"A PSYCHOLOGICAL STUDY OF THE SEQUELAE OF ENCEPHALITIS LETHARGICA IN CHILDREN."

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by

The Rev. JOHN COCHRANE MURDOCH CONN, M.A.

Minister of Kelvinside Old Church,
Glasgow.

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-1931-

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Case No.68. Age 11½ yrs.
I.A. at last test undetermined.
Severe Parkinsonianism present.

PREFATORY NOTE.

A Psychological Study of the Sequelae of Encephalitis Lethargica in Children, is a thesis embodying the results of a research carried out at the Royal Hospital for Sick Children, Yorkhill, Glasgow.

It was begun in 1923, and the actual testing was completed by the end of 1928. All the material has been collected and analysed by the writer, who is wholly responsible for the work as presented.

An attempt has been made to study intensively, over a period of years, a group of children who have suffered from encephalitis lethargica. Part I. A. deals with the intellectual changes that follow the disease, as judged by the response to certain well-known intelligence tests, repeated at varying intervals after the onset of the disease. Part I. B. is a study of the affective-conative changes. And Part II. aims at relating physical signs, symptoms, and sequelae to intelligence and conduct.

ACKNOWLEDGMENTS.

I desire to acknowledge my indebtedness to the Medical Research Council for a grant, which, though given to finance a larger investigation ("Intelligence and Disease"), enabled the present work to be carried out.

To Professor Leonard Findlay (Dept. of Paediatrics, Glasgow University), in whose medical wards, at the Royal Hospital for Sick Children, Glasgow, the observations were made, & much medical information about the cases obtained, I am deeply grateful; not only for his direction of the work, but also for his generous encouragement & constant interest.

It has been my good fortune to work under three Supervisors, in the Department of Psychology, Glasgow University:- Dr. Henry J. Watt, Dr. Shepherd Dawson, & Dr. Robert H. Thouless. To all of them I am deeply grateful, for guidance, ready counsel, valuable suggestions, & criticisms.

My obligation is greatest to Dr. Dawson for his unremitting & invaluable assistance. During six years of collaboration in psychological research, for the Medical Research Council, & the Scottish Council for Research in Education, I have learned from him anything I know about Statistical Method.

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INTRODUCTION.

Until recently the medical profession in the field of Pediatrics concentrated on the physical side of the child. The psychology of the sick child has been neglected or overlooked. Child Psychology is only 30 years old, & is only now becoming an applied science. Recently, many short studies have appeared, dealing with the psychological aspect of disease in childhood; but these have dealt with only a small group, or groups, of subjects, & the conclusions are necessarily unreliable because of the short period of time over which the enquiry lasted. The rise of child clinics & child-welfare work has created a new interest in the sick child from the psychological point of view. We want to know the relationship between disease & psychological well-being in the widest meaning of the term; including intellectual, emotional, moral and motor. Doctors and educationists are asking: "Does disease retard intellectual growth? And to what extent? Is the arrestment temporary, or permanent? What is the influence of the different diseases upon the developing mind? What illnesses, if any, modify or alter disposition and character? And what is the nature of the modification? " In every illness we should expect the psyche of the child to be affected in some way or

another/

another . Sometimes we shall perhaps find an emotional change , sometimes a behaviour change, sometimes an intellectual one, and sometimes two or more combined. The psychology of the sick child is a fertile and desirable field for study. A great deal may be brought to our knowledge both in the symptomatology and subsequently in the treatment of the various diseases of childhood, for there is much to indicate that each disease, or group of diseases, carries with it special psychological phenomena.

Dr. Terman's book, "The Intelligence of School Children", appeared in 1921. On page 151, he writes, -- (after dealing with the effect of adenoids on the intelligence) "Investigations on a larger scale should be made to determine the effect of intelligence, not only of adenoids, but also of such factors as malnutrition, chorea, loss of sleep, fatigue, hookworm, malaria, etc."

In June 1922, there was begun by the late Dr. Henry J. Watt, (Lecturer on Psychology, at Glasgow University) at the Royal Hospital for Sick Children, Glasgow, under the direction of Dr. Leonard Findlay, (Prof. of Pediatrics) an investigation into the intelligence of sick children. To what extent the writer's much respected teacher and master obtained the suggestion and the inspiration from the book quoted will never be known: suffice it to say that at the time of his death (1925), he & the present writer, were investigating on

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a large scale the problems to which Terman referred.

In June 1923, when the writer took up work at the hospital, a special study was being made, by another member of the hospital staff (Dr. Mary M. Stevenson), into "The Life History of Epidemic Encephalitis in the Child."(98) In addition to his ordinary work, he had the opportunity from time to time, of re-testing a few encephalitic cases in connection with the above inquiry. It soon became apparent that these showed mental deterioration. Consequently, he commenced making a systematic study of these, & additional cases: a study which has grown in completeness from year to year. Today, attention is chiefly focussed upon the personal consequences of encephalitis lethargica. For, in proportion to the number attacked, there is probably no other infectious or contagious disease in this country, which produces so much consequent ill-health & disablement. The results of the disease on children are certainly peculiar & deplorable in many cases. There is something diabolically malign in a disease which can transform a child of normal intelligence into a 'low grade' defective, & a well-behaved boy into a moral imbecile.

The purpose of this thesis is to record the results of an attempt to investigate the psychological after-effects of encephalitis lethargica in children. The number of cases is not so great, nor is the investigation so comprehensive throughout as could be wished, but there is much to commend its publication in its present form.

Since some earlier findings were published in 1926,(21) the inquiry has been continued & broadened, & is now more complete & comprehensive.

In/

In the examination of mental traits we are still far from the exactness & objectivity of the physical sciences; yet despite their weaknesses, the now well known intelligence tests have an objectivity which places them above the opinions of casual observers, in value. We have many times had members of the hospital staff differ greatly in their estimate of a patient's intelligence. Very little reliance, therefore, can be placed on those references in the literature dealing with the subject under investigation, where the differences noted are due to personal opinion. When one observer, for instance, reaches the conviction that a patient's memory is impaired, & another equally competent observer is just as certain that it is unimpaired,- as frequently happens,- it becomes essential that we abandon random casual observation in favour of more careful, precise, & systematic observation. We have no comparable measuring scale for intellect such as we have for height & weight; but we are moving towards it. When we obtain such a scale we shall no more score a child a "mental age 124 months", than we should think of scoring him a "height or weight age 124 months."

Recently some advance in this direction has been made, & it is desirable that this progress should show itself in observations on the memory, intelligence, emotional disposition, etc., of patients whose ailments are being subjected to scientific examination. Mental tests were ~~first invented~~ and used by Sir Francis Galton(1883), who, up till then, had given mental measurement its greatest impetus.

For/

For twenty years thereafter, the tests used were generally for the measuring of specific abilities and capacities. Tests were devised to test different kinds of memory, attention, imagination etc.. A science of intelligence testing has gradually replaced intuitive art; with the result that today, largely as the result of Binet's work, intelligence tests are no longer a novelty, but are used as a matter of course in schools, courts, hospitals, etc.. "No wonder," Dr. Terman writes, "mentality tests have acquired such a wide vogue. They have demonstrated their usefulness in the study of the feeble-minded, in the grading of school children, in determining the mental responsibility of offenders, & in the selection of employees." Their wider application is only a matter of time.

The prediction made by Francis Galton fifty odd years ago,- that it would sometime be possible to obtain a general knowledge of the intellectual capacities of man,- is being realised today. Twenty years have seen the foundation of a new science. Thanks to the impetus given by Binet (1905), we can now measure in a fairly satisfactory way one of the factors making up human personality,- intelligence. Binet brought into his well known scale of intelligence tests the very ideas which stood out in popular opinion of intelligence. His work had from the outset a decidedly practical turn. Binet himself

applied/

applied his scale to particular types of insanity (1909). He investigated the intelligence of general paralytics and senile dements. His efforts were at first largely devoted to the measurement of the higher and more complex processes, e.g. reasoning, imagination, etc.

The purpose of the scale is to measure "general intelligence." The scale consists of a miscellaneous collection of exercises, --"tests of memory, language, comprehension, size of vocabulary, eye-hand coordinations, judgment, reasoning, resourcefulness, and ingenuity in difficult practical situations, ability to detect absurdities, etc." (Intelligence of School Children) -- which require for their performance, knowledge and skill that a normal child in a normal environment acquires in fairly well-marked stages.

The Binet tests as translated by Burt[10] (which were used in the present investigation,) are by no means perfect, but they are in general use and have been well standardised for English children. Repeated testing has shown which tests are performed successfully by children of different ages, and they have been arranged as far as possible in order of difficulty. The tests are believed to test "intelligence" as distinct from "knowledge." Stern's definition is the generally accepted one: "General intelligence is the ability of the organism to adjust itself adequately to new situations." Auguste Comte had

already defined intelligence as nothing but, "the aptitude for modifying one's behaviour in accordance with the circumstances of each case." Intelligence may mean and include a great deal, but it does not comprise the whole mind. It is only one of many mental abilities of the mind. It is difficult to say what qualities any test measures, but at the best it will test only certain aspects of the mind. Non-intellectual aspects of mentality, (e.g. temperament, character, etc.) are not tested by the intelligence tests. This statement is neccessary in the light of what follows.

These Intelligence tests are loosely and erroneously called 'mental tests.' When a child of n years passes those tests which are passed by normal or average children of x years, he is said to have a 'mental age' (M.A.) of x years. Binet himself contributed the 'mental age' concept. It is an absolute measure. Further, it is limited in scope, being of no use for adults or very superior children. It merely indicates the level of development reached; it does not tell us whether a child is bright, dull, or average. Moreover, if interpreted in the wider and truer sense it should include knowledge, whereas we have just seen that the purpose of the tests is to exclude knowledge. We purpose substituting therefore for the concept of "mental age" that of "intelligence age" (I.A.).

About 1912 a group of German psychologists employing the Binet Scale expressed dissatisfaction with ~~kkk~~ Binet's method of expressing intelligence retardation in terms of the absolute difference between age & mental age. Bobertag proposed to use the ratio of the two (physical or chronological age (C.A.), & mental age (M.A.)), as a more adequate expression of retardation. This was termed the "intelligence quotient"(I.Q.).(Bobertag gives Wm. Stern the credit for devising & naming this device, but Stern acknowledges his indebtedness to Bobertag.(23)). Stern(94) is also credited with proposing the term 'mental quotient". He was also one of the first to propose the use of the term "ratio," denoting the ratio of the I.A. to the C.A. rather than the difference. The I.Q., the concept which German champions, is not so much a quotient as the ratio the intelligence age bears to the actual age. $I.Q. = \frac{I.A. \times 100}{C.A.}$.
Otis designates it the "Absolute Intelligence Quotient." Yerkes uses "Intelligence Coefficient."(95) "Mental Ratio" is a truer designation. But, since we have seen fit to substitute the term "Intelligence Age"(I.A.) for "Mental Age" (M.A.), here also we must substitute "Intelligence Ratio"(I.R.) for "Mental Ratio"(M.R.), for the same reason. We have failed to find the term I.R. used in the literature. One writer, Florence Mateer, entitles an article "The Diagnostic Fallibility of Intelligence Ratios," but in the context uses M.A./

M.A. and I.Q. (Ped. Sem. XXV, 1918, p. 385). The I.R. makes possible direct comparison of children of different C.A.s, and it is a basis for prediction.

THE CONSTANCY OF THE I.R.

In so much as our own findings in the present enquiry are, in part, the result of comparing the first I.R. with that of successive I.R.'s of retests at varying intervals, it is essential at this point to discuss in some detail the problem of the constancy of the I.R. If the I.R. is to have any diagnostic value, we cannot just assume that the I.R. remains constant: - in other words, - that the child's I.A. increases proportionately with his C.A., or that $\frac{\text{I.A.}}{\text{C.A.}}$ = a constant.

If this assumption be valid we can calculate the I.A. that a child of given I.R. should reach after a given interval.

Suppose two children with I.R.s 75 and 100 to be retested at the end of a year; and suppose that the I.A. of each rises by nine months, then the first child is developing normally, for the increase in his I.A. in twelve months should be 75% of 12 which is 9; the other child is actually developing more slowly than he ought, for, as his I.R. was 100, his I.A. should in twelve months increase 100% of 12: he has, in fact, fallen three months below the level of normal development. Hence the significance of an increase or decrease of I.A. depends both on the length of the interval between the tests & on the actual magnitude of the initial I.R.

Statistical studies have shown that, on the whole, the I.R. remains relatively constant from one test to another. But owing to the variability of the Scales employed (sometimes two Scales were used), the conditions under which the tests were given, the interval between the tests, together with the number of subjects tested & re-tested, the chronological age range, the group means, the number of examiners employed, it is difficult to arrive at anything more than a very general estimate of the constancy of the I.R. from these studies. The central tendency of the changes, ranges for the different inquiries, from a decrease of 2.3 (Terman) to an increase of 1.6 (Pugg & Colloton). The Terman re-tests were made under an extraordinary variety of conditions. Yet the results show that their combined influence is in most cases small. The I.R. remained equally constant for the three groups (bright, average, dull) between the ages 3 or 4, & 14 or 15 years. "It makes little difference whether the child was bright, average, or dull; how long an interval separated the tests; or what the age of the child was at the earlier test." (The Intelligence of School Children, p .138). "The chance that a child I.R. 85, will later test 73, is 1 in 40." (ibid 149) These figures approximate to the means at first & last tests of our cases considered in the group. Elsewhere Terman says, ("The Measurement of Intelligence" p. 63),"Retests of children have been found to yield I.R. results almost identical with those secured from 2 to 4 years earlier by the same tests. The average difference found between the I.R. second test & the I.R. first test was only four/

four points (4%), & the greatest difference found was only 8%." There is a fairly close agreement between Terman's results & those of Gray & Marsden(33), Garrison & Poull(29), Pugg & Colloton(82). Gray & Marsden found that,"602 of the 665 tests were again passed (90.5%), & conclude: "This shows a high probability that any test passed successfully in one year, will be passed the following year. At least 90% of the children are correctly classified by the first test.""There seems to be no very marked difference of variability, or of median change in I.F."" The diagnostic value of the tests is high." Baldwin & Stecher conclude: "For practical purposes the I.F. remains sufficiently constant for a group as a whole, but the individual records show fluctuations which are smoothed out in obtaining general averages." (Journal of Educational Research VolViii, No.4. Nov. 1923, p.375). Kluver (Psychological Clinic,XVl. No's. 3 & 4, 1925. p.110-16) writes: "Re-tests of the same children show that the I.F. varies within certain limits, which are however, in most cases, so narrow, that practically one can speak of constancy. Changes to such an extent that pronounced sub-normality becomes normality, or normality super-normality, or vice-versa, hardly ever occur." Irwin & Marks,("Fitting the School to the Child" 1924 p.98) say: "The I.F. does not fluctuate sufficiently to demand frequent re-testing." Huhlmann ("Journal of Applied Psychology", V. 1921, p.195), maintains that the course of the I.F. is roughly a straight line. And Poull adds, ("Journal of Educational Psychology," Xll,1921. p.323) "The indication is that mental defectives are not more variable than normal subjects."

I.R. FLUCTUATION.

The I.R. does fluctuate slightly, but not sufficiently to invalidate the general argument. Certain factors prevent the I.R. from being mathematically constant in retestings, and are always present to invalidate any individual test result. Changes in I.R. from test to test may be due to any one, or more than one, of the following:- A. The inadequacy of the measuring scale,- the imperfections in the scale; the erroneous age assignment of the tests; the nature of the tests themselves; the subjective character of parts of the tests; the weakness of the tests at the upper end of the scale; the difficulty of the later tests (the inadequacy of the tests in the upper end of the scale is acknowledged by Terman ("Mental & Physical Traits of a Thousand Gifted Children"). Dr. Burt has also found the tests too difficult for English children); the "all or none" method of scoring (half passes not counting); the difference in size of the intelligence age steps ; the different month values of the individual tests (one twelfth to six twelfths of a year). For example, to quote Gray's and

Marsden's/

Marsden's[23] example: "a child with a 100 I.R. needs to add twelve months to his C.A. in a year to get and an I.R. of 100 the following year: while a child with an I.R. 111, needs to add $\frac{111 \times 12}{100}$ = 13.32months in a year to maintain a perfectly constant I.R. As a child cannot score precisely this extra amount under any circumstances his I.R. is bound to show a small variation." (p. 316). And again from the same writers:

"Or to look at the matter another way. Suppose a child with C.A. at first test 144months, and I.A. 160months; then the I.R. = $\frac{160 \times 100}{144}$ = 111. If the child passes the next year, three tests at XIV years, his I.A. becomes 172, and his I.R. will be 110;/ & if 4 extra tests are passed the I.R. becomes 113." The greater the scatter the greater the effect.

If the I.R. of a child of 8 years, -- and who is two years retarded, -- is to remain constant, he must be three years retarded at 12years of age, and four years at 16. In other words for the I.R. to remain constant the child's intelligence must grow at a rate proportionate to his I.R. In the case of a very superior child of 12 or 14 years, the I.R. thereafter cannot maintain its constancy because of the weakness of the scale itself.

B. Dr. E. A. Lincoln has pointed out (Jour.Educ,Psych. Nov. '22, p. 484): "An I.R. cannot be constant, when the conditions under which the child is tested are variable from very necessity."

These variable conditions include the administration of the tests, errors in giving and scoring, thoroughness of the examination, difference in interpretation of test results, the examiner's methods, his personality & mood at time of examination, & the number of examiners.

C. Variability of the subject's cooperation due to attitude during examination, fatigue, changes in the environment; irregularity in the rate of mental development, due to illness & disease. It is well known that the I.Q.s of neurotic & psychopathic children are less constant than those of normals. Our own results confirm those of Terman (101) when he writes: "In certain types of pathological subjects the I.Q. may undergo large fluctuations. Epileptics, for instance, frequently deteriorate from something like normality to middle grade deficiency in the course of a few years."(p.150). We have found the same thing[22] so has Burt.(10. p.154)

There are several influences which may be thought to have an effect upon our test results:-

(1) The effect of different examiners.

What can be said on this point has only an indirect bearing on the present enquiry in which the testing was performed by the same person. Hildreth (46) found a coefficient of correlation of .789 ±.012 when each examination of a pair was performed by different examiners, & a coefficient of correlation of

.871 ±.007≠ when each was performed by the same examiner. Terman (101) found the correlation between tests made by different examiners to be .929. Gray & Marsden (33) concluded from their data that,"the figures obtained by different examiners in testing the same subjects show close agreement." "The agreement is remarkable." We may conclude that the tests when performed by the same person should be very reliable.

(2) The effect of interval between tests & scores.

Terman believes that the interval between the tests makes little difference. He found(99) that,"A group of subjects tested on two successive days (by one of his students) shows almost as large,& as frequent, I.Q. changes as tests separated by a year." And again:(101)"Tests separated by more than five years show a greater tendency towards increase of I.Q. than is the case with shorter intervals." Cuneo & Terman(101) write: "Retests agree closely with the first test whether performed 2 days, 6 months, or 2 years later." Hildreth(46) found "little difference in the amount of variation in test results when the time-interval is under three years." Odell (Jour. Educ. Psycho. XVI, 1925) says:"Whether the earlier testing has occurred within the past year, or previous to that time, appears to make little difference." Finally, Gray & Marsden(35) found, "little diminution in

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≠ Here & throughout this thesis the value that follows the sign ± is the 'probable error' of the value which precedes it.

the correlation coefficient with the lengthening of the interval between the tests." Their figures show only a slightly diminishing correlation as the interval between the testings increases. As they point out, this may be due to some extent to the later tests being too difficult; or it may also be due, partly, to the growth of intelligence ceasing at different ages in different persons.

(3) **The effect of practice.** Practice effect is difficult to gauge: much depends on the interval between the Tests.

Garrison (Jour.Educ.Psych., XIII, 1922, 307) is of the opinion that "a slight practice effect is evident."

Odell (Jour.Educ.Psych., XVI, 1925) writes: "That on the whole there is a well-marked tendency for the median score of those who had never been tested before to be somewhat lower than the medians of those who had taken intelligence tests previously.... . For the total group the superiority of those who had been tested at some previous time was slightly more than 2 points (2% I.Q.).

Terman(101) found little change in individual tests as the result of practice. "It is rather surprising that children profit little in a retest from their experience in the first test. One would naturally expect," he writes, "a considerable improvement due to their feeling more at ease and the

opportunity to think over their earlier mistakes & correct them. However, this advantage yields the child, on the average, only 2 or 3 points in I.Q., even when the test is repeated within a few days." Cuneo & Terman[19] write: "It appears memory of a previous test has no appreciable influence after the lapse of a few months, & that the effect is negligible even after an interval of only 2 days (with younger children)." The most conclusive finding on this point is that of Gray & Marsden:[34] "Practice once a year appears to have very little effect on the I.Q.... The same wrong answer is very frequently given in successive years. Little is remembered of a test from year to year." In any case, so far as the present inquiry is concerned, any 'practice effect' is favourable to the patients, & only makes the re-test results higher than they should be.

(4). <u>The Effect of Chronological Age upon Test Results.</u>

Is age a factor determining I.R. changes? Do the tests have a varying accuracy at different C.A. levels throughout the scale? Does the I.R. remain constant for all ages? Huhlmann (Jour.of Applied Psycho. V. No.3 1921) says: "The tendency to deteriorate is definitely related to age. The loss in M.A. occurs more frequently with the older cases." Hildreth[46] found, " in young children,-3 to 5 year group, & 6 to 8 years of age at first test,- a greater tendency towards increase than to decrease in I.Q. Children in the 9 to 11 years group, showed results very similar to the total. For the children over 12 years at first test,the variations are not over four points in either direction,for the middle 50% of the cases, & the central tendency of/

changes is .42 ."

(5) The effect of grade or initial I.R. on retest results:

Is the intelligence growth curve the same in form for all grades of intelligence? Is grade a factor determining I.R. changes?

Hildreth (46) believes "there is a greater tendency to positive increase when the I.Q. on the retest is between 80 & 109, than in any higher level." Anderson (1) found that "the highest initial I.Q. showed the greatest loss" (mentally defective children): and Huhlmann (Jour. of Applied Psychol. III, 1921) that, "the I.Q. decreased more with the higher grades than the lower." Pugg & Colloton (82),on the contrary, maintain that,"differences in degree of intelligence seem not to be a factor. The differences in retests will be approximately the same irrespective of intelligence."

Undoubtedly the best work done to date,relative to this & other questions dealt with in this chapter, is that of Gray & Marsden (33). Let us hear what they say: "Neither P.A., nor I.Q. group, nor M.A., nor interval between the tests, appear to have an influence on the change of I.Q. in any marked degree."

In what follows then, we are assuming that the mean I.R. of any <u>normal group</u> at a first test, will be found to be the same at all successive tests, in spite of fluctuations in <u>individual cases</u>, due to any of the factors mentioned.

PROCEDURE.

This strange malady known as epidemic or lethargic encephalitis first appeared in Glasgow during the early months of 1918. The earliest cases included in this study were brought to the Royal Hospital for Sick Children in March of that year, and the succeeding months. The largest number of our cases were admitted in 1920, '23, and '24. In all eighty-three cases have passed through the Hospital since 1918 to 1927. It is from these that the fifty-five forming the basis of the present study have been drawn.≠

Many of these cases have been reported by Prof. Findlay(27)) Findlay & Shiskin(26): Anderson,(2) and Stevenson(97). The last work particularly is closely related to the present study.

It became apparent, as time went on, that the most serious aspect of this "new disease" was the development of sequelae. These may develop months or years after the onset of the disease. And, as Dr. Stevenson says(98), "after 8 years it is apparent that no limit to the possible developments is yet known."

As many as possible of these cases have been seen at regular intervals and examined by the writer up to the end of 1928.

≠The group is in no way selected;& though small may be regarded as a representative one,including as it does both severe & not-severe cases,bed-cases,& children now attending ordinary schools,as well as some attending 'special' schools, some who are working, & some who are inmates in institutions of one kind or another.

All the first tests were given in the hospital, as soon as possible after the acute stage of the illness had passed. Two of these (cases 56 & 72) were conducted while the children were acutely ill, & have been omitted from the statistical analysis. As this stage of the disease is marked by lethargy & mental dullness, the only effect of this precaution is to raise the I.R. at the first test, presumably nearer to what it was before the onset of the disease. The examination was given in the absence of the parent, & under ideal conditions of quiet & privacy. Moreover, an acquaintanceship had been established with the child, usually some days before the actual examination took place, & in no instance was the test incomplete. The test was always given at one sitting, lasting roughly from forty to fifty minutes; a little longer being required because the child was tested in bed. Early onset of fatigue is characteristic of some of the cases, at later tests, but we do not think this factor has, to any great extent, influenced the results. Many of the more difficult tests were given to the child early in the examination, before undue fatigue could have set in. Besides, cognisance was given to this eventuality, & due allowance made. Some doubtful cases have been excluded, leaving a group of 55. The diagnosis in two of these cases is still rather doubtful (No.s 83 & 87). In none of these was there any history or appearance of an associated disease. Of the 55, 53 were tested twice, 41 three times, 28 four times, 17 five times, 2 six times, & 1 seven times. (197 tests in all).

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With regard to some of the re-tests the conditions of the testing were not so stable. The majority, however, were again tested in the same room under similar conditions, with one of the parents, -- who had brought the child back to hospital for the purpose, -- sitting outside. Several cases had early become bed-ridden and had to be visited and examined at their homes; while a few were examined sometimes privately, sometimes in the presence of others, in one institution or another, to which they had been removed. As the study proceeded fewer of the children were able, or willing, to come to hospital to be tested, and consequently had to be visited. Not only did it take longer to get at the children as time went on, -- on account of removals to new homes or institutions, -- but as a result of the progressive nature of the physical and mental sequelae, the actual testing was greatly prolonged, and was in some cases very difficult, and in a few quite impossible. These latter were unable to sit up in bed, talk or move their arms, and a squeeze of the hand, or a blinking of the eye-lid etc., had to suffice for an answer to the test. These factors have all been taken into account and no incomplete, or at any rate doubtful, test result has been included or allowed to invalidate the general findings. The inability of many to meet the travelling expenses (for our cases are gathered from all quarters), or to afford the time away from the home, or even

to get away for one reason or another, -- were the common reason given for non-attendance with the child at hospital. Frequently as many as three and four letters had to be written before the child was ultimately tested. The whole-hearted willingness to cooperate with us, on the part of many parents, was wonderful, despite the fact that they knew, or saw, that we could do, or were doing, nothing to benefit the child. One or two, year after year, have travelled long distances to keep appointments, and some have by letter and otherwise thanked us for our interest and wished us success in our work.

It may be suggested that when the test is given to the child in bed both the actual response and the time taken to perform the test will be interfered with. As Binet set time-limits to some of the tests it might be asked: "What did you do when re-testing the later cases many of whom had become lethargic and displayed greater or lesser motor disturbances?" In order to meet the slowing down of the patient's responses, the time limit was extended, indeed in some instances quite neglected, when delay seemed to be due to this cause. As a time-limit only increases the difficulty of a test, the only effect of an extension is to improve the child's estimated intelligence status, which, as we shall see, merely strengthens the conclusions arrived at in our inquiry. Our own impression is that any existent motor disturbance is no handicap, -- an impression which is

confirmed by comparing the group showing this symptom (Parkinsonian syndrome, see p. 227) with the others. Despite the fact that at first sight, -- and to all appearance, -- the former look much lower intellectually, closer and longer observation proves this opinion to be erroneous. No other modification was made in the procedure recommended.

There is still another possible criticism. The assumption underlying the success of the Binet tests is that a normal child in a normal environment will at a given age reach a certain stage of intellectual development, and that if a child reaches this stage earlier (or later) than the average child, it is because he is of superior (or inferior) intelligence. If the environment be abnormal the results of the tests are so far fallacious. The difficulty is to determine what is a normal and what an abnormal environment. A normal environment as required by the tests themselves may be defined as one in which the growing child is allowed to read, write, count, handle money, enjoy the ordinary opportunities of receiving instruction, and of play. It may be objected that a child suffering from the after-effects of encephalitis lethargica will not have the same opportunities as ordinary healthy children, and so his intelligence will be under-rated. This criticism is not so serious as may at first sight appear. Of our total cases, 34 have attended school at some period since their

illness, and 21 are still attending a school - ordinary or special, - 23 have now left school. Of these last, 5 are now working, & 5 others have been employed. The others run about at home, and in the streets, and even those confined in institutions have the advantages of social intercourse, and in some cases, when able to profit by the same, -- receive educational instruction there. There are some who are now shop-message-boys; some who go their mother's errands; and some who are too low intellectually to handle money: but all receive every encouragement from their parents and fellows to return to normality.

P A R T. I.

DISTURBANCES OF MENTALITY.

A. Intellectual Changes.

PART I.

DISTURBANCES OF MENTALITY.

A. Mental changes.

The manifestations and sequelae of encephalitis lethargica are varied, and liable to change in nature and severity with time. But at any one time distubbances of mentality will be found to be the commonest and most striking of the after-effects of chronic epidemic encephalitis. The mental changes, especially in children, are very important. The fact that the sequelae vary very enormously in form and intensity suggests that encephalitis lethargica may disturb any mental function. The mental changes vary from slight loss of emotional control or slowness of mental response to acute dementia or idiocy.(77)

Howell found(49) "Mental changes or some alteration in character constituted the commonest residual symptoms noted in 18 out of 34 patients (53%). The severity varied from loss of emotional control to dementia."

Saunders - Jacobs(87) from a study of 100 children whose ages ranged from 5 - 15 years, found the mental sequelae "to vary from slight alterations in disposition and behaviour, to acute homicidal insanity."

Says Buzzard:(12) "Experience has taught us that many defects of function on the part of the higher centres follow encephalitis lethargica:- lack of concentration and decision, depression, restlessness, alteration of mental capacity, change in

behaviour and adaptation, loss of moral sense."

Shrubsall[88] mentions the following residual symptoms or sequelae:- character changes, mental hebetude, failure of intellectual development, or even acute mental disorder.

Depression, melancholia, apathy, mania, pathological optimism, mental deficiency, loss of memory, inability to concentrate, change of disposition, (which is always for the worse) and conduct changes, are among the most frequently occurring. (12)(24)(38)(75).

Cloake, (quoted by Shrubsall[88]) has described the symptoms of cerebral damage as including: (1) The narrowing and weakening of the mental capacity and field of thought; the remoter associations being lost with a consequential diminution of the power of reasoning, especially where intricate associations are necessary. (2) Slowing up of the stream of thought. (2) Weakening of the power of attention, and hence impairment of the memory for recent events. (3) Slowing up of the stream of thought. (4) Rapid mental apathy. (5) Impairment of inhibitions especially of instinctive processes; the latter showing itself in conduct disturbances.

Coombs[17] writes:"Here is a disease, or group of diseases, probCoombs[17]tive in origin, capable of leaving behind very serious depreciation of the higher functions of the brain," and, he adds, it has a "possible bearing on the sources of some forms

of mental deficiency."

Stevenson[97] found mental changes to be the most frequent of the later symptoms among children. And from the references in the literature it would also appear that disturbances of mentality are more serious in children.[55].

Hall found[39] "Children and young people (under 18) (89.4% of the group) showed a rather greater liability to mental affection than did the patients of adult years."

Coulter[18] "The cases in children seem to have resulted in the most havoc, for the greatest destruction to the mental and nervous apparatus is found in the children."

Duncan[24] found that the percentage of his cases with mental sequelae was about the same for all ages, but that children of ages 1 - 10 years were more liable to severe mental after-effects." He studied 83 cases who could be followed at least eighteen months after the onset. He found the mental sequelae to "vary from minor defects, such as impairment of memory and alteration of sleep rhythm, to more severe conditions, such as neuroses, mental deficiency, and insanity. Among 78 patients, apparently permanent mental sequelae were found in 56, or 72%."

Purser[75], Riddoch[77], and Auden,[3] also state that a large proportion of their cases were children and adolescents.

Mental disorders varying from defective memory or

emotional instability, to moral degradation and dementia, were found in nearly seven-tenths of Riddoch's patients (ibid. p.1084).

Abrahamson[78] found mental sequelae in 50%.

Wimmer[109] stated that of 25 children attacked 11 died, 2 were untraced, and the remaining 12 all showed pronounced psychological changes.

Grossman[36] out of 89 cases found over 50% with mental abnormalities, and Hall commenting on these figures said that slight changes were probably present in many more.

Hallowell[40] concludes from her study: "The psychological examination in 71% of cases seems to reveal some abnormality, either feeble-mindedness, hyperkinesis, or abnormal slowness."

Paterson & Spence[71] selected 25 cases, ages three months to eleven years, and after excluding all patients who, before the onset of the illness, were not of normal health or intelligence, concluded that in the majority of cases encephalitis in children is followed by permanent after-effects, either physical or mental. In only 25% was recovery complete. Among the 24 surviving cases the mental condition was affected in 18 (75%). Of these, 7 are grossly M.D., and in a state of permanent and hopeless idiocy. Others show minor degrees of mental derangement. In other words, they found mental changes of varying degree; from mild deterioration to complete idiocy.

Collin & Réquin[15] found that the typical psychic sequelae

after encephalitis in small children, is mental backwardness, which may be as severe as idiocy. Distubbances of character are not marked. Children who were about 7 years old have also arrested mental development and disturbances of character, while in older children (up to 17 years) mental deterioration though almost constant is less pronounced than the changes of character.

Glen,(30) reporting on 6 cases of encephalitis in children, found "altered mental characteristics and abnormal behaviour constituted a prominent feature of the cases."

Shrubsall(88) "In childhood the check in mental growth and weakening of inhibitions are the most marked features."

The foregoing data indicate, that of children attacked by encephalitis about 50 - 70% of survivors show some psychological changes.

Note:

The Annual Report of the Chief Medical Officer of the Board of Education (1924) states that 26.4% exhibited some degree of mental change. And in more than half this number of English School Children, the mental changes were severe.
Of 134 children admitted to Winchmore Hill between November 1925 & Dec. '26, mental changes were reported in 75 (56%).
In the Medical Research Council Report of the Shieffield Epidemic 1924, mental changes are reported in 53, or 21.1%. (interval between onset & review was short).

DISORDERS OF SPECIAL MENTAL FUNCTIONS:

I. INTELLECTUAL CHANGES:

If we disregard the few cases in children suffering from definite mental disease, the mental changes following encephalitis may be divided into intellectual, emotional, and moral.

Despite the rapid yearly increase of literature on the after-effects of encephalitis, little work of any real value has yet appeared dealing scientifically with the intellectual changes of the disease. Intelligence tests have been used, but for the most part casually, and apparently with some diffidence. No sufficiently definite and comprehensive investigation has up to the present been made with a large group over a period of years. We have already pointed out the inadvisability of arriving at an estimate of intellectual capacity from random observation and general opinion. It is necessary to add, that while scientific measurement of intelligence is better than mere impression, nevertheless it is equally fallacious to arrive at a general conclusion from the scientific examination of a very few cases, examined once, or even twice, or even a large group tested at varying intervals after the onset of the disease, the individuals of which have never been re-tested at all. The conflicting statements appearing in the literature are to be considered in the light of the foregoing remarks. Is it necessary to add that some psychological

knowledge and expertness in intelligence testing is a pre-requisite.?

Considering the possible toxic origin of the disease, & the severity of the infection as judged by the early and late physical and mental sequelae, one might expect considerable defect to be found in the field of intellect.

Hill[47] reporting on 67 cases gives case histories of 3 individuals, in 2 of whom the I.A. is stated (in years). Of one of these cases he writes as follows: "Her intelligence is normal. A recent Binet Simon test shows her at least up to her age standard, while a similar test done at the age of 9 years (onset) gave her I.A. as 11+." It is obvious, of course, that there is deterioration here for the I.R. drops from 122+, to apparently 100(after an interval of 2 years). 5 cases showed serious mental retardation (only 1 definitely feeble-minded), and 5 were mentally normal. He concludes: "The patients never suffer from a gross defect in intelligence. In nearly all, the parents say with certainty that no falling off in general intelligence was apparent to them."

Anderson[2] states that the children "do not suffer serious mental defect."

Hall[39] "Though the I.Q. as measured by Stoddart's modification of the Binet-Simon tests, was found to be very much below normal in several cases, it was difficult to

determine whether any actual impairment of intelligence was present, since the poor response to a test might be accounted for by the derangement of attention, or by bradykinesia and bradyphrenia of the patient, -- the first preventing adequate continuity of concentration, the second group of factors causing rapid fatigue, and disinclination for mental effort generally. Any defect of intelligence so recorded, therefore, would appear to be rather of a functional character than to be due to any organic brain involvement."

Dr. Potts (in the discussion that followed Dr. Marshall's paper[73]) said that "in the later stages there was no loss of intelligence although there was always in children a failure of other mental faculties to develop and sometimes an actual regression."

Robin[79] concluded from a study of 7 children (7 - 15 yrs) that while "backwardness in learning was one of the symptoms which made its appearance for the first time in a subject previously normal,"..."there was no intellectual enfeeblement."

Bonhoeffer[8] found no intellectual defect in any of his cases.

Leahy & Sands[59] give two I.R.s of a group of 6 cases studied, whose ages ranged from 5 - 14½ years:- Case I., C.A. 8, and I.R. 100, when tested <u>one month</u> after admission to hospital: Case II. C.A. 8½ I.A. 6yrs, 4mths.

I.R. 79 (said to have been bright at school before illness): tested six months after onset. The remaining cases are said to have no intelligence defect, but no I.R.s are given.

Beverley & Sherman(7) give the I.R.s of 2 cases. Case I. C.A. 11, I.A. 8:10, I.R. 78-: re-tested after six months interval, and showed "no evidence of mental deterioration." Case II. C.A. 13, I.A. 11:6, I.R. 86. Re-tested two years later I.A. 15:4, I.R. 99,-"no deterioration in intelligence"- and conclude: "The psychologic examination gives no evidence of deterioration of intelligence. .... The general impression after observing their behaviour in the examination room is that the intelligence is low. The childish mannerisms, ... the appearance of deterioration, are in marked contrast with the high rating obtained by intelligence tests."

Kennedy(54) reports the case of a boy age 10, whose I.A. tested by Stanford Revision of the Binet-Simon tests, was normal, having an I.R. of 100. Yet, in spite of this result, we are told the boy was at a school for the feeble-minded.

Hohman(48) gives the I.R. in 1 of 11 cases studied. He is a boy age 12, onset 1919: I.R. March 1921 was 87; I.R. at second test (presumably date of publication) was 100.

Glen(30) reports on 6 cases admitted to the Darenth Training Colony. Apparently all were tested by the Binet-Simon method, although only one I.R., is given. Case II, who gained

several distinctions for ability before her illness, had an I.R. of 71 when examined one year after onset, & C.A.15years. "Now mental faculties show marked impairment." Another case (No.3) age 9 years at onset, when re-tested 3 months later, was reported to be mentally normal. But when examined again 4 years after onset the "mental powers showed marked deterioration." This patient also previous to the illness had gained several distinctions at school. The other 4 cases are said to be intellectually normal: (No.1 onset 11 years examined one year later; No.4 onset at 14 years & examined 2 years later; No.5 onset at 11 years & examined 3 years later; No.6 onset at 11 years & examined 5 years later). Other writers,- with equally good reason for doing so,- are just as emphatic that intellectual deterioration is found. Buzzard(12) admits a progressive mental deterioration in a few children. Alterations in the intellectual capacity are also noted by Naville(66). Three cases described by Jordana(52) six years, nine years, & thirteen years of age respectively, "had not developed mentally to keep pace with their apparently normal physical growth." Saunders-Jacobs(87) found from her study of 100 children ranging from five to fifteen years of age, varying degrees of impairment.

"A large proportion of them are quite intelligent... Some of them must,however,be definitely classed as mentally defective." Duncan[24] also found various degrees of mental deficiency. Kwindt[58] applied standard tests to 13 young patients,& found 6 of them normal, 4 one year behind, & 3 two years behind. Jewesbury[51] describes the case of a girl age 10, who,although at the time of her illness was mentally very clear, is now distinctly backward. She attends a 'special' school, & the authorities there regard her as a very backward child. Hamel & Merland[41] are of opinion that in their cases, "there is arrest of psychic development with loss of power to acquire further knowledge. The actual state which presents itself is one of dementia." Herd[45] formed the same opinion from his cases. Auden[3] found among 64 cases of children 5 to 15 years of age, that 29 cases(45.3%) suffered from reduced intelligence. Cruchet (Brit. Med. Jour. 1:1028, June 8, 1929) reports a case age 10 at onset (1920), who before his illness was, if anything, mentally advanced for his age: now he was rather backward: his intelligence appeared to have slackened: his words were those of a child younger than himself: his mental state became increasingly unsatisfactory. Four years later (age 14), it was found impossible to teach him a trade. The mother said:"In my opinion my son's brain has not progressed: it has remained as it was when he was 10," the age when he took the illness. McCowan & Cook[62] also report a case of a girl age 11 years, who showed "very definite intellectual deterioration,as shown by successive Binet tests." They add:"It is probably the abnormal brightness about their own illness,that has led many physicians to aver that there is no mental deterioration in many of these patients... Close observation shows some degree of mental degeneration in nearly every case."

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TABLE I.
HALLOWELL'S TABLE (REVISED).

Case Number.	Date of Onset.	Date of Examination.	Time between Onset & Exam.	Age at Onset.	Age at Examination.	M.A.	I.Q.	Previous Mentality.	Latest Report.
1	1916	28/3/22	6yrs.	7yr.	13yr.	12/6.	96.	normal	same
2	1918	29/1/23	5:3	6	11:3	10:3	91	normal	more manageable
3	Oct/18	16/10/22	4:3	11	15:3	13:5	88	normal	---
4	Jan/19	23/3/22	3:8	2	5:8	2:0?	35?	normal	no improvement
5	Feb/19	3/10/22	4:4	6	10:4	9:0	87	school satisfact.	little improvement
6	Feb/19	8/22	3:6	birth	3:6	1:10½?	25?	---	no improvement
7	1919	20/11/22	3:8	3	6:8	6:6	97	slow	no improvement
8	Sum/19	20/11/22	3:2	9	12:2	9:9	80	slow	improving
9	Mar/20	16/1/23	7:0	7	14:0	11:4	81	normal	improving
10	Apr/20	11/1/23	3:2	12	15:2	13:2	87	repeated grades	same
11	Apr/20	25/10/22	3:0	16	19:0	10:3	64	slow intellect.	same
12	Apr/20	6/4/22	2:8	8	10:8	11:8	109	---	little improvement
13	Nov/20	26/10/22	2:6	4	6:6	6:6	100	average	improv.restless,difficult
14	Jan/21	16/5/22	1:5	7	8:5	5:6	65	very bright	improv.uncontrol.at home
15	Feb/21	25/10/21	1:6	9	10:6	10:1	96	normal:repeated	no change:at spec.school
16	Feb/21	23/5/22	1:0	10	11:0	7:10	71	slow	no improvement:hypomania
17	Jun/21	17/8/22	1:1	7	8:1	7:5	92	repeated	said to be improving
18	Feb/22	19/8/22	1:6	13	14:6	14:1	97	average	working
19	Mar/22	12/12/22	0:10	7	7:10	6:5	82	normal	improv. agitated at times
20	Apr/22	26/10/22	0:6	1:6	2:0	-:6?	25?	normal	no improvement
21	Apr/22	7/11/22	0:9	11	11:9	10:4	88	good	improv. in grade for age
22	May/22	3/10/22	1:1	13	14:1	13:5	95	average	improving:working
23	Jun/22	20/9/22	0:9	8	8:9	6:7?	75?	average	recovered
24	Nov/22	6/2/23	1:3	9	10:3	9:0	88	good	improved

Note: Case 4 is reported as being a 'low imbecile': Case 6 as an 'idiot': Case 20 as an 'idiot': & Case 23 as a 'dull normal'
We have given these cases an estimated I.Q. as shown above.

We pass now to the more systematised work that has been done in the attempt to measure the effect of encephalitis on the intelligence of children, & the extent of the intellectual arrestment. The best piece of work so far published, is an article by Hallowell,[40] who describes the results of applying Binet & other tests to 24 children suffering from encephalitis. Seventeen of these cases have been published in a study by Dr. Ebaugh.[25] Fourteen of these are included in Hallowell's study. The author's purpose, she states, was "to ascertain whether the psychological examination would throw any light on any of the behaviour disorders; also to discover whether there is any similarity of reaction patterns; & especially whether the encephalitis permanently lessens the mentality of the child." The tests given included a series of 'performance tests',- form-board, mazes, triangles, memory span,-& abbreviated Stanford Revision of Binet: and the examination was made from 7 years to 6 months after onset. The mean time interval between onset & examination was 32 months.

We have summarised & revised the results,which are shown in Table I. Three cases (12½%) definitely feeble-minded(idiots) were attributed to the encephalitis with no chance of normality being attained. Twenty one children with onset at 3 to 16 years seemed to suffer no change in degree of mentality.

The only previous systematic work to our own, done with British children, is that of Shrubsall's.[89] Of 25 cases observed/

observed 2 - 3 years later there was little or no intellectual impairment in 5, and marked intellectual impairment in 8. One case examined at age 4½ years - 2½ years after onset, had a I.A. of not more than 2½. Another examined at 12 years, 1 year after onset, was "distinctly in advance of his age." "When again seen there had been no sign of intellectual impairment." Another case age 10, who previous to illness gained prizes at school, had a I.A. on the Binet Scale of 10 years: "no intellectual impairment." While another with a I.A. of 11 years, "showed marked deterioration in attainments."

More recently Shrubsall[88] writes: "Intellect and intelligence may be affected in a greater or less degree ranging from mental hebetude to imbecility. In quite young children mental growth may be altogether checked, but this is by no means always the case. In many cases the failure, (in the intelligence tests), seems to depend on a lack of desire, or interest, than on actual intellectual impairment. In older children it seems that there is a simultaneous gain and loss: mental growth being accompanied by the development of a condition of dementia, so that the rate of progress gradually showed down, until the loss exceeded the gain and obvious deterioration set in. In 4 such cases the responses to intelligence tests showed an increasing degree of scattering." He found a reduction of intelligence in 56/143 (39.16%).

TABLE II.

Shrubsall's Table.(88. page 216)

Mental Age as Ascertained at Varying Periods after Onset.

Case No.	P.A. Onset	Years after onset. 1	2	3	4	5	6	7	8	9
1	-1	-	-	-	-	2	2	-	-	1-2
2	3			4-5	-	3-4	3	-	-	-
3	3	-	-	4	-	-	-	8	8-9	-
4	4	5	-	7	-	-	-	7	-	-
5	5	-	-	5-6	7	8	-	-	-	-
6	5	-	6	-	6	7	-	-	-	-
7	6	-	8+	-	-	-	-	10+	-	-
8	6	-	7	-	8+	10	-	-	-	-
9	6	-	8	7-8	7-8	-	-	-	-	-
10	8	-	-	-	10	-	-	9-10	-	-
11	10	-	10	-	11	-	-	-	-	-
12	10	8	8	9-10	-	-	-	-	-	+
13	10	9	9	9	-	-	-	-	-	-
14	10	-	12	12	12	-	-	-	-	-
15	10	13	-	-	12	-	-	-	-	-
16	10	-	8	-	9	-	-	-	-	-
17	10	-	-	10-11	9	-	-	-	-	-
18	11	12	11	-	-	-	-	-	-	-
19	11	-	9	10	-	-	-	-	-	-
20	11	9	10	-	-	-	-	-	-	-
21	12	-	12-13	11-12	-	-	-	-	-	-

note:- "If a strict method of time limits had been employed in the tests all would have secured a much lower score." (p.215)

The accompanying table shows the progress in 21 school children examined on two or more occasions by the Binet Tests. A table such as this, based on such a small group of cases, is not of much statistical value. The I.A.s are too general, & besides, we want to know the I.A. of each patient at, or soon after, onset. Shrubsall's general conclusion from these results is that "in some there is a slow deterioration, some remain at the level at which they probably were prior to the illness; in a few after a period of arrest there is a slow recovery." More recently, Cruchet (Brit. Med. Jour. 1:1029, June 8th., 1929) has expressed a somewhat similar view: "The child's mental state, at a given phase in his illness, undergoes a sort of regression: but it is not a regression that goes on increasingly: it stops at a period which varies according to the intensity of the encephalitis. A child of 10 may regress to the M.A. of 6 or 7, or even younger: a child of 15 or 16 may fall back to the intellectual level of 10 or 12. In certain cases, when the illness is over, the patient gradually recovers the abilities temporarily lost, & starts again on the upward grade towards the normal state. In other cases the psychic condition becomes fixed at the point of regression reached by the patient, or else it becomes stabilised at the age of the child at the time of its illness."

It is apparent that a much wider study of the effect of epidemic encephalitis on the intelligence of children is necessary. The present inquiry is an attempt to meet this need.

The most convincing evidence of the effect of encephalitis lethargica on the intelligence of children would be provided by tests applied both before & at intervals after the onset of the illness. For obvious reasons these must always be rare. (there is only one such case referred to in the literature on the subject[40]). As none of our cases were tested before their illness - so far as we know,- we are compelled to collect what information we can from an analysis of the records at our disposal.

THE VARIABILITY OF INTELLIGENCE IN ENCEPHALITIC CHILDREN.

