate language, his spontaneous
utterances were little altered. It was found that in spite of his improvement under tuition, he persisted in talking gibberish to other patients. It was then apparent that if education in methods of speech was to be successful, he would have to be completely isolated for a time. He was, therefore, isolated and given amusements but forbidden to read to himself or to converse in his own language. Instruction in articulation was continued daily. He was gradually taught to join syllables so as to form words, and then to combine words into sentences. He was made to speak very slowly, as any attempt at speed resulted in a return of his faulty speech. After three months he spoke quite well enough to be intelligible, and had learned to read an elementary reading book.

The same method was adopted with a second patient. In three months, one month of which was in isolation, "he had made considerable improvement, and his articulation became quite intelligible." Afterwards, he made slow but distinct progress though receiving no special guidance beyond that at home and at an elementary school.

Colman strongly approved of the method employed by Hadden, but specified the need for a special instructor to be always with the child until he learned to speak properly.

Guthrie developed the above method. While pointing out that the patient must be taught to imitate by eye what he cannot do by ear, he emphasized the need to use other senses as well. The sense of touch could be used for gutturals by placing the patient's hand on the speaker's throat. By a study of the patient, it could be ascertained which sounds were most faultily pronounced. Monosyllabic sentences in which these sounds occurred both as initials and terminals were used and the patient made to reproduce them by the aid of the eye and touch. It was insisted that the sentences employed should be meaningless, otherwise the patient would learn them with ease in his own speech and cease to take pains to reproduce them carefully. Guthrie also advised exercises to train the visual memory and the cultivation of the ear by systematic musical training.

It is difficult to suggest a general method of education for use in all cases of congenital word-deafness as individual defects and tendencies must be considered as well as the fundamental defect, but the following outline of the principles to be followed might serve as a basis upon which to build up a scheme of treatment for the individual case.

'(1) Training in articulation is carried out by sight and touch.
(2) Lip-reading is taught as for deaf-mutes.
(3) The ear is cultivated, as far as possible, by getting the patient to associate the correct sounds used to form words with the speaker's words as appreciated by sight and touch, and also with the sight of the objects named.
(4) Teaching in a class for deaf-mutes is to be avoided if possible and a personal instructor is to be employed, to be in daily contact with the patient
until he has progressed far enough to understand speech and to use spoken language well enough to be intelligible.

(5) If the tendency to use a defective speech or to talk gibberish persists, the patient is to be isolated and kept in silence excepting during the periods of instruction. The tuition during this period of isolation is to be more intensive than in the ordinary case, and isolation is to be terminated only when the patient can and will use his recently acquired methods of articulation sufficiently well in his attempts at conversation to make his speech intelligible.

(6) When the use of speech and the understanding of spoken language have progressed far enough, the teaching of reading and writing by a personal instructor using a similar synthetic method is to be proceeded with. This is necessary because of the possible presence of a complicating defect in the visual field such as occurred in our own patient.

(7) As much advantage as possible should be taken of the patient's power to appreciate shape and form, to remember pictures and to use figures.

Having taught the patient to speak intelligibly, to understand spoken language and to read and write, it is possible to provide him with an education similar to that given to other children. In doing so, the methods to be employed must be so chosen as to make no use of the function in which he is deficient. To do so would simply lead to discouragement and the feeling of failure, together with their undesirable results. Speech, writing and reading improve and become normal according to the accounts of some of the cases in the literature, but there is rarely much improvement in the appreciation of spoken language by ear. Yearsley, however, succeeded to a certain extent in cultivating the auditory appreciation of the spoken word in his patient, and it is possible that in other cases there is some slight dormant ability to understand the significance of sounds, which can be developed to a certain extent by systematic training. As all degrees of the defect probably occur, from a limited inability to appreciate the significance of numbers or musical sounds to a complete inability to appreciate the significance of sounds at all, it is advisable to proceed with measures designed to cultivate the ear as long as possible in order to develop whatever latent function may exist.

The choice of a suitable occupation is next to be considered. This choice resolves itself into the recognition of such special abilities as the patient has in spite of his congenital defect, and the avoidance of any type of work which depends for its successful issue upon the appreciation of spoken language by ear. It is quite as important as, or even more important than, the use of correct methods in the elementary education of the individual. The defect precludes the possibility of success in certain fields of endeavour, and these must be carefully avoided if the patient is to be properly socialized and become a self-supporting and self-respecting economic unit. Vocational education adapted to the special abilities of the individual must follow the orthodox elementary education if the antisocial consequences of his defect are to be avoided.
SUMMARY AND CONCLUSIONS.

