of cortisone therapy. No remarkable effects were noted by these workers on heart size or blood pressure, but in three cases tachycardia was replaced by bradycardia. The dosages of cortisone used were considerably greater than in the present series; on reducing the daily dosage from 200 mg. to 100 mg. the heart rate increased to normal levels. Hench and his associates offered no explanation of the cardiovascular action of cortisone.

Summary

Cortisone was administered to 11 patients (3 males and 8 females) with chronic adrenal insufficiency.

The drug was given by intramuscular injection or pellet implantation in doses of 163 to 850 mg. over 5 to 18 days.

All patients had been treated previously by various forms of replacement therapy.

The cardiograms in six of the patients showed the abnormalities often encountered in chronic adrenal insufficiency—namely, abnormal T waves or prolonged PR or QT intervals. In the remaining five patients the cardiograms were normal.

After cortisone therapy four of the six abnormal cardiograms improved, and two were unchanged. No effect was noted in the five normal cardiograms. The improvement was still present in one patient five months after the treatment was stopped. In two others in whom cortisone pellets had been implanted cardiographic improvement was maintained over a two-months observation period. The cardiogram in one patient had partly regressed two months after cortisone was suspended.

The way in which cortisone influences the cardiogram in chronic adrenal insufficiency is unknown.

This study was aided in part by a grant from the National Heart Institute, United States Public Health Service (Grant No. H-446).

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The Ministry of Health has advised local authorities to make certain changes in the record cards for diphtheria immunization and vaccination. The Ministry suggests that the cards should be of postcard size with the address to which they are to be sent printed on the reverse. Immunization cards should be white and vaccination cards green. Some local health authorities have included on the cards a form of consent to be signed by the parent or guardian. This appears to be unnecessary where the vaccination or immunization is done by a practitioner at the instance of the parents in the ordinary course of his practice, and the Minister feels that it should be omitted. Other arrangements should be made when formal consent may be required for inoculations done at a local health authority centre. Among other changes suggested is a provision on the new card for the practitioner simply to indicate whether any unusual or general reaction or other sequelae to vaccination have occurred. Practitioners should be allowed to use rubber stamps in giving their name and address on the cards.

FURTHER OBSERVATIONS ON THE AGE OF THE MENARCHE

BY

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In an earlier paper (Wilson and Sutherland, 1949) data collected from nine secondary schools in Oxford and Oxfordshire were used to study the onset of menstruation in relation to height and weight. In the first part of the present paper an analysis similar to the earlier one is made for seven schools elsewhere in the South of England, and the two sets of findings are compared. In the second part, serial records of height and weight, kept as a routine by two schools, are studied to see what information they give of growth processes in the adolescent girl.

First Investigation

The new data were obtained from five day schools and one boarding-school in Dorset and from one day school in Essex. The information consists of the ages, heights, and weights of 1,707 girls attending these schools in the summer term of 1949, together with a record of whether or not menstrual periods had started. Similar data were available for comparative purposes for 1,284 girls attending eight schools in Oxford and Oxfordshire in the autumn term of 1948.* In the case of children whose menstrual periods had already begun, the age at the menarche was also requested. But since it is possible to determine the average age of the menarche without using this extra information (which may not be fully reliable), it has been necessary to use it in only one analysis (Table III). In both surveys, children attending day schools were excluded if they had not been resident in the area for at least three years preceding the menarche or the date of the inquiry, whichever occurred earlier.

Age of the Menarche

A criticism of most studies relating to this subject is that they depend upon the girl's memory of her age at the menarche, and experience has shown that this cannot be wholly trusted even a short while after the event. A close examination of our data for Oxford and Oxfordshire shows certain discrepancies which may well be due to faulty memory. For this reason a different method of calculating the average age of the menarche, known technically as probit analysis, has been adopted. It can be used when, as in this instance, the age-range of the girls questioned is the same as that in which menstrual periods usually begin—namely, 9 to 18 years. Only two pieces of information are required from each girl—her present age and whether or not her periods have started—and these can both be recorded with a high degree of reliability.