The intelligence of our encephalitic patients ranges from feeble-mindedness up to a grade about equal to the average of the other children. The highest I.R. at the first test was 110, & the lowest 59.≠ The figures for the remaining (974) hospital non-encephalitic patients are 139 and 34: and of the Ruchill Fever Hospital 250 convalescent scarlet fever cases, 137 and 52. Burt & Spielman ("A Study in Vocational Guidance," M.R.C. Report, No.33. London 1926), found the range of the hundred group forming the basis of their study to be I.R. 134 to I.R. 62. The corresponding figures for the healthy siblings of our encephalitics are 114 to 73. A comparison of these figures shows that there is nothing unusual about our encephalitics as a group.

The variability of the group, as measured by the standard deviation, is slightly lower than that of the rest of the patients. The S.D. of the encephalitics is 12.12;while that of the others is 14.66. Since the means of the two groups are different,the coefficient of variation, which is the standard deviation expressed as a percentage of the mean, gives a better measure of the variability than does the S.D. itself. This for the encephalitic group is 14.46 ±0.92; while for the others it is 16.18 ±0.26. The difference (1.72 ±0.96) is not significant.

≠ The corresponding figures in Hallowell's group (p.36) are 109 and 64. The latter figure excludes 3 imbeciles whose I.R.s are unknown.

THE I.R.s OF ENCEPHALITIC AND OTHER CHILDREN.

The mean intelligence ratio of the 55 encephalitic cases at their first test, which was performed at intervals ranging from a few days to eight years four months (Case 18) after the onset of the illness (the average being 17 months), was 83.83 ±1.103. This mean is appreciably & significantly below the average of other non-encephalitic hospital children which is 90.53 ±0.32 (974 cases). The difference between these means is 6.69, & the probable error of this difference is ±1.15.≠ Whence it follows that the odds against this difference being due to chance are 11,627 to 1. In other words, if we took at random a sample of 55 cases out of the total 1,020, the chances against the mean of these cases differing from the mean of all the cases by ±6.69 or more, are 11,627 to 1.≠≠ When patients suffering from diseases of the ductless glands and of the brain are excluded, the mean I.R. of the rest of the patients is 91.76 ±0.35; which is still more above that of the encephalitics.≠≠≠

So far we have compared the mean I.R. of the encephalitics with the means of other children who, however normal they may be, are inmates in hospital suffering from diseases varying

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≠ A difference between two means is regarded as significant when it is three times its probable error.

≠≠Calculated from "Tables for Statisticians and Biometricians" K. Pearson,(Cambridge, 1924.)

≠≠≠As regards 'social class' there is no reason to believe that there is any difference between the two groups compared: all were admitted to the same hospital in the ordinary way.

varying in severity. They are 'sick children.' But the significance of our figures becomes still greater when we contrast a group of convalescent scarlet fever children, of approximately the same age. These children - an unselected group- when tested in a fever hospital (X) just before discharge, gave a mean I.R. of 95.10 ±0.60. (250 cases). Hence our encephalitics, as a class, are distinctly below other children in intelligence. ≠

As our 55 cases differ from the rest, so far as we know, only in being cases of encephalitis lethargica, these figures not only show that at the time of testing, these patients were of lower intelligence than the rest of the hospital population, but suggest a causal connection between this disease & diminishing intelligence. If the illness did not produce the deterioration of intelligence, then either we must believe that this is the one chance in 11,500 , or we must accept the remote possibility that the encephalitics were of lower intelligence before their illness, & that this disease attacks most readily those of meaner intelligence. We have seen elsewhere that the range of intelligence in the encephalitic group is comparable with that of a normal group. (p. 42)

≠ This conclusion is confirmed by Hallowell's results. We have calculated the mean & the probable error of the mean for her cases. The mean of the 20 cases whose I.Rs are given is 87.7 (± 1.685). When the 4 cases designated idiots are included, the mean I.R. of the total 24 cases is 79.75 (± 3.050). (see p. 36)

(X) Ruchill Hospital, Glasgow: tested by the writer. These children were drawn from homes a little superior(on the whole) to the Yorkhill cases, so that a slight 'social class difference' may be present here.

I.Rs. of MALE and FEMALE PATIENTS COMPARED.

Our series of post-encephalitic children comprises 41 males, & 14 females. The mean I.R. of the former at their first test was 82.658 ± 1.408. The mean I.R. of the latter at their first test was 87.286 ± 1.795. The difference between the means is 4.627 ± 2.282, which is not significant. Comparing these two groups at their last test, the mean I.R. of the males (39 cases)≠ was 69.154 ± 1.584; that of the females (14 cases) 76.143 ± 1.743. The difference between these means is 6.989 ± 2.355, which is barely significant, but ~~not sufficiently significant to mean anything.~~ When we look through the female group (which is small in number) we find one case, & one case only, which shows an increase, in I.R. & a big increase,-/from first to last test: namely, 87 to 95. Omitting this case from both first & last test comparisons, the difference between the means of the males & females at their first test is 4.649 ± 2.390, & at their last test 5.538 ± 2.235. Since each of the mean differences is only twice its probable error, it is not significant.

Comparing the male & female groups for amount of I.R. deterioration we get the following figures: -13.508 ± 2.12, for the males, & -11.143 ± 2.502 for the females. These figures are obtained by subtracting the last test I.R. mean from the first test I.R. mean. The difference between these figures is 2.362, & the probable error is ± 3.28: hence the difference is not significant. Eliminating one case in the female group, as formerly, the revised figures are: instead

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≠ Two cases were only tested once.

of 11.143 ± 2.503, 12.616 ± 2.494. The difference between this latter figure & 13.508 (males) is 0.892, & the probable error ± 3.27: which is much less significant.

There is therefore no sex difference in the intelligence of boys & girls who contract encephalitis lethargica≠, & in the years that follow the onset each sex deteriorates to an equal extent. Our figures would probably be even more conclusive in a series of cases with the sexes more equally distributed.

≠ The same is true of the Yorkhill Hospital group of 1020. For the boys n.= 502, σ.= 14.57, mean I.R.= 90.54 ±0.44: for the girls n= 518, σ.= 14.92, mean I.R.= 90.02 ±0.44.

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note:-

Burt's results for normal children show that "at almost every age the girls outstrip the boys...On an average ....by about three tenths of a year." (10 . p.193)
Terman states:- "The latest studies indicate that girls are slightly superior to boys in brightness at all ages from the very earliest up to fourteen. The difference is slight & amounts at most to not more than 3 or 4%."
(102. p.60)

I.R.s. OF HEALTHY BROTHERS AND SISTERS OF PATIENTS.

A further line of inquiry is to compare the I.R.s of the patients with those of their brothers & sisters. There are of course, as is apparent to everybody, all kinds of variations between siblings in respect of intellectual ability. Yet correlations to determine the resemblance between siblings as regards intelligence, yield on the whole coefficients clustering between .50 & .60 for full siblings, & of about .80 for those who are twins.(104)

We brought up to hospital for examination, 100 healthy brothers & sisters of 100 hospital patients, chosen at random from the 1020 group of Yorkhill cases. The 100 hospital patients were considered a fair sample of the general hospital population. The mean I.R. of these was 91.7 ± 0.94. The mean I.R. of their healthy brothers & sisters was 90.8 ± 0.82. The correlation coefficient is +0.45 ±0.05.

If encephalitis lethargica has not an adverse effect on the intelligence of children, we should expect our patients to have an I.R. mean not significantly different from the mean of their healthy brothers & sisters.

TABLE III.

Test Results of Brothers and Sisters of patients.

Column (1) Sex. M = Male, F= Female.
" *(2) Case Number, e.g. IV = sister of patient 4.
" (3) Date of Examination.
" (4) Time between the 1st. and 2nd. tests. (in months).
" (5) Chronological Age at time of test.
" (6) Intelligence Age.
" (7) Intelligence Ratio.
" (8) Increase in Chronological Age (in months).
" (9) Rise in Intelligence Age (in months).
" (10) Rise in Intelligence Ratio.

*NOTE:- The Roman Numerals used in Column (2) correspond to the Arabic Numbering used in Appendix X, Table V, Column (2).

Cases starred (*) denote a second sibling tested.

TABLE III.

1	2	3	4	5	6	7	8	9	10
F	IV	7/6/26		11:8	10:40	89			
F	XII	3/5/27		12:9	11:46	89			
F	XIII	28/6/26		9:11	10:88	108			
	a	6/10/28	27	12:3	12:80	103	2:4	1:112	-5
M	XIV	20/7/26		13:8	13:60	99			
	a	28/7/28	24	15:8	14:40	91	2:0	0:100	-8
M	XXI	14/6/26		6:9	6:30	93			
M	XXVI	31/7/26		7:11	8:14	103			
	a	8/10/28	26	10:1	10:42	103	2:2	2:28	0
M	XXXI	14/6/26		3:11	3:52	88			
F	XXXI*	14/6/26		13:4	11:96	89			
M	XXXVII	7/8/26		4:3	3:82	87			
	a	22/9/28	26	6:5	5:46	84	2:2	1:84	-3
M	XLI	7/8/26		5:9	6:70	114			
	a	9/5/27	9	6:6	7:50	114	0:9	0:100	0
M	XLI*	9/5/27		4:9	4:70	96			
M	XLIV	31/7/26		4:9	3:72	76			
F	XLIX	7/7/26		6:6	7:30	112			
M	L	31/7/26		8:	8:98	110			
F	LI	7/7/26		3:4	3:24	96			
	a	27/9/28	26	5:6	5:15	93	2:2	1:111	-3
M	LI*	7/7/26		8:9	6:100	78			
	a	27/9/28	27	11:	8:	73	2:3	1:20	-5
F	LII	7/6/26		12:	11:92	98			
F	LII*	7/6/26		9:3	7:54	81			
	a	1/9/28	27	11:6	9:74	84	2:3	2:20	3
F	LIII	30/7/26		5:2	5:40	103			
F	LVI	7/7/26		7:2	6:100	95			
	a	20/9/28	26	9:4	8:58	91	2:2	1:78	-4
M	LVI*	7/7/26		10:7	8:110	84			
M	LVII	7/7/26		10:4	9:108	96			
	a	4/10/28	27	12:7	11:22	89	2:3	1:34	-7
M	LVIII	16/5/27		4:1	3:91	92			
	a	1/9/28	16	5:4	5:51	102	1:3	1:80	10
M	LX	24/7/26		8:	8:40	104			
	a	20/10/28	27	10:3	10:64	103	2:3	2:24	-1
F	LXI	7/7/26		7:3	8:10	111			
	a	4/11/28	28	9:7	10:46	108	2:4	2:36	-3
M	LXII	24/7/26		12:10	10:116	85			
	a	23/7/28	24	14:10	11:116	81	2:0	1:0	-4
M	LXIV	31/7/26		5:3	5:45	102			

1	2	3	4	5	6	7	8	9	10
F	LXX	7/6/26		8:2	8:64	104			
M	LXXI	28/6/26		10:10	10:56	97			
M	LXXIII	30/7/26		8:1	7:20	89			
	a	6/10/28	26	10:4	8:110	86	2:3	1:90	-3
M	LXXVI	28/7/28		14:3	11:112	84			
F	LXXX	30/6/27		6:4	5:105	93			
F	LXXXIII	10/5/28		4:7	5:6	110			
F	LXXXIV	22/9/28		4:6	4:82	104			

The brothers & sisters of 29 patients were tested under exactly the same conditions as the sick children. They numbered 34, for in 5 families we were able to test 2 healthy children. The parents were requested in writing to bring to hospital a healthy sibling, preferably the one nearest in age to the patient. The results are given in Table III.

The mean I.R. of these 34 brothers & sisters (19 males & 15 females) was 95.85(P.E.±1.16); the mean I.R. of the 29 patients at their first test was 85.00 (P.E.±1.53). The difference between these two means is 10.85, & its P.E. is ±1.92: hence it is significant. The mean of the same 29 cases at a second test was 76.86 (P.E. ±1.75). The difference between 95.85 & 76.86, i.e. 18.99, is much more significant. Even the difference between the first & second means of the patients themselves, 8.14 with a P.E. of ±2.33, is significant. These revised groups & figures agree closely with the earlier results of Dawson & Conn.[17. p.365]

Since then (1926) 15 (10 males & 5 females) of the 34 brothers & sisters have been tested a second time: the mean I.R.is 93.67 (P.E.±1.93). The difference between the first (34 cases) mean, & this second mean (15 of these 34) is 2.18; but as its P.E. is ±2.65 this difference is insignificant. The first mean of the 15 tested twice was 95.86 (P.E. ±1.82); giving a similar mean difference,& probable error of the difference.

The mean I.R. at the second test of the brothers & sisters (15 cases) was 93.67; the mean I.R. at the second test of the patients was 76.86 (29 cases). The difference of 16.81 is even more significant than the difference of 10.85 between the first tests of the same groups (34 & 29 cases respectively).

The mean I.R./of the 15 patients whose brothers & sisters at the second test were tested twice was 76.07 (P.E. ± 2.81); the mean I.R. of the corresponding 15 brothers & sisters being 93.67, the difference is 17.60, & the probable error of this difference is±3.41: hence it is significant.

One other comparison is possible: combining the first & second tests of both the patients & their brothers & sisters. The mean I.R. of the 49 tests of the healthy brothers & sisters is 95.18 (P.E. ± 1.00); the mean I.R. of the 58 tests (29 first tests & 29 second tests) of the patients is 80.93 (P.E. ± 1.22). The difference of the means is 14.25; its probable error is ± 1.58: hence it is very significant.

Therefore, although children in the same family do vary in intelligence, it is highly improbable that the above differences are due to chance.

Corroborative support of the difference in intelligence, between the patients & their healthy brothers & sisters, is supplied by Table IV.

The parent when asked to compare for intelligence, the patient with the other sibling tested, maintained that in 18 cases it was the patient who was the cleverer or brighter before the illness, while in 4 it was the healthy sibling (two pairs were judged to be the same). In one of these (case 26) it is obvious that considerable deterioration must have taken place before the date of the first test. In only three of the thirteen cases (number 56, 73, 76) do the I.R.s at the first test exceed the corresponding I.R.s of the

TABLE IV.

"PATIENT and HEALTHY SIBLING COMPARED for INTELLIGENCE"(by parent).

Judged to be the Cleverer Before Illness.				Judged to be the Cleverer At Present.			
Case No. (Pat.)	Pat. 1st. I.R.	Case No. (Sib.)	B. or S. (sibling) 1st. I.R.	Case No. (Pat.)	Pat. Last I.R.	Case No. (Sib.)	B. or S. (sibling) Last I.R.
	80	IV	89		70	IV	89
12	70		89		63	XII	89
	75	XIII	108		75	XIII	103
26	81	(same) XXVI	103		49	XXVI	103
31	69		89		69	XXXI	89
	73	XXXVII	87		55	XXXVII	84
49	82		112		73	XLIX	112
					96	L	110
51	79		78	51	77		73
52	98		98		82	LII	98
56	110		95	56	82		91
57	97		96		76	LVII	89
58	87	(same) LVIII	92				
60	103		104				
62	75		85	62	71		81
64	80		102		80	LXIV	102
70	86		104				
73	98		89		56	LXXIII	86
76	96		84				
	88	LXXXIV	104		84	LXXXIV	104
(15)		(6)		(5)		(13)	

note:-only the case number of the child judged to be the cleverer is entered; while the I.R.s of all cases are entered for comparison. Patient & sibling bear the same case number : the latter being denoted by Roman numerals.

brothers & sisters; whereas six cases have, by the time of the first test, I.R.s much below those of their brothers & sisters, and presumably, if the parent's opinion is to be trusted, have deteriorated since the illness to that extent. Moreover, the I.R.s of the four cases reported to have been more intelligent before the illness, are actually significantly higher than the I.R.s of the four sibling patients: thus confirming the parent's judgment.

The comparison made by the parent after the illness is equally enlightening. Only three of the patients are now considered to be superior intellectually to the healthy brothers & sisters. In two cases (number 56, and 62) this judgment is not borne out by a comparison of the I.R.s; while in the remaining case (number 51) the difference of four points is too small to be significant. Thirteen of the brothers & sisters are now judged to be brighter than the patients, and in all thirteen cases this judgment is confirmed by a comparison of the I.R.s at the last test.

Such judgments are not of much value, but they at least support the conclusion that the difference between the intelligence of the patients and that of their healthy brothers and sisters is the result of the illness.

RE-TESTS OF PATIENTS.

In his "Intelligence of School Children,"(101) Terman has given the I.R.s of 428 children who were tested twice. The tests used varied somewhat, & extended over a time interval of 1 day to 7 years, & were made by 33 different examiners. 28% of the tests however were given by the same examiner. For the purpose of comparing Terman's figures with our own, we have calculated from his Table XXVI(p.143) the means of the first & second tests. They are: mean of the first tests 104.170 ±0.712; mean of the second tests 105.397 ±0.729. The difference between these means is 1.227, & its probable error is almost as large, ±1.019. Hence there is no significant difference between the means of his first & of his second tests.

To obtain some further evidence of the reliability of I.R. constancy, we re-tested 100 children of our original 974 group. The only selection made was the exclusion of epileptics, for obvious reasons. To obtain the hundred cases the I.R. distribution for the 974 was reduced proportionately to 100 and arranged in I.R. groups of 10. Children taken at random from the original I.R. distribution groups were written to and asked to appear for re-testing.

The/

The mean I.R. of the 100 at their first test was 89.91 ±0.82; the mean at the second test was 89.62 ±0.78. The difference between the means is 0.29, and is not significant.

One hundred & forty two re-tests of encephalitic patients are used in this enquiry. The mean I.R. of these, irrespective of time interval between the tests, is 74.35 (± 0.794). The first test mean I.R. of the 55 patients was 83.83 (±1.103). As ~~we know~~ there is good reason to expect no considerable difference between the first, & successive tests of the same healthy children, the difference of 9.48 (± 1.36) which is significant, must be due to the effect of the disease. ≠

Adding together all the tests used in this enquiry, (55 first tests, & 142 re-tests), we obtain a mean I.R. of 77.00 (± 0.582); which when compared with the means of the 'controls' above quoted, suggests that we are dealing with a group of children much below normal in intelligence, & whose sub-normality has been produced by encephalitis lethargica.

≠ note: Burt found dimirution in I.R. to be commoner than increase. "But neither speed nor amount of decline are, as a rule, considerable. Apart from accident, disease, or other extraneous factor, seldom, if ever, does a young child of nearly average ability grow up into a typical case of mental defect. In the few individuals that have been brought to me as clear examples of complete transition some definite disturbance has been discoverable as the underlying cause." (10. p.154).

The conclusion already arrived at from the above lines of inquiry, receives further confirmation from a comparison of the I.R.s of patients tested a second, third, fourth, etc., time . The results of these re-tests are recorded in Table V in detail.

Column(1) shows the sex of the patient: Column (2), the case number of the same in the series: Column (3), the date of onset of the illness: Column (4), the dates of successive tests: Column (5), the time interval between the onset & the tests (in years & months): Column (6), the interval between the first & successive tests (in months): Column (7), the chronological ages at the time of the tests: Column (8), the intelligence ages: Column (9), the intelligence ratios at each test: Column (10), the increase in chronological age (in months): Column (11), the actual increase in intelligence age (in months): Column (12), the rise in intelligence ratio: Column (13), the expected increase in intelligence age with normal development (in months); based on the assumption that the intelligence ratio remains constant (see p.9f.): i.e. the intelligence age that a child of known intelligence ratio should reach after a given interval: Column (14), the actual rise above the expected level of normal development (in months): Column (15), the index of development, a figure which shows whether development is normal, & gives a measure of the stability of intelligence. The figures in this column give a measure of the rate of development, & so provide a method/

TABLE V.

Results of Re-tests. (Patients).

Column	(1)	Sex. M = Male, F = Female.
"	(2)	Case Number and Successive Tests, e.g. 4 = first test, 4a = second test, etc.
"	(3)	Date of Onset of Illness.
"	(4)	Dates of Successive Tests.
"	(5)	Interval between Onset and Tests.
"	(6)	Time between 1st. and Successive Tests. (in months).
"	(7)	Chronological Age at Time of Test.
"	(8)	Intelligence Age.
"	(9)	Intelligence Ratio.
"	(10)	Increase in Chronological Age. (in months).
"	(11)	Rise in Intelligence Age. (in months).
"	(12)	Rise in Intelligence Ratio.
"	(13)	Expected Rise in Intelligence Age with normal development, i.e. (6) x I.R./100.
"	(14)	Rise above expected level of normal development, i.e. (11) - (13) (in months).
"	(15)	Index of Development, i.e. (11)/(13).

TABLE V.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
M	4	6/18	19/8/22	4:2		9:	7:25	80						
	a		13/11/22	4:5	3	9:3	7:25	78	3	0	-2	2.4	-2.4	0.00
	b		13/6/25	7:0	34	11:10	9:40	79	34	25.5	-1	27.2	-1.7	0.94
	c		24/5/27	9:0	57	13:9	10:108	79	57	44.3	-1	45.6	-1.3	0.97
	d		23/10/28	10:5	74	15:2	10:72	70	74	40.7	-10	59.2	-18.5	0.69
M	7	1/19	8/11/22	3:10		13:6	10:93	80						
	a		17/10/25	6:9	35	16:5	12:32	77	35	17.9	-3	28.0	-10.1	0.64
	b		18/8/27	8:7	57	18:3	Not tested.							
F	8	6/19	29/6/22	3:0		10:8	7:80	72						
	a		9/5/25	5:11	34	13:7	7:40	54	35	-4.0	-18	24.5	-28.5	-0.16
	b		7/7/26	7:1	48	14:9	9:74	65	49	23.4	-7	34.6	-11.2	0.68
	c		16/9/27	8:4	63	15:11	9:70	60	63	23.0	-12	45.4	-22.4	0.51
	d		1/9/28	9:3	74	16:10	10:88	62	74	36.8	-10	53.3	-16.5	0.69
M	11	12/20	10/11/22	1:11		10:7	6:110	65						
	a		23/5/27	6:6	54	15:2	7:70	50	55	8.0	-15	35.1	-27.1	0.23
	b		1/11/28	7:11	72	16:7	8:	50	72	13.0	-15	46.8	-33.8	0.28
F	12	6/20	8/11/22	2:5		12:9	8:110	70						
	a		17/5/27	7:0	54	17:3	10:	63	54	13.0	-7	37.0	-24.0	0.34
	b		17/10/28	8:5	71	18:8	Undetermined.							
M	13	5/20	9/5/25	5:0		7:7	5:80	75						
	a		28/6/26	6:2	14	8:8	7:10	82	13	17.0	7	10.5	6.5	1.62
	b		6/8/27	7:3	27	9:10	6:90	69	27	13.0	-6	20.2	-7.2	0.64
	c		6/10/28	8:5	41	11:	8:40	76	41	32.0	1	30.8	1.2	1.04
	d		14/12/28	8:7	43	11.2	8:50	75	43	33.0	0	32.2	0.8	1.02

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
M	14	6/20	3/10/25	5:4		9:5	5:65	59						
	a		6/8/27	7:2	22	11:4	5:115	53	23	5.0	-6	13.0	-8.0	0.38
	b		28/7/28	8:2	34	12:3	6:110	56	34	16.5	-3	20.1	-3.6	0.82
M	17	7/20	29/6/22	2:0		12:2	9:103	81						
M	18	6/20	25/10/28	8:4		14:11	9:70	64						
M	19	6/20	24/2/23	2:8		8:8	7:105	91						
	a		28/3/25	4:9	25	10:9	7:110	74	25	0.5	-17	22.7	-22.2	0.02
	b		22/9/27	7:3	55	13:3	9:34	70	55	16.9	-21	50.1	-33.2	0.34
	c		23/10/28	8:4	68	14:4	9:104	69	68	23.9	-22	61.9	-38.0	0.39
F	20	6/20	22/6/22	2:1		11:9	11:48	97						
	a		6/3/25	4:9	32	14:5	11:28	78	32	-2.0	-19	31.0	-33.0	-0.06
	b		31/7/26	6:2	49	15:10	11:44	72	49	-0.4	-25	47.5	-47.9	-0.01
M	21	5/20	22/6/22	2:1		8:8	6:85	77						
	a		10/2/25	4:9	32	11:4	7:	62	32	3.5	-15	24.6	-21.1	0.14
	b		16/8/27	7:4	62	13:10	7:50	54	62	8.5	-23	47.7	-39.2	0.18
	c		10/10/28	8:5	76	15:	7:10	47	76	4.5	-30	58.5	-54.0	0.08
M	26	5/20	2/11/22	2:6		8:9	7:14	81						
	a		21/11/25	5:7	37	11:9	6:5	51	36	-12.9	-30	30.0	-42.9	-0.43
	b		31/7/26	6:3	45	12:6	7:20	57	45	0.6	-24	36.4	-35.8	0.02
	c		17/1/27	6:9	50	12:11	7:50	57	50	3.6	-24	40.5	-36.9	0.09
	d		8/10/28	8:5	71	14:8	7:30	49	71	1.6	-32	57.5	-55.9	0.03
M	31	5/20	7/11/22	2:6		13:7	9:50	69						
	a		9/5/25	5:0	30	16:2	9:40	58	31	-1.0	-11	20.7	-21.7	-0.05
	b		6/6/27	7:1	55	18:2	10:8	63	55	7.8	-6	38.0	-30.2	0.21
	c		1/9/28	8:4	70	19:5	11:8	69	70	19.8	0	48.3	-28.5	0.41

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
M	32	6/20	27/6/22	2:0		6:2	4:40	70						
	a		18/6/27	7:0	60	11:2	5:40	48	60	12.0	-22	42.0	-30.0	0.29
M	37	7/20	26/10/22	2:4		3:11	2:104	73						
	a		10/5/23	2:10	6	4:6	3:8	68	7	2.4	-5	4.4	-2.0	0.55
	b		23/5/25	4:11	31	6:6	3:102	59	31	11.8	-14	22.6	-10.8	0.52
	c		7/8/26	6:1	45	7:9	4:76	60	46	21.2	-13	32.9	-11.7	0.64
	d		27/8/27	7:2	58	8:9	4:72	53	58	20.8	-20	42.3	-21.5	0.49
	e		27/7/28	8:1	69	9:8	5:56	57	69	31.2	-16	50.4	-19.2	0.62
	f		17/11/28	8:5	73	10:	5:60	55	73	31.6	-18	53.3	-21.7	0.59
F	41	6/22	13/2/26	3:8		7:	5:110	85						
	a		28/5/27	5:0	15	8:4	5:110	71	16	0	-14	12.8	-12.8	0.00
	b		26/11/28	6:6	33	9:10	6:70	67	34	8.0	-18	28.1	-20.1	0.28
F	43	2/23	14/12/23	0:10		7:3	6:30	86						
	a		20/11/28	5:9	59	12:2	9:60	78	59	39.0	-8	50.7	-11.7	0.77
M	44	8/22	1/2/23	0:6		3:6	2:60	71						
	a		2/5/23	0:9	3	3:9	2:60	67	3	0	-4	2.1	-2.1	0.00
	b		13/6/25	2:10	28	5:11	3:102	65	29	16.2	-6	19.9	-3.7	0.81
	c		31/7/26	4:0	42	7:	3:87	53	42	14.7	-18	29.8	-15.1	0.49
	d		12/8/27	5:0	54	8:1	3:97	47	55	15.7	-24	38.3	-22.6	0.41
F	45	1/23	22/1/24	1:0		12:10	10:38	80						
	a		7/8/26	3:7	31	15:4	10:32	67	30	-0.6	-13	24.8	-25.4	-0.02
	b		23/9/27	4:9	44	16:6	10:82	67	44	4.4	-13	35.2	-30.8	0.125
	c		15/9/28	5:8	56	17:5	11:42	71	55	12.4	-9	44.8	-32.4	0.28
F	47	2/23	24/10/25	2:9		4:3	3:82	87						
	a		15/11/26	3:10	13	5:3	4:115	94	12	15.3	7	11.3	4.0	1.35
	b		23/9/27	4:8	23	6:2	6:5	98	23	28.3	11	20.0	8.3	1.415
	c		1/9/28	5:7	34	7:1	6:90	95	34	36.8	8	29.6	7.2	1.24
	d		14/12/28	6:10	38	7:4	7:	95	37	39.8	8	33.1	6.7	1.20

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
F	49	1/23	7/7/23	0:6		6:6	5:40	82						
	a		15/8/25	2:7	25	8:7	6:30	73	25	11.0	-9	20.5	-9.5	0.54
M	50	3/23	2/4/23	0:1		3:2	2:104	91						
	a		28/3/25	2:1	24	5:2	3:111	76	24	12.7	-15	21.8	-9.1	0.58
	b		12/8/27	4:5	52	7:6	7:90	103	52	58.6	12	47.3	11.3	1.24
	c		6/10/28	5:7	66	8:8	8:40	96	66	65.6	5	60.1	5.5	1.09
M	51	2/23	7/3/23	0:1		5:5	4:36	79						
	a		3/10/25	2:8	31	8:	5:110	74	31	19.4	-5	24.5	-5.1	0.79
	b		7/7/26	3:5	40	8:9	7:40	84	40	36.4	5	31.6	4.8	1.15
	c		18/8/27	4:7	53	9:10	8:10	82	53	45.4	3	41.9	3.5	1.08
	d		27/9/28	5:8	67	11:	8:50	77	67	49.4	-2	52.9	-3.5	0.93
F	52	2/23	1/11/23	0:9		11:8	11:56	98						
	a		16/6/25	2:5	19	13:4	11:80	87	20	2.4	-11	18.6	-16.2	0.13
	b		24/5/27	4:4	43	15:3	12:40	81	43	10.4	-17	42.1	-31.7	0.25
	c		1/9/28	5:7	58	16:6	13:20	82	58	20.4	-16	56.8	-36.4	0.36
F	53	11/23	7/2/24	0:3		5:7	5:80	101						
	a		30/7/26	2:9	30	8:1	7:	87	30	16:0	-14	30.3	-14.3	0.53
	b		11/8/27	3:9	42	9:1	7:110	87	42	27.0	-14	42.4	-15.4	0.64
	c		30/1/28	4:8	48	9:7	8:40	87	48	32.0	-14	48.5	-16.5	0.66
	d		22/11/28	5:1	57	10:4	8:90	85	57	37.0	-16	57.6	-20.6	0.64
M	55	2/23	21/3/23	0:1		10:	6:54	64						
	a		17/11/28	5:9	68	15:8	6:49	41	68	-0.5	-23	43.5	-44.0	-0.01
M	56	2/23	7/3/23	0:1		9:3	10:23	110						
	a		1/5/23	0:3	2	9:5	10:72	113	2	4.9	3	2.2	2.7	2.23
	b		27/11/25	2:10	33	12:	9:94	82	33	-4.9	-28	36.3	-41.2	-0.13
	c		20/8/27	4:7	53	13:9	11:52	83	54	14.9	-27	58.3	-43.4	0.26
	d		20/9/28	5:8	66	14:10	12:12	82	67	22.9	-28	72.6	-49.7	0.32

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
M	57	1/23	10/2/23	0:1		9:8	9:44	97						
	a		16/1/25	2:0	23	11:8	9:60	81	24	1.6	-16	22.3	-20.7	0.07
	b		4/8/27	4:7	54	14:2	11:28	79	54	22.4	-18	52.4	-30.0	0.43
	c		4/10/28	5:9	68	15:4	10:118	72	68	19.4	-25	66.0	-46.6	0.29
	d		14/12/28	5:11	70	15:7	11:98	76	71	29.4	-21	67.9	-38.5	0.43
M	58	1/24	6/2/26	2:1		7:	6:10	87						
	a		16/5/27	3:5	15	8:4	6:80	80	16	7.0	-7	13.1	-6.1	0.53
	b		1/9/28	4:8	31	9:7	7:90	81	31	20.0	-6	27.0	-7.0	0.74
M	59	5/24	15/8/24	0:3		10:10	11:112	110						
	a		27/6/25	1:2	10	11:8	11:32	97	10	-8.0	-13	11.0	-19.0	-0.73
	b		20/8/27	3:4	36	13:10	13:36	96	36	16.4	-14	39.6	-23.2	0.41
	c		3/12/28	4:7	52	15:1	13:56	89	51	18.4	-21	57.2	-38.8	0.32
M	60	4/24	24/10/25	1:6		10:2	10:52	103						
	a		24/7/26	2:3	9	10:11	10:72	97	9	2.0	-6	9.3	-7.3	0.22
	b		11/8/27	3:4	22	11:11	10:52	88	21	0	-15	22.7	-22.7	0.00
	c		18/1/28	3:9	27	12:4	11:56	93	26	12.4	-10	27.8	-15.4	0.45
	d		20/10/28	4:6	36	13:1	11:72	89	35	14.0	-14	37.1	-23.1	0.38
F	61	4/24	12/9/24	0:5		3:6	3:48	97						
	a		23/5/25	1:2	8	4:3	3:78	86	9	3.0	-11	7.8	-4.8	0.38
	b		7/7/26	2:3	22	5:4	4:110	92	22	18.2	-5	21.3	-3.1	0.85
	c		5/10/27	3:6	37	6:7	5:30	80	37	22.2	-17	35.9	-13.7	0.62
	d		4/11/28	4:7	50	7:8	5:56	71	50	24.8	-26	48.5	-23.7	0.51
M	62	6/24	13/11/25	1:5		13:5	10:8	75						
	a		12/9/27	3:3	23	15:3	11:112	78	23	22.4	3	17.3	5.1	1.29
	b		23/7/28	4:2	32	16:1	11:52	71	32	16.4	-4	24.0	-7.6	0.68

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
M	64	6/24	5/12/25	1:6		8:9	7:	80						
	a		24/7/26	2:2	8	9:4	7:40	79	7	4.0	-1	6.4	-2.4	0.625
	b		11/8/27	3:2	20	10:5	7:80	74	20	8.0	-6	16.0	-8.0	0.50
	c		8/10/28	4:4	34	11:7	8:90	76	34	21.0	-4	27.2	-6.2	0.77
	d		14/12/28	4:6	36	11:9	9:44	80	36	28.4	0	28.8	-0.4	0.99
M	65	6/24	22/1/25	0:8		8:10	9:80	109						
	a		2/11/25	1:5	9	9:7	9:	94	9	-8.0	-15	9.8	-17.8	-0.82
	b		20/8/27	3:3	31	11:5	10:84	94	31	12.4	-15	33.8	-21.4	0.37
	c		20/1/28	3:8	36	11:10	9:104	83	36	2.4	-26	39.2	-36.8	0.06
	d		27/8/28	4:3	43	12:6	11:32	90	44	19.2	-19	46.9	-27.7	0.41
	e		14/12/28	4:6	47	12:9	11:92	92	47	25.2	-17	51.2	-26.0	0.49
M	66	4/24	28/4/24	0:0		6:9	5:100	86						
	a		23/5/25	1:1	13	7:10	5:60	70	13	-4.0	-16	11.2	-15.2	-0.36
	b		28/1/27	2:9	33	9:6	8:10	85	33	27.0	-1	28.4	-1.4	0.95
	c		24/8/27	3:4	40	10:1	7:50	74	40	19.0	-12	34.4	-15.4	0.55
	d		30/11/28	4:7	55	11:4	9:42	82	55	42.2	-4	47.3	-5.1	0.89
M	67	5/24	22/5/24	0:0		11:7	11:16	96						
	a		24/8/27	3:3	39	14:10	10:88	72	39	-4.8	-24	37.4	-42.2	-0.13
	b		20/9/28	4:4	52	15:11	11:32	71	52	1.6	-25	49.9	-48.3	0.03
	c		20/12/28	4:7	55	16:2	11:32	70	55	1.6	-26	52.8	-51.2	0.03
F	68	5/24	12/8/24	0:3		7:6	5:100	78						
	a		24/4/25	1:0	8	8:2	5:110	72	8	1.0	-6	6.2	-5.2	0.16
	b		29/8/27	3:4	37	10:7	Undetermined.							
	c		17/10/28	4:6	50	11:8	Undetermined.							
M	69	4/24	12/5/24	0:1		6:5	4:57	70						
	a		7/3/25	0:11	10	7:2	5:20	72	9	8.3	2	7.0	1.3	1.19
	b		9/5/27	3:1	36	9:4	6:50	69	35	23.3	-1	25.2	-1.9	0.92
	c		10/10/28	4:6	53	10:10	7:100	72	53	40.3	2	37.1	3.2	1.09

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
M	70	4/24	1/7/24	0:3		7:9	6:80	86						
	a		16/6/25	1:3	11	8:9	7:80	88	12	12.0	2	9.5	2.5	1.26
	b		23/8/27	3:5	38	10:11	7:80	70	38	12.0	-16	32.7	-20.7	0.37
	c		15/10/28	4:7	51	12:1	7:40	61	52	8.0	-25	43.9	-35.9	0.18
M	71	4/24	9/5/24	0:0		11:10	10:8	85						
	a		28/3/25	0:11	11	12:9	9:114	78	11	-1.4	-7	9.4	-10.8	-0.15
	b		28/6/26	2:2	26	14:	10:24	73	26	1.6	-12	22.1	-20.5	0.07
	c		16/9/27	3:5	40	15:2	11:12	73	40	12.4	-12	34.0	-21.6	0.36
M	72	4/24	26/7/24	0:4		13:1	9:14	70						
	a		26/9/24	0:6	2	13:3	9:88	73	2	7.4	3	1.4	6.0	5.29
	b		22/8/27	3:5	37	16:2	Undetermined.							
	c		16/10/28	4:7	51	17:3	Undetermined.							
M	73	5/24	27/5/24	0:0		4:7	4:60	98						
	a		30/7/26	2:2	26	6:9	4:21	62	26	-3.9	-36	25.5	-29.4	-0.15
	b		11/8/27	3:3	38	7:9	4:100	62	38	4.0	-36	37.2	-33.2	0.11
	c		6/10/28	4:5	52	8:11	5:20	58	52	8.0	-40	51.0	-43.0	0.16
	d		14/12/28	4:7	55	9:2	5:20	56	55	8.0	-42	53.9	-45.9	0.15
M	74	4/24	28/4/24	0:1		12:1	10:88	89						
	a		17/10/25	1:7	18	13:7	11:36	83	18	6.8	-6	16.0	-9.2	0.42
	b		19/9/27	3:6	41	15:6	11:8	71	41	4.0	-18	36.5	-32.5	0.11
M	75	5/24	24/8/25	1:4		9:3	7:100	85						
	a		23/5/27	3:1	21	11:	9:80	88	21	22.0	3	17.8	4.2	1.24
	b		6/11/28	4:6	38	12:6	7:100	63	39	0	-22	32.3	-32.3	0.00
M	76	8/24	20/2/26	1:7		9:1	8:90	96						
	a		2/6/27	2:10	15	10:5	8:100	85	16	1.0	-11	14.4	-13.4	0.07
	b		28/7/28	4:0	29	11:7	7:50	64	30	-16.0	-32	27.8	-43.8	-0.58

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
M	79	2/25	28/2/25	0:1		7:9	6:110	89						
	a		21/9/27	2:8	31	10:4	5:80	55	31	-15.0	-34	27.6	-42.6	-0.54
M	80	5/24	24/6/27	3:2		7:7	5:45	71						
	a		19/11/28	4:7	17	9:	5:95	64	17	5.0	-7	12.1	-7.1	0.41
M	81	5/26	19/8/26	0:4		12:5	7:60	60						
	a		12/11/28	2:6	27	14:8	7:70	52	27	1.0	-8	10.8	-9.8	0.09
M	83	3/26*	1/7/26	0:4		5:2	5:25	101						
	a		10/5/27	1:2	10	6:1	6:40	104	11	13.5	3	10.1	3.4	1.34
	b		30/4/28	2:2	22	7:	7:30	104	22	24.5	3	22.2	2.3	1.10
F	84	1/26	18/8/27	1:8		6:1	5:45	88						
	a		22/9/28	2:9	13	7:2	6:5	84	13	8.0	-4	11.4	-3.4	0.70
M	85	12/24	5/1/25	0:1		11:4	9:30	82						
	a		16/9/27	2:10	32	14:1	10:64	75	33	15.4	-7	26.2	-10.8	0.59
	b		2/10/28	3:10	45	15:1	10:88	71	45	17.8	-11	36.9	-19.1	0.48
F	86	1/25	30/5/25	0:5		12:6	12:76	101						
	a		21/5/27	2:5	24	14:5	13:76	95	23	12.0	-6	24.2	-12.2	0.50
	b		6/10/28	3:9	40	15:10	14:40	91	40	20.4	-10	40.4	-20.0	0.50
M	87	12/26*	10/2/27	0:2		12:6	10:56	84						
	a		23/8/27	0:9	6	13:1	10:96	83	7	4.0	-1	5.0	-1.0	0.80
	b		12/11/28	1:11	21	14:3	11:46	80	21	11.0	-4	17.6	-6.6	0.625

(* Not definitely Enceph. Letha. Diagnosis still doubtful.)
Note: Case 64 has been tested a sixth time with the following result: date of test, 11/2/30; C.A.12;11; I.A.9;2; I.R.71.(Terman Scale).

method of comparing the various cases at a glance. They are the ratios of actual increase in intelligence age (shown in column (11)), to the expected increase with normal development (given in column (13)). If the actual rise in intelligence age be equal to the expected rise, the figure appearing in Column (15) is "1", or unity, indicating that development is normal; when it is between "0" & "1", it denotes retardation; when there is no increase, it is "0", & denotes stagnation; when it is a negative quantity, there is retrogression.

Fifty three of the fifty five cases were tested a second time, at varying intervals (2 to 68 months) after the onset of the illness, when the mean I.R. was found to be 74.92 (± 1.38): 41 cases were tested a third time, & the mean I.R. was 75.04 (± 1.405): 28 of these cases were tested a fourth time, & the mean I.R. was 73.82 (± 1.60): 17 were tested a fifth time, & the mean was 72.88 (± 2.32): 2 were tested six times; their mean I.R. was 74.5: 1 tested a seventh time had an I.R. 55 , at the last test. ≠

Since the first test mean I.R. of the total 55 cases (83.83 ± 1.10), was significantly lower than the controls, all these re-test I.R. means are much more significantly lower.

To bring out the true significance of these re-test results, we must compare the mean I.R. of the same cases, at their first & second, first & third, first & fourth, first & fifth tests respectively. This is done in Table IX.

The/

≠ It has become increasingly difficult to test these patients, owing to distance, address unknown, failure to respond to invitation to come to hospital,& severe physical deterioration.

The 58 cases, whose mean I.R. at the second test was 74.92 (± 1.38), had at their first test a mean of 84.26 (± 1.115). The difference between these means is 9.34 (± 1.77); whence it follows that the odds against the difference being due to chance are 2,666 to 1. This is still stronger evidence of the effect of encephalitis lethargica on the intelligence of children.

The 41 cases whose mean I.R. at the third test was 75.05 (± 1.405), had at their first test a mean of 86.78 (± 1.31). The difference between these means is 11.73 (± 1.92); whence it follows that the odds against the difference being due to chance are 25,772 to 1.

The 28 cases whose mean I.R. at the fourth test was 73.82 (± 1.60), had at their first test a mean of 87.57 (± 1.585). The difference between these means is 13.75 (± 2.25); whence it follows that the odds against this difference being due to chance are 26,454 to 1.

The 17 cases whose mean I.R. at the fifth test was 72.88 (± 2.32), had at their first test a mean of 88.17 (± 2.09). The difference of the means is 15.29 (± 3.13); whence it follows that the odds against the difference being due to chance are 1,025 to 1. This is a big drop from the preceding odds, but the true significance of this difference appears from what follows. These same 17 cases, whose mean I.R. at the first test was 88.17 (± 2.095), had at their fourth test a mean of 74.59 (± 2.04). The difference between these means is 13.59 (± 2.93); whence it follows that the odds against this difference/

difference being due to chance are only 576 to 1. The mean I.P. of these same cases at the third test was 77.59(±2.035). The difference between this & the first mean is 10.59(±2.92); whence it follows that the odds against the difference being due to chance are only 68 to 1. The mean I.P. of these same 17 cases at the second test was 78.65 (± 2.55). The difference between this & the first mean is 9.53 (± 3.30); whence it follows that the odds against this difference being due to chance are only 18 to 1. So that the significance of the difference, as measured by the probability, steadily increases in the group of patients tested five times, from first to fifth test.≠

An examination of Table V yields some additional information. As the intelligence age (I.A.) marks the level of intellectual development reached by the patients, it is obvious from column (11) that in 4 cases there is actual retrogression; in 2 of these it is considerable; in the other 2 the retrogression is of such slight degree that it amounts practically to stagnation. In other 3 cases the I.A. was undeterminable at the last test, & presumably these too are suffering from retrogression. In 6 cases out of the remaining 45 the I.A. is practically stationary. The other 39 cases show some growth, but in 12 only is the growth in I.A. at all considerable (case numbers 14,43,47,50,51,53,58,64,66,69,84,86). Three have I.A.s less than a year behind their C.A.s, & I.P.s over 90: the I.A.s of the remainder range from 1½ years to 6 years below the corresponding C.A. So that while intellectual growth has

≠It should be noticed that 9 cases at the last test were over 16 years of age, though their I.R. is calculated from that number, & is therefore higher than it ought to be.

has not ceased in these cases, it is not proportionate to the increase in physical age, & in some of the cases it is doubtful whether the apparent improvement has any significance. The true meaning of these figures is brought out in the succeeding columns. From column (14) which gives the actual rise above the expected level of normal development, we find that in every case but 4 it is negative at the last test. There was then in 48 of our 52 cases (92%) a drop in the normal rate of development.≠ This is shown in another way in column (12) which gives the actual increase in I.P.

From column (15) we observe that there are only 9 cases with an index of development figure of + 0.74 & over, at the last test. Table VI shows the distribution at the successive tests of all the indices of development. Those indices around 1 are classed as normal in development, those around + 0.75 as nearly normal, those around +0.50 as retarded, those around +0.25 as seriously retarded, those around 0 as stagnation, & those - 0.50 as retrogression. The mean index of development of the various groups, as classified, approximates to these numbers. Of 138 indices 23 (16.7%) fall in the 'normal' category with a mean of 1.13; 19 (13.8%) are 'nearly normal' with a mean of + 0.72; 35 (25.4%) are 'retarded' with a mean of + 0.49; 25 (18.1%) are 'seriously retarded' with a mean of + 0.26; while 30 (21.7%) are 'stationary' with a mean of + 0.002; and 6 (4.3%) are in the 'retrogression' category with a mean of - 0.58.

Comparing the distribution figures vertically,- the indices based on the 1st. & 2nd., 1st. & 3rd., 1st.& 4th., & 1st.& 5th. tests,- we notice that the numbers in the various developmental/

≠ At second test 84.6%: at third test 90.2%

TABLE VI. "DISTRIBUTION OF INDICES OF DEVELOPMENT"

Development.	Mean index of devt.	No. of Indices at Each Developmental Level for tests 1st & 2nd	1st & 3rd	1st & 4th	1st & 5th	1st & 6th	1st & 7th	Total %	Mean int. On.-Test
Normal	1.13	6≠	6≠	6	5	-	-	23 = 16.7%	months 57
Nearly Normal	.72	5	8	3	3	-	-	19= 13.8%	62
Retarded	.49	12	7	7	6	2	1	35= 25.4%	52
Seriously Retarded	.26	7	8	8	2	-	-	25= 18.1%	61
Stagnation	+0.002	15	10	4	1	-	-	30= 21.7%	51
Retro-gression	-0.58	5	1	-	-	-	-	6= 4.3%	32
		50≠	40≠	28	17	2	1	138	

≠ Case 83 omitted: diagnosis doubtful.
Cases 56 & 72 who were re-tested 2 months after first test, & had indices of 2.23 & 5.29 respectively, have also been omitted.

Table VII.

Development	Distribution for Tests 1st.& 2nd.	1st.& last.	Mean Time Inter.C-Test 1st.& 2nd.	1st.& last.
Normal	6	7	35mths.	67mths.
Nearly normal	5	6	45	83½
Retarded	12	11	35½	64½
Seriously retarded	7	9	53	64½
Stagnation	15	6	43	71
Retro-gression	5	1	28½	48

-mental categories, remain fairly stationary from test to test. The decrease in the two lowest levels from test to test is not as significant as would at first sight appear, as those cases whose I.P.s were undeterminable at the later tests, probably truly belong to these categories.

We cannot conclude from these distribution figures, that in time there is a tendency to return to normal. If this were so we would expect the mean time interval between the onset of the illness & the successive tests, of the cases with indices falling in the 'normal' category, to be very much longer than the mean of those at the lower end of the table. Apart from the small 'retrogression' group, which has a mean time interval of 32 months, there is no significant difference between the other groups, to warrant the conclusion that the distribution of these cases, based on the index of development, is affected or determined by the length of time that has elapsed since the onset of the illness.

Better still, perhaps, is to compare the distribution of the indices of the cases based on the first & second tests, with the distribution based on the first & last tests. This is shown in Table VII, along with the mean time interval between the onset & the tests. Of the 50 cases tested twice, 6 were normal in their rate of development, 5/more were nearly so, 12 were retarded, 7 were seriously retarded, 15 were characterised by completely arrested development, & 5 were serious cases of retrogression. Based on the last index of 40 cases (15 cases in our series of 55 have less than two indices), the numbers in the/

the various categories are as follows: 7 normal, 6 more nearly normal, 11 retarded, 9 seriously retarded, 6 stagnation, & one retrogression. Here again the "undeterminable cases" are probably omitted from the lower end of the scale of development. And it is doubtful if there is any real or considerable improvement, or tendency toward improvement, with time.