1. The condition known as congenital word-deafness is reviewed and discussed.

2. Attention is drawn to the varying nomenclature used since 1867 to describe the condition. The descriptive terms that have been applied to the resulting speech disorder gave no indication of the presence of defect in the auditory field.

3. The literature of the subject is reviewed and the various recorded cases discussed.

4. The clinical features of the defect are: incidence in boys much more frequently than in girls, a familial factor in about one-third of the cases, inability to appreciate the significance of spoken words, slight defects in the appreciation of written and printed symbols, absence of or defects in speech, and defects in writing and spelling resembling those in speech. These features occur in a child whose hearing and other functions are perfectly normal.

5. The condition is due primarily to a defect on a lower level of function than that which results in true aphasia and might be more correctly termed 'congenital auditory imperception.'

6. It is probably due to absence or defective development of the parts of the brain concerned in auditory reception, and the changes are bilateral in distribution.

7. The fundamental defect is inability to appreciate the significance of the spoken word (word-meaning-deafness) and the associated defects in speech, visual appreciation and writing are of the nature of a complicating aphasia of the type described by Head as 'verbal aphasia.'

8. Children suffering from the defect are potentially normal mentally, but because of their difficulty in understanding speech and their inability to express themselves intelligibly may be thought to be mentally defective. In a good environment they can become normal mentally, but in a poor environment and in the absence of sympathetic education they may become imbeciles from deprivation.

9. In some cases the psychological reaction of the patient to his disability, to society and to his vocation, if he has one, may be disordered and lead to antisocial behaviour and delinquencies.

10. Early diagnosis and education are essential. The method of education must be adapted to the individual as well as to the defect. Elementary education must be followed by vocational training for an occupation which makes use of such special abilities as the patient has and places as little stress as possible upon the function which is defective.

11. Because of the widespread distribution of the defects, education through channels other than the auditory is much more difficult than might be suggested by the apparent limitation of the defect to the auditory field.

12. Congenital word-deafness is relatively infrequent and much less
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common than congenital word-blindness; but the incidence of the condition in the general population is probably much greater than is suggested by the small number of cases reported in the literature.

13. In children who are slow in learning to speak, backward at school or apparently mentally defective, this condition should be excluded before a diagnosis of mental deficiency or defective intelligence is made.

14. Early investigation and diagnosis are necessary if special education is to produce good results. The later the condition is diagnosed and special education begun, the more difficult and less successful are attempts at the socialization of the patient.

REFERENCES.

2 Worster-Drought, C., and Allen, I. M., ibid. 1929, ix, 289.
3 Head, H., Brain, 1920, xliii, 87.
5 Ireland, quoted by Kerr (ref. No. 38).
12 Coen, R., Pathologie und Therapie der Sprachanomalien, Leipzig, 1886.
16 Wyllie, R., Disorders of Speech, Edinburgh, 1894, 122.
19 Gee, S., Medical Lectures and Clinical Aphorisms, London, 1902.
21 Town, C. H., The Psychological Clinic, 1911-12, v, 167.
27 Rutherford, W. J., ibid. 1911, i, 1348.
29 Burr, C. W., Pediatrics, 1912, xxiv, 137.
30 Levy, M., Rev. de Méd., 1911, xxxi, 496.
32 Jackson, Hughlings, Brain, 1915, xxxviii, 1.
34 Wallin, J. E. W., Clinical and Abnormal Psychology, Boston, 1927, p. 374.
Certain information relative to the subject has also been obtained from the following books and papers to which there is no direct reference in the text:—

Head, H., Brain, 1915, xxxviii, 1.
Henschen, S. E., Arch. of Neurol. and Psychiat., 1925, xiii, 226.
Kahlmann, F., Handbook of Mental Tests, Baltimore, 1922.
Stark, M. A., Brain, 1889-90, xii, 82.
CONGENITAL AUDITORY IMPERCEPTION (CONGENITAL WORD-DEAFNESS): AND ITS RELATION TO IDIOGLOSSIA AND OTHER SPEECH DEFECTS

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