It is appropriate here to quote from our earlier article (21. p.365): "With such a dismal picture before us, it is gratifying to find that 4 of the 5 cases in which the index of development is above +0.75 are of fairly long standing; namely 6;1 years, 7;0 years, 2;8 years, & 2;10 years at the time of the second test: in the fifth case the illness had lasted 1;3 years at the time of the second test. This suggests that, while arrested development is characteristic of most of our cases during the years following the onset of the illness, yet a few of the older cases show signs of a return to the normal (4 of the 14 whose illness was of more than 30 months' duration)." This encouraging suggestion receives some corroboration from our latest results. Of 10 cases whose illness had, at the time of the last test, lasted 8 years or more, only one falls in the 'normal' group, with an index of development around '1', three fall in the 'nearly normal' group, three in the 'retarded' group, one in the 'seriously retarded', & two in the 'stagnation' group. Of the 13 cases comprising the 'normal' & 'nearly normal' groups, 4 are cases in which the illness had lasted 8 years or more; 5 in which it lasted 56 months or less. While the

15/

15 comprising the 'seriously retarded' & 'stagnation' groups, include 3 in which the illness had lasted 8 years or more; & 7 in which it lasted 56 months or less.≠

But a glance through the time interval columns in Table VII, & a comparison of group with group, does not enable us to conclude that the time factor is playing any considerable part in the return of these patients to a normal rate of development.≠≠

All this additional evidence supports the conclusion already arrived at,-that encephalitis lethargica tends to produce intellectual deterioration,-& prepares the way for the consideration of the influence of time interval between the tests on the deterioration.

≠≠ The figures below, based on a slightly different method of classification, show the same thing.

Index of development.	Mean Time Interval between Tests (in mths.) 1st.& 2nd.	1st.& 3rd.	1st.& 4th.	1st.& 5th.
+0.75 & over	18.2	32.4	48.3	48.0
.74 to .50	21.2	32.4	46.6	63.7
.49 to .26	29.8	45.5	53.4	54.5
.25 to .01	23.6	45.1	53.3	63.0

As the mean time interval between the tests increases, the mean index of development tends to decrease.

≠ For the cases whose I.R. s were undetermined at the last test the duration of the illness was 8;5, 4;6, 4;7 years.

INTELLECTUAL DETERIORATION IN RELATION TO DURATION OF ILLNESS.

I.R.s of cases of long and cases of short duration: (first tests).

Our first tests fall into two practically equal groups: in 28 of them the interval between the onset of the illness & the performance of the first test was less than 12 months; in the remaining 27 it ranged from 12 months to over 8 years. The mean I.R. of the first group is 88.21 ±1.69; that of the second is 79.30 ±1.34. The difference between these means is 8.92 ±2.16≠: whence it follows that the odds against this difference being due to chance are 186 to 1. As the outstanding difference between the two groups is in respect of the duration of the illness at the time of the test, we have here strong confirmation of the suggestion made in the last section (pp.68f.), that this disease adversely affects the intelligence of children.

Intelligence Age and duration of illness: (all tests).

Re-test results show that the mean I.A. increases little after the onset of the disease. Of the total 197 tests, 29 were performed at varying intervals within 12 months after onset;≠≠ the average C.A. of the children tested was $8\frac{90}{120}$; & the average I.A. $7\frac{74}{120}$: 18 tests were performed between $1\frac{1}{2}$ & 2 years; average C.A.$9\frac{70}{120}$; average I.A.$8\frac{21}{120}$: 30 tests, between $2\frac{1}{2}$ & 3years;
average C.A.$9\frac{60}{120}$; average I.A.$7\frac{60}{120}$: 26 tests, between $3\frac{1}{2}$ & 4yrs.
average C.A.$11\frac{10}{120}$; average I.A.$8\frac{68}{120}$: 31 tests, between $4\frac{1}{2}$ & 5yrs.
average C.A.$11\frac{40}{120}$; average I.A.$8\frac{52}{120}$: 13 tests, between $5\frac{1}{2}$ & 6yrs.
average C.A.$12\frac{60}{120}$; average I.A.$8\frac{104}{120}$: 10 tests, between $6\frac{1}{2}$ & 7yrs.
average C.A.$12\frac{70}{120}$; average I.A.$8\frac{18}{120}$: 8 tests, between $7\frac{1}{2}$ & 8yrs.
average C.A.13. ; average I.A.$7\frac{86}{120}$: 12 tests 8yrs., or more;
average C.A.$14\frac{10}{120}$; average I.A.$8\frac{114}{120}$. The arrested intellectual

≠ Dividing Hallowell's cases into 2 practically equal groups, the mean I.R. of 13 tested under 3 yrs. from onset was 83.3; of 11 tested over 3 yrs., 75.5: difference between means 7.8.

≠≠ Where 2 tests of the same patient fall within the same class interval, the average C.A. & I.A. has been taken.

development is here shown by the almost stationary nature of the mean I.A.s, though the mean C.A.s steadily rise. The average retardation in terms of mental years increases as the interval between onset & date of test increases.

TABLE VIII.- INTELLECTUAL DETERIORATION IN RELATION TO DURATION OF ILLNESS. (all tests).

Interval between onset & tests.	No. of tests.	Mean I.R.	Probable error.
up to 1 11/12yrs.	51	86.31	±1.23
2 - 3 11/12	60	79.35	±0.93
4 - 5 11/12	53	74.13	±1.27
6 & over	33	62.94	±1.16

Intelligence Ratio and duration of illness:(all tests).

Table VIII shows the drop in the I.R. as the interval between onset & date of test increases.

Fifty one/

Fifty one of the total test results were obtained at intervals under 2 years from the date of the onset of the illness. The mean I.R. of this group is 86.31 (± 1.23). Sixty tests were performed at intervals ranging from 2 to 3;11 years after onset. The mean I.R. of this group is 79.35 (± 0.935). The difference between these means is 6.96 (± 1.545); whence it follows that the odds against this difference being due to chance are 422 to 1.

Fifty three tests were performed at intervals ranging from 4 to 5;11 years after onset. The mean I.R. of this group is 74.13 (± 1.27). The difference between this mean & 86.31 is 12.18 (± 1.77); whence it follows that the odds against this difference being due to chance are 301,258 to 1.

Thirty three tests in the series were performed at intervals of 6 years & over, after onset. The mean of the I.R.'s of these is 62.94 (± 1.16). The difference between this mean & 86.31 is 23.37 (± 1.69); whence it follows that the odds against this difference being due to chance are enormous. (This can't be calculated from Pearson's Tables).

From this we conclude that the longer the illness lasts the lower becomes the mean intelligence of the patients so afflicted. At anyrate the above figures suggest some correlation between 'interval of time since onset' and 'degree of deterioration.'

INTERVAL BETWEEN TESTS AND INTELLECTUAL DETERIORATION.

A more detailed examination of the data, taking account of the interval between the tests, points in the same direction. (Table IX). The distribution of all second tests, shows that the significance of the difference of the means, of the same cases, from first to second test, increases as the time interval between the tests increases. The same is true of all third, & of all fourth tests, etc. As the numbers in the successive re-tests are small, when grouped on a time-interval basis, we have summed all re-tests thus grouped.
Sixteen re-tests were performed at some period between onset & eleven months thereafter. The mean I.R. of these is 84.3. As the mean of these same cases at the first test was 87.9, the difference of the means is 3.6. But as the probable error is almost as large (±3.28), this difference is not significant.
Twenty re-tests were performed at some period between 12 months & 23 months. The mean I.R. of these is 81.8. The mean of these same cases at the first test was 86.5. The difference of the means, though larger, is still not significant, being only twice its probable error,- 4.7 ± 2.35.
Thirty two re-tests were performed at some period between 24 months & 35 months. The mean I.R. of these is 72.7. The mean of the same cases at the first test was 84.7. The difference is now significant, being six times its probable error,- 12.0 ± 2.08. Twenty eight re-tests were performed at some period between 36 & 47 months. The mean I.R. of these is 75.4. Their first test mean was 89.1. The difference,

13.7/

TABLE ix.

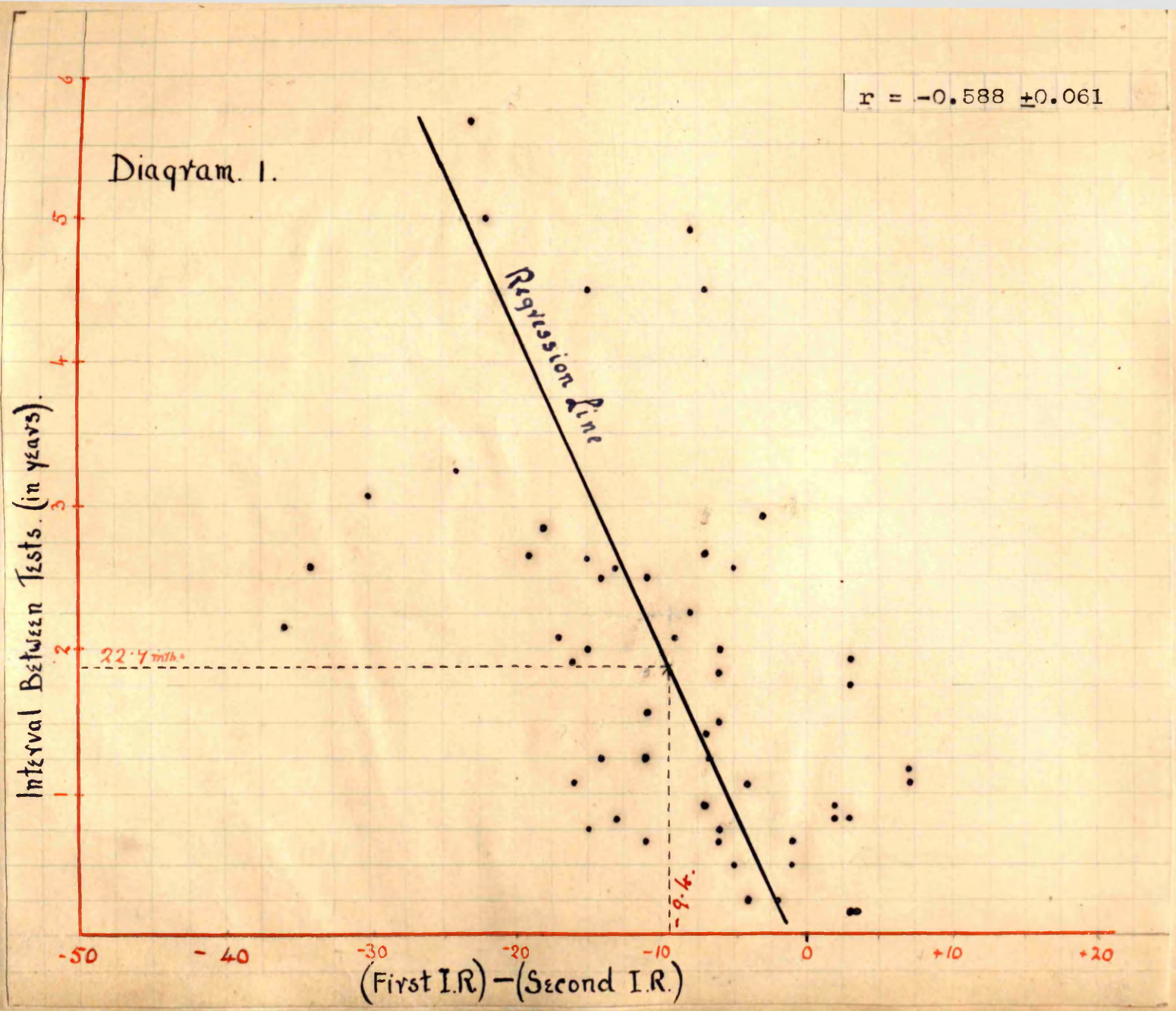
Interval between Tests and Mental Deterioration.

Interval between Tests. (in months.)	1st.	2nd.	3rd.	4th.	5th.	6th.	7th.	TOTALS
	Intelligence Tests. (Patients)							
	(55)=83.8 ±1.10							
-11		(16)=87.9 (16)=84.3 D.= 3.6 ±3.28						(16)=87.9 (16)=84.3 D.= 3.6 ±3.28
12-23		(14)=84.1 (14)=78.6 D.= 6.5 ±2.66	(6)=92.0 (6)=89.3 D.= 2.7 ±3.70					(20)=86.5 (20)=81.8 D.= 4.7 ±2.35
24-35		(16)=84.3 (16)=69.9 D.=14.4 ±2.78	(13)=83.9 (13)=72.7 D.=11.2 ±3.28	(3)=90.0 (3)=88.0 D.= 2.0				(32)=84.7 (32)=72.7 D.=12.0 ±2.08
36-47		(2)=88.5 (2)=61.5 D.=27.0	(13)=89.2 (13)=74.5 D.=14.7 ±2.99	(7)=85.1 (7)=71.3 D.=13.8 ±4.16	(5)=90.8 (5)=85.8 D.= 5.0 ±4.51	(1)=109.0 (1)= 92.0 D.= 17.0		(28)=89.1 (28)=75.4 D.=13.7 ±2.22
48-59		(3)=73.7 (3)=63.7 D.=10.0	(7)=87.6 (7)=74.7 D.=12.9 ±4.25	(12)=90.7 (12)=74.2 D.=16.5 ±3.22	(6)=87.7 (6)=65.7 D.=22.0 ±5.20			(28)=87.5 (28)=71.4 D.=16.1 ±2.32
60-71		(2)=67.0 (2)=44.5 D.=22.5	(1)=77.0 (1)=54.0 D.=23.0	(5)=84.0 (5)=73.2 D.=10.8 ±4.77	(4)=91.8 (4)=71.0 D.=20.8 ±6.04	(1)=73.0 (1)=57.0 D.=16.0		(13)=82.4 (13)=65.4 D.=17.0 ±3.73
72-83			(1)=65.0 (1)=50.0 D.=15.0	(1)=77.0 (1)=47.0 D.=30.0	(2)=76.0 (2)=66.0 D.=10.0		(1)=73.0 (1)=55.0 D.=18.0	(5)=73.4 (5)=56.8 D.=16.6 ±2.94
		(53)=84.3 (53)=74.9 D.= 9.4 ±1.77	(41)=86.8 (41)=75.0 D.=11.8 ±1.92	(28)=87.6 (28)=73.8 D.=13.8 ±2.25	(17)=88.2 (17)=72.9 D.=15.3 ±3.13	(2)=91.0 (2)=74.5 D.=16.5	(1)=73.0 (1)=55.0 D.=18.0	

*Note:
e.g. (16) = No. of cases.
87.9 = Mean of 1st. Tests.
84.3 = Mean of 2nd. Tests.
D. = Difference of Means.
± = Probable Error of this difference.

13.7 ±2.22 is still equally significant. Twenty eight re-tests were performed at some period between 48 & 59 months. The mean I.R. of these is 71.4. Their first test mean was 87.5. The difference has risen to seven times its P.E.-16.1 ±2.32. In the next group the number of re-tests is reduced to 13, & the figures become less reliable. But the I.R. difference of the means is still significant- 17.0 ±3.73. The 5 re-tests performed at some period between 72 & 83 months after the date of the first test, had a mean I.R. of 56.8, as compared with a first test mean of 73.4. The difference, 16.6 ±2.94, is still significant. The low I.R.s of these 5 cases at their first test are not due to a lengthy time interval between onset & test, as 3 of them were examined within 3 months of onset, & 2 were by that time borderline defectives. The other 2 were examined at intervals of 1:5 years & 2:9 years, respectively; which may account for their low I.R.s of 73 & 77.

Diagram I shows the relationship between (a) the interval between the tests (col.6), & (b) the difference between the first & the second I.R.(col.s 9 & 12). The points lie roughly along a line from the upper left-hand corner to the lower right-hand corner of the page (the Regression Line), suggesting a correlation between these two sets of values. The calculated correlation coefficient is -0.59 ±0.06. This is significant, & suggests that retardation in intellectual growth varies directly with the length of the interval between the tests


r = -0.588 ±0.061
Diagram. 1.
Regression Line
Interval Between Tests. (in years).
22·4 mths.
-9·4.
-50
-40
-30
-20
-10
0
+10
+20
(First I.R.) – (Second I.R.)

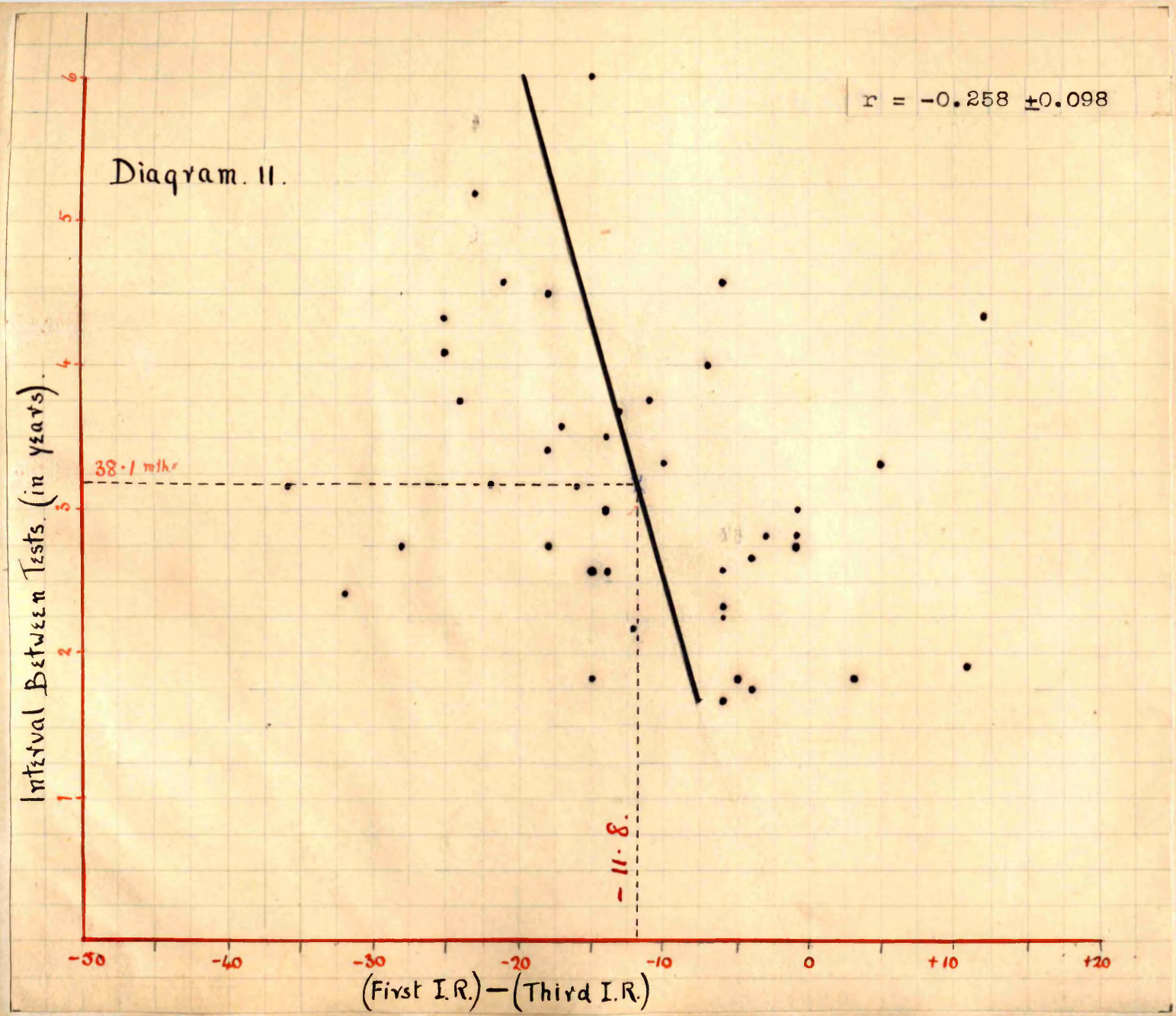


Diagram. 11.
r = -0.258 ±0.098
Interval Between Tests. (in years).
38·1 mths
-11·8.
-50
-40
-30
-20
-10
0
+10
+20
(First I.R.) — (Third I.R.)

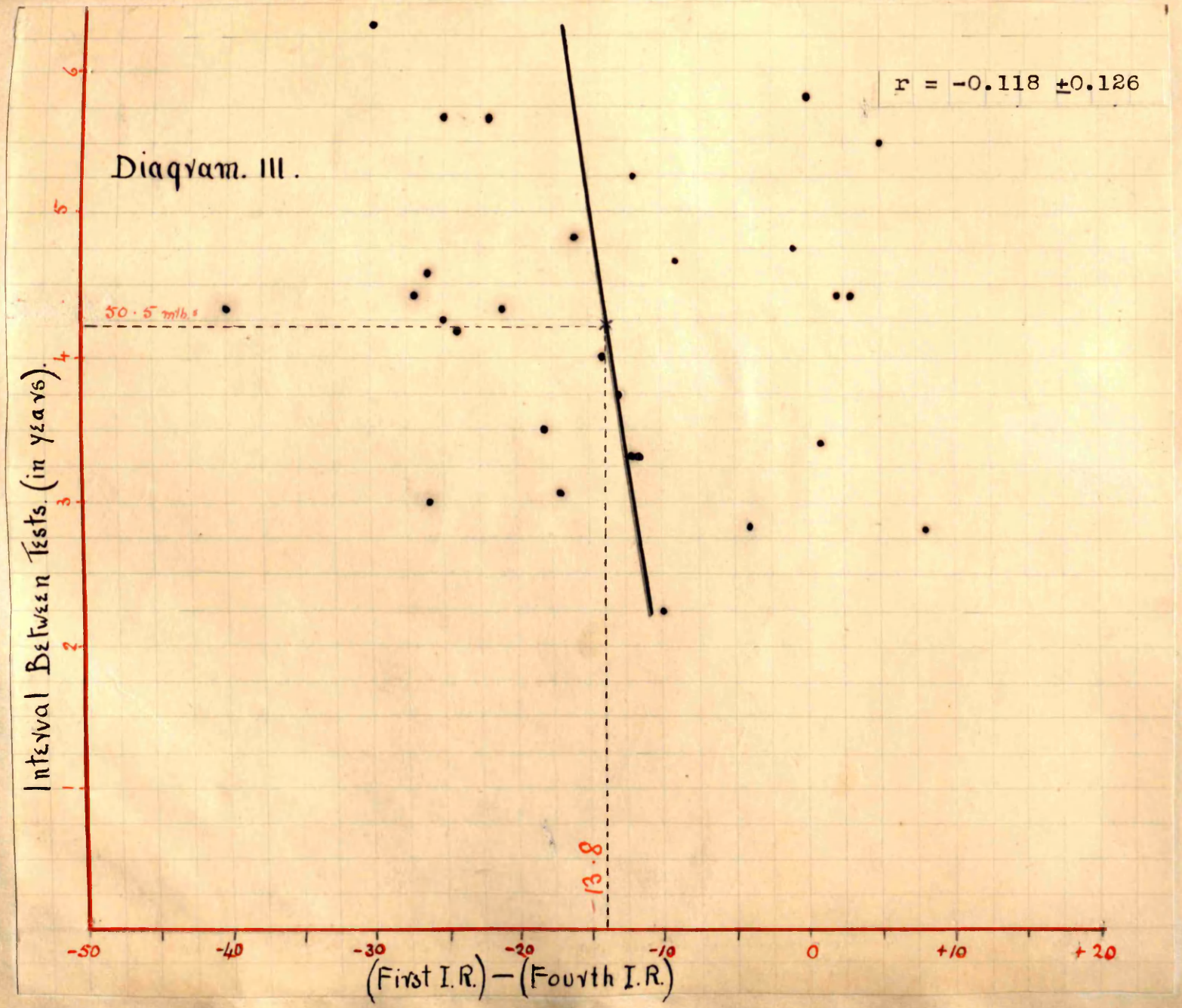
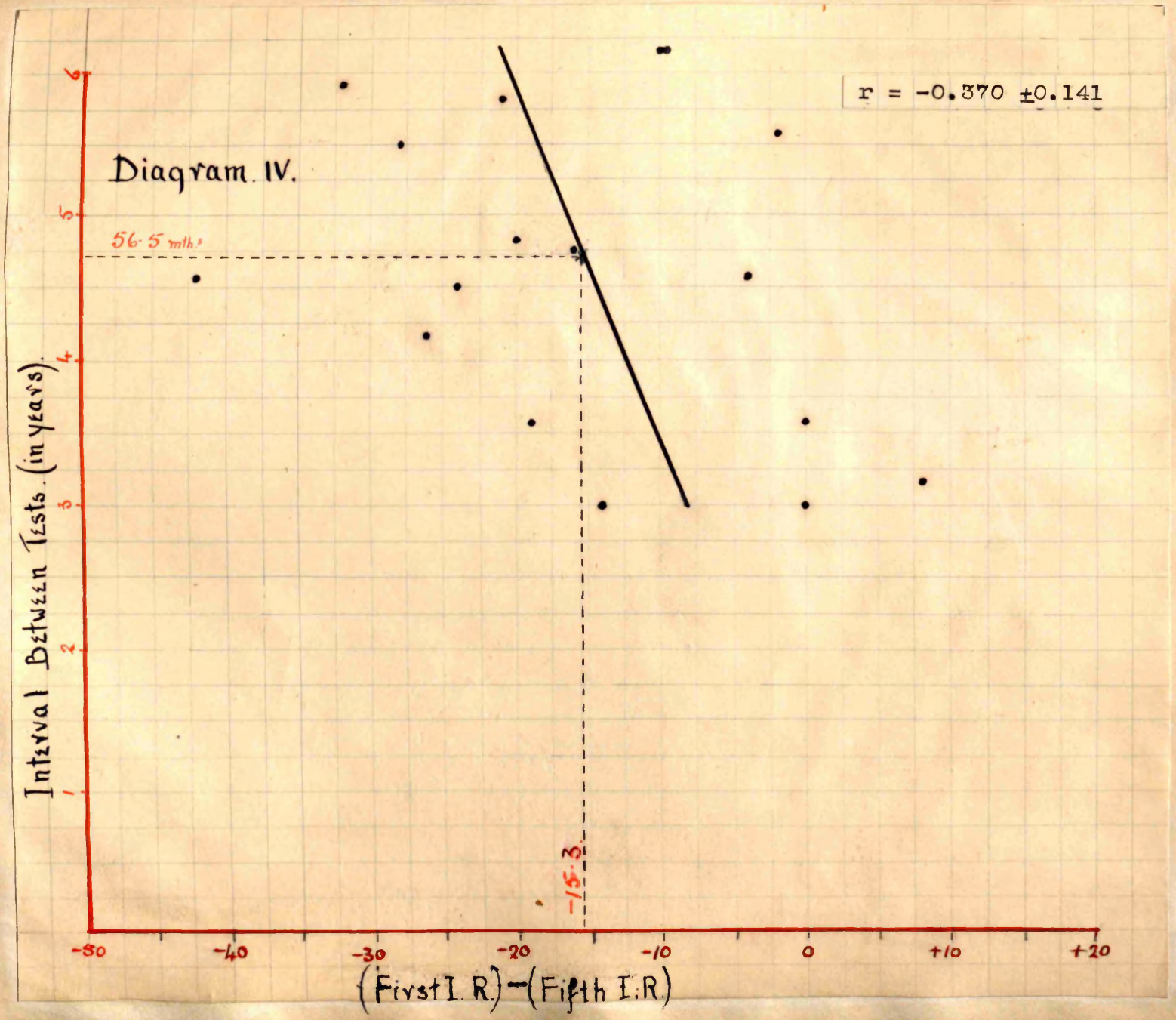


Diagram. III.
r = -0.118 ±0.126
Interval Between Tests. (in years).
50·5 mths.
-13·8
-50
-40
-30
-20
-10
0
+10
+20
(First I.R.) — (Fourth I.R.)


r = -0.370 ±0.141
Diagram. IV.
56·5 mths.
-15·3.
Interval Between Tests. (in years).
6
5
4
3
2
1
-50
-40
-30
-20
-10
0
+10
+20
(First I. R.) — (Fifth I. R.)

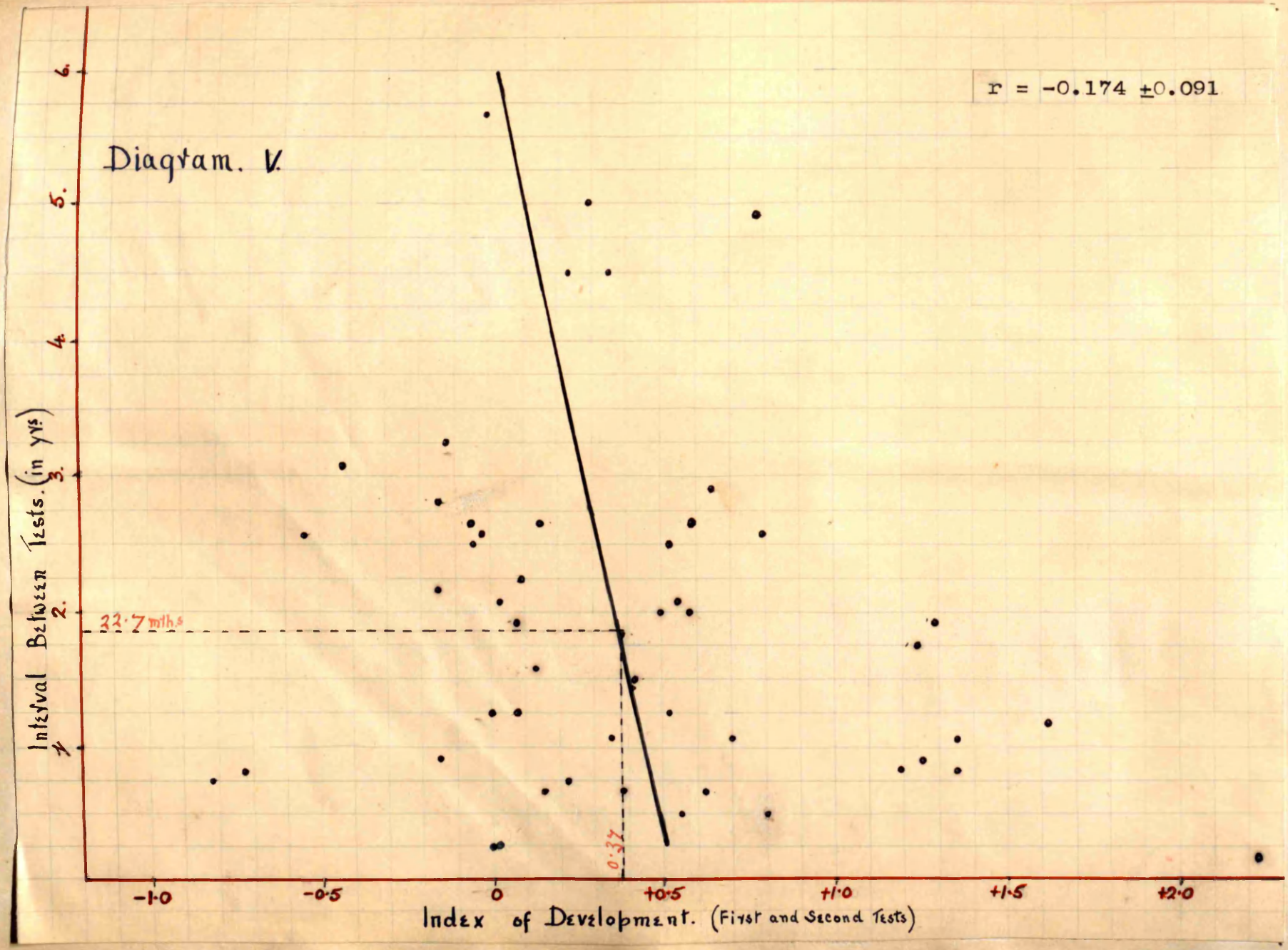


Diagram. V.
r = -0.174 ±0.091
Interval Between Tests. (in yrs)
6.
5.
4.
3.
2.
1
22·7 mths
0·37
-1·0
-0·5
0
+0·5
+1·0
+1·5
+2·0
Index of Development. (First and Second Tests)

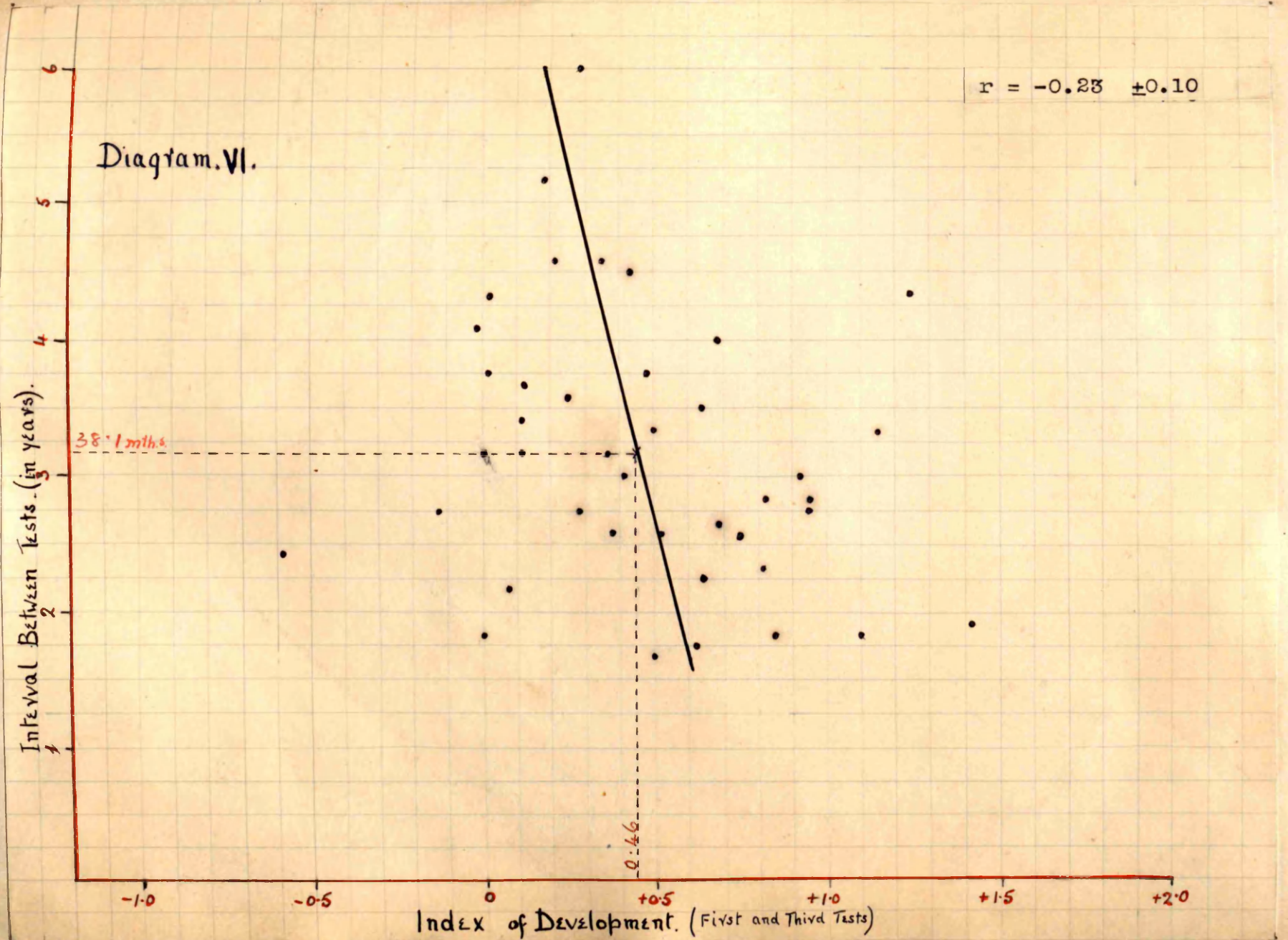


Diagram. VI.
r = -0.23 ±0.10
Interval Between Tests. (in years).
1
2
3
4
5
6
38·1 mths.
0·446
-1·0
-0·5
0
+0·5
+1·0
+1·5
+2·0
Index of Development. (First and Third Tests)

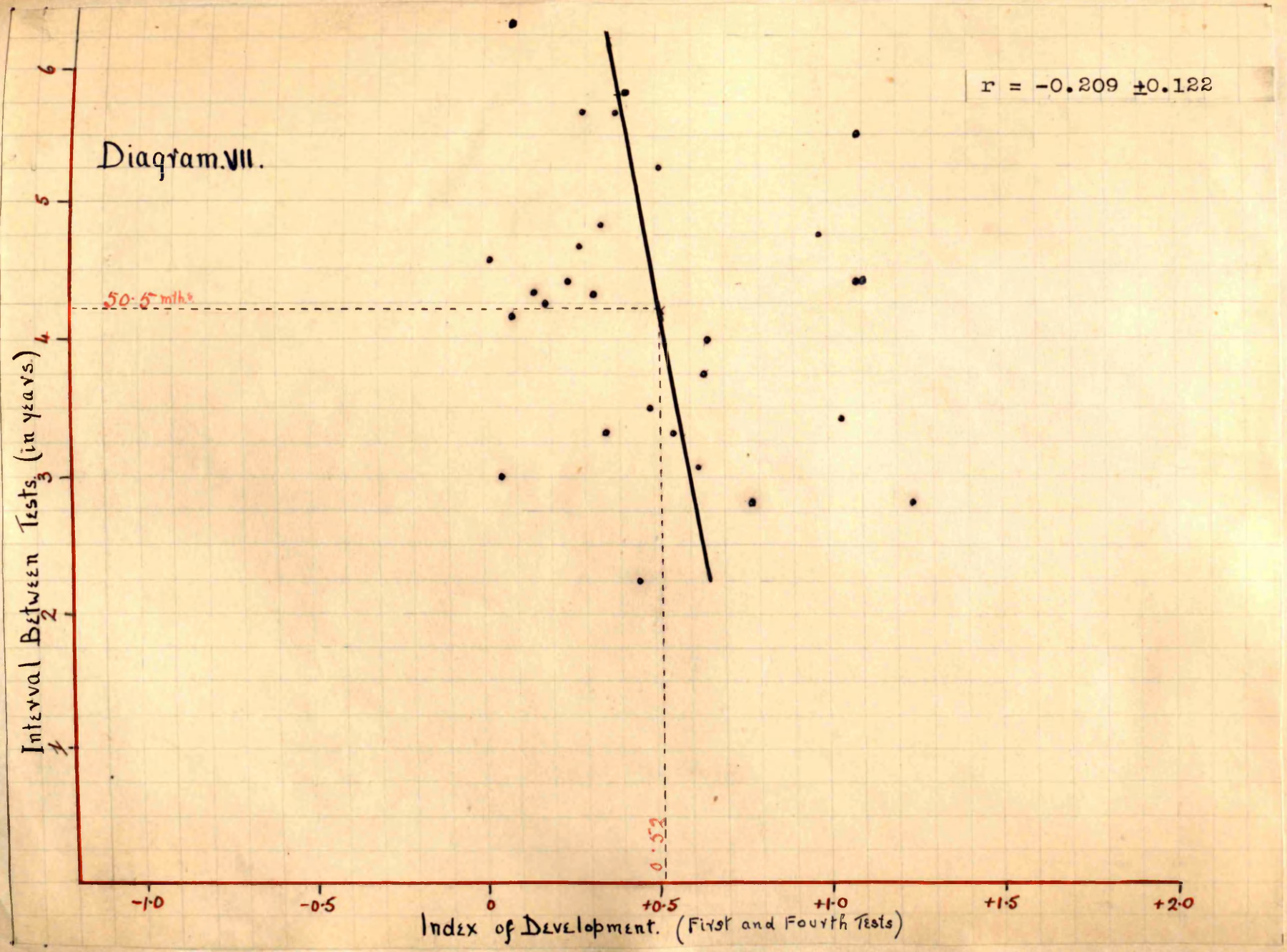


Diagram. VII.
r = -0.209 ±0.122
Interval Between Tests (in years)
1
2
3
4
5
6
50·5 mths
0·52
-1·0
-0·5
0
+0·5
+1·0
+1·5
+2·0
Index of Development. (First and Fourth Tests)

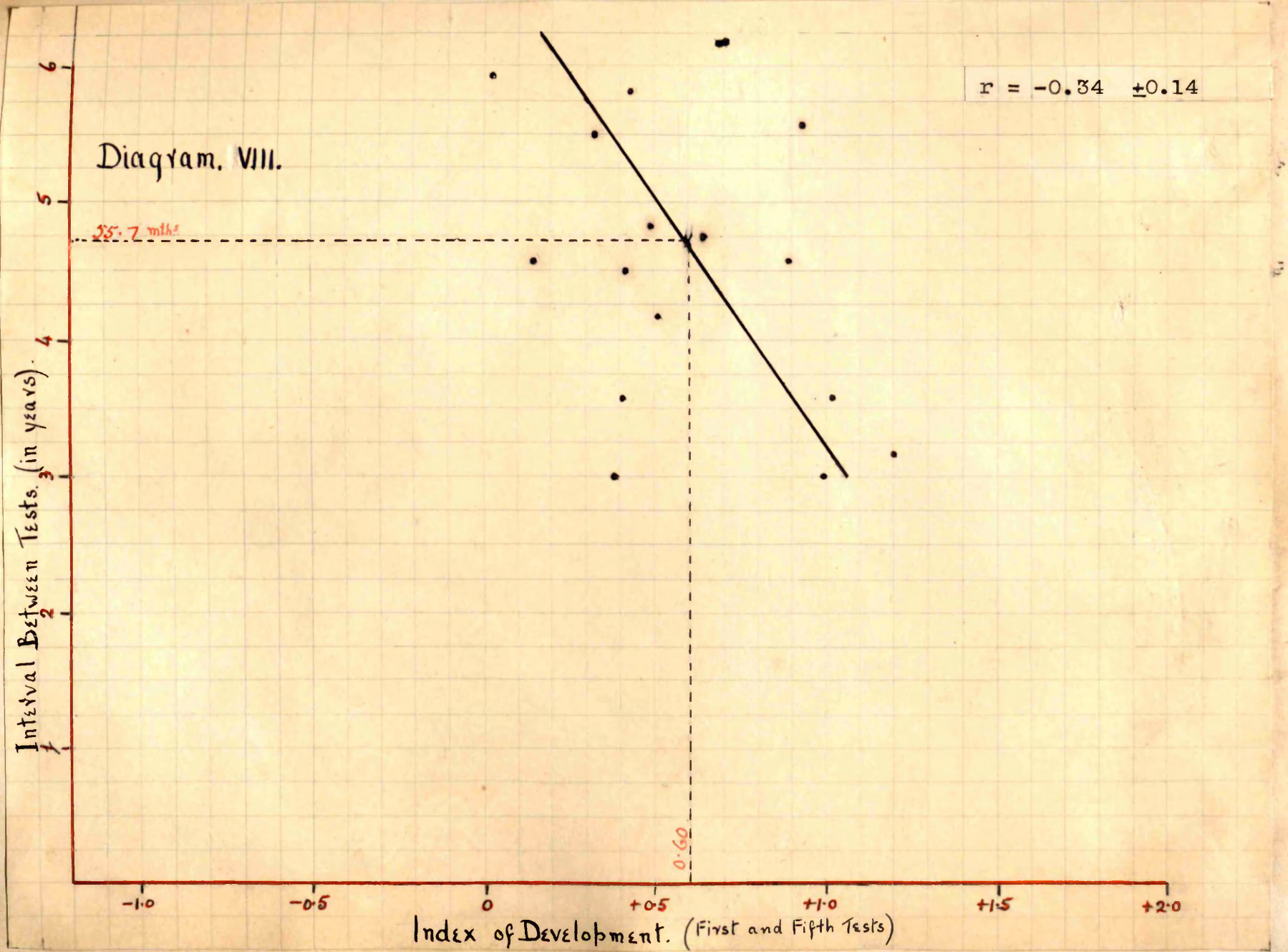


Diagram. VIII.
r = -0.34 ±0.14
25.7 mths
0.60
Interval Between Tests. (in years)
1
2
3
4
5
6
-1.0
-0.5
0
+0.5
+1.0
+1.5
+2.0
Index of Development. (First and Fifth Tests)

tests/.

Diagram II shows the relationship between the interval between the tests, & the difference between the first & third I.R. The number of cases is smaller, & the regression line suggests a smaller correlation. The calculated correlation is -0.26 ±0.10; & is not significant.

In Diagram III, which shows the interval between the tests, & the difference between the first & fourth I.R., the number of cases is still smaller, & the calculated correlation is only -0.12 ±0.13; which is likewise not significant.

In Diagram IV the regression line again suggests a slight correlation between the two sets of values. The calculated correlation is -0.37 ±0.14; which, however, is not significant, though it should be noticed that the number of cases is very small.

The foregoing calculations are concerned with absolute increase in the I.R.; they take no account of mental growth relative to initial capacity. When we plot the interval between the tests against the index of development, which, as shown above, indicates whether development is normal or not, & gives a truer figure of the relationship, we get the scatter-diagrams V to VIII which show, with one exception (Diag. VII), smaller correlations than Diagrams I to IV. The correlation for Diagram V is -0.17 ±0.09; which is not significant. For Diagram VI it is -0.23 ±0.10; which is likewise not significant. For Diagram VII it is -0.21 ±0.12;this also is not significant. The highest correlation is found in Diagram/

Diagram VIII:- -0.34 ±0.14; which,however, is not large enough to be significant. Hence the higher correlations between (a) the interval between the tests, & (b) the difference between the first & successive I.R.s, are due to neglect of the partial dependence of this difference on the magnitude of the ratio itself. The signs, however, are still negative.

It follows,then, that while our observations throughout prove no constant significant correlation between the length of the interval between the tests, & the degree of intellectual deterioration, there is at least the suggestion of such a connection, which might be found to be more pronounced in larger groups of cases, & after further & more comprehensive examination.

THE RELATIONSHIP BETWEEN AGE AT ONSET AND INTELLECTUAL DETERIORATION.

The arrested intellectual development already noted provides an explanation of the disastrous effect of encephalitis lethargica on very young children. The influence of age at the time of the onset of the disease has a very definite bearing on the later intelligence status of the child, as has been pointed out by other investigators.

Riddoch[77] says: "Of 9 children who had been under 6 years of age at the time of the acute illness, 6 of them, two or three years later, were backward in mental development."

Kennedy[54] says: "Of 6 children who suffered from the acute illness before the age of four, & in whom the sequelae were most severe, one child is well, & five are mentally defective as a result of encephalitis lethargica (two being high-grade idiots).

Hallowell[40] says: "Three cases (12½%) were definitely feeble-minded as a result of the disease. The disease in each of the three cases occurred in the first or second year of life. It would seem to appear that if epidemic encephalitis occurs during the first two years of infancy feeble-mindedness is apt to result."

Duncan[24] says: "Of 9 children who were below the age of six at the time of the acute attack, 6 were backward in mental development when seen two or three years later; the other 3 in all of whom the original illness was comparatively mild were normal:/

normal: from which he concludes that "it appears that children under ten are the most liable to severe mental sequelae,(& the least liable to severe physical sequelae) since there is arrested or impaired development, as well as the defect due to actual damage of the brain."

Shrubsall[88] also found "intellectual changes & conduct disturbances to be most prominent in the younger child (& physical changes least prominent). The effects appeared to be more severe the younger the child at the time of the attack. In younger children the rate of mental growth seems to have been seriously retarded, & in some of them mental deficiency has followed: this has been most evident in the case of those attacked by encephalitis lethargica during pre-school age."

Ebaugh[25] found "mental deficiency to be one of the sequelae especially to be considered if encephalitis occurs during infancy. In 3 such cases, 2 developed the disease at the age of 2 years. One of these,- previously normal,- four years later had still an I.A. of 2 years. One infant, who had the disease at birth, 2 years later presented the picture of an idiot." Collin and Réquin[15] also found mental backwardness, of greater or less severity, to be typical psychic sequelae of encephalitis in infants.

Hall[38] remarks, that his cases of idiocy were practically limited to infants up to 5 years of age.

Paterson and Spence[71] report 7 cases of idiocy out of 17 at this/

this age. Dr. Cyril Burt[11], commenting on their data, stresses the apparent influence of age: "The younger the child the more serious the after-results. If we analyse the table of results which the investigators (Paterson & Spence) publish, it would appear that in children under three years, gross mental defect is likely to ensue. With children aged between four and eight, the milder degrees of dullness, backwardness, and such lighter grades of mental defect as are characteristic of special schools are apt most frequently to be found. With children aged between eight and twelve there may be a slight retardation in general intelligence, but the chief disturbance is one of temperament and character."

The same general finding was obtained by Stevenson[98]. Of her series, 20 were under five years when acutely ill. Of these 5 cannot be traced. Of the remaining 15, 2 are now intelligent and normal children, 6 are of very poor intelligence, 3 are examples of the Parkinsonian syndrome with fair intelligence, 4 died at intervals from eight to twenty months after the original onset of illness, all being imbecile. And she concludes: "The low mental average of the children who survived, and the condition of those who died, certainly appear to support the opinion that the disease bears more hardly on the young child than on those of more advanced years."

When an attack of encephalitis lethargica stops mental development,/

development, the degree of impairment it produces will depend on the age of the patient at the time of onset of the disease. Imbecility is a necessary consequence of the arrest of mental development at an early age, for an imbecile is one whose mind remains the mind of an infant, and any child whose mental growth ceases at the age of three or four must become an imbecile.

Older children show less deterioration because their development is arrested at a higher level: the child of 10 still retains his mental age 10, and so may appear dull, stupid and unable to profit from instruction at school, but he is not reduced to imbecility. A numerical example will make this clear. Suppose three children, of ages 4, 8, and 12 years, and I.R.s 100, cease to develop mentally, then at the end of three years their I.A.'s will be still 4, 8, and 12 respectively, but their chronological ages will be 7, 11, and 15, and their I.R.s 57, 73, and 80; the youngest will be definitely feebleminded, the second will be on the borderline of deficiency and the third will be merely dull and backward.

Eleven of our patients had I.R.s of not more than 60 at their last test; of these 5 were less than 5 years old at the onset of their illness (45.5%): of the 38 with I.R.s over 60 only 10 were then less than 5 years old (26.3%). Of the 21 with I.R.s below 71, 8 were less than 5 years old at the onset of their illness, (38.1%

TABLE: X. -"AGE AT ONSET AND INTELLECTUAL DETERIORATION."

(1)	(2)	(3)	(4)	(5)
47	18	95	87	1.20
37	19	55	73	0.59
13	31	75	75	1.02
44	36	47	71	0.41
50	37	96	91	1.09
61	37	71	97	0.51
41	40	67	85	0.28
14	49	56	59	0.82
32	50	48	70	0.29
80	53	64	71	0.41
84	53	84	88	0.70
73	55	56	98	0.15
4	58	70	80	0.69
58	59	81	87	0.74
51	64	77	79	0.93
53	64	85	101	0.64
49	72	73	82	0.54
19	72	69	91	0.39
26	75	49	81	0.03
69	76	72	70	1.09
43	77	78	86	0.77
21	79	47	77	0.08
66	81	82	86	0.89
76	86	64	96	-0.58
64	87	80	80	0.99
70	90	61	86	0.18
79	91	55	89	-0.54
8	92	62	72	0.69
75	95	63	85	0.00
65	98	92	109	0.49
11	104	50	65	0.28
60	104	89	103	0.38
56	110	82	110	0.32
57	115	76	97	0.43
20	116	72	97	-0.01
55	119	41	64	-0.01
59	127	89	110	0.32
52	131	82	98	0.36
31	133	69	69	0.41
85	135	71	82	0.48
67	139	70	96	0.03
45	142	71	80	0.28
71	142	73	85	0.36
62	144	71	75	0.68
74	144	71	89	0.11
81	145	52	60	0.09
86	145	91	101	0.50
87	148	80	84	0.62

Column (1): case number.
" (2): age at onset (in months).
" (3): I.R. at last test.
" (4): I.R. at first test.
" (5): index of development.

whereas, of the remaining 28 above 70, only 7 were then of this age(25%). The incidence of mental defect is therefore relatively much higher among the very young,than among the older children. The mean age at onset of the 21 cases whose I.R.s were <u>below</u> 71 at the last test was 6;8 years; that of the 28 cases <u>above</u> 70 was 7;9 years.

A further analysis of the data gives the following results. Fourteen cases were <u>under 5 years</u> of age at onset (mean 42.5 mths.). These had a mean I.R. of 68.93 at their last test: 15 cases were between 5 & 8 years old at onset (mean 80.7mths.). The last test mean I.R. of these was 67.80: 14 cases were between 8 & 11;11 years(mean 122.5mths.):Their last test mean I.R. was 73.35: 5 cases were between 12 & 12;4years(mean 145.2 months), & had a last test mean I.R. of 73.00.

Twenty nine cases <u>under 8 years</u> old at the onset of the illness(mean=62.6mths),had a mean I.R. at their last test of 68.34(mean at first test 82.52). Nineteen cases <u>over</u> 8 years (mean=128.8mths),had a mean I.R. of 73.26(mean at first test 88.11). The differences between the two groups are not at all significant: the varying intervals between the onset & the tests being sufficient to account for them(for the 29 cases the last test average interval was 68 mths.;first test 21 mths.: for the 19 cases,the corresponding intervals were 58, & 6mths.).

Of the 7 cases <u>under 3;6 years</u> at onset, 2 are normal, 3 are borderline defectives, & 2 are low mental defectives. Of the 5 cases <u>12 years & over</u> at onset, 1 is normal, 1 dull & backward, 2 are border-line cases, & 1 is a low mental defective. Of the 14 cases <u>under 5</u> at onset, 2 are normal(mean I.R.95.5), 2 are dull & backward(mean I.R.82.5), 4 are border-line defectives(mean I.R.70.75), & 6 are feeble-minded(mean I.R.54.3). Of the 12 cases over

ten/

ten years at onset, 2 are normal (mean I.R. 90.0), 2 are dull & backward (mean I.R. 81.0), 7 are borderline defectives (mean I.R. 70.86), one is mentally defective (I.R. 52).

The two cases with the highest I.R.'s at the last test, viz. 95, & 96, were, at the time of the onset of the disease, aged 1;6 (the youngest child in our series affected), & 3;1 years respectively: while the child with the lowest I.R. at the last test, viz. 41, was 9;11 years old at the time of the onset. The I.R.'s of both the former cases (case numbers 47, & 50), were higher at the last test than at the first; the I.R. of the latter case (case number 55) has gone down by 23%.

Therefore, while in general those children who are attacked by encephalitis lethargica early in life, deteriorate intellectually, on the whole, more than do those who are attacked later, exceptions are met with, where a very young child may escape & develop normally, while an older child suffers gross deterioration.

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note.

Hallowell's results (based on one test performed at varying intervals after onset) confirm our own conclusions. The 3 youngest children at time of onset are feeble-minded: but the next two, aged 3 & 4 years respectively at onset, are normal with I.R.'s of 97 & 100. The oldest child in the series, aged 16 years at onset, had an I.R. of 64.

An examination of the index of development ratios (Table X) shows the same thing: 4 have an index figure of 1.00 or more, i.e. are developing normally; & of these 3 were less than 5 years old at the onset of the illness.

"DISTRIBUTION OF INTELLIGENCE FOR PATIENTS."

Table XI exhibits the distribution of intelligence for the Royal Hospital for Sick Children cases (1020), & for our patients; & also Burt's figures for his 'normals' & 'defectives.' The mean 'intelligence age,' & 'intelligence ratio,' are given for the several age groups. The data of this age-and-intelligence table are plotted graphically in Figure IX . Among the normals the average I.A. coincides almost exactly with the C.A., except in the older years. On this point Burt writes,(10. p.148) "Here the reduction in the size of the averages for intelligence, an attenuation due to the lack of higher tests, becomes pronounced." Among the encephalitics,(as among the mental defectives) the amount of retardation progressively increases. The curve, or trajectory, of growth is for them very much flattened at the top. The decline insinuates that by the age of 14, many of the encephalitic children, "like"many of the defectives, are nearing their mental limit." In the 3 years following 14, these patients only progressed by 7 months in I.A. And among the oldest patients the I.A. is stationary. What Burt says of older defectives of all levels, is equally true of our encephalitics; "They exhibit a premature loss of developmental impetus. Like a shell projected with an inadequate charge, their momentum is exhausted half-way to the target." (10. p.155). In comparing the graphs it should be remembered that the evaluation of the I.A. & I.R. from C.A.13 upwards, is less precise than at the earlier ages. This is a weakness most apparent in the encephalitic graphs on account of the large number (57) of tests of children 13 years of age & over included. From age 13 onwards the number of tests per year of life are few,

TABLE:- X1. "DISTRIBUTION OF INTELLIGENCE."

ENCEPHALITIC CHILDREN:

Cases	Ave.C.A.	Ave.I.A.	Ave.I.R.
5	3:7yr.	2:10yr.	80
4	4:5 "	3:10½"	85
7	5:5 "	4:8 "	87
10	6:5 "	5:1 "	80
19	7:5 "	5:11 "	80
18	8:6½"	6:8 "	78
21	9:5 "	7:7 "	81
15	10:6 "	8:1 "	77
23	11:6 "	9:1 "	79
18	12:5 "	9:5 "	76
15	13:6 "	10:3 "	76
13	14:6 "	10:5 "	72
17	15:5 "	10:9 "	69
12	16:11½"	10:10½"	67

NORMALS AND MENTAL DEFECTIVES: (BURT. p.145)(10)

Normals.		Defectives.	
Ave. C.A.	Ave. I.A.	Ave.I.A.	Ave.I.R.
3:6	3:8	--	--
4:6	4:7	--	--
5:6	5:6	--	--
6:6	6:6	4:2	64.6
7:6	7:7	4:11	65.3
8:6	8:7	5:6	64.7
9:6	9:5	5:11	62.1
10:6	10:7	6:6	61.9
11:6	11:5	7:2	62.6
12:6	12:4	7:8	61.6
13:6	13:1	8:0	59.3
14:6	13:10	8:4	57.2

ROYAL HOSPITAL FOR SICK CHILDREN:

C.A. in yrs.	Frequency.	Mean I.R.
3-3;11	82	96.4
4-	118	86.5
5-	118	89.5
6-	103	89.9
7-	120	92.9
8-	114	90.6
9-	117	91.9
10-	105	91.4
11-	87	87.3
12-	47	84.6
13-	8	82.0
14-	1	82.0

Ave. 7;7yrs.

TABLE XII

AVERAGE RETARDATION IN I.A. AND I.R. FOR EACH CHRONOLOGICAL YEAR. (groups compared).

Chronological Year	I.A. Normals minus Defects.	I.A. Normals minus Encephal.	I.A. Encephal. minus Defectives	I.R. Encephal. minus Defects.
3:6	--	:10	--	--
4:6	--	:8½	--	--
5:6	--	:10	--	--
6:6	2:4	1:5	:11	15.3
7:6	2:8	1:8	1:0	15.0
8:6	3:1	1:11	1:2	13.2
9:6	3:6	1:10	1:8	18.6
10:6	4:1	2:6	1:7	15.1
11:6	4:3	2:4	1:11	16.2
12:6	4:8	2:11	1:9	14.6
13:6	5:1	2:10	2:3	17.0
14:6	5:6	3:5	2:1	14.6

and they are likewise thought to be proportionately harder. Only 9 tests of children age 13 & over are included in the R.H.S.C. group; so that any variation in difficulty between the tests should have little effect on the coefficient of correlation of I.R. with C.A. for this group. The correlation in fact is -0.059 ±0.021: which, though negative, is not significant, & warrants us in believing that the Binet Scale between the ages 3 & 13, is satisfactory for the purpose of comparing the distribution of intelligence among encephalitic children between the same ages:- always remembering, of course, that the R.H.S.C. group is itself a sub-normal one. The disparity in the I.R. graphs at age 3, is due in the case of the encephalitics to the small number of cases, & in the case of the 1020 group to the relatively high I.R.s of the 3 year olds. The high mean I.R. of 96 (which is higher than the mean of the whole group) is due to the elimination of incomplete test results, which in turn, is usually an indication of low intelligence: nor are the tests applicable to children with an I.A. below 3. The sub-normality of the encephalitics at all ages up to 13 is apparent.

FIG. IX. "Distribution according to Intelligence Age and Intelligence Ratio of Encephalitic children at each chronological year." (all tests).

FIG. X. "I.A. Growth Curves for 17 Patients Tested more than 4 Times."

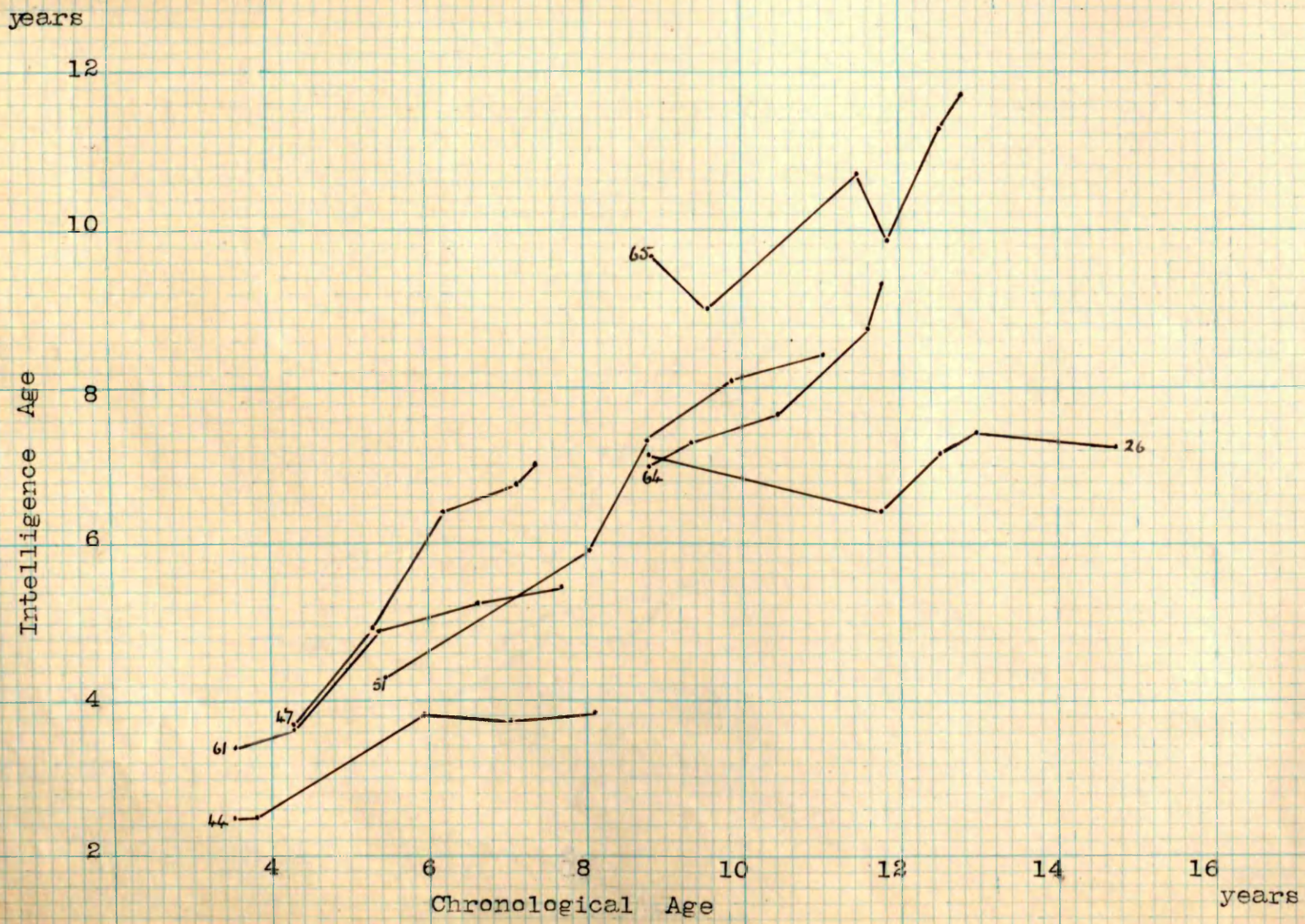


FIG. X. (continued).

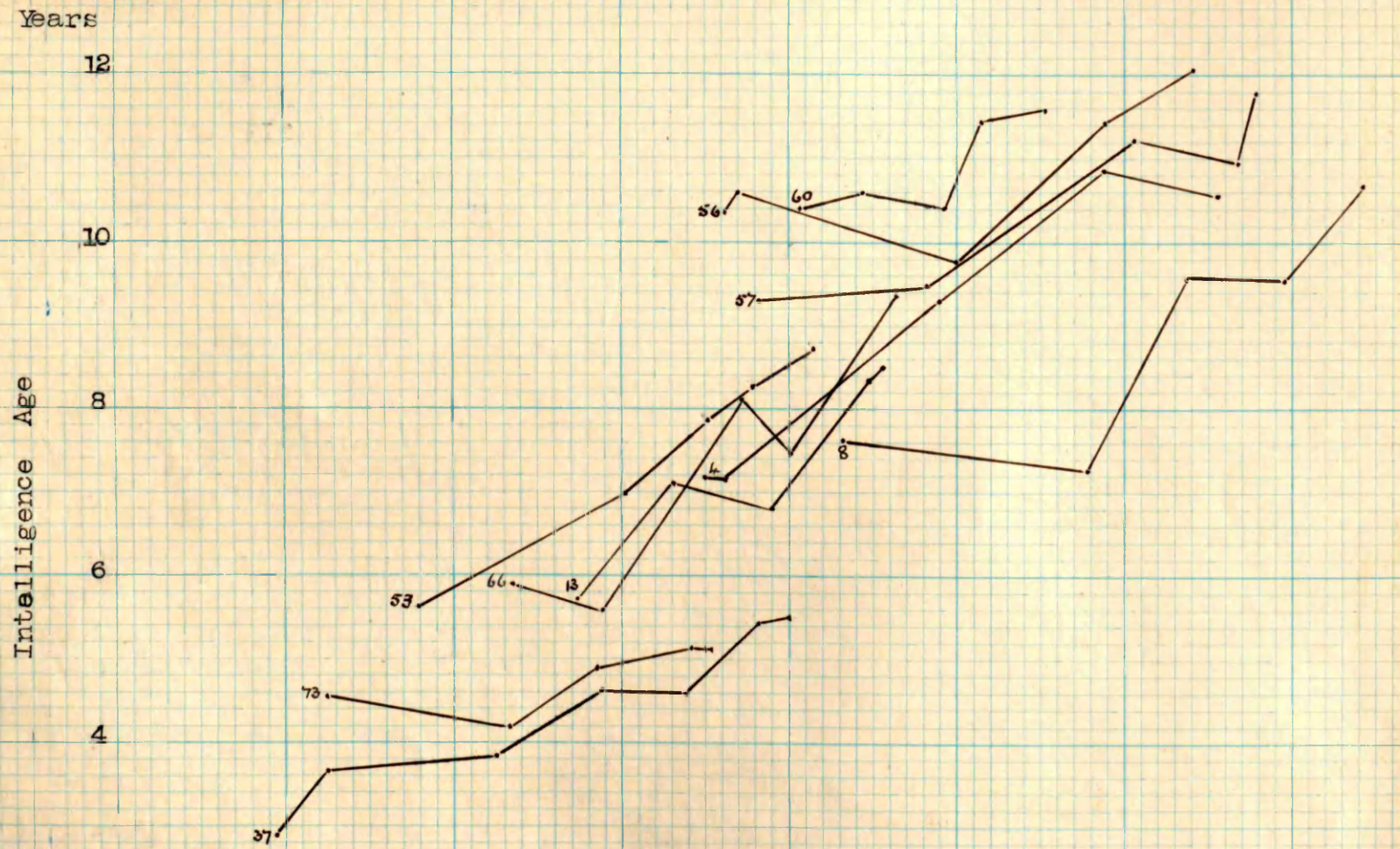


FIG. XI. " I.R. Growth Curves of the Same 17 Patients."

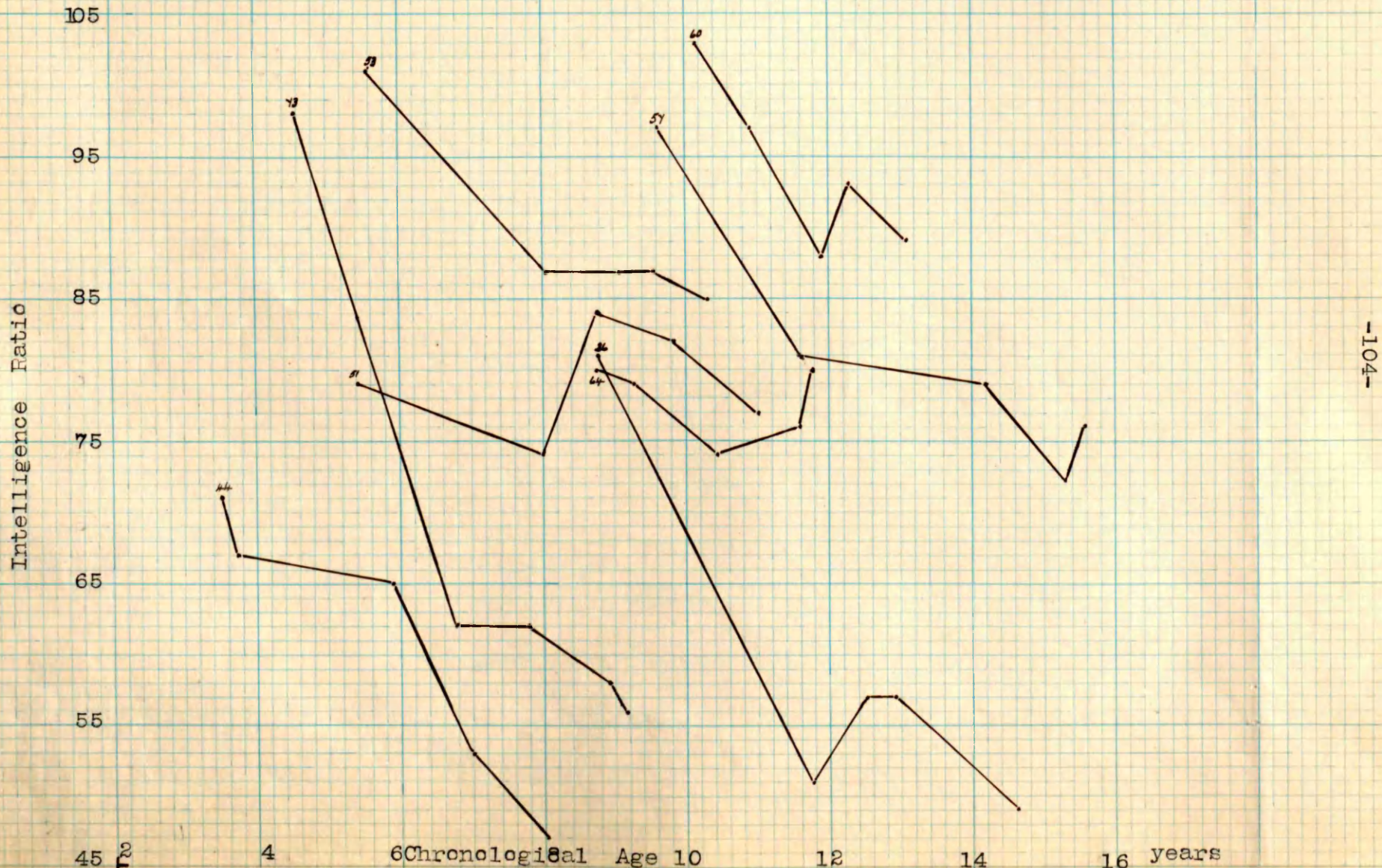


FIG. XI. (continued).

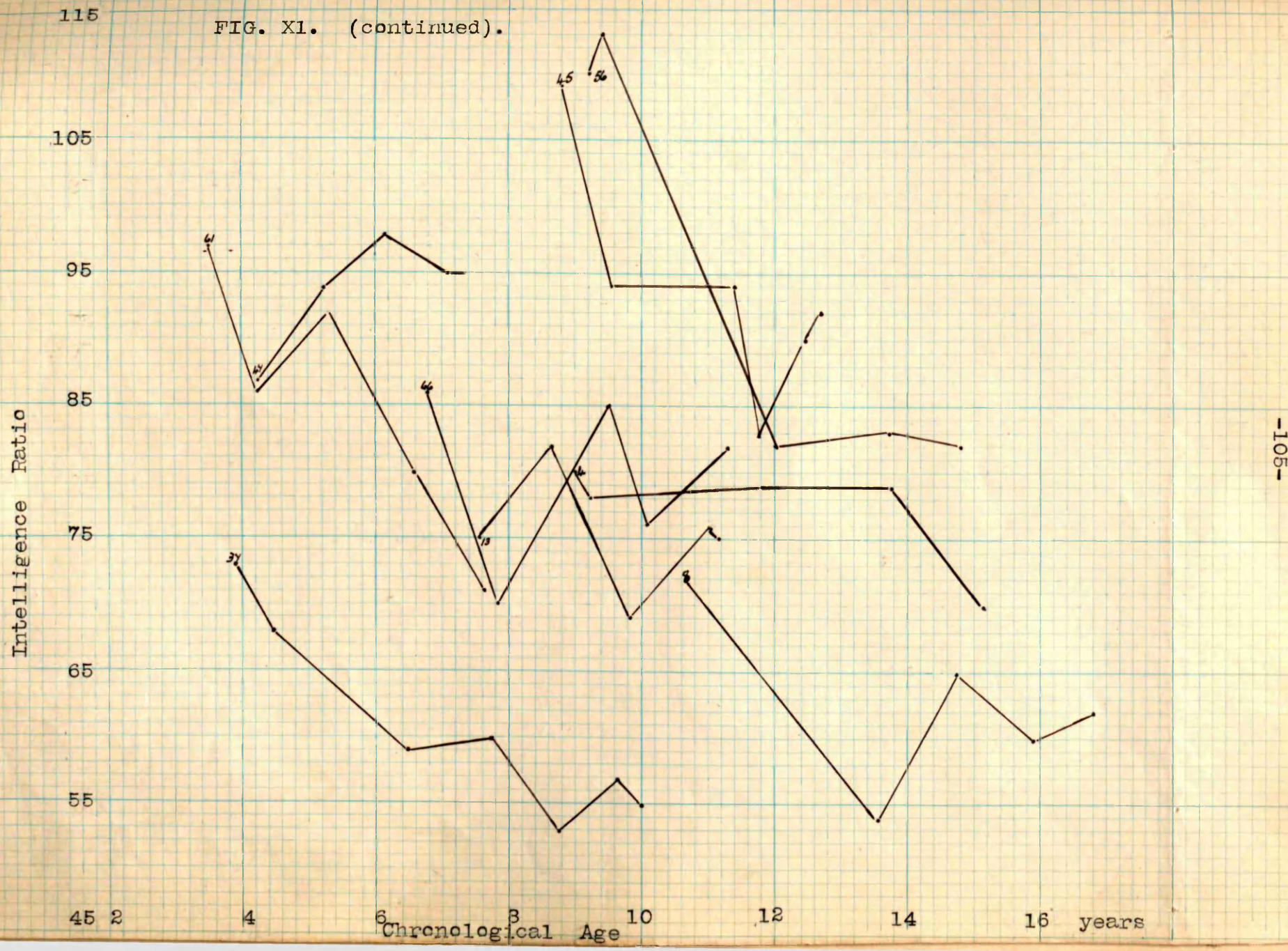


Figure X is the plotted I.A.s of the 17 encephalitics who were tested 5 times or more. They are interesting as individual developmental charts. The irregularities are what might be expected. But the general trend is in close agreement with the summed encephalitic curve in Fig. IX . About 50% (8 cases) start off with an I.A. falling approximately along Burt's curve for normals.

Figure XI is the plotted I.R.s of the same 17 cases. The most significant feature here is the large fall in the levels, in many cases, in the early years immediately following the onset of the illness, & then the flattening out, displaying constancy of the I.R. on a lower mental level.

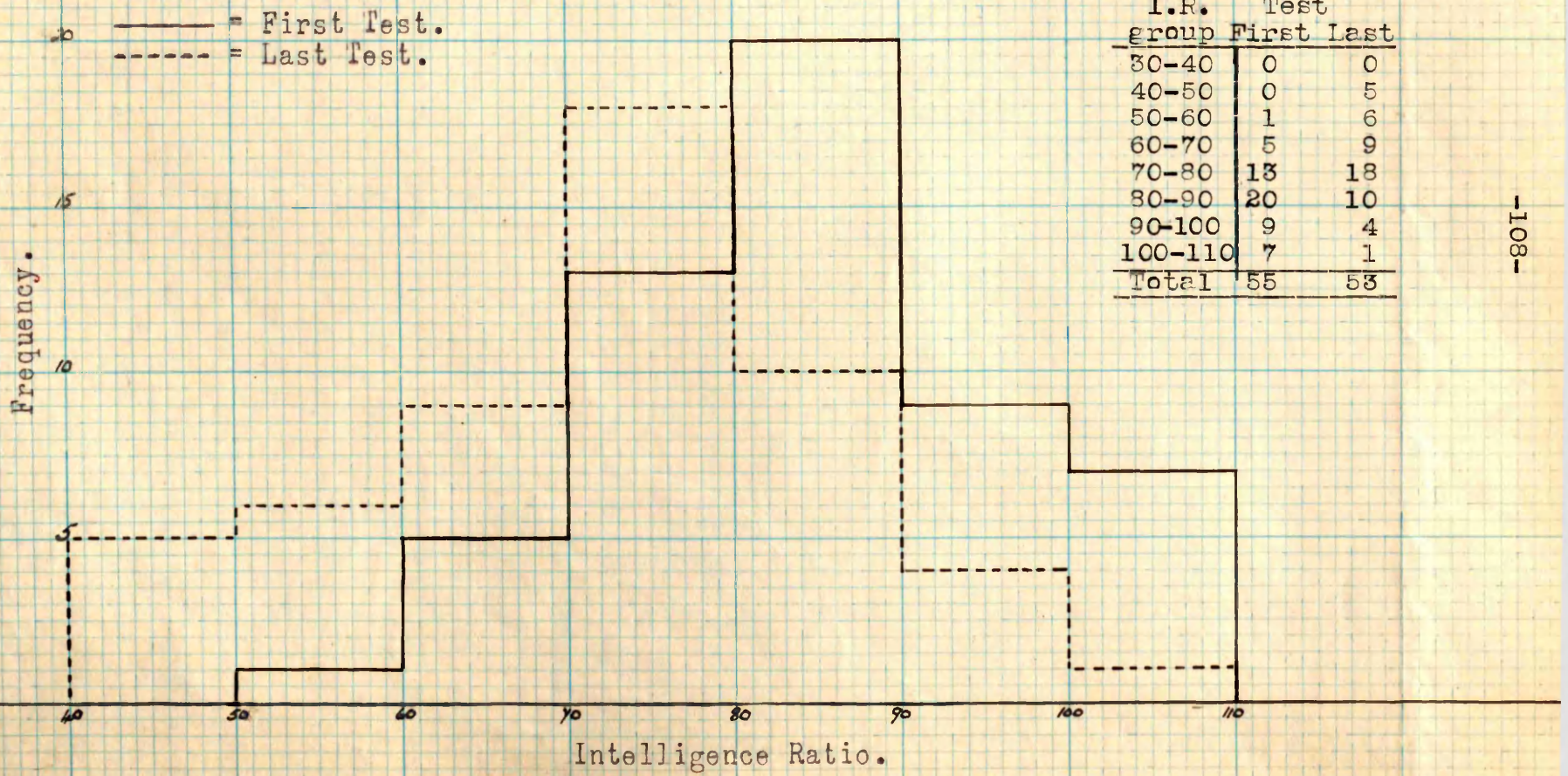
TABLE XIII.

Age in Relation to Mental Deterioration.

Chronological Age.	Tests (Patients). 1	2	3	4	5	6	7	Total Cases	Mean I.R.
3-3 11/12	(4)=83.	(1)=67.						(5)	=79.8
4-4 11/12	(2)=92.5	(2)=77.						(4)	=84.7
5-5 11/12	(3)=93.7	(2)=85.	(2)=78.5					(7)	=86.9
6-6 11/12	(5)=79.2	(2)=83.	(2)=78.5	(1)=80.				(10)	=79.9
7-7 11/12	(8)=82.1	(3)=75.3	3=89.7	(3)=69.3	(2)=83.			(19)	=80.3
8-8 11/12	(5)=87.6	(8)=78.4	1=84.	(2)=77.	(2)=50.			(18)	=77.9
9-9 11/12	(6)=87.8	(5)=85.6	(6)=76.3	(2)=84.5	(1)=56.	(1)=57.		(21)	=80.7
10-10 11/12	(5)=82.8	(4)=77.7	(2)=72.	(2)=73.	(1)=85.		(1)=55.	(15)	=77.
11-11 11/12	(5)=91.6	(7)=68.6	(4)=81.2	(3)=78.3	(4)=78.5			(23)	=78.8
12-12 11/12	(7)=80.7	(2)=78.	(4)=64.5	(3)=70.3	(1)=90.	(1)=92.		(18)	=76.2
13-13 11/12	(4)=73.5	(5)=76.	(3)=73.3	(2)=81.	(1)=89			(15)	=76.3
14-14 11/12	(1)=64.	(5)=74.4	(4)=74.2	(1)=69.	(2)=65.5			(13)	=71.8
15-15 11/12		(4)=59.	(6)=76.2	(5)=68.2	(2)=73.			(17)	=69.4
16 & over		(3)=66.	(4)=62.7	(4)=73.	(1)=62.			(12)	=66.9

Numbers in brackets are the number of cases.

FIG.XII. Histogram showing scores made by Encephalitic children.



I.R. group	Frequencies Test First	Last
30-40	0	0
40-50	0	5
50-60	1	6
60-70	5	9
70-80	13	18
80-90	20	10
90-100	9	4
100-110	7	1
Total	55	53

PROGNOSIS AS REGARDS INTELLIGENCE.

The question as to whether the intellectual effects remain is not easy to answer. Whether these are confined to the years immediately following the illness, or are life-long, is important but as yet uncertain. Parker[70] reporting on 3 cases writes:"Their progress has been so steady that there seems some reason to hope that they will eventually regain their previous mental level." Dr. Howell's[49] experience was that "patients who had suffered a mental change did not tend to improve. The clever child who had become stupid remained more or less in statu quo."

The seriousness of the effects of encephalitis lethargica on the intelligence of children is shown by the fact that the patients had at the final test a mean I.R. of 71.00 ±1.29. (the mean of Burt's mental defectives was 63.3). Of 49 cases 19(38.8%) had at their final test I.R.s below 70≠, while 34 (69.3%) had I.R.s below 80. Not one reached the 100. For the normal population the corresponding proportions, calculated from Terman's figures,[101] are 3% & 11%. For the other 974 children tested in the hospital (which included several mental defectives who had been admitted for purposes of observation), they are 6% & 20% (Dawson & Conn).[21]

The general characteristic of the group as a whole is a very serious arrest. Measured by the mean index of development the children are developing at only half the rate at which normal children develop, though within the group practically every possibility in the way of intellectual growth is found.

≠ An I.R. below 70 is almost uneducable. The possession of a low I.R.(below 80) is a great handicap against success in life. And if physical & emotional handicaps are also present, as in these cases, the outlook is by no means hopeful. (see "The Backward Child in the Elementary School," Thomas MacLaren, (Thesis MS. Glasg. Univ. Lib.1930).

ATTENTION DISORDERS.

Buzzard,[12] Leahy & Sands,[59] Lind,[61] Saunders-Jacobs,[87] Gillespie,[9] Shrubsall,[88] Hallowell,[40] Glen,[30] Duncan,[24] Auden,[3] all found some distractibility, & the normal power of concentration lacking. Hall[39] says: " voluntary attention was frequently diminished, but instinctive attention was markedly increased, the patient showing an abnormal degree of curiosity." McPhail[64] reports marked "fluctuations of attention." Hill[47] refers to their inability to concentrate in school. And Stevenson[98] writes: "The largest class,- the definitely backward- suffer very markedly from the lack of concentration & of perseverance, which is spoken of so much in adult cases. The defect is found in the other groups as well. But in these children it is very obvious; ... even in play they show little sustained interest. In the majority of cases this is accompanied by other sequelae, but in a few long-standing cases it is the only sequelae left."

Table XIV gives, in detail, particulars of our cases classified as regards ability to concentrate, by the teacher, the examiner, & the parent.

TABLE XIV.

ATTENTION. (patients).

CASE No.	I.R. Last Test	REPORT OF TEACHER	EXAMINER	PARENT
4	70		poor	
7	77			
8	62		poor	
11	50			
12	63			
13	75	easily gained, but can't be long held		poor when tired
14	56	can be fixed for only a very short time	poor	good
18				
19	69			good
20	72			
21	47		poor	poor
26	49		poor	poor
31	69			good
32	48			
37	55	none	poor	poor
41	67	poor		poor
43	78	wanders badly: seems quite unable to concentrate		
44	47		none	
45	71		poor	
47	95	very attentive		good
49	73			

ATTENTION: (continued).

Case No.	I.R. Last Test	REPORT OF TEACHER	REPORT OF EXAMINER	REPORT OF PARENT
50	96	dreamy:unable to tell what has been said:mind wanders.		good.
51	77	very inattentive.		
52	82		good	
53	85	good		
55	41		none	
56	82	very good		
57	76	inattentive	none	poor
58	81		poor	
59	89			good
60	89	attentive		
61	71			
62	71		good	
64	80	difficult to hold		
65	92	not good: easily distracted		
66	82			
67	70		poor	poor
68	72			
69	72	varies	poor	
70	61		none	poor
71	73			
72	73			
73	56		none	poor

ATTENTION: (continued).

CASE No.	I.R. Last Test	REPORT OF TEACHER	EXAMINER	PARENT
74	71			poor
75	63		poor	none
76	64			
79	55		poor	
80	64			
81	52		none	
83	104	extremely good		
84	84	wanders:little interest		wanders
85	71			
86	91			
87	80			inattentive

The variability & unreliability of personal estimates of the power of attention, apart from objective measurement, is apparent from the table. Unfortunately, in many cases, our records are incomplete. Only in 38 cases have we the opinion of one or more of the three people who made the estimate. With a very few exceptions there is usually agreement between two at least of the estimates. In 5 instances the school teacher reports 'attention' to be good; & in 12, poor. (these are of course the best of our cases: those attending school). In 6 instances the parent reports attention to be good; & in 13 poor./

poor. In 2 instances only does the examiner report attention to be good; while in 18 it is poor. These figures are the least reliable, as the examiner was not in the habit of making a note when the child's attention appeared to him to be quite normal, as judged by behaviour during performance of the test. But 18 cases showed abnormal distractibility, resulting in unusually poor responses, even after repetition of the question beyond the number of times permitted.

It seems a fair conclusion to draw from the available data, that there is considerable variation in the ability of these children to concentrate, for any length of time. While some appear to be quite normal in this respect, many, perhaps two - thirds,- suffer from attention disorders, apparent both in school & out of it.

MEMORY CHANGES.

On this point (as elsewhere) there is some great diversity of opinion, no doubt due to the lack of objective methods of measurement, and the adherence to random casual observation. The conflicting views found in the literature are no more than what one might expect.

Hohman[48] has called attention to the remarkably clear memory of many of the adult patients under his care. And Anderson[2] adds that, "a noteworthy characteristic in the case of children is that all have excellent memories, and I must admit that this may play a considerable part in giving one the impression that their intelligence is not markedly impaired."

Beverley & Sherman,[7] and Leahy & Sands,[59] also hold the opinion that memory is good.

On the other hand Lind[61], Gillespie,[9] and Wimmer,[109] report cases displaying marked impairment of memory.

Duncan[24] found memory defects to be frequent, but not severe.

Table XV gives the same information for 'memory,' as Table XIV did for 'attention.' A few cases display quite remarkable memories. Case No. 75, for example, can repeat with ease the alphabet backwards, without error; a performance which he is said to have been able to do before his illness. Nevertheless, although it is true that many of these children show, in the years following the illness, no impairment in memory/

TABLE XV.

MEMORY. (patients).

CASE No.	I.R. Last Test.	REPORT OF TEACHER.	EXAMINER.	PARENT.
4	70			
7	77			
8	62		poor	
11	50			
12	63			
13	75	fairly good	fairly good	good
14	56	fair		good
18				
19	69			good
20	72			
21	47			poor
26	49		poor	none
31	69			good
32	48			
37	55			poor
41	67			good
43	78	fairly retentive		
44	47			
45	71			
47	95			good
49	73			
50	96	satisfactory		good
51	77	has to be told everything 2 or 3 times		

(Memory table continued).

52	82			good
53	85	good		
55	41			
56	82	Very good		
57	76			good
58	81		bad	good
59	89			good
60	89	retentive	good	good
61	71			good
62	71		good	good
64	80	good		poor
65	92	good:varies	poor	good
66	82			good
67	70		poor	good
68	72			
69	72	good		good
70	61			good
71	73		poor	poor
72	73			
73	56			good
74	71			
75	63		good	good
76	64			good
79	55			
80	64			
81	52			

(Memory table continued).

83	104	very good		
84	84	very poor	good	poor
85	71			bad
86	91			poor
87	80			

memory, others do undoubtedly suffer from memory defects varying in severity.

It would appear from what information we have, that 'attention disorders' are more frequently found in post-encephalitic children, than 'memory changes.'≠

≠ See also the unexpected success of the encephalitics in the 'repeating of numbers' tests: Appendix II, p. 258.

SCHOOL PROGRESS AFTER ENCEPHALITIS LETHARGICA.

Shrubsall[38] says that the common history of a child returning to school was that work fell off badly. In some he found a diminished capacity for education. He reports a case where educational attainments were "much below his previous standard." And another case showed "impairment of educational aptitudes." "So far," he writes, "as children who return to school were concerned observation first showed a marked lowering of the M.A. score, but afterwards improved at examinations at intervals of a few months." "Encephalitis has not prevented some children from making satisfactory intellectual progress, though there is reason to doubt if they have done as well as they would have, had they not been afflicted." "In one or two instances children have gained scholarships."

Kennedy[44] reports a case who is 3rd on the school honour roll, and another who made no progress at school. Six children out of a group of 20 are attending school and making fair progress."

Hallowell[40] reports a case making "little progress along academic lines;" but another case "is now back in regular grade."

Hohman[48] reports a case where the I.R. was 87 two years after onset, and is now 100 (18months later), being accompanied by very good work at school; having been promoted twice."

Robin[80] found that "backwardness in learning, made its appearance in subjects previously normal, but with no intellectual enfeeblement."

Kerr[55] says that "teachers note the work falls off." "Although he may still manage intelligence tests well, in school he is practically ineducable from want of attention and respect."

"The children" says Wimmer,[109] "become backward at school, perhaps primarily on account of their lack of mental perseverance". He adds that it is doubtful whether actual defects of intelligence are present in the majority of cases.

Hohman[48] says: "At school the teachers found them impudent, disrespectful, disobedient, or no longer amenable to discipline. .... Instead of being interested in the school work and averagely diligent they become indolent and indifferent."

Saunders-Jacobs[87] says: "Many of the children appear to have retained whatever knowledge or skill they had before their illness, but experience great difficulty in learning anything new."

Hamel & Merland[42] are of the opinion that there is arrest of psychic development with loss of power to acquire further knowledge and also retrocession of educational nations.

It is difficult to obtain from the haphazard references in the literature any true idea of the percentage of total cases who ever return to school after the illness, and what the progress

TABLE XVI.- "PROGRESS OF 16 CASES ATTENDING SCHOOL."

1 Case Number.	2 School.*	3 I.R. Last Test.	4 Teacher's Estimate of Intelligence,	5 Position in Class.(of 100)	6 Average Age of Class.(yrs.)	7 No. of years retarded.	8 School Attendance. (percentage.)	9 Quality of School - Work. (Teacher's Report.)
13	S	75	More intelligent than appears: easily 'put out' if questioned by a stranger. Much more intelligent than speech suggests	74	8	3:2	Almost perfect.	Writing poor; unable to keep lines: Reading scarcely intelligible owing to defective speech, but seems to grasp the meaning: Arithmetic:- able for sums equal to 7yrs. old child. Very correct in spelling. Honest attempt to do all work: well done up to limits of his ability (equal to a child of 7yrs). Able to print, write, draw and do handwork. Reading ability very slight (only 2nd infant reader having been reached). Arithmetic:- able to add & subtract if allowed to use dots, strokes, blocks: quite unfit for simplest mental calculation.
14	O	56	Equal to child of 7yrs. Reasoning fair.	Not placed.	-	- 4?	Almost perfect. Never late.	
26	S	49	I.Q. 61.	Not placed.	10-16	1:6?	Very reg.	Reading & Spelling very good (Stan. 4). Arithmetic very elementary. Writing, neat but rigid. Sometimes exhibits knowledge of things outside the school curriculum. Very slow.
43	O	78	Fair. Slow to grasp.	Not graded.	11:2	1:0	Excellent.	Read. & Spell. fairly good. Writes an aver. dictation. Is of little use at Arithmetic. Can now memorise up to four-times table.

1	2	3	4	5	6	7	8	9
47	0	95	Average.	56	6	1:4	91%.	Good. Reads fairly well & recites well. Not quite so good at counting, but is capable of reasoning out the little problems given. Children with whom she started school have passed into the Junior Dept. last Feb. At that time this child was put back into the lowest class.
50	0	96	Average: not bright at answering, nor at gen. intell.	42	8:6	0:2	Satisfactory.	Average, in matter, but below average in neatness. Ordinary writing and work of class he does as well as the average child.
51	0	77	Fair:slow in uptake.	70	9:6	1:6	98%.	Fairly good.
53	0	85	Quite normal.	58	8 - 9	2:0	Good.	Good. Anxious to learn. Needle-work very good. Jun. I. work being repeated.
56	0	82	Above average(class) very intelligent.	5	12:	2:10	94%.	Very good indeed. 93% in last exam. Remarkable progress during last six months.
58	S	81	Enrolled MD. LQ. 72	--	--	2-?	Regular.	2yrs behind normal child in attainments.
60	S	89	INtelligent: good reasoning. LQ. 101	23	13-18	0:0	Almost perfect.	Very well done. Oral work excellent. Displays a desire to be first.
64	0	80	Occasional intell. mostly dull,dreamy, & slow. On the whole, mentally below normal.	75	11:	0:9	Excellent.	Generally very uneven. In highly "rational" subjects, e.gz writing, repetition, he is quite normal and even good.
			latest report 1930 I.R.71. Before illness normal:now badly affected.		9	4	Excellent	5 classes below for age: stationary for last few years.

1	2	3	4	5	6	7	8	9
65	S	92	Intelligent clever boy before illness. Very good general intelligence.	Not placed.	11:5	1:4	Very Good.	Good, if time enough is given: much mental inertia has to be overcome. Writing particularly slow. Though he can spell very well, he falls very far behind in dictation. A written composition (usually well done), takes him several days to accomplish: stops to dream frequently during the process. Cannot change quickly from one subject to another. Must finish one task before he will begin another. Seems to worry over his school-work. Is very fond of reading, & seems to understand what he reads.
69	S	72	Fair.	45	10:0	0:10	Good.	Good.
✱ 83	O	104	Slightly above ave.	39	7:6	0:0	100%.	Poor at first, but work got gradually and steadily better, until it was very good. At the end of this term, had he still been at school he would probably have been top of the boys. We were well satisfied with his progress. Reading very fluent. Counting very good and quick.
84	S	84	I.Q. 81.8	80	7:6	0:0	54%.	Reading poor; Arithmetic very poor; Handwork poor. Little interest in work or play.

* "O" stands for 'ordinary' school.
"S" .. .. 'special' ..

✱ Case No. 83, diagnosis doubtful.

Analysis of Table XVI shows that of the 16 cases attending school, seven are in attendance at "special" schools, & nine at"ordinary"schools. The highest I.R. of those attending an 'ordinary' school ≠ is 96; the lowest I.R. is 77. The highest I.R. of those attending a 'special' school is 92; the lowest is 49. (The comparison of the means of these two groups appears elsewhere. p.134) These figures,together with the teacher's estimate of intelligence, show that while low intelligence is probably the chief factor determining attendance at a 'special' school, there are other determinants,such as educational backwardness, physical abnormalities, & temperamental/unsuitability. and conduct

From all the evidence available it is obvious that case 14, with an I.R. of 56 at the last test, should not be attending an 'ordinary' school. He lives in a rural district & attends the village school. His behaviour is normal: his C.A.12;3,; his I.A. 6;11, agreeing with the teacher's estimate. He is not 'placed' in class, & is obviously a 'special' school case. The reasons for case 65 attending a 'special' school, though having an I.R. of 92, are obvious from an examination of his school record.

In four instances the teacher has furnished an I.R. rating. One of these approximates to our own: one is 9% lower than our estimate: the remaining two cases are each 12% above ours. One of these latter is, even accepting the teacher's rating (I.R.61), definitely feeble-minded; while the other,though credited with an I.R. of 101, is likewise in attendance at a

≠ Omitting case 83 (diagnosis doubtful); & case 14 (see above).

a "special school".

Three cases are in grade for age; three are under one year retarded; five are under two years retarded; and five are two years and over, - two of these being three years retarded. In other words, six are under one year retarded, while ten are one year and over. If the information available were more definite the percentage of those retarded would be greater.

As regards position in class, based on a percentage basis, the best boy occupies fifth place; the second best occupies twenty-third place (in a special school); nine fall in the bottom two-thirds of their respective classes, - six of them in the bottom fifty percent; and of the five not placed three are in special schools, and a fourth should be.

In considering the educational attainments it should be noticed that these children are now, and have been for varying intervals, in most regular attendance at school. Indeed the percentages of attendance are surprisingly high. These children, therefore, are receiving every chance to make up leeway in school subjects. There are discrepancies between the teacher's estimate of intelligenc and the same person's report on the quality of school work. For instance, case no. 69. Again, case no. 26, with an I.R. 61 (teachers rating), is reported as being very good at reading and spelling. But this judgment is based on the standard IV level; whereas the boy is age for leaving school (14; 8 years) in arithmetic, however,

is very elementary. On the other hand, case no. 47, with an I.R. of 95 (our rating) is judged by the teacher to be of average intelligence, and yet the quality of her school-work is such that she was recently put back. This is a case where the intelligence appears so far to be left intact, but apparently backwardness in the school subjects persists, and at the present she is behind children of her own chronological age. Case no. 53, with "average intelligence," has also "repeated", and is two years retarded. We might sum up column 9 thus:-

Quality of School-work.

good		fair		poor	
O.	S.	O.	S.	O.	S.
47		43			13
50		51		14*	
53		64			26
56			65		58
	60*		69		84
83**					

O. = Ordinary school.
S. = Special school.
**Diagnosis doubtful.

Such a classification is difficult to make from the available data, but the distribution seems to point to a fair degree of accuracy. Of the five reported to be doing "good" school-work, four children are attending ordinary schools; the fifth (case no. 60) is of average intelligence, but is in attendance at a special school for other reasons than intellectual ones. The five performing "fair work" are about equally distributed between ordinary and

special schools; the proportion being 3 to 2. Four of the five reported as doing 'poor work' are in attendance at special schools; the fifth (case 14) should be, & but for reasons stated above would be.

Some additional evidence of a more general nature is available. The parent , in 27 of the total cases, has supplied, at one test or another, the opinion of the patient's school teacher as regards progress made at school. In 11 of these the school record is reported to be 'good', & in 16 definitely 'bad'. The following are characteristic expressions taken from the records: "The teacher says she is slow at learning"; "not making much progress"; "little or no progress"; "used to be all right: now lessons are more difficult he seems to be losing"; "below average"; "almost incapable of learning"; "not getting on at all"; "was put back"; "backward"; "slow in picking up"; "can't write"; "can't count"(frequently reported).

In 36 cases the parent has expressed her own opinion as to her child's scholastic ability. In 17 cases the child is reported as making normal or 'good' progress; in 19, 'bad' or poor progress. Such are typical statements: "Can't learn"; "he's the 'daft' one of the family"; "called dafty by the other children"; "smartest in the family before the illness, but not now"; "used to be smart at 'picking up', but not now"; "does not seem to understand lessons"; "just like a child"; "was smart before illness,but does not seem to understand lessons now"; "a big dunce"; "has lost terribly"; "not so sensible since illness"; "poor learner"; "can't be trusted to go a message now" (several times reported).

The/

The examiner has himself ventured to express an opinion on the scholastic attainments of 47 of the patients. Thirteen are passed as normal, or at least as showing no pronounced backwardness, while 34 are reported as being either backward, dull, childish, or mentally defective.≠

The general impression from all the data is, that these post-encephalitic children are not making progress along academic lines equal to the average child, age for age. Fifty per cent at least are seriously retarded. Let us remember that the cases reported on in Table XVI are the best of the group: cases who for physical or intellectual reasons are unable to attend a place of instruction are not included.

≠ Unfortunately no Educational Tests, such as Burt's, were given to these children. Reasons for this omission readily suggest themselves: the inaccessibility of many of the cases, the circumstances under which the interview took place, the time required to make the study of each case, the early onset of fatigue in many cases, etc..

THE INFLUENCE OF SCHOOLING ON THE I.P.

We must now compare the intellectual progress of those children who have been attending school, with the progress of those not attending, to find the effect of schooling, or rather the lack of it, on our intelligence test results.

The effect of schooling on test results of normal children is still undetermined. Burt(10) writes: "There can be little doubt that with the Binet-Simon Scale a child's I.A. is a measure, not only of the amount of intelligence with which he is congenitally endowed, not only of the plane of intelligence at which in the course of his development & growth he has arrived: it is also an index largely, if not mainly, of the mass of scholastic information & skill which, in virtue of attendance more or less regular, by dint of instruction, more or less effective, he has progressively accumulated in school." Burt's data show that intelligence as measured by Binet I.A. ratings is unquestionably influenced by academic education. On the other hand, there are those who believe the tests are little influenced by the subject's educational advantages: that schooling, or the lack of it, does not affect the test results. Terman(101) maintains: "That the lack of schooling does not prevent a subject from earning an average or superior score in the test." More recently(100) he writes: "In regard to the influence of schooling I do not find any evidence (in the Year

Book/

Book of the National Society for the Study of Education, Part I, 1928) that the I.R. is very greatly affected by the ordinary differences found among children with respect to school attendance. The evidence, so far as it goes, indicates that if this influence is present at all, it is relatively small."

The younger the child the less is the result influenced by schooling. As the child grows older education will influence the results more, if Burt's view is correct.

Table 17 brings out the following facts:
Thirteen patients did not attend school before their illness, being under the school admission age. The I.R. mean of these at their first test was 84.08 (± 1.95); at their last test it was 72.08 (± 3.33), being a difference in the means of 12.00 (± 3.86). Thirty eight older patients prior to their illness, were in attendance at 'ordinary' schools. The first test I.R. mean of these was 83.47 (± 1.51), & the last I.R. mean 71.30 (± 1.35). The difference of these means is 12.18 (± 2.02). These two groups, differing mainly in age & period of school attendance, deteriorate to about the same extent. This supports Terman's view rather than Burt's.
Twenty one cases are receiving instruction at present in 'ordinary,' 'special,' or 'institution' schools. The mean I.R. of these at the first test was 86.33 (± 1.10); at the last test, 77.86 (± 2.12). The difference of the means is 8.47 (± 2.91)./

TABLE XVII.

Influence of Schooling upon Test Results.

School Attendance.	Mean I.R. 1st Test. P.E.m.	Mean I.R. Last Test. P.E.m.	Diff. of Means P.Ed.
Receiving instruction at present in ordinary, special or institution school	(21)86.333±1.996	(21)77.857±2.121	8.47±2.91
(a) In 'ordinary' schools.	(10)88.000±2.882	(10)83.500±2.660	4.50±3.92
(b) In 'special' schools.	(11)84.818±2.725	(11)72.727±2.874	12.09±3.96
In 'regular' attendance, ('ordinary'; 'special'; 'institution') since illness.	(22)86.818±1.900	(22)77.682±2.125	9.14±2.85
(a) Regularity unknown.	(7)80.714	(7)71.714	
(b) Only for short intervals. (a few months to 3 years.)	(12)85.333±2.677	(11)66.545±2.658	18.79±3.77
(c) Not at all.	(12)77.833±1.934	(12)62.333±1.560	15.50±2.49

Numbers in brackets are cases tested.

Little or none. (Not at school before, or since, or if at all, only for a short time, or in an institution school.)	(9)80.556±2.581	(9)60.667±1.841	19.89±3.17
Not attending at present (and under 14 years.)	(9)82.667±2.280	(9)58.889±1.724	23.78±2.86
Not attending at present (and over 14 years.)	(23)80.478±1.838	(20)69.000±2.241	11.48±2.90
*(a) never worked.	(13)75.615±2.251	(10)61.300±2.726	14.32±3.81
(b) Worked: but not at present. (unable to keep job.)	(5)82.600±2.713	(5)72.000±0.714	10.60±2.81
**(c) Working at present (able to keep job.)	(5)91.000±3.695	(5)81.400±2.340	9.60±4.37
At school before illness. (all attended 'ordinary')	(38)83.474±1.509	(37)71.297±1.349	12.18±2.02
Not at school before illness. (under age)	(13)84.077±1.949	(13)72.077±3.335	12.00±3.86

- *Only one case (No. 52) is physically and mentally fit to work: 3 could not be tested.
**One case (No. 87) diagnosis doubtful.

(± 2.91). Ten of these twenty one patients are attending 'ordinary' schools. Their first & last I.R. means are 88.00 (± 2.88); & 83.50 (± 2.66): the difference 4.50 (± 3.92) is not significant. Eleven of the twenty one are attending 'special' schools. The corresponding figures for these are, 84.82 (± 2.72); & 72.73 (± 2.87): the difference of 12.09 (± 3.96) is a significant one. As these two groups had at the time of the first test mean I.R.s not significantly different, while by the time of the last test, the difference has become significant, either we must conclude that, since both are receiving educational instruction of some kind, the kind of instruction given to the children in attendance at the 'special' schools does not stimulate intellectual growth, as does the instruction given to the children in attendance at the 'ordinary' schools, & accounts for the significant drop in the I.R. mean difference, or, as is far more likely, the greater degree of intellectual deterioration found among the 'special schools' children accounts for their attendance there.

In all 22 children have received regular instruction of some kind, in a school of some kind, since recovering from their illness. The first test I.R. mean of these was 86.82 (± 1.90); the last test I.R. mean was 77.68 (± 2.12): the difference, 9.14 (± 2.85), is significant. So that the I.R. drops in spite of school attendance.

Twelve cases have been in attendance for short periods varying from a few months to three years. The first test I.R. mean/

mean of these was 85.33 (± 2.68); the last test I.R. mean was 66.54 (± 2.66); the difference 18.79 (± 3.77) is very significant. Other 12 cases who have not received any school instruction since their illness, had at their first test a mean I.R. of 77.83 (± 1.93); & at their last test 62.33(± 1.56): the difference, 15.50 (± 2.49), is equally significant. Here again it might be thought that the lack of schooling accounts for the low I.R. mean at the last test, & the significant deterioration. But considering the low intelligence level of the group at the first test, it seems reasonable to assume that these cases were originally, or early after the onset of the disease, so low mentally, or too low, to profit by school attendance. Physical incapacity was in some cases a contributory explanation of non-attendance. This might also explain why the 12 cases who have been in attendance for a short period since their illness, while having a mean approximately the same as the 22 cases who have been in regular attendance since their illness, have deteriorated to a much greater extent by the time of the last test. (for the relationship of physical condition to intellectual deterioration see p. 211).

The Table supplies some additional confirmatory evidence in support of our conclusion. Nine children never attended any place of instruction before their illness, nor have they done so since, or if so only for a very short time. They had at their first test an I.R. mean of 80.56 (± 2.58), which is not significantly different from the mean of the whole group, many/

many of whom were in regular attendance at school prior to their illness. They have,however, deteriorated greatly by the time of the last test: the I.R. mean now being 60.67 (± 1.84). The difference of the means is 19.89 (± 3.17). Here again the intellectual deterioration may be due to physical incapacity, or to non-attendance at school, or to the disease itself having affected them more adversely.

Again 9 children under 14 years, who should still be attending school, are not doing so. Their first test I.R. mean was 82.67 (± 2.28); their last test I.R. mean was 58.89 (± 1.72): the difference of these means 23.78 (± 2.86) is very significant. As the first test mean of these nine is the same as that of the whole group, presumably the great intellectual deterioration is the explanation of the non-attendance at school.

Twenty three patients are not now attending school,having reached,or passed,the leaving age (14 years). Of these 13 have not yet been employed, &, unfortunately, with the exception perhaps of one case, are never likely to be. They had an I.R. mean at their first test of 75.61 (± 2.25); & at their last test,of 61.30 (± 2.73). Borderline defectives to commence with, they are now mental defectives of a low grade: the difference of the means being 14.32 (± 3.81).

Five cases have worked, though they are unemployed at present, through their own fault, having been unable to perform their work to their employer's satisfaction. The I.R. mean of these at their first test was 82.60 (± 2.71); at their last/

last test, 72.00 (± 0.71): the difference 10.60 (± 2.81) is likewise significant. There is little hope of these patients ever being in constant employment: what work they do will be of the simplest kind.

Fortunately five cases are at present employed, & are apparently not likely to lose their jobs on account of low intelligence at anyrate. The first test I.R. mean of these was 91.00 (± 3.69); at the last test it was 81.40 (± 2.34). The deterioration of 9.60 (± 4.37) is <u>not</u> significant. In one of these cases (No. 87) the diagnosis is doubtful, & he has only been employed for the past four months. Of the other four cases, two are among the earliest, with dates of onset 10, & 8½ years ago respectively. The former has been working as an errand boy for one year now, & is giving satisfaction, so far; the latter has been constantly employed since leaving school, first as 'fire-lighter' maker, & then milk boy. He has been in his present employment as an apprentice blacksmith for the last 2½ years. The dates of onset in the remaining two cases were 4½ & 3;9 years respectively. Both are steadily employed & are giving satisfaction.

So that in all four cases a fairly long period has elapsed since the onset of the acute illness, which leads us to hope that in time many of our cases,now over 14 & not working,may yet be able to do so. Unless this hope is realised we are faced with a serious after-care problem. At present something like 50% of the cases over 14 years are not employed, & only 20% or so, are constantly so. The seriousness of the situation is brought out in the accompanying chart

TABLE 18. -CASES NOT AT SCHOOL AT PRESENT -- AND WHY?

Case No.		Particulars.
4	Over 14.	Working for the past year as a message boy: No complaints about his work.
7	Over 14.	Working since leaving school. First as a 'fire-lighter' maker: later as a milk-boy. For the past 2½ years driving a steam-hammer as a blacksmith's apprentice. Recently sat successfully the required examination for enlistment in the Royal Engineers. One of the best recoveries.
8	Over 14.	Was put out of school for tormenting other children. Assists mother with housework.
11	Over 14.	In an institution for the last 2 years. Rapidly deteriorating mentally and physically.
12	Over 14.	Put out of school for bad behaviour. Now confined to bed and helpless.
18	Over 14.	Partially incapacitated.
19	Over 14.	Has never worked: unfit.
20	Over 14.	-----
21	Over 14.	Put out of special school for disturbing other children. Not working.
26	Over 14.	In an institution for mental defectives.
31	Over 14.	A mason's helper for a short time. Hasn't worked for several years.
32	Under 14.	Badly behaved. In an institution for years.
37	Under 14.	In an institution for mental defectives.
41	Under 14.	Was in an institution for mental defectives. Now at home.
44	Under 14.	Unsuitable for special school. Now in an institution for mental defectives.

TABLE XVIII. (continued).

Case No.		Particulars.
45	Over 14.	Has been in several jobs but lost them for carelessness, and "carrying on".
52	Over 14.	Has never been out working:- helps at home.
55	Over 14.	In an institution for mental defectives.
57	Over 14.	Delivered milk for 1½ days; was sacked, and received no pay.
59	Over 14.	Working: delivers newspapers morning and evening, and works in a fish shop during the day. Earns 15/- a week.
62	Over 14.	Helpless physically.
67	Over 14.	Was in an institution for mental defectives. Now at home. Has never worked.
68	Under 14.	Bed-ridden.
70	Under 14.	Helpless and confined to bed.
71	Over 14.	Has been in about a dozen jobs, but always was sacked.
72	Over 14.	Confined to bed and helpless.
73	Under 14.	Refused admission to any school; considered too dangerous: mentally defective.
74	Over 14.	Had to leave school. Confined to bed. Died.
75	Under 14.	Was in an institution. Now at home. A chair case.
76	Under 14.	Unfit and mentally deficient.
79	Under 14.	Individual confinement in an asylum on account of dangerous, impulsive, excitement.
80	Under 14.	In an institution: confined to bed.

TABLE XVIII. (continued).

Case No.	Particulars.
81	Over 14. Mentally defective: has never worked.
85	Over 14. Worked 3 months and was sacked.
86	Over 14. Working in a shop and appears to be giving satisfaction.
87	Over 14. A grocer's message boy for the last 4 months.

P A R T. I.

DISTURBANCES OF MENTALITY.

B. Affective-conative Changes.

PART I.

B. "AFFECTIVE - CONATIVE CHANGES."

In the psychological study of the encephalitic child we have bisected the mind into two parts, the intellectual & the emotional. Thus far our study has been confined to the former; or what might be better named the cognitive changes following encephalitis. We turn now to the emotional side, which includes character & temperamental changes. Because of the difficulty of defining these terms, & separating the tendencies falling under each, we prefer to use the name "affective-conative".≠ Included under it are all tendencies other than intellectual ones measurable by intelligence tests, - traits of character, strength of instincts, feelings, habits, interests, stability of mood, etc.

We might expect these patients,-knowing that they have deteriorated intellectually as a result of encephalitis,- to be affected also on the affective-conative level. It is not surprising, therefore, to find that among the most apparent & most distressing of the mental effects of this disease is a change of character. Behaviour changes, Weidner(108) says, "occur practically only in children, but are typical." And according to Hohman,(48) "are the most striking feature." According to our own results, next to the intellectual changes, changes in conduct are probably the most frequent, & to the psychologist they are equally important & interesting.

Many /

≠ The term "Psychomotor" seems less suitable for these combined changes of affect & motion.

Many of these juvenile post-encephalitics are incorrigible, & some of them are so morally disorientated that they might well come within the following description of the moral imbecile, by Dr. Tredgold:

> "The moral imbecile is not lacking in the capacity for acquiring school knowledge, as are all ordinary imbeciles, & a large number of the feeble-minded. On the contrary, he is often possessed of a cleverness, even a brilliance, which distinguishes him very widely from most ordinary defectives. He is also usually a good conversationalist, is ready at repartee, & nimble-witted; he has an engaging manner, & is an exceedingly plausible & ready liar. But he is absolutely devoid of all moral & altruistic feeling. He will lie when the truth would answer his purpose just as well. He knows neither shame nor gratitude, & will requite the utmost kindness & consideration with heartless robbery; in doing which he will not even refrain from violence. At the same time he is so devoid of the capacity for mental comparison & discrimination, for forming judgments & for looking ahead- in short, of those attributes of mind which collectively constitute wisdom or common sense- that he is quite unable to appreciate the personal disadvantages of such conduct. Even in the commission of his crimes, he will either neglect the most simple & obvious precautions, or he will act with such a total disregard of prudence as to make detection inevitable."

Such a character is to be found among our patients.≠

Frequent/

≠ A few of our most badly behaved cases have I.R.s at last test over 80 (No.s 53,66,84), & even over 90 (No.s 65,86). But it is not true to say that "intellect is often unimpaired in these cases."(Parsons,A.C. "Proc. Roy. Soc. Med.", XXi, June 1928). For though still approaching average intelligence the I.R. has dropped considerably since the time of the first test.
Shrubsall(110, p.77) appears to take no cognisance of this possible deterioration, when he says: "that there appears to be very little,if any,intellectual lack in the subjects of such (conduct) changes. The writer was recently impressed, both by the alacrity & accuracy with which certain boys answered the questions being put to them during some intelligence tests, & was not surprised to hear afterwards, that these very troublesome boys had not been certified as mental defectives."

Frequent references occur in the literature to changes in character, disposition, & behaviour, in children who have had encephalitis. Buzzard[12] says: "Bright, well-behaved individuals before the illness, subsequently most of lose/their moral sense, & become quite ungovernable at home or at school." Hallowell[40] says:" Many presented acute social problems, both in the school & the home." Marshall[65] also refers to "the naughty child's apparent disregard of all moral considerations that make him impossible at home, at school, or in the sick ward." And Hall (Royal Society of Medicine, Jan.13th. 1925) writes that, "Hooliganism, homicide, & suicide, in children of tender years, are events to which the community is unaccustomed, & for which it is unprepared. Each & all of these are now recognised sequelae of epidemic encephalitis in children, & indeed are its special characteristics." Glen[30], Lind[61], Robin[80], Collin & Réquin[16], Naville[67], Saunders-Jacobs,[87] & Duncan,[24] all refer to the frequency & severity of the disturbances of character, & the abnormalities in behaviour that are found in children. Kennedy[54] found 23 out of 61 cases (37.7%), under 14 years of age, showed changes in behaviour & personality. Shrubsall[88] examining 119 children, nine months after the acute attack, found 44 (37%) with conduct changes (quoted by Hill). We do not know where Hill obtained these figures, for in the article he is supposed to quote from (88. p.217), we read that o of 143 cases, conduct disturbances were found in 70 (49%). Of 67 cases Hill[47] himself found 26 (38.8%) showing behaviour/

behaviour disorders. Auden[3] reports moral defects and character changes in 21 out of 64 cases (32.8%); & perverted habits in 29 cases (45.3%). Ebaugh[25] among 17 children 2 to 14 years old, found a change in the patient's character & disposition in 10 cases (58.8%). In Stevenson's series "46 out of the 73 (63%) cases seen in the later stages showed a definite deterioration in conduct."[97. p.77] ≠ Dawson & Conn[21] found 29 of their 46 cases, "showed some sign of emotional or moral disturbance (63%); the remaining 17 appeared to have suffered no change in character or disposition." Our fuller study of these & additional cases, shows that of 52 patients of whom we have detailed knowledge, only 7 appear to have suffered no change whatever in character or disposition: the remaining 45 cases (86%) have all shown signs of emotional or moral disturbance, at some time since the illness. (see Appendix III.). Based on the parent's judgment alone, the numbers are as follows:- in 17 cases no change has been observed; while 24 (59%) have changed for the worse since the illness (no information is available for the remaining 13 cases). A frequent remark made by the parent is that the child has "completely changed."

These children often show no other

stigma/

≠ The figures in her MS.[98] are 44/68 (64.7%). The patients included in our own series, grouped according to Stevenson's classification, give 16/25 (64%) as showing some change for the worse.

stigma of the disease; many being physically normal. Some changes in disposition may be, in a few cases, the only sign of incomplete recovery, but it is a feature, - and often a prominent feature, - in nearly every case. Conduct changes may follow immediately after the acute attack, or may only appear many months afterwards. When once they do appear they may persist for years in their original form.≠

Here then are children who were, prior to suffering from encephalitis, normal in behaviour & character, but who apparently as an unfortunate result of disease become bad and naughty children in whom the lower appetites and emotional tendencies are expressed in an uncontrolled way. Much of the conduct of such children is reflex, instinctive, or automatic action: it is crude & primitive. Hill describes well the type:(47) "All the forms of misbehaviour are of a primitive and instinctive type of reaction, and their immediate cause appears to be a slavery of the children to primitive and instinctive tendencies. These tendencies, which are present but more under intelligent control in the normal child, seem to have their normal affective accompaniment

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≠ Unlike the born delinquent who displays an original evil impulse, and the congenital pervert whose perversity gets worse with age.

so greatly exaggerated, that obedience to them, in spite of the child's intelligence, is compulsory. The pleasure of satisfying them is so seductive, & the pain of obstructing them so unbearable, that sensual, crude, & instinctive forms of behaviour have to be indulged in."(p.3)

Dawson & Conn[21] had earlier than Hill[47] drawn attention to the "compulsive"≠ - i.e. due to some inner urge,- nature of the outbursts. The children seem to know right from wrong: they want to behave well, but their good intention does not prevent early & frequent repetition of the misdeed. Genuine remorse is felt & frequently expressed; but they seem unable to control themselves. Chastisement or suasion fail to restrain the wild acts. Thus Anderson[2] says:"They appear to be acutely conscious of the impulse to do wrong, but are quite unable to control it." One of her patients made this remark: "I am a bad boy. I know I am a bad boy, but I cannot help it." While a patient of Hill's "on sitting down at a table pushed a porcelain vessel out of her reach for fear she might have an uncontrollable impulse to smash it &, having spat furiously at me, burst into tears & would not be consoled, blaming herself bitterly." "Another patient said he often had a "feeling" that he must go into his garden & hurt his dog."

Among our own cases No. 51 knows when he does wrong, & is sorry/

≠ The victims of compulsive acts are generally children of an unstable temperament. (see Burt.(111. p.586)

sorry afterwards; but whipping has no effect. Case No.60 when spoken to replied, "I know I was doing wrong, but I cannot help it: I'm sorry." Case 75 also confessed that he could "not help doing wrong, although he knew he was being bad & doing wrong." Perhaps the best illustrative case of all is No.73 who incessantly spits on anything & everything, using his fingers to assist the saliva on its journey. The father carries a strap in his pocket, but even a good whipping is followed immediately by a repetition of the misdemeanour. Even the bribe of money is no deterrent. He tries to get the coin, but he simply cannot earn it.

Hill(47) found that: "Advice, admonition & punishment, though the patient receives them with genuine penitence, & promises of amendment, are without effect, for primitive tendencies are naturally uninfluenced, & as soon as these arise again the patients relapse." "They are fundamentally uninfluenced by environmental changes; the effect of discipline etc., being quite superficial." We are of opinion that the outbursts are somewhat controllable, for they vary with the patient's social environment: a child who is comparatively docile in hospital is sometimes unmanageable at home. Frequently at the conclusion of our examination of a child the parent would say:"And how did he behave?" And was greatly surprised when told, "splendidly! no complaint whatever!" "Well, you should have seen him this morning; you should have seen him in the car coming to hospital:he gave me a red face." Hall(38) also states, "that these children can be controlled is shown in many ways. Most of them improve considerably in hospital."

Apart from definite deterioration of character, emotional changes, more or less marked, are general. Changes in the emotional disposition may occur varying in degree from a slight intensification of emotionality -- shown in immoderate laughing and crying, general excitability and noisiness, -- to maniacal outbursts, from paltry peccadillos to serious criminal offences. There is a simplicity and childishness of outlook and demeanour.

McCowan & Cook[62] consider the "main changes lie in the emotional sphere." Stevenson[98] says: "Almost all our cases show an emotional reaction which was not present before. Laughter, tears, anger, expressions of affection, appear in rapid succession from slight cause. Few show a normal shyness or reserve. They are garrulous, curious, and demonstrative." And we may add - hypersensitive, and suggestible.

The inadequate and inconsistent emotional reactions of these patients have also been noted by Leahy & Sands[59], Lind[61], McKenzie[63], Marshall[65]. "There seems," writes Hill[47], "a general increase in the affective side of the child's life: and in a child whose behaviour is so much more than in an adult immediately determined by instinctive tendencies and responses, whose power of intelligence, reflection and control control is/

is so undeveloped, & who is normally so ready to satisfy its appetites, to blaze into anger or dissolve into tears, it is easy to see how an increase in affective response to stimuli, whether mental or physical, pleasurable or painful, can exaggerate primitive & instinctive tendencies & produce their omnipotence."(p.3) Such weakening of inhibition & excessive emotionality is true of our cases as a group, & Shrubsall(88) stands alone when he says: "apathy is commoner than excessive emotional changes." It is certainly not commoner in our experience, & is only found in severe cases of long duration. It was such that Wechsler(106) had in mind when he wrote: "There seems to be a paralysis of the emotions- general apathy. In severe cases the patient is a vegetating automaton without either intellectual or emotional life, barely showing a human flicker, & not betraying the slightest of struggle physically or psychically."(p.178).

Unfortunately we have attained nothing like the finality or certainty in the measurement of emotion, which we have reached in the measurement of intelligence. Yet these are needed as much as intelligence tests. One of the possible experimental methods- associative reaction- could not be applied to our patients owing to the slowed responses in many cases, itself a sequel of the disease.

As no trustworthy objective emotional or moral tests were given to our patients, we had to fall back on the only other possible avenue of approach - observation & personal estimates. The method of observation was the one employed and recommended by Burt in his study of young delinquents ."For all practical purposes," he writes,"in cases of every kind where temperamental & moral qualities have to be assessed, we are driven to place our faith more in the method of observation than in the method of experiment."(111.p.413)

Valentine (Brit. Jl. Psycho. xix.Jan.1929,p.235) found that, "brief interviews give little or no reliable evidence of the character of children."Oates (The Forum of Education, V.vii. No.3. Nov.1929, p.185) on the other hand, found that "judgments of temperamental qualities based upon long & intimate knowledge of the subjects have a fairly high degree of reliability." The mother through constant association probably knows her child better than any other person,- teacher or doctor. Even if illiterate the mother must have some important knowledge to supply in regard to her child. The trustworthiness/

trustworthiness of her information will vary with her own intelligence, temperament, character, & social status. Nevertheless there are possibilities in the parental interview as a source of information about the child's disposition & bahaviour.≠

In an attempt to get at the diversity & relative frequency of the affective-conative changes that follow encephalitis, we prepared the following classified table from the references in the literature:- TABLE XIX.

Nature of the disorder.	References.
1. Emotional Instability:- (nervousness,- excitable,- hysterical tendencies,- neurosis,- nervous fears,- timidity,- cries easily,- depression).	(3),(4),(48),(87), (88),(89),(24),(109) (70),(25),(40),(63), (65),(30),(98).
11. Restlessness:- (overactivity,- motor-fidgetiness).	(61),(108),(31),(32) (48), (3),(4),(88), (89),(40),(109),(47).
111. Irritability:-	(61),(59),(3),(48), (87),(88),(24),(109)
1V. Bad tempered:- (rage,- fits of anger).	(31),(48),(88),(87), (40),(24),(47),(109) (98).
V. Impulsive motor acts:- (violence,- violent conduct,- screaming acts,- uncontrollable,- destructiveness).	(59),(108),(7),(48), (87),(40),(63),(65), (109),(98),(47).

≠ Burt ("A Study in Vocational Guidance," M.R.C. Lond.1926) holds that the reliability of the parent's judgments will vary with the different qualities. The simple or primary qualities,- those based on instincts & emotions- can be estimated with greater reliability than those that have been termed secondary or complex. Acquisitiveness & curiosity are the least reliable. Cheerfulness, bad-temperedness, assertiveness, or submissiveness, are qualities which are bound to impress different parents in much the same way. And women give more reliable judgments than men. (pp. 58 - 68).

VI. Impudence and Disobedience:- (48),(12),
(obstinacy,- undisciplined,- unmanageable, (40),(65),
ungovernable,- incorrigible,- punish- (98),(47).
ment no effect).

VII. Aggressiveness:- (quarrelsomeness,- (48),(87),
hostility,- bossy,- fighting,- cruelty, (40).
mischievous.

VIII. Untruthfulness:- (lying,- deceitful). (31),(48),
(87),(40).

IX. Thieving:- (pilfering,- dishonesty). (31),(87),
(24),(88),
(89),(98),
(30),(109).

X. Sexual Precocity:- (assault,- immor-- (59),(31),
(32),(108),
ality,- masturbation,- excessive (51),(48),
(40),(88),
eroticism,- exhibitionism,- over- (89),(70),
(74),(47),
affectionateness,- immodesty). (109).

XI. Wandering:- (truancy,- vagrancy). (48),(30),
(109).

XII. Suicide, and Murder:- (attempted,- (38),(40),
(98),(109).
auto-mutilation).

XIII. Slow Reaction Time:- (54),(40),
(30).

Other disorders occurring less frequently are:- fatiguibility, begging, scratching, biting, curiosity, meddlesomeness, talkativeness, screaming, spitting, obscenity, swearing.

The/

The above appears to be roughly the order of frequency. Auden[3] found irritability in 45/64 cases (71.3%). Shrubsall[88] found irritability, morbidness, restlessness, & excitability in 45; lack of control in 26; pilfering in 18; & sexual assaults in 2,cases. Hill[47] found "anger and restlessness common to all but the mildest cases." Hallowell[40] found 50% suffering from overactivity or restlessness. Stevenson[98] found the order of frequency of the conduct changes to be:- (1) Irritability, bad temper, violence: (2) Destructiveness: (3) Cruelty to children & animals: (4) Untruthfulness: (5) Dirty habits: (6) Thieving: (7) Sexual precocity. The first four were by far the most frequent. Considering only those same seven traits, our own order,based on the last examination of 41 cases, agrees closely with Stevenson's: irritability (39%): untruthfulness (24%): destructiveness (20%): cruelty (17%): thieving (12%): dirty habits (7%): sexual precocity (5%). The order for the same cases, when all examinations are included, becomes,- cruelty, irritability, untruthfulness, destructiveness, thieving, dirty habits, sexual precocity. The most significant change in order being cruelty.

Hall (Brit. Med. Jl. 9th Mar.'29, p.445), put all traits into two groups, & concluded that 25.5% of children under 18 years suffer from moral changes; 44.7% from conduct disorders.≠ We have,following his scheme, endeavoured to so group our cases, but have found it quite impossible to do so. There is too much over-lapping. As has been pointed out by Wimmer,there is a/

≠ Roughly 40 of our traits fall in the former category; 55 in the latter.

a certain uniformity in all the patients showing behaviour & character changes, despite the fact that at any one time one or more of the above disturbances may be most apparent. The mixed type is common, if not commonest, & hence the difficulty of analysing these affective-conative changes. Webb (Brit. Jl. Psycho. V.i. Monograph Supp.3. 1915) concluded that there exists a general character factor which pervades the whole make-up of an individual, & named this trait "perseverance." Burt (111. p.422,506) also believes in "general emotionality." "A single liability to one particular instinct tends.... to be accompanied by a liability more or less excessive to most of the remainder. This correlation is clearer among children than among adults, & among delinquent children than among virtuous. Thus, as with intellectual capacities, so with emotional: a single central factor pervades them all." ≠ Widespread instability of the emotions is characteristic of encephalitics.

In view of the difficulty of classification we studied individual traits. From the references in the literature, & our own earlier case notes, we drew up a questionnaire list of affective-conative traits. (p.155) The table was constructed with a view to being useful for the study of children showing behaviour & temperamental disorders. The questions were put to the parent consequtively. The parent's answers were not confined to 'yes' or 'no', but instances, concrete facts, and actual behaviour, were asked for. In addition personal notes were made by the examiner during the time the child was being tested. The Questionnaire was as follows:

≠ Grimberg's clinical studies of criminals in the making, led him to the same conclusion. ("Emotion & Delinquency," Lon. '28).

TABLE XX. -AFFECTIVE-CONATIVE QUESTIONNAIRE.

(1).ACTIVITY:-Emotional, excitable, noisy, nervous, highly strung, restless, attentive, laughs too much, cries too much, cries easily, wild-outbursts, impulsive, apathetic, depressed, introspective, does silly things, poor self-control, slow in doing things. (Trait numbers 1 - 18)

(2).SOCIABILITY:-kind, affectionate,friendly, good-natured, selfish, jealous, stays in house, plays with others younger, led away by others, anti-social tendencies, wilful, disobedient. (19 - 31)

(3).ASSERTIVENESS:-a bully, shy, conceited, shows off, careful of personal appearance, easily influenced for good, for bad. (32 - 38)

(4).IRASCIBILITY:-bad-tempered, vicious-temper, violent, irritable, fights, aggressive, quarrelsome, obstinate, defiant, destructive, cruel (to younger children), teases, torments (without provocation), mischievous, fits of anger, rage, outbursts compulsive (automatic), outbursts controllable, bites, scratches, screams. (39 - 59)

(5).CURIOSITY:-inquisitive, asks questions, uninterested, wanders from home, wanders from school, goes to pictures. (60 - 65)

(6).FAMILY RELATIONSHIPS:-brother & sister; parent & child; parental attitude to patient (harsh, bitter, cruel, nagging, solicitous). (66 - 68)

(7).MORAL CONDUCT:-change of character, criminal tendencies, in trouble with police, with neighbours, lies, steals (degree & type), naughty, deceitful, treacherous, bad sex habits, immoral tendencies, clean habits, untidy, spits, swears, picks nose, bites nails, aware of danger, can manage himself, needs supervision, needs to be controlled, unmanageable, remorseful (contrition).(73 - 95)

(8).MENTAL HEALTH:-pathological symptoms, 'daft', hysteria, neurosis,(psychoneurosis.). (69 - 72)

It is of paramont importance to distinguish inborn emotional & instinctive tendencies, from those that may have been acquired through the illness. Just as we should have liked to know the intelligence ratio of the patient before the illness; so with his temperamental make-up. To this end the parent was asked as far as possible to rate the child for the various qualities shown in Table XX (p.155) now, as compared with what he used to be before his illness. It has not been possible to obtain a picture of each child's original disposition prior to his illness. Our data chiefly show those changes which are present now, & believed to be super-imposed by encephalitis. The 90 odd traits specified have been roughly & very generally classified into fairly well marked categories. The synonyms used in reference to many of the traits, are a check on the reliability of the parent's estimate, since the parents differ somewhat in social status & intelligence. The tendencies are not sharply marked off from one another by any clear cut lines.

And while the categories are more or less arbitrary, & are to be employed for their practical utility alone, they, nevertheless, one after another, betray a close & curious correspondence with the accredited classification of the primordial instincts of mankind.

The results are shown diagrammatically in Fig. XIII. & should be a useful record if any later study is undertaken of the same cases.

AFFECTIVE - CONATIVE CHANGES.

Key to Figure XIII(p.158).

\+ = Trait reported by parent to be PRESENT at last test.

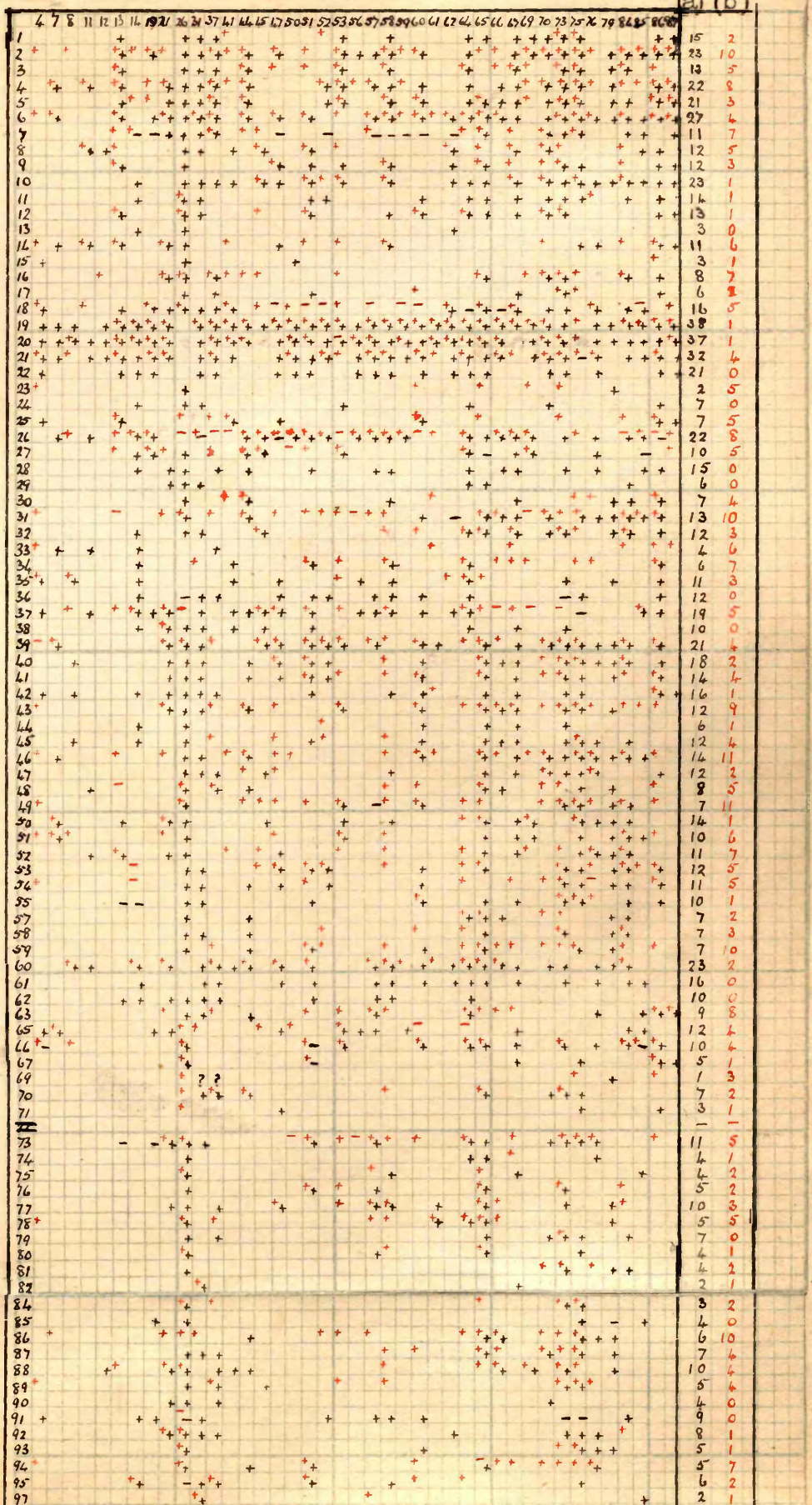
— = :: :: :: :: :: :: ABSENT :: :: ::

\+ = :: :: :: :: :: :: PRESENT at an earlier test.

— = :: :: :: :: :: :: ABSENT :: :: :: :: ::

Numbers reading horizontally correspond to Case numbers.
Numbers vertically (left) correspond to serial numbers of affective-conative traits.(see p.155)
Numbers vertically (right) are the frequencies for these traits: (a) computed from last test questionnaire;
(b) additional cases previously reported.

FIGURE X111. Case Numbers



AFFECTIVE - CONATIVE CHANGES.

Frequency Table..

TABLE XX1.

1 Trait Number.	2 TRAIT.	3 Patients. (41 cases.)	4 Controls. (41 cases.)	5 Difference.	6 Patients %.	7 Controls %.	8 Rank of Patients. (last test.)	9 Rank of Patients. (All tests.)	10 Rank of Controls.	11 Frequency Ratio.	12 X^2
(19)	Kind.	38	40	2	93	98	1	1	5½	.95	1.051
(20)	Affectionate.	37	40	3	90	98	2	2	5½	.92	1.917
(21)	Friendly.	32	41	9	78	100	3	3	2	.78	10.109
(6)	Restless.	27	8	19	66	20	4	5	18	3.30	17.995
(2)	Excitable.	23	10	13	56	24	6	4	16	2.33	8.570
(10)	Laughs or cries easily	23	13	10	56	32	6	12	11½	1.75	4.952
(60)	Inquisitive.	23	11	12	56	27	6	9	14½	2.07	7.235
(4)	Nervous.	22	12	10	54	29	8½	6½	13	1.86	5.025
(26)	Plays with others.	22	38	16	54	93	8½	6½	8	.58	15.903
(5)	Highly strung.	21	11	10	51	27	11	12	14½	1.89	5.125
(22)	Good-natured.	21	40	19	51	98	11	16	5½	.52	23.108
(39)	Bad-tempered.	21	6	15	51	15	11	9	25	3.40	12.424
(37)	Easily influenced for good.	19	40	21	46	98	13	12	5½	.47	26.648
(40)	Vicious.	18	5	13	44	12	14	18	29	3.67	10.212
(18)	Slow action.	16	2	14	39	5	16	16	47½	7.80	13.951
(42)	Irritable.	16	6	10	39	15	16	27	25	2.60	6.240
(61)	Asks questions.	16	14	2	39	34	16	34	10	1.15	.210
(1)	Emotional.	15	2	13	37	5	18½	27	47½	7.40	12.541
(28)	Easily led.	15	4	11	37	10	18½	41	35½	3.70	8.289
(11)	Wild outbursts.	14	3	11	34	7	21½	41	42	4.86	8.979
(41)	Violent.	14	2	12	34	5	21½	21	47½	6.80	11.182
(46)	Obstinate.	14	7	7	34	17	21½	9	20½	2.00	3.137
(50)	Teases.	14	2	12	34	5	21½	41	47½	6.80	11.182
(3)	Noisy.	13	6	7	32	15	25	21	25	2.13	3.357
(12)	Impulsive.	13	9	4	32	22	25	47	17	1.45	.994
(31)	Disobedient.	13	4	9	32	10	25	14	35½	3.20	6.011
(8)	Laughs too much.	12	4	8	29	10	31	27	35½	2.90	4.970
(9)	Cries too much.	12	4	8	29	10	31	41	35½	2.90	4.970
(32)	A bully.	12	5	7	29	12	31	41	29	2.42	3.636
(36)	Careful of personal appearance.	12	37	25	29	90	31	54	9	.32	31.694
(43)	Fights.	12	2	10	29	5	31	16	47½	5.80	8.613

TABLE XXI (contd.)

1	2	3	4	5	6	7	8	9	10	11	12
(45)	Quarrelsome.	12	1	11	29	2	31	34	56½	14.50	11.055
(47)	Defiant.	12	7	5	29	17	31	47	20½	1.70	.877
(53)	Fits of anger.	12	0	12	29	0	31	27	77½	29.00	14.057
(65)	Cinema-goer.	12	4	8	29	10	31	34	35½	2.90	4.970
(7)	Inattentive.	11	3	8	27	7	38½	21	42	3.86	5.513
(14)	Depressed; moody.	11	6	5	27	15	38½	27	25	1.80	.950
(35)	Shows off.	11	7	4	27	17	38½	47	20½	1.59	1.139
(52)	Mischievous.	11	4	7	27	10	38½	21	31½	2.70	3.998
(54)	Rage.	11	0	11	27	0	38½	34	77½		12.704
(73)	Changed character.	11	0	11	27	0	38½	34	77½		12.704
(27)	Plays with younger children.	10	3	7	24	7	45½	41	42	3.43	4.479
(38)	Easily influenced for bad.	10	0	10	24	0	45½	61	77½		11.389
(51)	Torments.	10	4	6	24	10	45½	34	35½	2.40	3.101
(55)	Compulsive outbursts.	10	1	9	24	2	45½	57	56½	12.00	8.504
(62)	Uninterested.	10	1	9	24	2	45½	61	56½	12.00	8.504
(66)	Abnormal sib relationship.	10	1	9	24	2	45½	47	56½	12.00	8.504
(77)	Lies.	10	0	10	24	0	45½	51	77½		11.389
(88)	Picks nose.	10	5	5	24	12	45½	47	29	2.00	2.040
(63)	Wanders from home.	9	0	9	22	0	50½	27	77½		10.110
(91)	Can look after self.	9	41	32	22	100	50½	66	2	.22	52.480
(16)	Childish. (does silly things.)	8	1	7	20	2	53	41	56½	10.00	6.116
(48)	Destructive.	8	4	4	20	10	53	51	35½	2.00	1.562
(92)	Requires supervision.	8	0	8	20	0	53	66	77½		8.865
(24)	Jealous.	7	6	1	17	15	59½	73	25	1.13	.091
(25)	Stays in house: plays alone.	7	2	5	17	5	59½	54	47½	3.40	3.129
(30)	Wilful.	7	2	5	17	5	59½	57	47½	3.40	3.120
(49)	Cruel to children and animals.	7	0	7	17	0	59½	21	77½		7.653
(57)	Bites.	7	1	6	17	2	59½	66	56½	8.50	4.986
(58)	Scratches.	7	1	6	17	2	59½	61	56½	8.50	4.986
(59)	Screams.	7	0	7	17	0	59½	27	77½		7.653
(70)	"Daft."	7	0	7	17	0	59½	66	77½		7.653
(79)	Naughty.	7	0	7	17	0	59½	73	77½		7.653
(87)	Swears.	7	1	6	17	2	59½	57	56½	8.50	4.986
(17)	Poor control.	6	0	6	15	0	67½	69½	77½		6.474
(29)	Anti-social.	6	0	6	15	0	67½	78	77½		6.474

TABLE XXI.(contd.)

1	2	3	4	5	6	7	8	9	10	11	12
(34)	Conceited.	6	7	1	15	17	67½	51	20½	.88	.091
(44)	Aggressive.	6	0	6	15	0	67½	73	77½		6.474
(86)	Spits.	6	0	6	15	0	67½	84	77½		6.474
(95)	Remorseful.	6	41	35	15	100	67½	69½	2	.15	61.064
(67)	Abnormal parent relationship.	5	0	5	12	0	73½	78	77½		5.325
(76)	In trouble with neighbours.	5	0	5	12	0	73½	73	77½		5.325
(78)	Steals.	5	0	5	12	0	73½	61	77½		5.325
(89)	Bites nails.	5	4	1	12	10	73½	66	35½	1.20	.125
(93)	Requires to be controlled.	5	0	5	12	0	73½	78	77½		5.325
(94)	Unmanageable.	5	0	5	12	0	73½	54	77½		5.325
(33)	Shy.	4	13	9	10	32	80	61	11½	.31	6.011
(74)	Criminal tendencies.	4	0	4	10	0	80	82	77½		4.205
(75)	In trouble with police.	4	0	4	10	0	80	78	77½		4.205
(80)	Deceitful.	4	0	4	10	0	80	82	77½		4.205
(81)	Treacherous.	4	0	4	10	0	80	78	77½		4.205
(85)	Untidy.	4	1	3	10	2	80	86	56½	5.00	1.917
(90)	Unaware of danger.	4	0	4	10	0	80	86	77½		4.205
(13)	Apathetic.	3	0	3	7	0	85½	90	77½		3.114
(15)	Introspective.	3	2	1	7	5	85½	86	47½	1.40	.213
(71)	Hysteria.	3	0	3	7	0	85½	86	77½		3.114
(84)	Unclean habits.	3	1	2	7	2	85½	82	56½	3.50	1.051
(23)	Selfish.	2	4	2	5	10	89	73	35½	.50	.719
(82)	Bad sex habits.	2	0	2	5	0	89	90	77½		2.050
(97)	Gambles.	2	0	2	5	0	89	90	77½		2.050
(69)	Pathological symptoms.	1	0	1	2	0	91	86	77½		1.012
(72)	Neurosis.	0	0	0	0	0	92½	93	77½		----
(98)	Begs.	0	0	0	0	0	92½	92	77½		----

Note:

The calculated correlation coefficient by the formula

$$r = \frac{S(xy)}{n\sigma_x\sigma_y}, = 0.629.$$

It seems desirable to consider the traits individually, to arrive at their relative frequency. This is done in Table XXI, which gives the number of children in the group of 41, at the time of the last test, reported by the parent as showing the several traits.(column 3). But before we know what weight attaches to the figures, we must turn to a 'control' or normal sample, & ask how often these same traits are to be found in them. Dr. Leonard Findlay suggested that the Questionnaire should be given to cardiac patients on reporting back to the out-door clinic at Yorkhill Hospital. The first 41 consecutive cases were chosen to act as a control group. The procedure was the same. The frequency figures for the controls are entered in column 4 of the table. The successive columns supply various modes of comparison of the two groups, & assess differences. The 'frequency ratio'(column 11), is the per-centage figure for the patients divided by the corresponding figure for the controls. We have applied the X^2 Test (column 12) to both groups. (see "Statistical Methods For Research Workers," R.A.Fisher. 1928. Ch.4. pp.77-96). X^2 may for fourfold tables, be directly calculated by the formula -

$$X^2 = \frac{(ad - bc)^2 (a + b + c + d)}{(a + b)(c + d)(a + c)(b + d)}$$

where a, b, c, and d, are the four observed numbers. (p.84) The reason why we quote X^2 in Table 22 , & not P, is because if the deviation is clearly significant, it is of no practical importance whether P is .01 or .000,001. And for this reason also Dr. Fisher, in his table of X^2, has not tabulated the value of X^2 beyond .01. The method is not designed to measure the/

These values have been confirmed by the application of the formula -

Coefficient of colligation (w)

$$= \frac{1 - \sqrt{\frac{Np\ Pn}{Pp\ Nn}}}{1 + \sqrt{\frac{Np\ Pn}{Pp\ Nn}}}$$

The probable errors of the coefficients have been obtained from -

$$p.e. = 0.6745 \frac{1-w^2}{4} \sqrt{\frac{1}{Pp} + \frac{1}{Pn} + \frac{1}{Np} + \frac{1}{Nn}}$$

When the association-coefficient is .5 or over, it may be considered significant.

the degree of association between one classification & another, but solely to test whether the observed departures from independence are, or are not, of a magnitude ascribable to chance: i.e. X^2 indicates significance. (p.87)."If P is between .1 & .9 there is no reason to suspect the hypothesis tested. If it is below .02 it is strongly indicated that the hypothesis fails to account for the whole of the facts. We shall not often be astray if we draw a conventional line at .05, & consider that higher values of X^2 indicate a real discrepancy. (p.77). In Table XX11 then, wherever $X^2 = 3.841$ or more, we say the deviations from expectation are clearly significant. This method is obviously the most applicable to our data. Burt in his study of the delinquent employed the coefficient of association, which is the per-centages reduced to one simple index-figure. It expresses in a single measurement the amount of similarity between the two groups for each trait specified. Says Burt(111. p.54):"The coefficient is a fractional number devised to measure, on a scale from 0 to 1, the degree to which any two conditions vary, or are found together." There are too many infinities in our data to make this measure of much value. We have, however, entered the coefficient, arrived at from Burt's graph,(10.p.219) as a subsidiary mode of comparison, in Table XX11.(see opposite page). In a foot-note Burt adds this warning(111.p.55): "It cannot be too strongly emphasised that, in dealing with the intangible qualities of human nature, these statistical measurements have nothing of the precision which they could claim if we had been weighing coal or chemicals instead of the mind of the erratic child/

child. They are simply compendious ways of summarising our rough data & nothing more."

Broadly speaking, however, the figures suggest the following deduction: certain traits are positively correlated with encephalitis lethargica; & some of them to a high degree. So that these particular affective-conative changes must be attributed to the disease. For other traits the actual numbers in the two groups are nearly alike: while ~~for~~ a still smaller number of traits, are negatively correlated with encephalitis. Judged by the values of X^2 the following proves to be the order of frequency: (Table XX11).

TABLE XX11. - "ORDER OF FREQUENCY."

Trait No.	TRAIT.	X^2	Coeffic. of Assoc.	
	(Patients predominating)			
6	Restlessness.	18.0	.5	
53	Fits of anger.	14.1	—	
18	Slow action.	13.9	.6	
54	Rage.	12.7	—	
73	Changed character.	12.7	—	
1	Emotional.	12.5	.5	
39	Bad-tempered.	12.4	.4	
38	Easily influenced(for bad).	11.4	—	
77	Tells lies.	11.4	—	
41	Violent.	11.2	.5	
50	Teases.	11.2	.5	
45	Quarrelsome.	11.1	.6	
40	Vicious.	10.2	.4	
63	Wanders.	10.1	—	
11	Wild outbursts.	9.0	.4	
92	Requires supervision.	8.9	—	
43	Fights.	8.6	.4	
2	Excitable.	8.6	.3	
55	Compulsive outbursts.	8.5	.6	
62	Uninterested.	8.5	.6	
66	Abnormal sib relations.	8.5	.6	
28	Easily led by others.	8.3	.4	
49	Cruel to younger children.	7.6	—	
59	Screams.	7.6	—	
70	"Daft."	7.6	—	
79	Naughty.	7.6	—	
60	Inquisitiveness.	7.2	.3	P= .01

TABLE XX11. (continued).

Trait No.	TRAIT.	X^2	Coeffic. Assoc.	
17	Poor self-control.	6.5	1	
29	Anti-social.	6.5	1	
44	Aggressive.	6.5	1	
86	Spits.	6.5	1	
42	Irritable.	6.2	.3	
16	Does silly,childish things.	6.1	.6	
31	Disobedient.	6.0	.3	
7	Inattentive.	5.5	.4	P= .02
67	Abnormal parent relations.	5.3	1	
76	Complaints from neighbours.	5.3	1	
78	Steals.	5.3	1	
93	Requires to be controlled.	5.3	1	
94	Unmanageable.	5.3	1	
10	Laughs & cries easily.	5.0	.5	
5	Highly strung.	5.0	.2	
4	Nervous.	5.0	.2	
8	Laughs too easily.	5.0	.3	
9	Cries too easily.	5.0	.3	
65	Cinema-goer.	5.0	.3	
57	Bites.	5.0	.6	
58	Scratches.	5.0	.6	
87	Swears.	5.0	.6	
27	Plays with younger children.	4.5	.3	
74	Criminal tendencies.	4.2	1	
75	In trouble with the police.	4.2	1	
80	Deceitful.	4.2	1	
81	Treacherous.	4.2	1	
90	Unaware of danger.	4.2	1	
52	Mischievous.	4.0	.3	P= .05
	(Patients & Controls approximately equal)			
32	A bully.	3.6	.3	
3	Noisy.	3.4	.2	
46	Obstinate.	3.1	.2	
51	Torments.	3.1	.2	
25	Stays in house.	3.1	.3	
30	Wilful.	3.1	.3	
13	Apathetic.	3.1	1	
71	Hysteria.	3.1	1	
88	Picks nose.	2.0	.2	
82	Bad sex habits.	2.0	1	
97	Gambles.	2.0	1	
20	Affectionate.	1.9	-.4	
85	Untidy.	1.9	.4	
48	Destructive.	1.6	.2	
35	Shows off.	1.1	.1	
19	Kind.	1.1	-.3	
84	Unclean habits.	1.0	.4	
69	Pathological symptoms.	1.0	1	

TABLE XXII (continued).

Trait No.	TRAIT.	X^2	Coeffic. Assoc.
14	Depressed.	1.0	.2
12	Impulsive.	1.0	.1
47	Defiant.	.9	.2
23	Selfish.	.7	-.2
61	Asks questions.	.2	.05
15	Introspective.	.2	.1
89	Bites finger nails.	.1	.0
24	Jealous.	.1	.05
34	Conceited.	.1	-.05
	(Controls predominating)		
33	Shy.	6.0	-.3
21	Friendly.	10.1	—
26	Plays with others.	15.9	-.5
22	Good-natured.	23.1	-.72
37	Easily influenced (for good)	26.6	-.74
36	Careful of appearance.	31.7	-.65 ≠
91	Looks after self.	52.5	—
95	Remorseful.	61.1	—

≠ The p.e. of most of the coefficients is around ± .13.

The interesting thing is, that in spite of the obvious weaknesses of the method,- e.g., the different meanings many of the terms have for different people, the unfamiliarity of many of the parents with many of the words, etc., the order of frequency in the table is in the closest agreement with the opinions of other writers on the subject; thus showing the reliability of the method.

The order of frequency is not greatly altered when all test records of the same 41 cases are considered. At the top end of the table the order is as follows:-

restless, excitable, slow action, disobedient, bad-tempered fights, nervous, obstinate, cruelty, fits of anger, screams, wanders from home, violent, rage, changed character, spits, emotional, inattentive, vicious, quarrelsome, does silly things, etc..

THE INFLUENCE OF AGE UPON BEHAVIOUR.

It has been said that behaviour is "worse in children who have had the disease before adolescence." And Anderson(2) writes that "the younger children tend to suffer mental impairment rather than moral perversion, while older children show a tendency in the opposite direction." Our observations lend no support to such a generalisation. Moral and emotional disturbance is present in children of all ages. ~~[illegible] patients who were below 5 years of age at their first test were suffering in this way.~~ Thirteen of our cases when seen at the last test were reported to be very badly behaved: their conduct was uncontrolled, & punishment had no deterrent effect. Four of the thirteen (30.8%) were under 5 years old at onset. And the average age at onset of the group was 86.7mths. In 20 cases seen at the last test, the behaviour was said to be controllable, & punishment was unnecessary,(not because of physical incapacity). Of these, 8 (40%) were under 5 years old at onset. And the average age at onset of the group was 80.5 months.

The average age at last test of the uncontrolled, badly behaved, group was 11;8 years; the average age of the well-behaved group at last test was 13;1 years.

From Table XXIII,it is apparent that age, both at onset & last test, has no influence upon the affective-conative changes that follow encephalitis lethargica.

TABLE XXIII.

"AGE AND AFFECTIVE- CONATIVE CHANGES."
(Summary of all available data)

Groups	Mean Ages First test	Last test
Worst cases of behaviour:uncontrollable.	7;3	11;8 years
Best cases .. .. controllable.	6;8½	13;1 ..
Character Unchanged.	6;8	12;11 ..
.. Changed.	7;9	12;6 ..
.. Unchanged (Stevenson's figures)	7;5	12;6 ..
.. Changed (.. ..)	7;4	13;5 ..
Temperament & Disposition (quiet, shy, introspective,dull)	7;3	11;11 ..
.. (bright, cheery,smile,talkative)	7;7	13;1 ..
Good Conduct	7;6	13;3 ..
Bad ..	7;6	12;6 ..
Conduct: improving.	6;10	12;10 ..
.. same.	7;9	12;10 ..
.. becoming worse.	7;7	13;0 ..
Moral conduct: good.	6;9	12;8 ..
.. .. bad.	7;8½	12;8 ..
Family Relationships: normal adjustment.	6;10	13;1 ..
.. .. abnormal ..	7;5	11;11 ..
Irascibility. (a) Irascible.	7;3	12;6 ..
.. (b) Non-irascible.	7;4	13;2 ..
Assertiveness. (a) Assertive.	7;2	12;4 ..
.. (b) Non-assertive.	7;2	13;2 ..
Activity. (a) Active & emotional.	7;4	12;5 ..
.. (b) Inactive & unemotional.	7;5	13;9 ..
Sociability. (a) Sociable.	7;10	13;6 ..
.. (b) Unsociable.	6;3	12;2 ..
Sleep disturbance.	7;5	12;10 ..

INTELLIGENCE & MORAL AND EMOTIONAL DISTURBANCE.

Of importance in connection with those children displaying personality and behaviour changes, is the consideration of their intellectual status.

We recall Terman's statement[101] that his children "were about as superior morally as they were intellectually. The correlation between I.R. and 24 mental, moral, and personal traits, being .76. Very dull children rated inferior in all traits."(p.184f.)

With reference to the encephalitic, McCowan & Cook[62] maintain that he "is almost invariably intellectually superior to his conduct."(p.1319).

Wimmer[109] is doubtful whether actual defects of intelligence are present in the majority of cases.(quoted by Hill). Of Hill's cases[47] "a number of the most marked cases of behaviour disorder gived a normal response to intelligence tests of their appropriate age, and none show serious retardation."

Kennedy[54] "There is no evidence to show that a considerable proportion of these patients are mentally retarded or deficient. Some of them appear dull and drowsy, but in their antics and behaviour they display a cunning that is not commensurate with greatly impaired mental faculties." It is difficult to reconcile this statement with what follows on the same page:- "The mentality of (20/23 with 6 exceptions, i.e.)

14/20, is so impaired by this or other sequelae that they have made little or no progress, and some of them are worse. The 6 exceptions are children who are attending school and making fair progress." (p.171).

Shrubsall[88] writes: "The demoralisation has certainly no relation to intellectual standards .... Sometimes the intelligence level is shown by the deed." "The conduct cases showed often little intellectual impairment." Marshall[65] found, "that the recognised mental tests show that the apparent precocity of the restless naughty child is not accompanied by a high I.Q. On the other hand it is quite exceptional for one of these children to have an I.Q. below 85." How can he reconcile that statement with this one which immediately follows it?- "Their mental powers do not mature. They are a sort of Peter Pan; -- they never grow up." (p.540).

Hall[38] writes: "that the children (in the "difficult child group"), are mentally inferior to what they were before, and to what they ought to be, is generally agreed, and this defect is increased by their long illness."

[Kennedy thinks that "there is no evidence that a considerable proportion of these are mentally retarded or deficient."]

And Anderson[2] states that "moral imbeciles do not suffer from severe mental defect, while those suffering from severely impaired intelligence do not present psychical and

emotional disturbances in any marked degree."
Stevenson[98] remarks, that in her series "the result of ordinary observation certainly points to mental deterioration. Children who have passed through periods of extremely violent behaviour, & who have now become docile (e.g. cases 5, 8, 10 & 29) show a very obvious feeble-mindedness. Lack of normal shyness frequently gives at first a false impression of intelligence, which is soon found to be incorrect."

Seventeen of our patients are reported by the parent to have suffered no change in character or conduct as a result of the illness, while 24 are said to have changed. The average I.R. of the former at the first test was 84.40 ±2.34; that of the latter 88.00 ±1.39: the difference between these means is 3.60, while its probable error is ±2.72, so that it is not significant. Again, the average I.R. of the former group at the last test was 74.9 ±1.94; that of the latter group 71.8 ±2.01: the difference between these means is 3.1, & its probable error is±2.79, so that it is not significant.

We have further classified the patients into two groups, based on the parent's reply to the questionnaire on affective-conative changes. Twenty three cases appear to be fairly normal emotionally & morally, 24 emotionally & morally unstable. The average I.R. of the former group at the first test was 83.52 ±1.91; that of the latter 87.33 ±1.42: the difference between these means 3.81 ±2.38, is not significant. The mean I.R. of the former group at the last test was 74.13 ±1.60; that of the latter group 69.33 ±1.86: the difference between/

between these means is 4.80 ±2.46; which is likewise not significant.≠ Thus a comparison of the two groups fails to show any significant difference in I.R. ~~The emotionally & morally unstable group, & the emotionally & morally normal group, deteriorate about equally intellectually.~~

One further classification was made. We compared the best behaved with the worst behaved cases. Twenty children, when last seen were well behaved; their conduct was controllable, & disciplinary measures were unnecessary(not because of physical infirmity or helplessness). The average I.R. of these cases at the first test was 81.60 ±2.05. Thirteen children were very badly behaved, displaying uncontrolled conduct, & upon them punishment had no deterrent effect. The mean I.R. of these at the first test was 92.54 ±1.68. The means of the two groups at the last test were 70.25 ±2.11 & 74.77 ±3.07 respectively. The difference between these latter means is 4.52 ±3.73 , which again is not significant.

Table XXIV summarises the foregoing, & in addition supplies information on the question of the extent of intellectual deterioration in the 'changed' & 'unchanged' conduct groups, respectively/

≠ We have classified the cases reported by Stevenson. Sixteen cases included in our inquiry are reported by her to be normal; leaving 25 others who show some change in conduct. The average I.R. of the former group at the first test was 87.81 ±2.06; that of the latter, 81.44 ±1.51: the difference between the means is 6.37 ±2.55
The mean I.R. of the 16 cases showing no conduct changes, at the last test, was 74.37 ±2.17; that of the 25 showing conduct changes was 67.4 ±1.67: the difference between the means is 6.97 ±2.74.

Table XXIV.- "Intelligence and Conduct Disturbance."

Conduct.	No. of Cases.	Mean I.R. first test	Mean I.R. last test.	Difference of Means.
"Unchanged" (good)	17 (P.)≠	84.4 ±2.34	74.9 ±1.94	9.5 ±3.04
	16 (S.)≠	87.81 ±2.06	74.37 ±2.17	13.44 ±2.99
	23 (C.)≠	83.52 ±1.91	74.13 ±1.60	9.39 ±2.49
	20 (C.)≠2	81.60 ±2.05	70.25 ±2.11	11.35 ±2.94
"Changed" (bad)	24 (P.)	88.0 ±1.39	71.8 ±2.01	16.2 ±2.44
	25 (S.)	81.44 ±1.51	67.4 ±1.67	14.04 ±2.25
	24 (C.)	87.33 ±1.42	69.33 ±1.86	18.00 ±2.34
	13 (C.)2	92.54 ±1.68	74.77 ±3.07	17.77 ±3.50

≠ (P.): classified from data supplied by Parent.
(S.): " " " " " Stevenson.
(C.): " " Conn's data.
(C.)2 " " Conn's data (best & worst cases only.)

It is apparent that the "changed" conduct cases suffer greater intellectual deterioration than those whose conduct remains "unchanged."

At the last test the parent was asked to say whether the child's behaviour was 'normal'; was 'bad & stationary'; was now definitely 'improving'; or was 'becoming worse.' The results are shown in Table XXV.

TABLE: XXV.- "Prognosis as regards Conduct, & Intelligence."

Conduct (at present)	No.of cases	Mean I.R. first test	Mean I.R. last test	Diff.of means	Mean index development
Normal.	7	87.14 ±4.41	77.7 ±3.34	9.3 ±5.53	+0.556 ±0.09
Improving.	22≠	80.05 ±1.55	71.00 ±1.65	9.05 ±2.26	+0.622 ±0.04
Unchanged. (bad)	16≠≠	84.06 ±1.82	68.19 ±2.11	15.87 ±2.79	+0.477 ±0.07
Becoming worse.	7	92.71 ±2.65	66.00 ±4.13	26.71 ±4.91	+0.021 ±0.11

≠ Including 7 cases now confined to bed: mean I.R., first test, of these was 71.86; last test 65.57. Excluding these the figures become 83.87, & 73.53.

≠≠ Including 4 cases now confined to bed: mean I.R., first test, of these was 81.25; last test 61.25. Excluding these cases the figures become 85.00, & 70.50.

Note. Children who are suffering from a progressive Parkinsonian syndrome, are often reported to be improving in behaviour. In these, motor incapacity, rather than any real improvement, may be producing the change.

Here again there is no significant difference between the mean I.R.s of the several groups, either at first or last test. Hence, the conclusion would seem to be, that whatever may be the ultimate explanation of the moral disturbance, it is not determined solely by the intelligence level of the patients. But the greater degree of intellectual deterioration among the 'changed' conduct cases, is again apparent. The difference between the first & last test I.R. means, for those who are 'normal' in conduct, is 9.3 ±5.53; for those whose conduct is 'improving' 9.05 ±2.26; for the 'badly behaved', showing little change, for better or for worse, 15.87 ±2.79; and for those definitely 'becoming worse', 26.71 ±4.91.

As/

As measured by the index of development, the normal in conduct cases are developing at half the normal rate intellectually; while those whose conduct is becoming worse are likewise lowest mentally,- scarcely making any progress. The difference of the means of these two groups is significant, being almost four times its probable error (+0.535 ±0.14).

Table XXVI is an attempt to discover if there is any connection between affective-conative defects (as classified in Table XX, p. 155), & deterioration of intelligence. It would be unwise to draw any conclusions from the figures. The classification of traits is empirical; there is considerable over-lapping of cases in the various groups, & there is the "g" factor already referred to (p. 154). Only one group (Group 6) calls for comment, when we consider the mean I.R. at the first test. Here, there is a difference in the means of 8.33 ±2.57. Ten patients who show some abnormality in home adjustment, either to a parent or a sibling, had at their first test an I.R. mean of 92.70 ±1.93; while 27 who are 'normal' had a mean of only 84.37 ±1.70. This significant difference,- which disappears at the last test,- seems to be due to the difference in time-interval between the onset of the disease & the first test, for the two groups: namely, 9 months & 21 months (normals) respectively. Again, when we consider the figures at the last test, only one group (Group 3) need be referred to. The mean I.R. difference between the 14 patients displaying excessively assertive character qualities, & the 27 who are unassertive, is 9.95 ±2.87. This figure becomes even more significant, when we/

TABLE XXVI.- Affective-Conative Changes.

Analysis - (General).

Type.		No. of Cases.	Mean M.R. 1st Test	Probable Error.	Mean M.R. last Test	Probable Error.
(1) Activity.	(a) Inactive..	9	87.78	±3.37	73.33	±3.40
	(b) Active.	40	84.17	±1.30	70.85	±1.46
	Diff.		3.61	±3.61	2.48	±3.70
(2) Sociability.	(a) Sociable.	26	85.19	±1.80	72.58	±1.59
	(b) Unsociable.	16	86.50	±1.63	70.81	±2.47
	Diff.		1.31	±2.43	1.77	±2.94
(3) Assertiveness.	(a) Assertive.	14	86.21	±1.95	65.57	±2.33
	(b) Unassertive.	27	86.37	±1.67	75.52	±1.68
	Diff.		.16	±2.57	9.95	±2.87
(4) Irascibility.	(a) Irascible.	26	87.08	±1.55	70.38	±1.94
	(b) Non-irascible.	19	83.26	±2.07	71.42	±1.92
	Diff.		3.82	±2.59	1.04	±2.73
(6) Family Relationships.	(a) Normal.	27	84.37	±1.70	73.48	±1.57
	(b) Abnormal.	10	92.70	±1.93	72.40	±3.07
	Diff.		8.33	±2.57	1.08	±3.45
(7) Moral Conduct.	(a) Good.	22	85.56	±1.97	75.05	±1.83
	(b) Bad.	18	87.17	±1.69	68.38	±2.07
	Diff.		1.61	±2.60	6.67	±2.76
(8) Mental Health.	Pathological.	17	82.82	±1.96	64.18	±2.28

NOTE:

(5) Curiosity. Only 3 cases were reported to be non-curious. (See foot-note above p. 151)

we take the mean time-interval between the onset & the test into account. For the'assertive' group,whose mean I.R. at the last test was 65.57 ±2.33, the interval was 62 months; while for the 'unassertive'group whose mean I.R. was 75.52 ±1.68, the mean time-interval was 72 months.(the longer the interval, the greater the intellectual deterioration).

The 9 'inactive' or unemotional, apathetic patients, have at both first & last tests, mean I.R.'s not significantly different from the 40 'active' or emotional patients. And both groups have deteriorated to the same extent. Which agrees with Marshall's statement that, "the apparent precocity of the restless naughty child is not accompanied by a high I.Q." Burt,(111.pp.305,525) in his study of young delinquents, while pointing out that lack of intelligence tends to accompany lack of energy,- that imbeciles are apathetic rather than excitable,- also states that, "the mental defective may be in temperament either assertive and impulsive (aggressive or emotional), or sullen & listless."(p.308) Webb(B.J.P.1915 (Vol.1: P.27)) has likewise proved that the correlation between I.R. & temperamental traits is low: temperament is independent of I.R. With these statements our own results are in agreement.

We further classified our patients, as far as possible, into two extreme groups, for temperament & disposition. The one group comprised children who during the performance of the tests impressed the examiner as being shy, quiet, introspective, giving no smile response, lacking in interest,- corresponding to what Burt calls the passive, sensitive, repressed child.(p.515) The other group was made up of children considered to be bright in/

in disposition, cheery, talkative, interested, ready to respond, - what Burt calls the active, demonstrative, excitable, unrepressed child. The mean I.R. of 17 cases comprising the first group (unemotional, plegmatic, or repressed temperament), is 85.35 ±2.21; at the first test: that of the 29 in the second group (emotional or unrepressed), at the corresponding test, is 83.07 ±1.69. The difference between these means is not significant (2.28 ± 2.78). The means at the last test for the same cases are 74.94 ±2.68, & 69.17 ±1.68. The difference (5.77±3.16) is likewise not significant.≠

≠ note:

The average I.R. of Burt's 'repressed' cases was 107,- decidedly above that of the ordinary child. The average I.R. of all his delinquent cases was 89. (p.556)

PATHOGENESIS OF BEHAVIOUR DISORDERS.

It is outwith the scope of this enquiry to deal with the various theories of pathogenesis which have been put forward. It may be mentioned in passing that Marshall considers that the patients suffer from psychomotor excitement similar to that occurring during an attack of acute mania of the manic-depressiv type. This theory is denied by Mapother. Shrubsall believes that the condition is due to a persistance of the mental upset of the acute stage of the illness as a habit or a psychoneurosis Leahy & Sands[59] "believe that the mental disorder ..... can be explained best on a purely physical basis." Auden[3] writes that the mechanism producing the heightened instability and diminished power of control may be that of "regression due to removal or suppression of the epicritic control over the protopathic instinctive tendencies."

Hill[47] says that the condition would seem to be due to an organic lesion of the brain, and thinks that it is possible to indicate the organic lesion responsible for the increase in the affective accompaniment of primitive and instinctive tendencies. "We suggest that the organic lesion is an encephalitic one producing a loss of cortical inhibition over, or chronic excitation of, the optic thalami." We know the thalamus is the seat of affective life, and it is fairly certain that behaviour disorders represent a primary disorder of affect.

Crude, primitive, instinctive behaviour is bound up with the thalamus. McDougall ("Outline of Psychology," London, 1922. p.104) says: " It has been shown that instinctive actions of the mammalia are chiefly dependent on the basal ganglia of the brain (especially the optic thalamus) ": "there is good evidence that each of the principal forms of instinctive activity is especially dependent upon a particularly small mass of nervous tissue within the basal ganglia." (p.104).≠

While it seems quite reasonable to believe that the explanation of the behaviour disorders in the present instance may be found in an involvement of the thalamus, we know that other conditions may also give rise to similar disturbances in conduct. We know, for instance, the effect disfunctioning of the glands has on conduct (as well as on intellect). Worster-Drought has recorded the case of moral imbecility associated with dyspituitarism. (see J. Neur. & Psycho. 1924, V, 146: and Proc. Roy. Soc. Med. 1925, XVIII, 2).

≠ Chorea, like encephalitis, is nearly always accompanied by some degree of emotional instability. Here also the lack of control often leads to misbehaviour. And recent pathological work suggests that the lesions in chorea affect much the same portion of the brain, - the basal ganglia & probably the motor cortex,- as the lesions left by encephalitis lethargica.

We also know that feeble-mindedness and delinquency are often found together:the former frequently as cause. And knowing that these children are suffering from serious general intellectual enfeeblement, the primitive character of their emotional reactions can,to some extent,be thus explained. For deterioration of the intelligence implies a disintegration of the higher, more complex mental functions, & a consequent slackening of control over the lower, more purely instinctive reactions, which would be the last to be affected. A defective intellect is the commonest cause of criminal conduct. Dr Goring (quoted by Burt p.296) says, "the one vital mental constitutional factor in the etiology of crime is defective intelligence."(10%). Healy says,"that mental deficiency forms the largest single cause of delinquency."(11.2%). Burt himself agrees that"mental deficiency beyond all controversy is a notable factor in the production of crime; a principal factor."(p.300). The average I.R. of the 197 delinquents studied by Burt was 89: 82% of the cases were below the middle line of average ability: 28% were technically dull: 8% were definitely mentally defective (a figure five times as great as the 'controls'). These children then, on account of low intelligence are unable "to perceive for themselves, or to hold effectively in mind, that what tempts them is dishonest, & that dishonesty is wrong, base in itself, & bad policy in the wrong run,"(111p.301); and,we would repeat, suffer from a slackening of control over the lower affective-conative reactions.

Undoubtedly/

Undoubtedly the physical condition of these children, also plays a part in producing the bad behaviour.≠ Poor health must mean poor control. Irritability rests often on a disturbed condition of body. Healy (111. p.436) "failed to find excessive irritability without some physical cause." But it must not be forgotten, that underneath the irritability which is such a common temperamental sequela of encephalitis, lies the instinct of anger. It is apparent from Table XL , that many of our worst cases physically are quite normal in conduct, while many of the worst behaved children are physically normal, or nearly so. Which supports Burt's conclusion that, "though common enough as an accessory & aggravating influence, physical defect is comparatively rare as a sole or predominant cause of bad behaviour." (p.249). Again he writes:"It is to be noticed that those in whom bodily discomfort induces serious moral & emotional reactions, are generally victims of a temperamental weakness as well as a physical."(p.267) And the emotional instability, & not the bodily weakness & illhealth, is the more likely cause of the misconduct. Illnesses like encephalitis & epilepsy dispose to nervous instability: this in turn is liable to result in criminal conduct, more especially if intellectual enfeeblement is also present. The affective- con-

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≠ Burt found (111. p.53) in 2.4% of the boys, & 2.7% of the girls suffering from encephalitis, that the disease seemed the major factor in the causation of the delinquent's faults. (average for boys & girls 3.5%: average for controls 0.2%).

conative changes following these two diseases are indeed very similar:-hypersensibility, obstinacy, irritability, inattentiveness, slowness of thought & reaction, general variability of mood, & lack of control. And the serious intellectual deterioration, caused by both epilepsy & encephalitis, is, along with the emotional instability, a possible explanation of the moral changes.

PROGNOSIS OF "CONDUCT CHANGES" GROUP.

Dr. Howell[49] fears that the 'easy' child who has become 'difficult' remains more or less in statu quo".

Auden[3] found a gradual improvement in the behaviour and self-control of the larger number of his series of children, even where the conduct had been very bad. In Kennedy's[54] series of 23, 6 were improved, and 17 showed no improvement, or had become worse.

Stevenson[98] found the prognosis favourable as regards defects in behaviour: "The children whose acute illness occurred in the years 1918 to '23 are, in the main, greatly improved in conduct, though there are still 8 whose behaviour is unchanged; one dating back to 1919. In 7 cases improvement in behaviour coincided with improvement in the time of sleep, and children who had been quite unmanageable became docile. In the majority, however, this had no effect. Where the acute illness was more recent, improvement is not so marked."

Hill says[47]: "Misbehaviour, whether immediately following the acute attack, or appearing only after some months, develops to a maximum fairly rapidly, and then runs a steady course for years, not progressing or retrogressing, except when in some cases Parkinsonian ism supervenes and, when pronounced, abolishes it."

Among our own patients the conduct of 7 was reported to be normal (only one of these was deteriorating physically), at the/

the time of the last test. In 22 cases the conduct was said to be improving (7 of these were bed-ridden): in 16 it was bad, & unchanged (4 were bed-ridden):and in 7 it was bad, & still deteriorating.(3 of these are physically normal, or nearly so). In other words, 22 are normal or improving in conduct (54%), & 19 are still very badly behaved, & are showing no improvement (46%).≠ The prognosis as regards conduct defects is thus quite favourable; though time appears to play no part in the return to normal. (see Table XL1.p.232)

≠ Eleven bed-ridden cases are excluded from these figures.

P A R T . II.

PHYSICAL SIGNS, SYMPTOMS, and SEQUELAE.

PART II.

PHYSICAL SIGNS, SYMPTOMS, and SEQUELAE.

As the cases used in this study were also used by Dr Stevenson, we are fortunate in having access to her published data for our present purpose. In addition, she has put at our disposal her detailed case notes, which we have used freely for this chapter.

Dr Stevenson found the most frequent EARLY symptoms to be,- insomnia, choreiform restlessness, lethargy, diplopia, headache, pain, delirium, & fever, in that order. Table XXVII shows the number of cases in the respective groups, together with the mean time interval (in months) between the onset & the first test, & the mean I.F. at first test. In the successive columns is shown the same information with the last test results as basis; & in the last column, the difference of the I.F. means. (in some instances, where it appeared necessary, the P.E. is added). There are one or two obvious but unavoidable weaknesses in the Table. These symptoms are seldom found singly. And while no one case presented all the symptoms observed, many presented many of them. This together with the small numbers in many of the groups, & the varying mean time intervals, makes classification & statistical evaluation rather difficult.

The Table also includes the LATER symptoms, which Stevenson found to occur in the following order of frequency:- nocturnal excitement, respiratory disturbances, loss of accommodation, myoclonic movements. "These when present tend to/

Table XXVII.

Physical Signs, Symptoms, and Sequelae.

	No. of cases.	Time between Onset & First Test. (mths.)	Mean I.R. at First Test.	Time between Onset and Last Test. (mths.)	Mean I.R. at Last Test.	Difference of Means.
INSOMNIA.	28	15	82.68	63	68.14	14.54
LETHARGY.	11	25	83.64	81	70.64	13.00
DIPLOPIA.	10	9	84.70	46	72.30	12.40
HEADACHE.	7	7	86.14	43	71.71	14.43
PAIN.	9	10	82.33	59	72.67	9.66
DELIRIUM.	9	11	83.67	62	64.89	18.78
RESPIRATORY DISTURBANCES. (rapid breathing: panting: blowing nose: sniffing.)	19	21	83.26	72	66.84	16.42
Occurring up to 2/12yrs.	7	12	86.90	55	73.00	13.90
" 3/12yrs. to 3ys.	12	26	81.20	82	63.25	17.95
At present: Normal.	4	39	78.25	77	69.00	9.25
" improved.	4	12	89.25	75	68.50	20.75
" unchanged.	10	15	85.90	62	69.50	16.40
ABSENCE OF REACTION ON ACCOMMODATION.	13	18	80.69	69	62.54	18.15
FUNDAL CHANGES: Acute Stage.	8	6	91.12	55	78.25	12.87
Late Stage.	3	24	80.33	84	67.66	12.67
COLLOIDAL GOLD TEST.+	7	14	76.71	63	68.00	8.71
TREMOR: coarse and fine.	18	25	79.50 ±1.75	63	64.25 ±1.38	15.25 ±2.23
none.	12	13	89.33 ±2.46	72.	75.08 ±2.10	14.25 ±3.23

Table XXVII (contd.)

	No. of cases.	Time between Onset & First Test. (mths.)	Mean I.R. at First Test.	Time between Onset & Last Test. (mths.)	Mean I.R. at Last Test.	Difference of Means.
SALIVATION: excessive. (& spitting)	23	18	85.30 ±1.63	66	67.76 ±1.77	17.54 ±2.41
CHOREIFORM RESTLESSNESS:						
in Acute Stage.	24	8	86.17	57	68.96	17.21
" Later " .	11	27	76.64	87	61.55	15.09
NOCTURNAL EXCITEMENT:						
Mild and moderate.	24	17	83.96	59	71.35	12.61
severe.	19	25	82.47	81	66.50	15.97
Duration: up to 6/12yr.	9	12	78.44 ±2.04	51	68.22 ±2.28	10.22 ±3.06
7/12 tp 1yr.	15	13	91.87 ±1.85	59	73.50 ±2.89	18.37 ±3.43
(Up to one year.)	24	12	86.83	56	71.43	15.40
1:1/12 to 2yrs.	7	18	85.29	81	69.86	15.43
2:1/12 and over.	8	35	71.87	96	60.37	11.50
(Over one year.)	15	27	78.13	89	64.80	13.33
FEVER. 99 - 102°	6	20	90.67	82	79.50	11.17
(a)Degree: 102 - 106°	16	5	83.75	52	69.75	14.00
(99 - 106°)	22	9	85.64	60	72.41	13.23
(b)Duration: under 1 week.	5	12	82.00	78	70.60	11.40
2wks. or less.	8	8	86.00	54	73.37	12.63
3wks. or less.	5	5	85.00	38	68.80	16.20
SPEED OF MOVEMENT: normal.	23	16	86.56 ±2.04	64	74.39 ±1.97	12.17 ±2.84
slow, & very slow.	25	21	81.32 ±1.59	65	68.12 ±1.55	13.20 ±2.22

Table XXVII (contd.)

	No. of cases.	Time between Onset & First Test. (mths.)	Mean I.R. at First Test.	Time between Onset & Last Test. (mths.)	Mean I.R. at Last Test.	Difference of Means.
GAIT:						
(a) unaffected.	22	13	89.73 ±1.72	61	79.95 ±1.45	9.78 ±2.25
(b) little affected.	8	18	81.00 ±2.82	72	67.00 ±2.57	14.00 ±3.82
(c) moderately affected. (rigid: festination & retropulsion.)	13	31	80.46 ±2.14	75	64.18 ±1.64	16.28 ±2.70
(d) severely affected. (immobile.)	7	16	71.86 ±1.74	54	*60.86 ±2.73	11.00 ±3.24
PHYSICAL SIGNS: (general)						
none now present.	25	14	88.56 ±1.57	64	79.42 ±1.35	9.14 ±2.07
still present.	23	24	78.35 ±1.72	66	*62.95 ±1.46	15.40 ±2.26
most severe cases	11	18	75.27 ±1.63	57	* 64.00 ±2.05	11.27 ±2.60

* This figure should possibly be lower as it includes cases (12, 68, 72,) whose I.R. s were undeterminable at last test.

to be persistent over years, but on the whole tend towards disappearance."(98 p.16). Stevenson adds: "Two or more of these might be present simultaneously or they might appear in sequence. No two cases presented these symptoms in exactly the same way."(p.58) As it seems desirable to do so, we have attempted to compare the mean I.P.A of the various groups, following Stevenson's classification, as far as possible.

ACUTELY ILL and not ACUTELY ILL CASES COMPARED:

We have already stated that none of our cases were tested when acutely ill (p20). Stevenson suggests that the limit of the acute stage of the illness should be taken as from the onset of the illness to the time at which there was apparent recovery, & the child was well enough to be sent home. This stage varies in length from days to months. As Stevenson recommends, we have included all cases tested four months & under, in the acutely ill group. These were compared with the remaining cases. Twenty acutely ill cases had at their first test a mean I.P. of 87.7; & at their last test, 71.8. The corresponding means for the remaining cases (i.e. all tested over four months after onset,) were 82.5 & 70.85. The difference of the means at the first test can be accounted for by the group differences in the time interval between onset & test. These figures seem to confirm the reliability of the testing, especially in those cases where the first test was performed soon after onset. The acutely ill cases do not appear to have suffered any handicap: whether or not the acute condition affects adversely or otherwise the child's ability to perform the test, is not apparent from the results. It is of interest

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to note that we have data to show that the acute stage of some illnesses, e.g. chorea, significantly increases the I.F. Chorea is not an illness that causes intellectual enfeeblement, & our results were obtained by testing a group of these children on admission to hospital while acutely ill, & re-testing them on recovery.

FEVER:

Twenty two of our patients showed a rise in temperature on admission to hospital (99-106°). As the others may, by the time of admission, have passed through a febrile period, a comparison of the two groups is not helpful in an attempt to discover the effect of the severity of the initial attack on the intelligence. The I.R. means of the fever group at both the first & last test, are practically the same as those for the whole series at the corresponding tests.

The fever group was further divided. Six cases with a temperature between 99 & 101° had a mean I.R. at the first test of 90.67 ±3.41; while 16 with temperatures 102 to 106° had a mean I.R. of only 83.75 ±2.59. The variation in average time interval between onset & tests, fails to make the difference (6.92 ±4.28) of the I.R. means significant. The group attaining the highest temperatures in the acute stage, deteriorated significantly more, however, (14.00 ±3.27), than the others (11.17 ±4.22). And the difference between the I.R. means of the two groups at the last test, (79.50 ±2.49 — 69.75 ±2.00; i.e. 9.75 ±3.19), is likewise significant, considering the big difference in the average time interval between onset & test (52 & 82 months).

The duration of the fever among the survivors does not appear to play any significant part in the amount of the intellectual deterioration.

LETHARGY: Lethargy was present in 11 of our cases during the acute stage. It varied in depth from case to case, & from time to time in the same case. In some instances, being the first symptom to appear, it was noticed by the teacher that the child was drowsy in school. In hospital they were often seen lying completely impassive. Sometimes the lethargy deepened into coma. Frequently we interrogated the patient at this stage. Attention was difficult to gain, & still more difficult to hold. But short questions like, "What's your name?" "How old are you?" & the shorter intelligence test questions, always elicited an answer,- sensible even though erroneous. It was this feature that led Stevenson to write:(98.p.24) that when roused from what "to all appearances," was a state of unconsciousness, "the intelligent response to questions was surprising, even while the face remained impassive."

The duration of the lethargy varied: most frequently from 10 to 23 days roughly. Included in Stevenson's series were two cases where it only lasted for 12 & 24 hours respectively, & four where it persisted for 9, 10, 14, & 16 weeks. Remarking on these variations, she merely says: "they do not appear to influence later developments."(97. p.59) So far as mental growth is concerned, we should like more detailed information than this, especially in view of one or two statements in the literature. Duncan(24. p.49) for instance, writes that, "among 13 patients who became backward or feeble-minded, drowsiness was present in every case early in the acute stage, & in all except two was very marked: in only one case was the attack of a mild character." The 11 of our cases in/

TABLE XXVIII. "Duration of Lethargy."

Case No.	Duration.	I.R. 1st. test	I.R. Last test.	Interval between Onset & tests: first	Interval between Onset & tests: last	Age at Onset.
12	9 hrs.	70	≠ 63	2;5yrs.	8;5yrs.	10;4yrs.
59	24 hrs.	110	89	0;3 ..	4;7 ..	10;7 ..
64	4 days	80	80	1;6 ..	4;6 ..	7;3 ..
37	6 days	73	55	2;4 ..	8;5 ..	1;7 ..
71	6 ..	85	73	0;0 ..	3;5 ..	11;10..
69	7 ..	70	72	0;1 ..	4;6 ..	6;4 ..
61	11 ..	97	71	0;5 ..	4;7 ..	3;1 ..
4	14 ..	80	70	4;2 ..	10;5 ..	4;10...
57	14 ..	97	76	0;1 ..	5;11..	9;7 ..
8	14 ..	72	62	3;0 ..	9;3 ..	7;8 ..
19	14 ..	91	69	2;8 ..	8;4 ..	6;0 ..
21	14 ..	77	47	2;1 ..	8;5 ..	6;7 ..
45	14 ..	80	71	1;0 ..	5;8 ..	11;10..
75	14 ..	85	63	1;4 ..	4;6 ..	7;11..
74	16 ..	89	71	0;1 ..	3;6 ..	12;0 ..
13	18 ..	75	75	5;0 ..	8;7 ..	2;7 ..
79	18 ..	89	55	0;1 ..	2;8 ..	7;8 ..
11	21 ..	65	50	1;11..	7;11..	8;8 ..
31	21 ..	69	69	2;6 ..	8;4 ..	11;1 ..
41	21 ..	85	67	3;8 ..	6;6 ..	3;4 ..
51	21 ..	79	77	0;1 ..	5;8 ..	5;4 ..
65	21 ..	109	92	0;8 ..	4;6 ..	8;2 ..
43	-- ≠≠	86	78	0;10..	5;9 ..	6;5 ..
44	--	71	47	0;6 ..	5;0 ..	3;0 ..
55	--	64	41	0;1 ..	5;9 ..	9;11..
60	--	103	89	1;6 ..	4;6 ..	8;8 ..
80	--	71	64	3;2 ..	4;7 ..	4;5 ..
81	--	60	52	0;4 ..	2;6 ..	12;1 ..
84	--	88	84	1;8 ..	2;9 ..	4;5 ..
32	28 ..	70	48	2;0 ..	7;0 ..	4;2 ..
70	28 ..	86	61	0;3 ..	4;7 ..	7;6 ..
72	35 ..	70	≠ 73	0;4 ..	0;6 ..	12;9 ..
20	42 ..	97	72	2;1 ..	6;2 ..	9;8 ..
68	63 ..	78	≠ 72	0;3 ..	1;0 ..	7;3 ..
49	70 ..	82	73	0;6 ..	2;7 ..	6;0 ..

≠ The I.R.'s of these cases were undeterminable at the last test, so the last known I.R. is here quoted.

≠≠ Duration of lethargy unknown; but somewhere between 10 and 23 days.

in whom drowsiness was present early in the acute stage, had I.P. means at both first & last tests,- 83.64, & 70.64 - practically identically the same as the corresponding means of the whole series (all cases). So that the non-lethargic cases deteriorate to the same extent as do the lethargic.(early symptom). Burt,(11. p.238) analysing Paterson & Spence's data, arrived at the conclusion, that the factor of the severity of the initial illness influences greatly the eventual condition of the patient: "After a short illness, the stupor lasting for a few days only, the child as a rule completely recovers. If the lethargy persists for three or four weeks, then mental deficiency may be expected, at any rate if the child is young."

We have already shown that mental deficiency is to be expected if a young child is attacked by this disease, & we have explained why.(p. 94) We have also seen that the severity of the initial illness, as judged by the temperature of the patient, does seem to play a part in the extent to which the patient's intelligence deteriorates: the higher the temperature the greater the deterioration.

Table 28 shows the cases classified according to duration of lethargy. In all,35 of our cases have suffered from lethargy. In 6 of these its duration lasted from less than a day up to 10 days: in 23 cases it varied from 10 to 23 days: & in 6 others the lethargy persisted for 4 weeks & more. An examination of the table shows that'age at onset'has no effect on the duration of the lethargy; & serious intellectual deterioration, which is found in each of the three groups, is independent of the duration period of the lethargy.

CHOREIFORM RESTLESSNESS: Among disturbances of the motor system, choreiform restlessness occurred as an early symptom in 24 cases, & in the later stages in 11 cases. The patient is in a constant state of movement for 24 hours a day. In the acute stage the movements vary from slight but constant restlessness to an almost maniacal condition, accompanied by insomnia & delirium, or some degree of mental confusion. The movements are momentarily controllable, & the child is able to answer questions quite intelligently, even when much excited. In the later stages the restlessness is not of the same extreme type. It consists of talkativeness, inquisitiveness, shrugging shoulders, handling people & objects, & fidgetiness generally. These are more controllable, especially when attention is gained.

The mean I.R. of the 24 children in whom this symptom was present in the acute stage was 86.17 at the first test, & 68.96 at the last test. The mean I.R. of the 11 children in whom this feature was observable in the later stages was 76.64 at the first test, & 61.55 at the last test. Taking into account the great variation in the mean time interval between the onset & the test in the two groups, it is doubtful if there is any significance in these figures. Both groups deteriorate to the same extent. Four cases included in both groups have mean I.R.s which show a like degree of deterioration. These are all the early physical signs & symptoms we need refer to. Of the others included in the table there is nothing in the results to warrant fuller statement.

Speech Changes.

The speech changes in children who have had encephalitis lethargica are varied. Not only do these changes vary from case to case, but they vary in many instances, in individual cases, from time to time, & from stage to stage of the illness.

Despite the over-lapping that occurs, it is possible to group the speech changes ~~recorded in Appendix ..... Table~~ as follows:-

TABLE XXIX.- "Speech Changes & Intelligence."

Group No.	Change.	No. of Cases.		Mean. First I.F.	Mean. Last I.F.
			Park.		
1	Normal & Almost Normal.	17	0	87.6 ±2.1397	79.9 ±2.1217
2	Quick, rapid.	7	3	88.6 ±2.6140	77.6 ±2.1813
3	Indistinct, & Slurring.	25	16	82.4 ±1.6552	67.2 ±1.8792
4	Slow, & Hesitation.	24	17	82.7 ±1.6078	66.7 ±2.0042
5	Stutter.	12	7	83.8 ±2.1892	66.4 ±2.9202
6	Low, Monotonous, & High Pitched.	12	9	81.1 ±2.1756	67.2 ±1.7740
7	Unable to Speak.	3	3	72.7	--- ----

Those children whose speech is at present normal, & those whose speech is rapid, (Groups 1 & 2, above) had at their first test a mean significantly higher than the mean of the whole group (83.83). The difference is still significantly greater at the last test.

Groups 3 to 7,- which we may call the abnormal speech group,- were placed in the above order to signify the different stages of increasing deterioration that might be expected to be found if there is any relationship between speech deterioration and deterioration in general following encephalitis.

/While

While the means of groups 3 to 6 at their first test were much the same as the whole group mean, their means at the last test were rather lower than the whole group mean at the last test (71.).

The fact that there is no significant difference between the individual groups 3 to 6 in the table, does not prove that there are not different degrees or stages of speech deterioration, but only that we have failed to prove it. The overlapping & the changes with time after onset, are factors which are difficult to eliminate.

The Parkinsons are not confined to any one group, but are found in every group with the exception of the normal group. As the severity of the speech defect increases there seems to be a corresponding increase in the proportion of cases who are Parkinsonian.

Group 7, comprises three cases who are now unable to speak, & who are all Parkinsons.

It is a question whether the speech defects are due to a physical or a mental cause. Stevenson (97 p.64) remarks: "That in the more pronounced Parkinsonian cases the voice has become high in pitch & monotonous in tone. Articulation tends to become slurring." And adds:" This may be partially due to immobility of the face, but certainly varies, usually becoming more pronounced in the evening."

In all speech difficulties there is a physical, an intellectual, or a temperamental aspect.

~~The explanation of the high slurring in the Parkinson~~

/cases

The changes are only what might be expected to follow encephalitis lethargica. It is known that some diseases do produce speech changes. High-pitched tone with indistinct articulation, for instance, is always a characteristic in stammerers who have had attacks of chorea. In encephalitis, probably due to emotional changes, the voice which follows as a sequela of the acute attack is often high & wavering. The tongue movements in speech are clumsy and ill-defined. But with high pitch slovenly articulation is almost inevitable. All the changes noted are to be expected, especially in the Parkinsonian cases. And, therefore, it is not surprising that the most severe speech changes are found in this group.

Motor coordination is likely to be weakest in those cases whose speech is slowed down, is indistinct, is high-pitched and monotonous, and who have great difficulty in speaking.

Indistinctness is an early speech difficulty: whereas low, monotonous, high-pitched speech is a later deterioration. Such vocalisation defects/

defects are probably physical. The functioning of the larynx ought to be automatic, and when there is a disturbance here, the upset is a deep-seated one.

But the speech incoordination may be due to a break-down of something cerebral. It is known that immobility is a common feature of feeble-mindedness. Tredgold ("Mental Deficiency" 1920), in speaking of the speech defects of the feeble-minded says: " The chief defects consist of a thickness and indistinctness of utterance; an imperfect articulation of consonants;.." Indeed, so great is the proportion of mental deficiency in children who are more or less afflicted with speech defects, that the mental defectives as a whole are sometimes described as "speech retarded." The proportion of mental defectives suffering from speech defects has been estimated by Descoeudres ("The Education of Mentally Defective Children" 1928, p. 175) as from 10 to 35 per cent.

The Intelligence Tests given to our patients include some that are admirably suited for studying the development of speech, when they are repeated year by year. As judged by the responses to the tests,the speech of many of our children is markedly underdeveloped.

It/

It is significant that the three cases in group 7 (numbers 12, 68, 72.) in whom the muscular incoordination is now complete, had I.Q's at the first time of testing of 70, 78, & 70, respectively. They were therefore low mentally from the onset,- if not actually before the onset,- of the illness. ~~xxxxxxxxx~~ ~~Their condition would expect to be expressx~~ No. 72 is reported to be able to speak during the night-time, & to swear when angry.

Articulation difficulties may be due to a physical defect or a central one. Our cases were not given the necessary tests to discover which was the primary cause. Defects of this order are, in our group, probably both mental & physical, since the Parkinsons appear in this group also. There appears to be no intelligence difference between this group & the 'vocalisation defective' group.

As regards the temperamental aspect of these speech defects, we should expect to find an emotional element in group 2 (Rapid Speech), group 3 (Indistinct & Slurring), group 4 (Hesitation), group 5 (Stutter), for all these difficulties are met with in hysteria. A stutter is to be distinguished from a stammer. Stutter is speech in which coordination is breaking down, causing considerable delay, or 'hold up.' It is the most serious defect of speech, & is associated with the neurotic constitution or temperament. Stammer is an ~~We do not expect groups 6 (Low Monotonous & High Pitched Speech) to correlate with emotional instability~~ articulatory difficulty with certain consonants, & is rarely associated with pathological conditions.

In all these groups, as expected, we find patients who have elsewhere been grouped as 'emotionally Unstable' (p.177). Those who have been classified as 'temperamentally normal' nearly all fall in the 'normal' speech group. (Table XXX).

TABLE XXX."Temperamental Aspect of Speech Defects." (Enceph. Leth.

No.	Speech Change.	Emotionally Unstable	Temperamentally Norm.
1	Normal & Almost Normal.	47,49,66,81,85,53,58 69,83,84,	8,43,45,50,56,59,61,
2	Quick, rapid.	31,52,57,66,75,86,87	
3	Indistinct and Slurring.	11,12,13,19,21,26,31 37,41,44,51,52,60,62 64,65,68,70,71,73,76 80,86.	55,
4	Slow and Hesitation.	11,12,13,19,21,26,41 51,62,64,65,67,70,73 76,79,80,83,84.	4,55,
5	Stutter.	13,37,44,67,75,76,80 83,87,70,73.	
6	Low,Monotonous & High Pitched.	11,12,13,26,31,58,67 68,69,76.	61,
7	Unable to Speak.	12,68,72.	

EXCESSIVE SALIVATION: This group is composed for the most part of Parkinsonian cases; though a few Parkinsonians do not show this later symptom. The group can be divided into two: those who spit, & those in whom the saliva flows too freely. Comparing the I.R. means of these two groups no significant difference in the amount of deterioration is found. And the means of the two combined are not unlike the means of the whole series. A few cases are improving, but there is no corresponding improvement in the I.P.

MYOCLONUS: Among our cases are 6 examples of this type of the disease. They exhibit rhythmical contractions of the muscles. Table 31 is based on information supplied by Stevenson, (97. p.61) with our own test results included.

TABLE XXXI. - MYOCLONIC CASES.

Case No.	Onset of Myoclonus.	Site.	Rate per min.	Present state of Myoclonus	Intelligence Ratio at successive tests.
52	2nd wk.	Respiratory	44	Lessening	98, 87, 81, 82
69	1st wk	Extraordinary muscles of respiration &arms	48	Lessening	70, 72, 69, 72
79	1st wk	Respiratory muscles & diaphragm.	60	Lessening Strongly present in sleep.	89, 55
70	4th wk	Right side mouth & platysma.	60-80	Unchanged	86, 88, 70, 61
49	24th mo.	Left side of nose.	50	Gone.	82, 73
71	19th mo.	Rgt. side of mouth.	44	Marked. In series of 3 or 4 then slight pause.	85, 78, 73, 73

There appears to be no connection between the medical details which the Table supplies & mental growth in these cases. The symptom is very persistent, & in the later stages other symptoms are also present.

NOCTURNAL EXCITEMENT: Nocturnal excitement has a prominent position among the sequelae in our series. "The course of events," writes Stevenson (97.p.72) "is now well known. As evening approaches the child becomes more & more talkative & noisy, occasionally even violent.... Almost invariably the child is anxious to sleep, & tries by every arrangement of the bed to encompass this end, but without effect, until at about 5 or 6 a.m. he falls asleep & remains so till the next afternoon." The sleep disturbance (narcolepsy) is associated with the chronic stage. In our series the average time from the onset of the acute illness to its appearance was about 10 weeks. Based on Stevenson's classification, 43 of the 53 cases in our series displayed this sequela in varying degree. Twenty four cases have suffered from nocturnal excitement of a mild or moderate kind.(e.g. lying awake; talking to one's self). The mean I.R. of these at the first test was 86.17 (average time interval between onset & test 17 months), & at the last test 71.35 (average time interval between onset & test 59 months). Nineteen cases have suffered from nocturnal excitement of a more severe nature.(e.g. roaring & shouting, anxiety, destructiveness etc.). The mean I.R. of these at the first test was 82.47 (average time interval between onset & test 25 months); and/

and at the last test 66.50 (average time interval between onset & test 81 months). The difference between the means is 15.97, as compared with a difference of 12.61 for the 'mild' group. Taking account of the variation in time interval between onset & test, together with the probable errors, the difference between 15.97 & 12.61 is not significant. Hence both groups deteriorate equally.

In four cases Stevenson reports inversion of the sleep rhythm to have been the first sign of illness noticed. Below are the intelligence test results for these cases.

TABLE XXX11.-INVERSION OF SLEEP RHYTHM:(First sign).

Case.	Duration.	Intelligence ratios.
14	2½ yrs.	59, 63, 56, -- --
44	2½ yrs.	71, 67, 65, 53, 47.
47	2½ yrs.	87, 94, 98, 95, 95.
43	1½ yrs.	86, 78. -- -- --

There was no history of an acute attack in these four cases. Nevertheless there may have been one. They deteriorate mentally just like the others. Their mean I.R. at the last test being practically the same as that of the whole group (69.00).

Table 33 shows the nature of the sleep disturbance in 19 severe cases, based on our own more recently collected data. Many of the children are reported by the parent to have suffered from 'night terrors.' It has been pointed out (Gillespie, R.D., "Sleep" 1929(p.72); Bailliere Tindal & Cox, London) that, "Night terrors are common in nervous children of the better endowed type intellectually." Seventeen of our 19 children are included among the 'nervous' children in Table 30 (p. 201). The I.R. mean of the 19 at the first test was 84.68 ±1.89; & at/

TABLE XXXIII.-- "Sleep Disturbance in Encephalitics."

Case No.	Nature of Disturbance.
14	------
20	------
21	Nocturnal excitement. Gets up at night and looks for things: Sings and talks.
26	Hysterical turns.
31	Hysterical turns: rises out of bed in anxiety; roars and shouts and covers head with bedclothes.
37	Night terrors: screams.
43	Nocturnal restlessness (now normal).
44	------
47	Nocturnal restlessness. Teacher complains of falling asleep in school.
53	Nocturnal restlessness. Rises and hits sister. Sings all night, sleeps all day.
57	Falls asleep in school at 2p.m.
62	Nocturnal restlessness.
65	Sleeps in school.
68	Goes to sleep 3a.m. Talks incessantly - imagines things are in the room and screeches
70	Nocturnal restlessness; night-terrors; screams and sings.
73	Night-terrors: "There he's again - the devil."
74	Nocturnal restlessness (early symptom): now dead.
85	Nocturnal restlessness. Walks in sleep. On two occasions almost threw himself out the window. Talks and raves.
87	Nocturnal restlessness: night-terrors; screams, - afraid of falling off buildings.

at the last test 68.58 ±2.16. The difference of the means (16.10), is very similar to the difference found with Stevenson's classification (15.97). So that nervous children of the poorer endowed type intellectually, may also suffer from night terrors following encephalitis lethargica.

Gillespie reports also a loss of emotional response, or apathy, in encephalitics who sleep over-much. "It is our emotions that move us," as William James said; & this lack of emotivity produces a condition of inactivity, resulting in drowsiness & sleep, at the wrong time. It is not the case, however, that every post-encephalitic who becomes apathetic, suffers from sleep disturbances. Case No. 50 has no sleep abnormality, & yet he is one of the most lifeless & emotionless children in the series. The school teacher says she wishes she could rouse him.

Stevenson (97) comments on the psychic element in the night restlessness: "Change of surroundings frequently produces normal sleep for a night or two; even a change from one ward to another having this effect:" also Dr. Anderson, who found injections of sterile water to be successful until the patient discovered the nature of the fluid injected. This is one of the most difficult sequelae to handle, both at home & in hospital, though it is not one of the most permanent. The duration of the nocturnal excitement with sleep by day, varies from months to years, & does not appear to have any causative effect on intellectual deterioration. Sooner or later other sequelae, including mental deficiency, supervene. That these are not the direct effect of the nocturnal excitement appears probable, since/

since two or three children now normal, have suffered from this sequela, at some period since the onset of the illness. For instance, case 47, whose I.R. is now above the first test I.R., & normal, suffered from nocturnal restlessness for 2 years. And case 59, who suffered from severe nocturnal restlessness for 6 months only, had at last test an I.R. 89.(I.R.110, first test) Kennedy[54] (p.169) believes that, "In the presence of other sequelae the child may recover from the sleep disturbance, but still be markedly impaired mentally." Cases 43 & 61 substantiate this statement.

SPEED OF MOVEMENT: Twenty three cases were classed by us as normal in respect of speed of movement, & 25 as slow or very slow. The difference of their I.R. means at the first test (5.24) is not significant, taking account of both the P.E. & the difference of the mean time intervals between onset & test. At the last test, with the mean time intervals between onset & test about equal, the difference of the I.R. means is 6.27, which is still slightly less than three times its probable error. And the two groups deteriorate about equally; 12.17 ±2.84, & 13.20 ±2.22, respectively. These figures are an answer to a possible criticism considered elsewhere (p. 22): that their slowness & not low intelligence gives these children a low estimated intellectual status. It is obvious that they have not been rated low mentally merely because of the prolonged time they took to perform the tests.

GAIT: Some evidence on the association between the physical condition/

condition & the mental growth is supplied by our figures dealing with the walking ability of the patient. In 22 cases we judged the gait to be unaffected at the time of the last test. Their mean I.R. is surprisingly high at both first & last tests. Those cases little & moderately affected have I.R. means somewhat lower at both first & last tests. While the severely affected cases not only have a mean I.R. at the last test much lower than should be expected, considering the time interval between onset & test,(a figure, 60.86 ±2.73, which is possibly rather high, since it leaves out a few cases whose I.P.s were undeterminable at the later tests), it is significant that at the time of the first test,- performed on an average of 16 months after onset,- they have a mean I.R. of only 71.86 ±1.74; which is 10% lower than the mean for the 'little affected' gait group. So that the children who are now unable to walk,have deteriorated most intellectually. And equally significant is the fact that they were at the time of the first test low mentally: the mean of the group denoting borderline defectives. From this it would seem that the dullest patients are those who in time are prone to become immobile. The immobile cases in our series are the most pathetic. [illegible] All come from the poorest of homes. Physically they are as helpless as infants. They lie silent in bed, very emaciated, & badly contorted. In one case the teeth have dropped out one by one; in another the gums have overgrown the teeth. Masti-

cation/

mastication is impossible; the hands never open; the legs & arms never straighten out; & the wonder is how they survive. It has been said these children are not so dull mentally "as they look." We have made strenuous & tedious endeavours, both by means of a sign language,(blinking the eyes, closing the eyes, squeezing the examiner's hand etc.) & with the mother's assistance, to obtain reliable information about the intelligence of these children, & there is not the slightest doubt about their low mentality. They deteriorate just like the others, & are ultimately inferior intellectually because originally inferior.

GENERAL PHYSICAL CONDITION: When last seen 25 patients were so far as the writer could see, physically normal in appearance. It is not denied that the number might have been considerably lower had the observer been a medical man. The mean I.R. of these at the first test was 88.56 ±1.57: at the last test 79.42 ±1.35: giving a mean I.R. difference of 9.14 ±2.07. In 23 other cases physical stigmata were still present,& easily observed. The I.R. means of these were 78.35 ±1.72, & 62.95 ±1.46. The difference is 15.40 ±2.26, which is much more significant. The two groups are about equal in numbers, & the mean time intervals between onset & last tests are much the same, yet the difference between the mean I.R.s is 16.47 ±1.99 which is significant. Not only do the patients with obvious physical sequelae deteriorate intellectually more than do those without them, but at the first test they also appear to be,as a group, lower mentally. Their mean I.R. at the first test being/

being lower than that of the others by 10.21 ±2.33 . The difference in mean time interval between onset & first test in the two groups will not account for this difference.

Twenty four cases are reported by the parent to be improving physically. Four Parkinsonian cases are included in this group(diagnosis doubtful). The age at onset appears to play no part in the improvement observed in these Parkinsonian cases. And this is true also of the non- Parkinsonians. One of the Parkinsonians was 5 years of age at onset; one 5½; one 8; & one 11 years. The interval between the onset & the last examination was 10;5, 5;8, 4;6, & 5;7, respectively. (cases 4,51,65,52). Their I.R.'s at last test were 70,77,92,82: (at first test, 80,79,109,98). Twenty one cases are reported to be deteriorating steadily. Among these are 11 whose physical stigmata are sufficiently severe ~~xx~~ to be disabling. All are now helpless or nearly so. The mean time interval between onset & last test for these cases is ~~xxix~~ 57 months, & yet their mean I.R. at last test is only 64.00 ±2.03; which figure should possibly be lower, as earlier I.P.s are included for three cases whose I.R.s could not be determined at the last test. The first test mean I.R. for these eleven cases (75.27 ±1.63), is significantly below the first test mean of the physically normal group, & the difference in the mean time interval between onset & test, will not account for the difference of 13.29 ± 2.26 between the I.R. means. This seems to imply that those patients who years after the acute stage suffer physical disabilities, likewise suffer from/

from the severest intellectual deterioration, & that those patients who have the highest I.R. following soon after the acute attack suffer least from physical sequelae.

Let us look into the relationship between the physical condition & the intelligence of the patients a little further. Table 34 gives the mean index of development between the first & last tests, & the mean I.R. at the first & last test, (with the probable errors), of 20 cases whose physical condition is bad, & becoming worse; & 28 cases whose physical condition is normal, or good & improving, together with the mean differencies.

TABLE XXXIV.

"General Physical Condition & Intelligence of Patients." [1]

Physical condition.	No of cases.	Mean I.R. first test.	Mean I.R. last test.	Mean index of development.
bad:& becoming worse.	20 ≠	78.81 ±1.616	63.05 ±1.401	+0.19 ±0.05
good: & improving.	28	87.64 ±1.633	77.29 ±1.742	+0.58 ±0.05
Difference of Means.		8.83	14.24	0.39
Probable Error.		±2.30	±2.24	±0.07

[1] c f. Table XL. p.231.
≠ case No 72 omitted: the index figure of 5.29 is obviously fallacious.

There is a significant difference between the two groups, both in respect of I.R. at first test, & also at last test: the 'good' group being significantly higher at both tests. And while the 'bad' group deteriorated 15.76 ±2.14 (78.81 - 63.05), the 'good' group only deteriorated 10.35 ±2.39 (87.64 - 77.29). There is likewise a significant difference in the mental progress/

progress as shown by the index of development. The mean index of those whose physical condition is improving is +0.58 ±0.05, i.e. a little more than half of the normal, while that of those whose physical condition is deteriorating is +0.19 ±0.05. The difference between these means (0.392 ±0.07) is significant, being five times its probable error.

It follows,then, that these observations indicate that there is a relationship, a very significant correlation, between general improvement in the physical condition of these patients & their mental progress. The relationship is not necessarily one of cause & effect. It is more likely that both the physical & intellectual deterioration are produced by the same causative factor, namely encephalitis lethargica.

THE PARKINSONIAN SYNDROME.

Another group of cases which can be classified fairly accurately, at any rate in time,- is the Parkinsonian. Various workers have reported that Parkinsonism is the most frequently occurring after-effect of the disease. Hill[47] found this to be the largest group. In a series of 92 studied by Grossman[36] who had survived acute attacks, & in 62 of whom disablement persisted, this took the form of Parkinsonism in 42 instances (45.65%). Von Economo[107] found it 10 times among 37 patients who developed sequelae (27%). Lévy[60] investigated 129 cases & noted the syndrome in 70 (54.3%). Kennedy[54] reports finding the syndrome in 21 of his 59 cases (35.6%). Davidson[20] gives the latest information about the Glasgow cases. Of 406 cases still living & traced, 118 are Parkinson & 288 are non- Parkinson (29%). Riddoch[77] found over 25% developed the syndrome. Of the 68 cases seen by Stevenson[98] in the later stages, 21 (30.8%)(14 were under 10, & 7 over 10 years of age), have shown some degree of the syndrome. 16 of the 46 cases reported by Dawson & Conn[22] developed the Parkinsonian syndrome (34.8%).

THE INTELLIGENCE OF THE PARKINSONIAN GROUP.

We seem justified in concluding that we are studying an unselected group. Consequently in considering intellectual deterioration in relation to the Parkinsonian syndrome, though our numbers for statistical purposes are small, yet the results obtained may be accepted as generally true.

The outstanding symptom in this group is extreme slowness in action & thought & speech. This is present in all to some extent.

It is difficult to imagine how Kennedy(54) formed the impression that the mind in these cases is little affected. Their very appearance leads one to expect mental deficiency. Although it has to be admitted that in their response to intelligence tests they often do much better than expected. Kennedy(54) writes:" In spite of the marked physical impairment & slow reaction time, it has been noted here & elsewhere, that there is very little effect on the mentality. These children learn & remember, but the time & effort required to elicit an answer from them leads to the idea that they are mentally defective."(p.167)

Duncan(24) writes: "The degree of mental impairment in these cases seems to vary directly with the severity of the physical condition. Those patients in whom the clinical features of paralysis agitans are present only in slight or moderate degree, have little or no mental disturbance. Complaints of impaired memory, difficulty in fixing the attention, are met

with, as in patients without the Parkinsonian syndrome, but not to any greater extent than in these. In the most advanced cases mental activity seems to be almost absent. There is progressive paralysis of mind closely analogous to the rigidity of the body, without of necessity proportional mental deterioration."

Henderson[43] says: "There appears striking differences of mentality in the Parkinsonian Encephalitics. Some become very observant, cunning, sly, & watch with great keenness all that happens.""Children often become bright mentally & even precocious; a striking contrast to their slow muscular movements." "One case (No.98) of a boy age 8 years is reported as being "extraordinarily bright mentally & even precocious": but no evidence to substantiate this statement is furnished. The writer continues: "On the other hand, probably the greater proportion of cases become mentally equally as dull & slow as are their muscular movements."(p.124)

Dawson & Conn[22] compared the intelligence of 16 of their patients who had developed the Parkinsonian syndrome with that of the others. Their mean I.R. at the first test was 84.90 (P.E. ± 2.0); that of the remaining 30 patients was 84.47 (P.E. ± 1.58). The difference between these averages is 0.43, & its probable error is ± 2.54: there was, therefore, no significant difference between the two groups at their first test. A later comparison made when the syndrome had clearly developed in all cases (in 6 of the cases it had not clearly developed at the time of the first test), gave the following results:- The mean I.R. of the Parkinsonian

group at the final test was 80.56 (P.E. ± 1.74), while that of the other patients was 75.27 (P.E. ± 1.50), The mean of the first group was 5.29 higher than that of the second, but, as the probable error of this difference was 2.30, it was not statistically significant. An examination of the "development ratios" of those who were tested twice gave the same result. From their figures Dawson & Conn concluded (p.366) that there was no significant difference between the intelligence of the group which had developed the Parkinsonian syndrome & the group which had not developed it. They were careful to add:"That this means only that our observations have failed to show a significant difference: it is still possible that more extensive testing might reveal such a difference." Since then (1926) the testing has continued, & the latest results are reported in Table XXXV.

Eight additional cases have been added to the Parkinsonian group, & one to the non- Parkinsonian. The period between the acute illness & the onset of the syndrome varies considerably. The longest period reported by Stevenson(98) being three years (one case). With one or two exceptions a time interval as long as this has intervened in our cases. This, together with our percentage, which is almost as high as any reported in the literature, seems to justify us in concluding that the groups have now reached their true proportionate relationship (namely 24 to 31, or 43.6%). Here again, as in other sections of this thesis, it may be objected that the writer, lacking a medical degree, is an unqualified person

to make a diagnosis. As the value of the conclusions arrived at from the figures is dependent upon a correct diagnosis, this criticism demands notice. The diagnosis, of the cases reported by Dawson & Conn, was made & confirmed by Professor Findlay & Dr. M. Stevenson. The latter's thesis was put at our disposal for the present classification. There were several additional cases not recently seen by Dr. Stevenson, & these were diagnosed by her from the writer's case notes, made from personal visits & observation. Moreover the signs & symptoms of the syndrome are well known, & as Stevenson[98] says, "the general appearance is in most cases unmistakeable." (p.63).

Table 35 shows the mean I.F. of the Parkinsonian group at successive tests, compared with the corresponding means of the other patients.

TABLE -XXXV.

	Tests. 1st.	2nd.	3rd.	4th.	5th.
Non Parkinson.	(31)=86.71 ±1.46	(31)=77.55 ±1.80	(24)=79.37 ±1.84	(18)=75.00 ±2.18	(11)=74.73 ±2.92
Parkinson.	(24)=80.12 ±1.73	(22)=71.23 ±2.03	(17)=68.94 ±1.75	(10)=71.70 ±2.07	(6)=69.50 ±3.74
Diff. Means. P.E. Diff.	6.58 ±2.27	6.32 ±2.71	10.43 ±2.53	3.30 ±3.01	5.23 ±4.75

note: The numbers in brackets are the number tested.

Table 36 shows the distribution of the Parkinsonian group & the Non-Parkinsonian group, according to age at time of acute illness. The distribution of the two groups is very similar, & both agree with the normal curve of distribution. Hall's (38) suggestion that the syndrome appears more readily in the older patients is not confirmed by our figures. On the contrary, age does not appear to affect the incidence of the syndrome. Stevenson (97) arrived at a similar conclusion.

Owing to the difficulty of finding out the exact date of the appearance of the syndrome, we have been unable to study what influence, if any, the age at the appearance of the syndrome, & the time interval between the onset & the appearance of the syndrome, have upon later intellectual development. It would seem that the syndrome may appear at any age, & at any time interval, from the date of the acute illness. In three cases (68, 72, 73) the syndrome appeared shortly after the acute stage,(within three weeks) & they are among the most deteriorated physically & mentally in the whole group. The chronological ages of these cases were respectively,7;4, 12;10, & 4;7. The intelligence ratios were 78, 70, 98, at the first test. Case number 73 with an I.R. of 98 at the first test has an I.R. of 56 at the last test. It has not been possible to determine the I.R.s of the other two cases at any of the last three examinations. This may either mean that if the syndrome appears soon after the acute illness the deterioration will be greatest, or it may mean that it is only a question of time till the other Parkinsonians deteriorate just as much.

To/

TABLE XXXV1.-

PARKINSON CASES. (24 cases).

Age at Time of Acute Illness.

Years	-3:11yrs.	4-5:11.	6-7:11	8-9:11.	10-11:11.	12-13:11.
Case Numbers	13,41,	51,4, 80,14, 73,	76,75, 70,86, 68①,18①,	65,11, 55,	52,67, 31,12②, 17①	62,74, 72②
Total	2	5	5(6)	3	4(5)	3

① Two cases (17,& 18) were tested once only.
② Three cases (12,68,72) whose intelligence it is now impossible to test.

Non- Parkinson Cases. (31 cases).

Age at Time of Acute Illness.

Years	-3:11yrs.	4-5:11.	6-7:11	8-9:11.	10-11:11.	12-13:11.
Case Numbers	50,47, 61,37, 44,	83,53, 84,58, 32,	66,64, 43,49, 69,19, 8,79, 21,	60,56, 57,20, 7,	59,71, 45,85,	86,87, 81,
Total	5	5	9	5	4	3

TABLE -XXXV11.- "AGE at ACUTE ILLNESS & INTELLECTUAL DETERIORATION:

Age at Acute Illness	PARKINSON (22 cases)				NON-PARKINSON (31 cases)			
years	mean at first test.	mean interval onset & test.	mean at last test.	mean interval onset & test.	mean at first test.	mean interval onset & test.	mean at last test.	mean interval onset & test.
up to 7;11.	(12) 81.08 ±1.95	27 mths.	(12) 64.50 ±1.55	71 mths.	(19) 84.16 ±1.51	15 mths.	(19) 72.84 ±2.56	64 mths.
8 to 13;11.	(10) 80.50 ±3.25	12 mths.	(10) 68.20 ±2.89	69 mths.	(12) 91.50 ±2.76	10 mths.	(12) 76.92 ±1.99	56½ mths.

Numbers within brackets are the number of cases in the groups.

To learn if age at acute illness has anything to do with later intellectual development, we grouped the cases as shown in Table 37 (p.219). The mean I.R. of the 12 Parkinsonian cases in whom the acute illness occurred when the children were 7;11 years & under, is 81.08 ± 1.95. The mean I.R. of the 10 Parkinsonians in whom the acute illness occurred when the children were 8 years & over, is 80.50 ± 3.25. The corresponding figures for the same children at their last test are 64.50 ± 1.55, and 68.20 ± 2.89. Therefore, neither at first test, nor at latest test, is there any significant difference in the means of the Parkinsonians who were under 7;11 years, & those who were over 8 years, at the time of the acute illness.

The approximate agreement between these figures & those for the Non- Parkinsonian group similarly classified is obvious at a glance. While the figures for the latter are higher throughout, the difference between the means at the last test of the Parkinsonians under eight, & those over eight,- namely 4%,- is the same as the difference between the Non- Parkinsonians (76.92 - 72.84). The figures at the first test of the Non-Parkinsonians do not agree as closely as expected. The 12 cases who were 8 years of age & over, at the time of the acute illness, have a mean I.R. of 91.50 ± 2.76; which is 7% higher than the mean of the 19 Non-Parkinsonian cases who were under eight years at the acute illness. But taking into account the probable error of this difference, it is not significant. The mean I.R. of the Non-Parkinsonian group under eight years, (84.16 ± 1.51), approximates to the corresponding Parkinsonian group mean I.R./

I.R.(81.08 ± 1.95), whereas the mean I.R. of the Non-Parkinsonians over 8 years at first test, is 11% higher than the corresponding mean of the Parkinsonians (80.50 ± 3.25). As there is progressive deterioration with time in all cases, it is possible certain differences in the mean time interval between the age at onset & test, may account for the disparity of the mean I.R.s between the groups in the table. The figures relative to the Parkinsonians are all correspondingly higher than those for the Non-Parkinsonians.(Table XXXVII) The lowest mean time interval is that for the Non-Parkinsonians over 8 years,-namely 10 months, & this may account for the group having the high I.R. mean at first test of 91.50 ± 2.76

These differences prepare us for the next step. Do children who develop this syndrome deteriorate intellectually more than do the children who remain free of it? We can compare the children in the two groups from test to test. Thirty one of the patients have,so far,not developed the syndrome. The mean I.R. of these at the first test was 86.71 ± 1.46.(Table XXXVI) The same 31 cases were tested a second time, when the mean was 77.55 ± 1.80. Twenty four of these thirty one cases at a third test had a mean of 79.37 ± 1.84. Eighteen of the thirty one at a fourth test had a mean of 75.00 ± 2.18. And eleven of the thirty one at a fifth test had a mean of 74.73 ± 2.92. The corresponding figures for the 24 patients,(8 additional cases not included in the earlier article[22]), who now show quite definite manifestations of the syndrome, are 80.12 ±1.73 (first test); 71.23 ± 2.03(second test: 22 cases); 68.94 ±1.75 (third/

(third test: 17 cases); 71.70 ± 2.07 (fourth test: 10 cases); & 69.50 ± 3.74 (fifth test: 6 cases).

From first to fifth test the Non-Parkinsonian group has deteriorated from 86.71 to 74.73, or 11.98%; & the Parkinsonian group from 80.12 to 69.50, or 10.62%. The Parkinsonians, therefore, are deteriorating with time, but only to the same extent as the Non-Parkinsonians; although it is noticeable that the means of the Non-Parkinsonians from first to fifth test, are throughout higher than the means of the Parkinsoniams at the corresponding test. The difference between the means varies from 6.58 ± 2.27 at the first test, to 6.32 ± 2.71 at the second; 10.43 ± 2.53, at the third; 3.30 ± 3.01, at the fourth; and 5.23 ± 4.15, at the fifth. One cannot conclude from these mean differences, that the patients who develop this syndrome are the lowest endowed intellectually. They may by the time of the first test have already deteriorated more. And we do not think that our estimates of the intelligence of the Parkinsonian patients have been adversely affected by slowness of motor response, for in cases where this infirmity was pronounced no time limits were set. Referring to the objection that the intellectual deterioration he found in the Parkinsonians was caused by severe bodily & probably psychical hindrance, Lange ("Psychiatrisch- Neurologische Wochenschrift," XXX.579, Dec.15th. 1928) found that in spite of increased doses of Scopolamine these patients showed no appreciably better result. Besides, they showed also an appreciable reduction of intellectual activity, if they were ready in their replies & had/

had no speech hindrance. Lange found in his study of 39 cases, that the intelligence of the child with pseudo-psychopathic condition did not suffer so much as that of the child with Parkinsonianism. The figures we have so far quoted do not lend support to Lange's statement. Both groups in the present inquiry deteriorate equally. And by the time of a fourth & a fifth test, any earlier barely significant difference between them has completely disappeared; the probable error of the difference being almost as large as the difference of the means. Comparison of the two groups based on the final retest gives the best result, as the syndrome has by that time definitely developed.

One test result of the five,- the third,- requires some consideration. Here the difference between the means is significant. But the mean of the Parkinsonians at the third test is not as low as it ought to be, for the I.R.s of three cases (12, 68, 72) could not be determined, & have not since been determined. There is not the slightest doubt in our own mind, that the intelligence of these patients has deteriorated, just as much as the physical capacities. It is to be noted that the I.R.s of these cases at the first test were significantly low, viz. 70, 78, & 70, respectively. Consequently the means of the Parkinsonians at the fourth & fifth tests are perhaps not as low as they ought to be, were the I.R.s of these three cases now determinable. The effect of this would be to increase the significance of the difference of the means of the two groups at the fourth & fifth tests, & thereby lend support to the statement/

statement that the Parkinsonians deteriorate more intellectually than do the other patients.

Before arriving at that conclusion let us subject the data to further supplementary statistical treatment, in order to minimise the difficulties. In Table 38, we have compared the mean I.P.S of the same cases in both groups, test by test. (Test 5 is omitted because the numbers are so small). The 31 Non-Parkinsonians had at their first test a mean of 86.71 ± 1.46; the mean of the 24 Parkinsonians was 80.12 ±1.73. The 31 Non-Parkinsonians tested a second time, had a mean I.R. at their first test of 86.71 ± 1.46; & at their second test, of 77.55 ± 1.80. The 22 Parkinsonians who were tested a second time had a mean I.R. at their first test of 80.82 ± 1.82; & at their second test, of 71.23 ± 2.03. The difference between the first means is roughly 6%, & the difference between the second means roughly 6%: which, as we have already said, is just barely significant. Moreover, the difference between the first & second means of both groups is 9.16 ± 2.32, for the Non-Parkinsonians (31 cases); & 9.59 ± 2.72, for the Parkinsonians (22 cases). Thus both groups at the time of a second test, have significantly deteriorated, & to the same extent.

Considering the third & fourth test means of the two groups, we find that the 24 Non-Parkinsonian cases tested three times, had at their first test a mean I.R. of 88.87 ± 1.63, (which is 2% higher than the first test mean of the 31 who were tested twice); the 17 Parkinsonian cases tested three times, had a first test mean I.R. of 83.80 ± 2.09 (which is/

TABLE XXXVIII.- "GROUPS COMPARED for INTELLECTUAL DETERIORATION"
(same cases at successive tests).

PARKINSON.

Tests.	Mean I.R. 1st.	Tests. 2nd.	3rd.	4th.
1st	(24)=80.12 ±1.73			
2nd	(22)=80.82 ±1.82	(22)=71.23 ±2.03 D.=9.59 P.Ed.±2.72		
3rd	(17)=83.80 ±2.09	(17)=73.80 ±2.25 D.=10.00 P.Ed.±3.07	(17)=68.94 ±1.75 D.=14.86 P.Ed.±2.72	
4th	(10)=87.10 ±2.55	(10)=74.60 ±2.79 D.=12.50 P.Ed.±3.78	(10)=73.00 ±2.31 D.=14.10 P.Ed.±3.44	(10)=71.70 ±2.07 D.=15.40 P.Ed.±3.28

NON-PARKINSON.

Tests.	Mean I.R. 1st.	Tests. 2nd.	3rd.	4th.
1st	(31)=86.71 ±1.46			
2nd	(31)=86.71 ±1.46	(31)=77.55 ±1.80 D.=9.16 P.Ed.±2.32		
3rd	(24)=88.87 ±1.63	(24)=80.71 ±1.88 D.=8.16 P.Ed.±2.49	(24)=79.37 ±1.84 D.=9.50 P.Ed.±2.45	
4th	(18)=87.83 ±2.02	(18)=79.00 ±2.26 D.=8.83 P.Ed.±3.03	(18)=78.11 ±2.18 D.=9.72 P.Ed.±2.97	(18)=75.00 ±2.18 D.=12.83 P.Ed.±2.97

is 3% higher than the first test mean of the 22 cases tested twice). The significance of this becomes more apparent when the first test mean of the 18 Non-Parkinsonians tested four times (viz. 87.83 ± 2.02), is compared with the first test mean of the 10 Parkinsonians tested four times(87.10 ± 2.55). The original differences of 6% between the groups at the first & second tests, which was decreased to 5% at the third test, have now disappeared. Obviously some selective process has been in operation, as has been suggested above. The first test mean of the Parkinsonians tested three times would be reduced, (as would that of those tested four times), to the expected figure (about 80), if the three cases whose I.R.s were undeterminable at a third test, could have been included; for they had at their first test I.R.s of only 70, 78, and 70, respectively. Assuming of course that these three cases deteriorate just like the others. The mean I.R. of the Parkinsonians tested four times would then be lower than 73.00 ± 2.31 at their third test; & lower than the mean of 71.70 ± 2.07 at their fourth test. The effect would be to increase the differences between the two groups.

A general analysis of Table 38 , which supplies more detailed information about the two groups, shows that the means of the two groups are probably not significantly higher in the Non-Parkinsonian group, from test to test. Considering the cases in both groups tested four times, the differences of the means of tests one & two, one & three, & one & four, are greater in the Parkinsonian group; being 12.50 ± 3.78 compared with/

with 8.83 ±3.03 (first and second tests); 14.10 ±3.44, compared with 9.72 ±2.97 (first and third tests); 15.40 ±3.28, compared with 12.83 ±2.97 (first and fourth tests); If the first test mean I.R. of the Parkinsonians tested four times be more accurately taken to be about 80, instead of 87, (for reasons stated above) the differences of the means for both groups would remain throughout only equally significant.

Here again it is possible that differences in the mean time interval between onset of acute illness and date of test, may have an influence upon the I.R. means of the groups compared. Table 39 shows that at every test the interval is greater for the Parkinsonians than for the Non- Parkinsonians; ranging from seven to fifteen months. Knowing that there is progressive intellectual deterioration with time, the effect of this variation in time interval is to further diminish the significance of the I.R. mean differences of the two groups.

An examination of the "development ratios" give similar results.

The earlier findings of Dawson & Conn are thus confirmed. Our figures still lend no support to Lange's statement. Nor do our tables support him when he says that," The Intelligence Quotient of both groups can/

TABLE XXXIX.

PARKINSON and NON-PARKINSON PATIENTS COMPARED for AVERAGE TIME INTERVALS between ONSET of ACUTE ILLNESS, and DATES OF TESTS. (in months).

number of cases.	Tests.				
	1st.	2nd.	3rd.	4th.	
31 Non-Parkinson	13	--	--	--	
24 Parkinson	24	--	--	--	
31 Non-Parkinson	13	34	--	--	
22 Parkinson	20	44½	--	--	
24 Non-Parkinson	12	29	48½	--	
17 Parkinson	22	44	62	--	
18 Non-Parkinson	12	28	50	63	
10 Parkinson	19	41	59½	72	

can improve in the course of time."

On the information available it does not appear as if the patients who develop the Parkinsonian syndrome deteriorate to any greater extent, or any less degree, than those patients who, so far, have not developed the syndrome.

PROGNOSIS IN THE PARKINSONIAN SYNDROME.

Stevenson (97) points out that there have been no deaths in her series of children who develop this syndrome. Nevertheless, she says the prognosis for the child seems to be worse in this, than in the other sequelae (page 48). It is sad to see many of them survive from year to year in the same helpless condition. Stevenson found only one case showing great improvement, and two showing slight improvement (case nos. 73 and 52 in our series); that is, three cases, of 14%, who show any signs of the disappearance of the syndrome. Only four of our cases (16 to 17%), nos. 4, 51, 52, 65, show any improvement physically (see Table 40. p.231): No. 73 is now among the deteriorating. Stevenson classified three as deteriorating after a stationary period, and fourteen whose deterioration was steadily progressive. Seventeen in our Table are classified as "bad", and "getting worse". (Note the closeness of the agreement between our Table analysis, and Stevenson's independent and earlier figures.). In three of our worst cases (Nos. 68, 72, & 73), the syndrome was of early onset; and has been rapidly progressive. Among the bedridden cases the period between the acute illness and the onset of the syndrome varied.

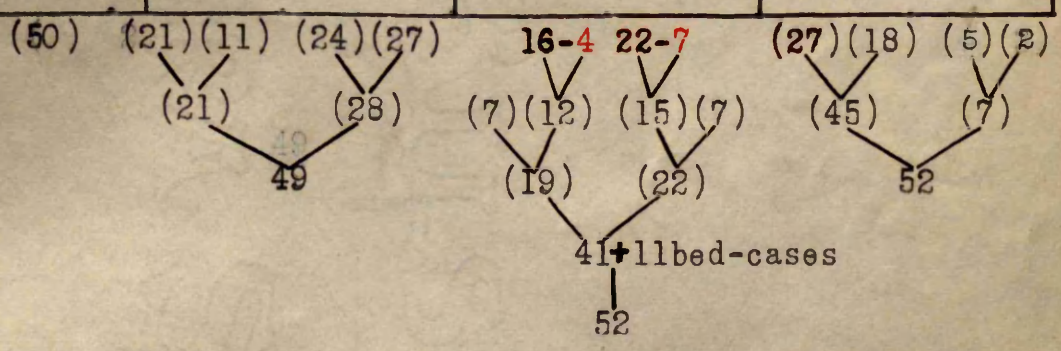
GENERAL PROGNOSIS

This disease, difficult to diagnose, & defiant as to treatment, is almost equally defiant as to prognosis. Whether a case is regarded as recovered or not, is largely a matter of the standard taken. Different criteria as regards recovery are used by different observers. Hence it is not surprising that there is considerable difference of opinion about the proportion who recover from the residua of the disease. From year to year there has to be a constant revision of the recovery per-centages. A fairly long interval has now elapsed in our series since the acute illness & therefore, our figures may be considered fairly reliable. Butterworth found that of 38 children (5 - 16 years) attacked during the previous 6 years, 28.9% apparently recovered. Shrubsall[89] found that 26/191 children (13.6%) made complete recoveries; Kerr[55,p.411] 10% ; Robb[78] 5% ("hardly a patient escapes without some relic of his illness"); Nonne, few cures out of 161. Grossman[37] concluded that 70% made a good recovery. When he re-examined his cases at a later time, one to three years after the acute illness, only 10/92 could then be regarded as complete recoveries. Duncan[24] found no trace of the disease in 4/83 cases; McKenzie[63] in 1/50. Stevenson[97] reports 3/65 making good recoveries, being normal physically & mentally. One has improved greatly. The others are all incapacitated for ordinary life, either by nervous sequelae or by mental defect. With the exception of the Parkinsonian syndrome, & the intellectual deterioration, Stevenson considers all/

TABLE XL.

PROGNOSIS OF SEQUELAE.

	Case No.	1st I.R	Last I.R.	Physical				Conduct				Intellectual			
P	4	80	70			I	N			I		W			
	7	80	77			I	N			I				I	
	8	72	62			I	N			I			B		
P	11	65	50	W	B				B				B		
P	12	70	63	W	B					I		W			
P	13	75	75	W	B					I			B		
P	14	59	56	W						I			B		
P	17	-------		-----		-----		-----		-----		-----		-----	
P	18	-------		-----		-----		-----		-----		-----		-----	
	19	91	69	W						I			B		
	20	-------		-----		-----			B			W			
	21	77	47	W				W				W			
P	26	81	49	W				W				W			
P	31	69	69	W					B					I	
	32	-------		-----		-----			B			W			
	37	73	55			I	N			I		W			
P	41	85	67	W						I		W			
	43	86	78			I	N			I		W			
	44	71	47				N		B			W			
	45	80	71			I	N			I			B		
	47	87	95			I	N			I					N
	49	82	73	-----		-----			B			W			
	50	91	96			I	N				N				N
P	51	79	77			I	N		B					I	
P	52	98	82			I				I			B		
	53	101	85			I	N	W					B		
P	55	64	41	W	B					I		W			
	56	110	82			I	N				N		B		
	57	97	76			I	N		B				B		
	58	87	81			I	N			I			B		
	59	110	89			I	N				N	W			
	60	103	89			I	N			I			B		
	61	97	71			I	N			I		W			
P	62	75	71	W	B					I			B		
	64	80	80			I	N			I				I	
P	65	109	92			I	N	W					B		
	66	86	82				N		B					I	
P	67	96	70	W				W					B		
P	68	78	72	W	B					I		W			
	69	70	72				N				N		B		
P	70	86	61	W	B				B			W			
	71	85	73	W							N		B		
P	72	70	73	W	B					I		W			
P	73	98	56	W					B			W			
P	74	89	71	W	B				B			W			
P	75	85	63	W	B				B			W			
P	76	96	64	W				W				W			
	79	89	55				N	W				W			
P	80	71	64	W	B					I		W			
	81	60	52			I	N				N	W			
	83	-------		-----		-----		-----		-----		-----		-----	
	84	88	84			I	N		B			W			
	85	82	71			I	N		B			W			
	86	101	91			I	N		B			W			
	87	84	80			I	N				N		B		



W. stands for cases becoming worse.
B. " " very bad and stationary cases.
I. " " cases that are improving.
N. " " " " " normal.

Cases in Red type are bed-ridden.

P = Parkinsonian cases.

all the other sequelae tend, on the whole, towards improvement. Among our own cases, only 2/49 may be said to have recovered from all after-effects, & now appear to be normal, or nearly so, in intelligence, in conduct & in physical condition (No.47 & 50).≠ All the others are still far from normal, either intellectually, or physically, or in conduct. (see Table XL.).

Measured by the index of development, seven cases are normal, with a figure around '1', but only two of these have an I.R. at last test over 90 (No.47 & 50); while four have I.R.s between 70 & 80. Of these latter, one (No.13) is poor physically, & becoming worse; one (No.51) is badly behaved, but normal physically; one (No.64) is normal physically, & improving in conduct; and one (No.69) is normal in conduct, & normal physically.

Table XL may be thus summarised, to show the order of recovery:-

TABLE XL1.

	Deteriorating.	Bad & Stationary	Improving	Normal.
Physical condition.	21	11	24	27
Conduct.	7	12≠≠	15≠≠≠	7
Intellectual condition.	27	18	5	2

Or further summarised thus:

	Bad or deteriorating		Normal or Improving:	
	No. Cases	%	No. Cases	%
Physical condition.	21	43%	28	57%
Conduct.	19≠≠	46%	22≠≠≠	54%
Intellectual condition.	45	86.5%	7	13.5%

≠≠ Excluding 4 cases confined to bed.
≠≠≠ Excluding 7 cases confined to bed.

≠ A recent letter (May 1931) from the mother says that Case 50 is in "perfect health."

The greatest improvement observable in these children, as judged some years after the onset of the acute illness, is in their physical condition. There is an almost equally great improvement in their conduct. But there is no equally favourable improvement in their intellectual growth. These results differ from Shrubsall's(89) conclusion, that the order is first of all an improvement in the physical condition, then a recovery in intellectual activities, spread over a slightly longer period (over two years), & lastly, often much later, & slower, a recovery in the conduct.(p.36).

GENERAL SUMMARY.

1. The range of intelligence in 55 encephalitic children at a first test is comparable with that of a normal group.
2. The variability in intelligence of the encephalitic group is not significantly different from that of other children. (see page 42)
3. The average intelligence of the encephalitic children is appreciably & significantly below the normal; being below the average of 974 non-encephalitic hospital patients, & still more below the average of 250 convalescent fever patients. This suggests a causal connection between encephalitis lethargica & diminishing intelligence. (pp. 43 & 44)
4. The encephalitic children differ significantly in intelligence from their healthy brothers & sisters, as judged by a comparison of the mean I.R.s at both a first & a second test; which also suggests that the difference is the result of the disease. (p. 52)
5. There is no significant sex difference in the intelligence of encephalitic boys & girls; & each sex deteriorates equally. (p. 46)
6. The average intelligence of the patients who were re-tested two, three, four, & five times, showed a significant deterioration at each re-test. Again suggesting that the disease adversely affects the intelligence.(671)
7. The longer the time interval between date of onset and test/

test, the lower becomes the average intelligence ratio: the mean intelligence age increases little after onset. (75)

8. Our observations do not permit the assertion of a significant correlation between length of interval between tests, & degree of intellectual impairment. (p. 90)

9. The intellectual deterioration is only relatively greater among young children; but the final effect of the arrest of development is more serious for them. (97)

10. As a group the patients are developing at about half the rate of normal children. Within the group are a few cases which appear to suffer no serious intellectual after-effects, but in the vast majority mental development is arrested, & intelligence reduced in some to the level of low grade defectives. (p. 109)

11. There is thus definite statistical evidence of intellectual deterioration that is due directly to encephalitis lethargica, & it is doubtful if the time factor is playing any considerable part in the return of the patients to a normal rate of development.

12. Attention disorders & memory changes are common, though not general: the former appear to be more common. (p. 114 & 118)

13. The children who are attending school are, with a few exceptions, not making progress along academic lines equal to the average child, age for age: most of the children are seriously retarded scholastically. (p. 129)

14. The intelligence test results do not appear to have been influenced to any great extent by 'schooling' or the lack of it. The I.R. decreases in spite of regular attendance at school. (p. 131)

15. The greater degree of intellectual deterioration is found among the children attending 'special' & 'institution' schools. (p. 134)

16. Thirteen of the 28 patients who are now left school & over 14 years of age, have not yet been employed, & are scarcely likely to be on account of low intelligence: 5 others have worked but are unemployed at present through their own fault. Only 5 are regularly employed & these are the brightest intellectually, having deteriorated little if any as a result of the illness. In all these cases a fairly long interval has elapsed since the onset of the illness. (p. 136)

17. Next to intellectual changes character changes are the most frequent sequelae, & they are often severe. (p.164)

18. Certain affective-conative traits are positively correlated with encephalitis lethargica,- some of them to a high degree,- & must be attributed to the disease. In order of frequency these are:- 'restlessness,''fits of anger,''slowness of action,''rage,''changed character,''very emotional,''bad tempered,''easily influenced for bad,''tells lies,''violent,''teases,' 'quarrelsome,' etc.. A few traits are negatively correlated with the disease:- 'remorse,''ability to look after self,''careful of personal appearance,' 'easily influenced for good,''good-natured,''plays with other children,''friendly,''shyness.' (p. 164)

19. Age, both at time of first test & at time of last test, has no influence upon the type & degree of the affective-conative changes that follow the disease. That is

to say, moral & emotional disturbance is present in children of all ages. (p. 167)

20. The 'changed' conduct group suffers greater intellectual deterioration than those whose conduct remains as it was before the illness. Measured by the index of development the'normal in conduct'cases are developing intellectually at half the rate of normal children, while those cases whose conduct is still becoming worse are scarcely making any progress intellectually. But whatever may be the ultimate explanation of the moral disturbance, it is not determined solely by the intelligence level of the patient. The serious intellectual deterioration caused by the disease, along with the emotional instability is a possible explanation of the moral disturbance. (pp. 173, 174, 175, & 184)

21. The prognosis as regards conduct is favourable: 54% of the cases are now normal or improving; though time appears to play no part in the return to normal behaviour. (p.185)

22. The [illegible] cases [illegible] tested within four months from onset , [illegible] and those tested over four months after onset , deteriorate intellectually to the same extent; though the former had the higher average I.R. at the first test. (p. 190)

23. The severity of the initial illness,as judged by the temperature of the patient, seems to play some part in the extent to which the patient's intelligence diminishes. Those children with the highest temperature in the acute stage/

stage of the illness deteriorate just significantly more intellectually than do those whose temperature was nearer normal. (pp. 191 & 194)

24. The duration of the fever & the lethargy in the survivors appears to play no significant part in the amount of the intellectual deterioration. (pp. 191 & 194)

25. Children who suffer from lethargy in the acute stage deteriorate intellectually just as much & no more than those who do not. (p. 194)

26. Speech defects varying in severity are common sequelae. The 'speech defectives' are likewise found to suffer more physically, intellectually & temperamentally, than do those cases whose speech is normal. (p.201)

27. Those patients whose 'speed of movement' has diminished, deteriorate intellectually just as much as, & not significantly more than, those who are normal in this respect. (p.207)

28. The children whose gait is most affected have deteriorated most intellectually, & at the time of the first test their average I.R. was significantly below that of those whose gait is at present normal: i.e. the dullest patients appear to be most prone in time to become immobile. (p. 208)

29. As regards physical condition in general, the patients with obvious physical sequelae deteriorate intellectually significantly more than do those without them, & at the first test they also appear to be as a group lower intellectually. (p. 209)

30. The patients whose physical condition is steadily deteriorating have suffered the greatest intellectual deterioration. Those who are improving physically had a mean I.R. at both the first & last test significantly higher than those who are becoming worse physically. The former are developing at a little more than half that of normals, while the latter are developing at less than a quarter: a significant difference.(p.210)

31. Our observations indicate a significant correlation between general physical improvement in these patients & their intellectual progress. (p. 212)

32. There is no significant difference between the intelligence of the children who have developed the Parkinsonian syndrome & the children who have remained free of it. The Parkinsonians deteriorate intellectually to the same extent, & only to the same extent, as those patients who so far have not developed the syndrome.(216)

33. About 4% of the cases have made good recoveries. The others are still far from normal, either intellectually, or physically, or in conduct. (p. 230)

34. The greatest improvement observed is in the physical condition of the patients (57%). There is an almost equally great improvement in their conduct (54%). But there is no equally favourable improvement in their intellectual growth. Only 13.5% approach the normal or are improving intellectually. The intellectual condition of 86.5% of cases is 'bad' or deteriorating. (p.233)

GENERAL CONCLUSIONS.

The enquiry may not have been so extensive as some others made from the purely medical stand-point, but its intensiveness gives it an importance all its own. And though the group of children studied over a period of years is small, the observations & conclusions should nevertheless be of considerable value.

All the evidence points in the same direction: viz. that while in a few cases encephalitis lethargica leaves no serious mental after-effects, yet it does on the whole arrest or retard mental development, to such an extent that it appreciably reduces the intelligence of the patients, amounting sometimes to imbecility. This arrestment is the most striking of the generalizations arrived at from our observations. The importance of this conclusion can hardly be over-estimated, for we are here in the presence of mental defect which is not innate: children, apparently sound and developing normally in mind & body, have by disease suffered intellectual deterioration, in some cases sufficiently grave to necessitate institutional care. In stressing the hereditibility of mental deficiency in recent years, psychologists have been prone to neglect disease supervening during the years of child-hood as a possible factor in the causation of mental deficiency.

Dr. Burt,(11) commenting on Paterson & Spence's data, arrived at a similar conclusion to our own: "Here we seem to have definite evidence that children who would otherwise have/

have grown up into normal & intelligent adults, are converted into mental or temperamental defectives by the misfortune of brain diseases in early child-hood."

Whatever may be our views on innate capacities, we have to acknowledge that by a misfortune of circumstance the growth of these capacities may be arrested or retarded with disastrous effects on mind as well as on body.

The other general conclusion is equally important from a social point of view. Disturbed conduct of varying degree & type, along with emotional changes, is found in many of the children, & not necessarily in those who are suffering from some degree of feeble-mindedness. It is perhaps a pity that no psychotherapeutic methods were, or could be, employed when studying the cases, to restore them to normality as regards behaviour. But it is gratifying to find a general tendency to improve in this connection, though there is no equally great intellectual improvement. Our results warrant the hope that the refractory behaviour & erratic temper will disappear before they blossom into irretrievable delinquency. But what the years of maturity hold in store for these unfortunates only time will show.

APPENDICES.

APPENDIX I.

Table A.

Showing Individual Test Results.

Column (1) Sex. M = Male, F = Female.
" (2) Patient's Case Number, e.g. 4 = first test, 4a = second test, etc.
" s (3) - (16) Chronological Age divisions on the Binet Scale.

Note:- x = individual tests given and passed.
o = individual tests given and failed.
x = individual tests not given and credited passed.
o = individual tests not given and credited failed.

Binet Scale

TABLE A.

Sex	Case Number	3	4	5	6	7	8	9	10	11	12	13	14	15	16
		1 2 3 4 5 6	7 8 9 10 11	12 13 14 15 16 17 18 19	20 21 22 23 24 25 26 27 28 29 30 31	32 33 34 35	36 37 38 39 40 41	42 43 44 45	46 47 48	49 50 51 52 53	54 55 56	57 58	59 60	61 62 63	64 65
M	4	xxxxxx	xxxxx	xxxoxxxx	xoxxxxxxxxxx	xxxo	xoxoxx	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	a	xxxxxx	xxxxx	xxxoxxxx	xoxxxxxxxxxx	xxxo	xoxoxx	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	b	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxx	ooo	ooooo	oxo	oo	oo	ooo	oo
	c	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxx	oxx	xooxo	oxo	ox	oo	ooo	oo
	d	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxx	xoo	xxoxo	oxx	oo	oo	ooo	oo
M	7	xxxxxx	xxxxx	xxxxxxxo	xxxxxxxxxxxx	xxxx	xxxxxx	xxxx	oxx	oxoxo	ooo	xo	oo	oxo	oo
	a	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxx	xxx	xooxx	oxx	xx	oo	ooo	oo
	b	Not tested.													
F	8	xxxxxx	xxxxx	oxxxoxxx	xxxxxoxxxxxx	xxxx	xxooox	ooxx	ooo	ooooo	ooo	oo	oo	ooo	oo
	a	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxo	oxxooo	xooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	b	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxo	xxox	oxo	oooox	ooo	xo	oo	ooo	oo
	c	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxoxo	xxox	oxo	ooooo	oxo	xo	oo	ooo	oo
	d	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxo	xxxx	oxo	xooox	xxo	xo	oo	ooo	oo
M	11	xxxxxx	xxxxx	xxxxxxxx	xxxooxxxxxxx	xxxo	oxooox	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	a	xxxxxx	xxxxx	xxxxxxxx	xxxoxxxxxxxx	oxoo	oxxxxx	oxoo	ooo	ooooo	oox	oo	oo	ooo	oo
	b	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xoxo	oxxxox	xxoo	ooo	ooooo	oox	oo	oo	ooo	oo
F	12	xxxxxx	xxxxx	xxxxxxxx	xxxxoxxxxxxx	xxxx	xxxooo	xxxx	ooo	ooooo	ooo	xo	oo	ooo	oo
	a	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxo	xxxx	oxo	ooooo	oxo	xo	oo	ooo	oo
	b	Undetermined.													
M	13	xxxxxx	xxxxx	xxxxxxxx	xxooxxxooxxx	oooo	oooooo	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	a	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxoxx	xooo	xoxooo	ooox	xoo	ooooo	ooo	oo	oo	ooo	oo
	b	xxxxxx	xxxxx	xxxxxxxx	xxooxxxxxoox	xooo	xxxooo	oooo	xoo	ooooo	ooo	oo	oo	ooo	oo
	c	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	oxxxoo	xxoo	xoo	ooooo	ooo	oo	oo	ooo	oo
	d	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxo	xxxxox	xxoo	xoo	ooooo	ooo	oo	oo	ooo	oo

		3	4	5	6	7	8	9	10	11	12	13	14	15	16
M	14	xxxxxx	xxxxx	xxxoxxxx	ooxxxooxxooo	xooo	oooooo	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	a	xxxxxx	xxxxx	xxxxoxxx	oxxxoxxxxxxx	xooo	oooooo	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	b	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xoxo	oxoooo	oxoo	ooo	ooooo	ooo	oo	oo	ooo	oo
M	17	xxxxxx	xxxxx	oxxxxxxx	xxxxxxxxxxxx	xxxx	xxxoox	xoxx	oox	oxoxo	oox	ox	oo	ooo	oo
M	18	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxo	xoo	ooooo	ooo	xo	oo	ooo	oo
M	19	xxxxxx	xxxxx	oxxxxxxx	xxxxxxxxxxxx	xxxo	xxxoox	oxoo	xoo	ooooo	ooo	oo	oo	ooo	oo
	a	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxoo	xoxxoo	xooo	xox	ooooo	ooo	oo	oo	ooo	oo
	b	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxoo	xxxxxx	xxxo	oox	xoooo	ooo	ox	oo	ooo	oo
	c	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxoo	xox	xoooo	ooo	ox	oo	ooo	oo
F	20	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxx	oxo	xoooox	xox	xo	ox	ooo	oo
	a	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxx	xxo	xoooox	oxx	xo	oo	ooo	oo
	b	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxx	xxx	ooooox	oxx	xo	oo	ooo	oo
M	21	xxxxxx	xxxxx	xxxxoxxx	xxxxooxxoxxx	xoxo	oooooo	ooox	xoo	ooooo	ooo	oo	oo	ooo	oo
	a	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxoo	xxooox	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	b	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxoo	oxooox	oxoo	ooo	ooooo	oox	oo	oo	ooo	oo
	c	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxoo	ooooxx	oxoo	ooo	ooooo	ooo	oo	oo	ooo	oo
M	26	xxxxxx	xxxxx	xxxxxxxx	xxxxooxxxxxo	xoxx	ooooox	oxoo	ooo	oxooo	ooo	oo	oo	ooo	oo
	a	xxxxxx	xxxxx	xxxxoxxx	xoxxxoxxxxxo	xooo	ooooox	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	b	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xooo	xooooo	xooo	ooo	ooooo	ooo	xo	oo	ooo	oo
	c	xxxxxx	xxxxx	xxxxxxxx	xxxxxooxxxxx	xxxo	xoooox	xoxo	ooo	ooooo	ooo	oo	oo	ooo	oo
	d	xxxxxx	xxxxx	xxxxxxxx	xxxxxxoxxxxx	xoxx	oooooxx	xooo	ooo	ooooo	ooo	oo	oo	ooo	oo
M	31	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxo	xxox	xoo	ooooo	ooo	xo	oo	ooo	oo
	a	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxo	xxxx	ooo	ooooo	ooo	xo	oo	ooo	oo
	b	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxo	xxxx	ooo	xoxoo	oox	xo	oo	ooo	oo
	c	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxoxx	xxxx	xxx	xooox	oox	xo	oo	ooo	oo

		3	4	5	6	7	8	9	10	11	12	13	14	15	16
M	32	xxxxxx	xxxxx	oxooooox	ooooooooooox	oooo	oooooo	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	a	xxxxxx	xxxxx	oxxxoxxx	xoxoxoxxxoox	oooo	oooooo	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
M	37	xxoxxo	oxooo	oooooooo	oooooooooooo	oooo	oooooo	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	a	xxoxxo	xxooo	oooooooo	oooooooooooo	oooo	oooooo	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	b	xxxxxx	xxxoo	oooxoxoo	oooooooooooo	oooo	oooooo	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	c	xxxxxx	xxxxo	oxxxxxxo	ooooooooxooo	oooo	oooooo	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	d	xxxxxx	xxxoo	xxxoxxxo	oooooxoxoxo	oooo	oooooo	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	e	xxxxxx	xxxxo	xxxxxxxx	ooxoxoxxxoox	oooo	oooooo	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	f	xxxxxx	xxxxx	xxxxxxxx	ooxoooxxxooo	oooo	oooooo	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
F	41	xxxxxx	xxxxx	xxxxxxxx	xxooxxxooxxx	oxoo	oooooo	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	a	xxxxxx	xxxxx	xxxxxxxx	xxooxoxxoxxx	oooo	oooooo	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	b	xxxxxx	xxxxx	xxxxxxxx	xxooxxxxoxxx	oxoo	oxxooo	xooo	ooo	ooooo	ooo	oo	oo	ooo	oo
F	43	xxxxxx	xxxxx	xxxxxxxx	xxooxoxxxxoo	xoxo	oxoooo	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	a	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxoxx	oxox	xxo	ooooo	ooo	ox	oo	ooo	oo
M	44	xooxxo	ooooo	oooooooo	oooooooooooo	oooo	oooooo	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	a	xooxxo	ooooo	oooooooo	oooooooooooo	oooo	oooooo	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	b	xxxxxx	xxoxo	oxoxoooo	oooooooooooo	oooo	oooooo	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	c	xxxxxx	oxxxo	oxoooooo	oooooooooooo	oooo	oooooo	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	d	xxxxxx	oxxxo	oxoooooo	ooooooooooox	oooo	oooooo	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
F	45	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxo	xxox	xxxoxx	oxxx	oxo	xooox	oox	xx	oo	ooo	oo
	a	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxoxx	xxoo	xxo	xxoox	oxx	oo	oo	ooo	oo
	b	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxo	oxx	xxoox	oxx	oo	oo	ooo	oo
	c	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxox	oxo	xxoox	oxx	xo	ox	ooo	oo
F	47	xxxxxo	xxoxo	xooooxo	oooooooooooo	oooo	oooooo	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	a	xxxxxx	xxxxx	xxoxxoxo	oooooooxooo	xooo	oooooo	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	b	xxxxxx	xxxxx	xxxxxxxo	oooooxxoxxxox	xoxo	ooooox	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo

		3	4	5	6	7	8	9	10	11	12	13	14	15	16
F	47	xxxxxo	xxoxo	xooooooxo	oooooooooooo	oooo	oooooo	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	a	xxxxxx	xxxxx	xxoxxoxo	ooooooooxooo	xooo	oooooo	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	b	xxxxxx	xxxxx	xxxxxxxo	oooooxxoxxxoxx	xoxo	ooooox	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	c	xxxxxx	xxxxx	xxxxxxxx	xxxoxxoxxxxx	xxxo	oxoooo	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	d	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxo	xxxo	ooxoox	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
F	49	xxxxxx	xxxxx	xxxxxxxx	xoxooooxoooox	oooo	oooooo	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	a	xxxxxx	xxxxx	xxxxxxxx	xoxooxxxxoox	xoxo	oxoooo	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
M	50	oxoxxx	oxooo	oooooooo	oooooooooooo	oooo	oooooo	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	a	xxxxxx	xxxxo	oooooxo	ooooooooooo	oooo	oooooo	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	b	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxox	xxox	xxxxox	xooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	c	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xoxxxx	xoxo	ooo	ooooo	ooo	oo	oo	ooo	oo
M	51	xxxxxx	xxxxo	ooxoxoxx	ooooooooooo	oooo	oooooo	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	a	xxxxxx	xxxxx	xxxxxxxx	xoxooxxxxxxx	oooo	oxoooo	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	b	xxxxxx	xxxxx	xxxxxxxx	xxxxxoxxxxox	xxxx	xxooox	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	c	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxox	ooxo	ooo	ooooo	ooo	oo	oo	ooo	oo
	d	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xoxx	xxxxox	xxoo	oxo	ooooo	ooo	oo	oo	ooo	oo
F	52	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxoxx	xxxx	oxo	xxxox	xxx	xo	oo	ooo	oo
	a	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxx	xxx	xxxxx	xxo	oo	oo	ooo	oo
	b	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxx	oxx	xxxxx	xxo	ox	ox	ooo	oo
	c	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxx	xxx	xxxxx	xxo	ox	xx	ooo	oo
F	53	xxxxxx	xxxxx	xxxxxxxx	xoooxxxxxxxo	oooo	oooooo	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	a	xxxxxx	xxxxx	xxxxxxxx	xxxoxxxxxxxx	xxoo	ooxoox	oxoo	ooo	ooooo	ooo	oo	oo	ooo	oo
	b	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxox	xxox	xxxxxx	oxoo	ooo	ooooo	ooo	oo	oo	ooo	oo
	c	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxoxx	xxoo	ooo	ooooo	ooo	oo	oo	ooo	oo
	d	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxox	ooo	ooooo	ooo	oo	oo	ooo	oo

		3	4	5	6	7	8	9	10	11	12	13	14	15	16
M	55	xxxxxx	xxxxx	xxxxxxxx	ooxxooxxxoxx	xoxo	ooooox	oooo	ooo	oooxo	ooo	oo	oo	ooo	oo
	a	xxxxxx	xxxxx	xxxoxxxx	xoxoxoxxxxxx	oooo	ooooxo	xooo	ooo	oooxo	ooo	oo	oo	ooo	oo
M	56	xxxxxx	xxxxx	oxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxo	xoo	xxooo	xoo	xo	oo	ooo	oo
	a	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxoxx	xxxx	oox	xxoxo	oox	xo	oo	ooo	oo
	b	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxo	ooo	xoooo	oox	ox	oo	ooo	oo
	c	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxx	oxx	xxoox	xxo	oo	ox	ooo	oo
	d	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxx	ooo	xxxoo	xxo	xx	ox	xoo	oo
M	57	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	oxxo	xoo	ooxoo	oox	oo	oo	ooo	oo
	a	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxoo	xox	ooooo	oox	oo	oo	ooo	oo
	b	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxx	oxx	ooxox	oxx	oo	ox	ooo	oo
	c	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxo	xxx	ooxox	oox	oo	ox	ooo	oo
	d	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxo	xxx	ooxox	oxx	ox	ox	ooo	oo
M	58	xxxxxx	xxxxx	xxxxxxxx	xxooxxooxoox	xooo	ooxoox	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	a	xxxxxx	xxxxx	xxxxxxxx	xxoxxxxxxoxx	oxoo	ooxoox	oxoo	ooo	ooooo	ooo	oo	oo	ooo	oo
	b	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	oxxoox	ooox	ooo	ooooo	ooo	oo	oo	ooo	oo
M	59	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxx	xxx	xoxox	oxo	xx	oo	ooo	oo
	a	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxx	xxx	xoxox	xxo	oo	oo	ooo	oo
	b	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxx	xxx	xxxox	xxx	xx	xo	ooo	oo
	c	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxx	oxx	xxxox	xxx	xx	ox	ooo	xo
M	60	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxx	ooo	xoxxo	oxo	xo	oo	ooo	oo
	a	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxx	xxo	xoxxo	oxo	oo	oo	ooo	oo
	b	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxx	ooo	xoxxo	oxo	oo	ox	ooo	oo
	c	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxx	xoo	xxxxo	oxo	xo	ox	ooo	oo
	d	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxx	xoo	xoxxo	oxx	xo	ox	ooo	oo

		3	4	5	6	7	8	9	10	11	12	13	14	15	16
F	61	xxxxxx	oxxoo	oooooooo	ooooooooooo	oooo	oooooo	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	a	xxxxxx	xxooo	oooooxx	ooooooooooo	oooo	oooooo	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	b	xxxxxx	xxxxx	xxxxooxx	ooooooxooox	oooo	oooooo	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	c	xxxxxx	xxxxx	xxxxxoxo	xxooxoxoxoox	oooo	oooooo	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	d	xxxxxx	xxxxo	xxxxxxxx	xxoxxooxxoxx	oooo	oooooo	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
M	62	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxx	xox	xxooo	ooo	oo	oo	ooo	oo
	a	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxx	xxx	xooxx	oxo	xo	xo	xox	oo
	b	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxx	xxx	xooxx	oxo	xo	oo	ooo	oo
M	64	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxoo	oxxoox	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	a	xxxxxx	xxxxx	xxxxxxxx	xxxxxooxxxxx	xxox	xxxooo	xooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	b	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxox	xxxoox	xooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	c	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxox	xooo	xxo	ooooo	ooo	oo	oo	ooo	oo
	d	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxox	xxxx	xoo	oooxo	ooo	oo	oo	ooo	oo
M	65	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxx	xox	ooooo	ooo	oo	oo	ooo	oo
	a	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxoo	xxxx	oox	ooooo	ooo	oo	oo	ooo	oo
	b	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxx	oxx	oooox	xoo	xo	oo	ooo	oo
	c	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxx	oxo	oxooo	oxo	oo	oo	ooo	oo
	d	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxx	xxx	xooxx	xxo	oo	oo	ooo	oo
	e	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxx	xxx	xxoox	xxo	ox	oo	ooo	oo
M	66	xxxxxx	xxxxx	xxxxxxxx	xxooxooxxxxx	oooo	ooooox	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	a	xxxxxx	xxxxx	xxxxxxxx	xoooxoxxxxoo	oooo	oooooo	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	b	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxox	ooxo	ooo	ooooo	ooo	oo	oo	ooo	oo
	c	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	oxxo	xoxxox	ooox	ooo	ooooo	ooo	oo	oo	ooo	oo
	d	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxoox	ooox	oxo	xooxx	ooo	xo	oo	ooo	oo

		3	4	5	6	7	8	9	10	11	12	13	14	15	16
M	67	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxx	xxx	xxoxx	oxo	oo	oo	ooo	oo
	a	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxx	xxx	xooox	oxo	oo	oo	ooo	oo
	b	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxx	xxx	xxoox	oxx	oo	oo	ooo	oo
	c	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxx	xxx	xxoox	oxx	oo	oo	ooo	oo
F	68	xxxxxx	xxxxx	xxxxxxxx	xxooxxooxooo	oxoo	oxoooo	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	a	xxxxxx	xxxxx	xxxxxxxx	xoooxxxoooox	xxoo	oooooo	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	b	Undetermined.													
	c	Undetermined.													
M	69	xxxxxx	xxxoo	xxxxooxo	oxooooooxxoo	oooo	oooooo	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	a	xxxxxx	xxxxx	oxxxoxxx	oxoooxxoxoxo	oooo	oooooo	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	b	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	oxoo	ooxooo	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	c	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxo	xxxoxx	oxoo	ooo	ooooo	ooo	oo	oo	ooo	oo
M	70	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxo	oxoo	oxxoox	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	a	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxo	xxxoox	xooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	b	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxo	xoxxox	xooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	c	xxxxxx	xxxxx	xxxxxxxx	xxxxxoxxxxox	xxxo	oxoxox	xooo	ooo	ooooo	ooo	oo	oo	ooo	oo
M	71	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxx	xox	oxoxo	ooo	oo	oo	ooo	oo
	a	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xoxx	xxx	oooxo	ooo	oo	oo	ooo	oo
	b	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxx	xxx	ooxoo	ooo	oo	oo	ooo	oo
	c	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxx	oxx	xxxoo	oox	oo	ox	ooo	oo
M	72	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxoxxxx	xxox	xoxxxx	xxxo	xxo	xoooo	ooo	oo	oo	ooo	oo
	a	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxx	oxo	xoxoo	ooo	oo	oo	ooo	oo
	b	Undetermined.													
	c	Undetermined.													

		3	4	5	6	7	8	9	10	11	12	13	14	15	16
M	73	xxxxxx	xxxxx	xxoooooxx	ooooooooooooo	oooo	oooooo	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	a	xxxxxx	xxxxo	oooxxoxo	ooooooooooooo	oooo	oooooo	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	b	xxxxxx	xxxxx	oxooxoxx	ooooooxxooxox	oooo	oooooo	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	c	xxxxxx	xxxxx	oooxxoxx	ooooxxxoxoox	xooo	oooooo	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	d	xxxxxx	xxxxx	oooxxoxx	ooooxxxooxox	xooo	oooooo	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
M	74	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxx	xxx	xxooo	oxo	oo	oo	ooo	oo
	a	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxx	oxo	xxxox	xxo	xo	oo	ooo	oo
	b	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxx	oxo	xooox	xoo	xx	oo	ooo	oo
M	75	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxoo	xxxxox	xxoo	ooo	ooooo	ooo	oo	oo	ooo	oo
	a	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxoo	oxo	ooooo	xoo	xo	oo	ooo	oo
	b	xxxxxx	xxxxx	xxxxxxxx	xxxoxxxoxxxx	xxxo	xxxoox	xooo	xoo	ooooo	ooo	oo	oo	ooo	oo
M	76	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	oxxx	xoxxxo	xxxx	xoo	ooooo	ooo	oo	oo	ooo	oo
	a	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	oxxx	xxxoxo	xoxx	xoo	ooooo	xoo	oo	oo	ooo	oo
	b	xxxxxx	xxxxx	xxxxxxxx	xoxxxoxxxxox	ooxx	xoxxox	xoox	ooo	ooooo	ooo	oo	oo	ooo	oo
M	79	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxoo	ooxooo	ooox	ooo	ooooo	ooo	oo	oo	ooo	oo
	a	xxxxxx	xxxxx	xxxxxxxx	xxxoxoxxoxox	oooo	oooooo	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
M	80	xxxxxx	xxxxx	xxoxooxx	oxxoooxooxxx	xooo	oooooo	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	a	xxxxxx	xxxxx	xxoxxxxx	ooooxoxxoxox	xooo	oooooo	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
M	81	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxo	xoxo	xooxoo	oxxx	ooo	ooooo	ooo	oo	oo	ooo	oo
	a	xxxxxx	xxxxx	xxxxxxxx	xxxxxxoxxxxx	xxxx	xxooxx	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
M	83	xxxxxx	xxxxx	xxoxxxxx	oxxoooxoxooo	oooo	oooooo	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	a	xxxxxx	xxxxx	xxxxxxxx	xxxoxoxoxxxx	xooo	oxxooo	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
F	84	xxxxxx	xxxxx	xxxoooxx	ooooxxxxxoxx	oooo	ooooox	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo
	a	xxxxxx	xxxxx	xxxoxxxx	xoooooxxxxxox	xooo	oxooox	oooo	ooo	ooooo	ooo	oo	oo	ooo	oo

		3	4	5	6	7	8	9	10	11	12	13	14	15	16
M	85	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xoxxxx	xxox	xox	ooooo	ooo	oo	oo	ooo	oo
	a	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxx	xox	xoooo	xxo	oo	oo	ooo	oo
	b	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxx	xox	xooxo	xxo	oo	oo	ooo	oo
F	86	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxx	xxx	xxxxo	oxo	xx	ox	ooo	oo
	a	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxx	xxx	xxxxo	xxx	xx	xo	xoo	oo
	b	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxx	xxx	xxxxx	xxx	xx	ox	oxo	xo
M	87	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxx	xoo	xxxxo	oxo	oo	oo	ooo	oo
	a	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxx	xoo	xxxxo	xxo	oo	oo	ooo	oo
	b	xxxxxx	xxxxx	xxxxxxxx	xxxxxxxxxxxx	xxxx	xxxxxx	xxxx	xxx	xoxxx	oxo	xo	oo	ooo	oo
Total Passes.		196 195 192 197 197 192	190 195 189 187 177	172 183 174 179 161 172 186 177	161 153 152 138 160 148 165 160 157 150 163	147 131 121 103	118 123 126 94 93 124	104 99 80 82	59 55 47	56 33 29 31 31	24 48 31	38 20	4 16	3 2 1	2 0
Mean Score.		194·8	187·6	175·1	156·2	125·5	113·0	91·25	53·7	37·2	34·3	29·0	10·0	2·0	1·0

Appendix II.

PERCENTAGE OF CORRECT RESPONSES TO THE SEVERAL TESTS.
(normals, mental defectives, & encephalitics compared).

TABLE A.

Order for Normals (Burt).	TEST.	% Normals. (Burt) *	% Encephalitics.	Order for Encephalitics	% Mental Defectives. (Burt). **
	Age III.				
1	Pointing.	98.7	99.5	3	98.8
2	2 Numbers.	98.5	99.0	4	96.2
3	Sex.	97.4	97.5	6	98.0
4	Surname.	97.3	100.0	1	98.1
5	Naming.	96.6	100.0	2	97.9
6	Picture (Enumeration).	96.0	97.5	7	95.7
	Age IV.				
7	6 Syllables.	95.1	96.4	8	87.5
8	3 Numbers.	93.6	99.0	5	93.0
9	4 Pennies.	92.8	95.9	9	93.5
10	2 Lines.	92.5	94.9	10	93.0
11	Comparing Faces.	90.7	89.8	13	87.6
	Age V.				
12	Triple Order.	89.1	87.3	17	83.3
13	Square.	88.5	92.9	12	89.9
14	10 Syllables.	87.2	88.3	16	80.9
15	Age.	87.0	89.3	15	84.0
16	Morning and Afternoon.	86.5	81.7	22	84.7
17	4 Colours.	85.7	87.3	18	83.9
18	4 Numbers.	85.0	94.4	11	71.7
19	2 Weights.	82.0	89.8	14	72.0
	Age VI.				
20	Fingers.	80.9	81.7	23	78.9
21	13 Pennies.	80.5	77.7	27	77.8
22	Diamond.	78.1	77.2	28	67.2
23	Transcription.	77.8	78.0	32	68.7
24	Days of Week.	77.5	81.2	24	67.4
25	4 Coins.	77.4	75.1	30	70.6
26	Divided Card.	76.7	83.8	20	62.7
27	Definition (Use).	76.6	81.2	25	73.7
28	5 Numbers.	76.4	84.5	19	53.7

* (10.p.133).
** (10.p.135): the youngest children included are 6 yrs.old.

Appendix II. (contd.)

29	.Picture (Description).	76.4	79.7	26	72.5
30	16 Syllables.	76.0	76.1	29	47.7
31	Right and Left.	75.9	82.7	21	68.2
	Age VII.				
32	Missing Features.	74.2	74.6	31	52.7
33	Pence and Halfpence.	69.1	66.5	33	52.8
34	Differences (Concrete).	68.8	61.4	37	45.2
35	Dictation.	66.7	52.3	40	18.2
	Age VIII.				
36	Reading (2 Facts).	63.1	59.9	38	18.6
37	Easy Questions.	62.8	62.4	36	54.3
38	Counting 20 to 1.	62.0	64.0	34	36.0
39	Date.	57.6	47.7	42	33.8
40	Change.	57.4	47.2	43	33.8
41	6 Numbers.	56.9	62.9	35	27.4
	Age IX.				
42	Months.	56.3	52.8	39	36.5
43	9 Coins.	54.6	50.3	41	41.3
44	Reading (6 Facts).	49.9	40.6	45	9.6
45	Definition (Class).	49.0	41.6	44	10.2
	Age X.				
46	5 Weights.	46.6	29.9	46	17.6
47	Sentence Building (2).	45.2	27.9	48	11.9
48	Memory Drawing.	41.4	23.9	50	11.5
	Age XI.				
49	Absurdities.	37.7	28.4	47	6.7
50	Difficult Questions.	35.6	16.8	53	4.5
51	60 Words.	35.0	14.7	56	4.6
52	7 Numbers.	33.2	15.7	54	4.5
53	Sentence Building (1).	31.8	18.8	52	3.4
	Age XII.				
54	3 Rhymes.	31.1	12.2	57	1.1
55	Mixed Sentences.	30.2	24.4	49	0.8
56	Picture (Interpretation)	29.6	15.7	55	11.8
	Age XIII.				
57	Suggestion.	28.9	19.3	51	17.1
58	Problems.	19.4	10.2	58	1.3

Appendix II. (contd.)

	Age XIV.				
59	26 Syllables.	16.9	2.4	60	0.7
60	Definition (Abstract).	15.7	8.1	59	
	Age XV.				
61	Folded Paper.	8.0	1.5	61	
62	Differences (Abstract).	7.2	1.0	62	
63	Reversed Triangles.	6.6	.5	64	
	Age XVI.				
64	Re-Statement.	4.8	1.0	63	
65	Difference (King, President).	3.4	0.0	65	

In Appendix II is given a table of comparison of the percentages of correct responses to the various tests by Burt's "normals", "mental defectives", and our "encephalitic" children. The table presents for these children respectively, the percentage of children passing each test in each age group, and are arranged in sequence based on Burt's "normals" (in each age group the average C.A. is $3\frac{1}{2}$, $4\frac{1}{2}$, etc.). Within the age groups in the case of the encephalitics it is seen that the general decline in the percentages taken one by one is interrupted here and there by a momentary rise, viz.-- tests 4, 5, 8, 13, 18, 24, 26, 28, 31, 38, 41, 49, 55, 57. These sporadic reversals are of some interest. Burt says they are generally caused by tests learned suddenly at a definite epoch in the child's school-life, e.g. 23, 36, 39 (10 p.134). Obviously this/

TABLE B.

Differences in Order of Difficulty for Normals (Burt) & Encephalitics.

+ sign indicates that a test is relatively easier for Normals.
− sign " " " " " " " " Encephalitic

Number of Test.	TEST.	Differences in Order.	
		Norms. to Encephal.	Norms. to M.D.
23	Transcription.	+9	+2
16	Morning and Afternoon.	+6	-3
21	13 Pennies.	+6	-2
22	Diamond.	+6	+6
12	Triple Order.	+5	+4
25	4 Coins.	+5	-1
35	Dictation.	+5	+8
51	60 Words.	+5	+1
3	Sex.	+3	0
20	Fingers.	+3	-2
34	Differences (Concrete).	+3	+1
39	Date.	+3	-1
40	Change.	+3	-1
50	Difficult Questions.	+3	+4
54	3 Rhymes.	+3	+3
1	Pointing.	+2	0
2	2 Numbers.	+2	+3
11	Comparing Faces.	+2	0
14	10 Syllables.	+2	+3
36	Reading (2 Facts).	+2	+6
48	Memory Drawing.	+2	0
52	7 Numbers.	+2	+1
6	Picture (Enumeration).	+1	0
7	6 Syllables.	+1	+5
17	4 Colours.	+1	-2
44	Reading (6 Facts).	+1	+6
47	Sentence Building (2).	+1	-1
59	26 Syllables.	+1	0
63	Reversed Triangle.	+1	

TABLE B. (contd.)

9	4 Pennies.	0	-2
10	2 Lines.	0	-1
15	Age.	0	-1
24	Days of Week.	0	+3
33	Pence and Halfpence.	0	-1
46	5 Weights.	0	-2
58	Problems.	0	-2
61	Folded Paper.	0	
62	Differences (Abstract).	0	
65	Differences (King, President).	0	
13	Square.	-1	-3
30	16 Syllables.	-1	+4
32	Missing Features.	-1	+1
37	Easy Questions.	-1	-7
45	Definition (Class).	-1	+4
53	Sentence Building (1).	-1	+2
56	Picture (Interpretation).	-1	-9
60	Definition (Abstract).	-1	
64	Re-Statement.	-1	
27	Definition (Use).	-2	-7
43	9 Coins.	-2	-7
49	Absurdities.	-2	+2
4	Surname.	-3	-2
5	Naming.	-3	-1
8	3 Numbers.	-3	0
29	Picture (Description).	-3	-8
42	Months.	-3	-5
38	Count 20 to 1.	-4	+2
19	2 Weights.	-5	+3
26	Divided Card.	-6	+3
41	6 Numbers.	-6	0
55	Mixed Sentences.	-6	+3
57	Suggestion.	-6	-12
18	4 Numbers.	-7	+5
28	5 Numbers.	-9	+3
31	Right and Left.	-10	-5

this is not the sole explanation here. With the encephalitics these reversals are so numerous and the percentages so high, that they call for further consideration. The encephalitics, as judged by the percentage of correct responses, show higher figures (5% or more) than the normals in the following tests:- 8, 18, 19, 24, 26, 27, 28, 31, 41 (55 is relatively easier). Thus No. 28 was found easier by the encephalitics than the preceding 8 tests and than all the tests following. Correspondingly the tests found to be the most difficult for encephalitic children, as judged by the lower percentage "pass" figure (5% or more) than that for "normals", are -- 16, 23, 34, 35, 39, 40 (and all others above 40 in the scale).

The order of difficulty is shown in another way in Table B, which clearly indicates the tests that were badly answered and those that were well answered. The differences of position shown by each test in the respective rankings have been calculated by subtraction and arranged according to size. Here, near the head of the first column, are to be found those tests which offer relatively the hardest obstacles to the encephalitics. The poorest responses were those made to the tests in transcription, counting 13 pennies, drawing (diamond). Towards the end of the list the plan of arrangement places those tests which, relatively speaking, prove easier for the encephalitic, viz. right and left hand, repeating numbers,/

TABLE C.

GROUP.	TESTS. Most difficult for enceph. +9 to +5	Easiest for enceph. -10 to -5	Almost equally difficult for norms. & enceph. +1	0	-1
SCHOLASTIC TESTS:					
a. of a lingusitic character.	35		44	65	
b. others requiring facility in manipulating words.	51	55	6,47		53,56
c. depending on acquirements which should be learnt at an earlyperiod.	23, 22			24	13
d. depending upon information learnt at school.		31			
TESTS OF MEMORY: (immediate)- a. syllables.	12?		7,59		30
b. numbers.		28,18,41			
REASONING TESTS, & tests involving critical perception.		26,19		10,46 61,62	32,64
LEAST DEPENDENT ON SCHOOLING: tests of general information depending principally on age & experience.	16	57	17,63	15,58	37,45, 60
COUNTING: mechanical.	21			9	
money tests.	25			33	

note:- Of the tests found to be most difficult by the encephalitics, only one (no.51) is a "time-limit" test; while of the tests found to be easiest by encephalitics, one (55) is a "time-limit" test: which is additional proof that these patients have suffered no handicap in the testing through slowness of response, when present.' (cf. p.22).
Another interesting comparison between the two series is that in one there are 4 tests which involve 'motor' response, in the other 3; in one 3 tests involve 'verbal' response, in the other 4; and in each, one test involves combined 'motor-verbal' response.

numbers, test of suggestibility, mixed sentences, divided card. For many tests the shift in location is pronounced. Test 57 (suggestion) proves for encephalitics, as for mental defectives, to be easier.

Attempts to classify the tests according to their special nature with a view to obtaining information upon special capacities is difficult though desirable. Simon himself doubted whether light could be thrown upon special capacities by means of the tests. Burt adds: "certainly such light as they yield in this quarter is but a general dim glitter with an occasional illuminating flash."(10 p.4,note 2).

We have attempted a classification and analysis with the aid of Burt's suggestions(pp. 4, 143, 144). The tests can be roughly grouped into several categories tolerably distinct, as shown in Table C. The numbers are the tests found to be the most difficult,and the easiest,for encephalitics. About 50% of the tests prove to be about equally difficult for normals and encephalitics (+1 to -1). It would seem, on the whole, that the tests found most difficult by encephalitics are those that are of a scholastic nature (linguistic, literary, & counting); just those tests which Burt says; "might be claimed are among the best tests of intelligence."(10 p.144) Many of the scholastic tests, he says, "stand among those that differentiate defectives most profoundly from the normal"(p.144).

They/

They likewise appear to distinguish normals from encephalitics most effectively.

The most remarkable thing of all in the results is the greater success of the encephalitics in the "repetition of numbers" tests (immediate memory); while in the "repetition of syllables", also a memory test, -- though of a more scholastic and linguistic nature, -- the encephalitics and normals are about equally successful only.

APPENDIX. III.

CHANGES IN CONDUCT FROM TEST TO TEST.
(as reported by parent and school teacher).

Case 4:- Cruel to sister; now normal. (P.)

'' 7:- Mischievous;football & cinema daft;a regular torment; clownish capers;cruel; now normal.(P.)

'' 8:- Silly conduct;put out of school for tormenting younger children; now normal.(P.)

'' 11:- Treacherous;cruel;destructive;mischievous.(P.)

'' 12:- Bahaviour too wicked for school;very troublesome;does silly things;(P.)

'' 13:- Destructive;mischievous;now normal.(P.)
Mischievous;often startles class by singing at unsuitable times;sometimes quite troublesome;on the whole,rather more normal than when admitted.(T.)

'' 14:- Destructive;violent;now normal.(P.)
Restless;excitable;obedient;can't be still;almost normal.(T.)

'' 17:- --------

'' 18:- Disobedient;unmanageable.(P.)

'' 19:- Teases & torments other children;now normal.(P.)

'' 20:- Dirty;resentful;complaints from neighbours;had to be put out of hospital;a nuisance;always fighting;disobedient;always asking money to go to the cinema.(P.)

'' 21:- Fights;disobedient;spits;careless of own safety;put out of school for disturbing other children;; problem at times;fondles everyone he meets;just a pest;mother heart-broken;& would not be sorry to see him'away';~~[illegible]~~
~~Generally well-behaved;occasional outbursts of anger when thwarted.(T.)~~

'' 26:- Spits;steals,outside & inside home;disobedient;destructive;cruel;dirty habits;cinema daft;has been in trouble with police; quarrelsome;spends money when sent an errand;does silly things; hysterical turns; delusions; has threatened to commit suicide;threatened mother with a razor;mother heart-broken.(P.)
Generally well-behaved;occasional outbursts of anger when thwarted.(T.)

Case 31:- Heavy smoker;vain;bad sex habits;anxiety dreams; wild outbursts;gambles any money he can obtain.(P.)

'' 32:- Noisy;cruel;destructive;steals;mischievous;fights; a 'little devil'.(P.)

'' 37:- Wanders from home & has to be taken home by police; destructive;steals things from other children;disobedient;fights;dirty habits;'gang' life a common topic of conversation;strange talk & conduct.(P.)

'' 41:- Mischievous;obstinate;always laughing,& without cause; now normal.(P.)

'' 43:- Very troublesome;quarrelsome;now normal.(P.)
Good;sulks if reproved;otherwise quite good-tempered.(T.)

'' 44:- Dirty habits;cruel to enemies;would take the bite out of their arm;fights;wanders from home badly;very destructive;disobedient;(P.)

'' 45:- Mischievous;cruel;craze for cinema;would murder you when angry;difficult to manage.(P.)

'' 47:- Worst of the family;difficult to manage;always in trouble for hitting other children;lies;now normal.(P.)
Conduct excellent.(T.)

'' 49:- Cruel to younger children;quarrelsome;behaviour childish;(P.)

'' 50:- Daft for the cinema;otherwise normal.(P.)
Very good;particularly quiet.(T.)

'' 51:- Hits parents;a wild boy;no fear;cruel to brother; wanders from home;runs after motors;neighbours complain about his behaviour;does not get on with other children;vain;completely changed.(P.)
Fair;something abnormal about him.(T.)

'' 52:- Quarrelsome;very disobedient;(P.)

'' 53:- Spits;cruel to younger children;wanders from home; troublesome;vain;cinema maniac;begs bottles from neighbours to get money to go to cinema;disobedient; untruthful;(P.)
Some days very restless;very easily excited.(T.)

'' 55:- --------

'' 56:- No behaviour complaints;normal.(P.)
Exemplary;apart from being rather quiet,he is quite normal in class.(T.)

Case 57:- A changed boy;spits;wanders away all day;lies; one instance of theft;disobedient;cinema daft;in Court & fined for gambling;a nuisance at school.(P.)

'' 58:- Clean habits;swears;destructive;wanders;disobedient; violent;quarrelsome;cruel to animals;mischievous; lies;steals;there was not a better boy before his illness,but now a great change.(P.)
Somewhat erratic;of a managing disposition;always in the lime-light, & never allows himself to be ignored.(T.)

'' 59:- Conduct same as before illness.(P.)

'' 60:- Throws weapons;cruel to children;violent;impulsive; swears;unsociable;destructive;looks wicked;mother broken-hearted about him;no complaints now;behaves like a normal boy.(P.)
Very good conduct;for a long time now no trouble.(T.)

'' 61:- At school always stealing things for eating; now normal.(P.)

'' 62:- Bad habits;fits of crying;(P.)

'' 64:- Steals things out house & gives them away to other children;spits;cruel to younger children;impulsive; will lift a knife & throw it at you;truancy;bully; fights;vain;different from before illness.(P.)
Excellent while under supervision;away from his teacher,not so good;periodically(once a month)takes a'strange turn'during which he involves himself in childish mischief & freely resorts to'fibbing'(T.)

'' 65:- Spits;cruel to younger children;steals;continually fighting;frequently in trouble with neighbours & police;disobedient;vain;vicious;destructive;wanders; lies badly;steals;swears;kisses everybody;a perfect nuisance;criminal tendencies;called'Charleston Willie' by other children;mother about ready for the asylum as result of his behaviour.(P.)
Behaves well under supervision;cannot be trusted if left;quarrelsome;allows himself to be the'butt'of other children's teasing;apt to dwell upon fancied wrongs;extremely sensitive to ridicule which rouses anger & often tears;very pugnacious;feelings strong & sometimes uncontrollable;strong likes & dislikes.(T.)

'' 66:- Bad habits;wanders;steals;fights;disobedient;vain;lies; swears;spits;impulsive;vicious;quarrelsome;destructive; an impossible child since illness.(P.)

'' 67:- Fits of crying;fights;wanders;mother says her life is in danger;wild outbursts;bully;violent;quarrelsome; destructive;cruel;self-abuse;exhibitionism;in trouble with police for assaulting a woman on a stair;attempted intercourse with mother;greatly changed since illness;should be in an institution.(P.)

Case 68:- Imagines things in the room;easily frightened;incontinence;mischievous;steals;(P.)

'' 69:- Greedy;stubborn;mischievous;noisy;now normal.(P.)
Variable;at times very quarrelsome.(T.)

'' 70:- Cruel to younger sister;fights;violent;swears;threw water over his father;disobedient;destructive;spits; does silly things;defiant;wild outbursts;before illness was a lovable child;now impossible to put up with.(P.)

'' 71:- Spits;'cross-word puzzle'daft;(P.)

'' 72:- Greedy;no bad habits;cruel;quarrelsome;swears;(P.)

'' 73:- Disobedient;impulsive;vicious;mischievous;destructive;very cruel to everybody;behaviour very bad; neighbours always complaining;flings knives at one; breaks dishes,& says'the devil told me to;' too dangerous to take into school;bites;nips;very selfish;unsociable;always fighting;wanders;very dirty habits;spits;swears badly;always crying;bully;conceited;quarrelsome;lies;incontinence;greatly changed(P)

'' 74:- Difficult;disobedient;vicious;swears;very troublesome;was to be removed to asylum,but died.(P.)

'' 75:- Disobedient;spits;cruel to younger children;quarrelsome;behaves in a silly way;assertive;swears;very troublesome;fits of crying;tantrums;noisy;hates mother;compulsive outbursts;cruelty to a dog; unclean habits;bites point of pencil repeatedly & deliberately;creeps round the room & makes shadows on the wall with hands;(P.)

'' 76:- Refractory;cruel to younger children;fights;mischievous;vain;disobedient;quarrelsome;spits;(P.)

'' 79:- Steals;disobedient;homosexuality;exhibitionism;in asylum;a perfect nuisance;noisy;assertive;vain; vicious;fights;destructive;cruel;lies;swears;dirty habits;treacherous.(P.)

'' 80:- Difficult to manage;(P.)

'' 81:- Behaviour has always been good.(P.)

'' 83:- Outrageous conduct;undresses in street;destructive; cruel to baby sister;several times threatened suicide when crossed;cannot get on with other children; hysterical turns;noisy;fights;wanders from home; disobedient;swears;will not rise in the morning,& will not go to school;(P.)
Occasional violent outbursts;impudent to teacher;(T)

Case 84:- Cannot go messages;ignorant of her own safety;fits of crying;very noisy;disobedient;violent;fights; cruel to younger children;lies;would eat you;picks hairs out her body;wild outbursts;pricks herself & others with pins;unsociable;bully.(P.)
Quite well behaved.(T.)

'' 85:- Cannot go messages;walks in his sleep;disobedient; fights a lot with brother;in court & fined for playing football on the street;travels long distances on backs of motors;plays pitch & toss.(P.)

'' 86:- Disobedient;wicked;outbursts of uncontrolled laughter;unsociable;has threatened to commit suicide by drowning;says she wants to die;asks morbid questions;fights with younger sister;destructive; wanders from home;hates mother;lies;unbearable at home;hysterical;wild outbursts;vain;(P.)

'' 87:- Behaviour has never given any trouble.(P.)

PERSONAL FILE.

Medical Research Council.

CHILD LIFE INVESTIGATION.

Address. Date,.....

Name,..... Birth,..... Age,..... No.....

Hospital,..... Ward,..... Admitted,..... M.A..... M.R.....

School,..... Last at School,..... Standard,.....

Father's occupation,..... Wassermann,..... Ht. s.,..... Ht. st.....

Walked,..... Talked,..... Ad. in ho.,..... Chn. in ho.,.....

Age of parents,..... Yrs. married,..... Rooms,.....

P.,..... Chn. alive,..... M.,..... S.B.,..... Age eldest,..... youngest,..... Pt.....

Diagnosis :

BINET SCALE: (BURT).

2	III.	1	2	3	4	5	6		
2·4	IV.	7	8	9	10	11			
1·5	V.	12	13	14	15	16	17	18	19
1	VI.	20	21	22	23	24	25	26	27
		28	29	30	31				
3	VII.	32	33	34	35				
2	VIII.	36	37	38	39	40	41		
3	IX.	42	43	44	45				
4	X.	46	47	48					
2·4	XI.	49	50	51	52	53			
4	XII.	54	55	56					
6	XIII.	57	58						
6	XIV.	59	60						
4	XV.	61	62	63					
6	XVI.	64	65						

1. Activity.
2. Sociability.
3. Assertiveness.
4. Irascibility.
5. Curiosity.
6. Family relationships.
7. Moral conduct.
8. Speech.
9 Intelligence.
10 Pathological symptoms.

MOTHER'S REPORT:-

(1) Progress since last seen.
(2) Present condition:
  (a) general health: other troubles.
  (b) behaviour:- better or worse.
  (c) attendance at school, & progress.
    Teacher's report: educability.
  (d) Brothers & sisters compared with patient: the cleverer before the illness & now.
  (e) Disciplinary methods: effect of punishment: etc..

EXAMINER'S REPORT:-

(1) Of Mother.
(2) Physique of Patient:
    condition normal or otherwise;
    appearance; expression; stigmata.
(3) Temperament & disposition.
(4) Estimate of intelligence;
    cooperation; speed.

TEACHER'S REPORT:-

(1) Estimate of intelligence.
(2) Position in class. e.g. 23rd. out of 40
(3) Quality of school work.
(4) Behaviour in class.
(5) Average age of class.
(6) Attendance.
(7) General remarks.

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