Table I summarizes the findings concerning the age of the menarche in five groups of schools. In the day schools in Essex and in Dorset the average age of the menarche was 13.4 years, in the Oxford and Oxfordshire schools

*Information from one of the nine schools previously studied had to be discarded because it related only to those girls who had attained the menarche.

TABLE I.—Average Age of the Menarche in Four Groups of Schools
(Calculated by Probit Analysis)

Group of Schools	No. of Schools	No. of Children	Mean Age of Menarche (Years), with Standard Error	Standard Deviation of Age of Menarche (Years)
Dorset (day) ..	5	1,151	13.38 $\pm$ 0.05	1.14
Essex (day) ..	1	155	13.38 $\pm$ 0.14	1.04
Oxford and Oxon (day) ..	8	1,284	13.61 $\pm$ 0.05	1.26
Dorset (boarding)	1	401	13.89 $\pm$ 0.11	1.13
All day schools ..	14	2,590	13.490 $\pm$ 0.037	1.191

it was 13.6 years, and in the Dorset boarding-school 13.9 years. The differences in mean age are slight, but statistically significant. The standard deviations range from 1.04 years to 1.26 years, but these variations are unimportant. Since the girls at the boarding-school represent the children of well-to-do parents, these findings suggest that there may be a relationship between sexual maturity and social background.

It is of interest to mention also that the data from each group of schools are consistent with the hypothesis that the age of the menarche follows a "normal" frequency distribution; this finding is a by-product of the probit analysis. This is true in particular of all the day-school girls, 2,590 in number, for whom the mean age at the menarche was 13.49 years, with a standard deviation of 1.19 years. In view of the large experience upon which these figures are based, they can probably be regarded as a reliable standard for day-school girls in the South of England. This standard indicates, for example, that only one girl in a hundred will menstruate for the first time before the age of 10 years 9 months, and only one in a

Graph showing percentage of girls who at a given age have attained the menarche (standard based on 2,590 girls).

hundred after the age of 16 years 3 months. The Graph presents this standard experience in the form of a curve, which shows at each age the percentage of girls who have attained the menarche.

Height and Weight

The girls were divided into those who had already passed the menarche and those who had not, and were then subdivided by age. Table II presents the mean heights and weights in the various schools for six of the resultant groups of children. Several important points emerge.

In the first place the figures for the 13-year-old girls in the middle of the table indicate that in each group of schools height and weight are substantially greater among those who have attained the menarche than among those

TABLE II.—Mean Heights and Weights of Certain Groups of Schoolgirls

Age when Measured (Years)	Group of Schools	No. of Girls	Mean Height (in.)	Mean Weight (lb.)
<i>Girls who had not passed the menarche</i>				
11-	Dorset (day)	66	57.9	84.3
	Essex	18	58.1	87.3
	Oxford and Oxon	158	58.0	84.3
	Dorset (boarding)	8	60.9	93.8
12-	Dorset (day)	193	59.1	87.7
	Essex	25	60.0	94.1
	Oxford and Oxon	220	59.4	87.2
	Dorset (boarding)	33	60.3	96.1
13-	Dorset (day)	112	60.7	94.3
	Essex	16	59.7	91.6
	Oxford and Oxon	151	60.9	93.0
	Dorset (boarding)	40	62.0	104.3
<i>Girls who had passed the menarche</i>				
13-	Dorset (day)	151	62.3	112.8
	Essex	15	61.0	110.6
	Oxford and Oxon	132	63.0	118.3
	Dorset (boarding)	28	64.3	119.9
14-	Dorset (day)	210	63.0	115.6
	Essex	33	64.0	122.0
	Oxford and Oxon	203	63.6	116.7
	Dorset (boarding)	48	64.3	125.4
15-	Dorset (day)	186	63.9	120.9
	Essex	22	63.9	122.0
	Oxford and Oxon	165	64.3	121.7
	Dorset (boarding)	60	65.2	129.6

Metric equivalents: 1 inch = 2.54 cm.; 1 lb. = 454 g.

In order to keep the table within a reasonable compass only those groups containing the largest numbers of children were included. However, the conclusions drawn from the table apply equally to the whole body of data.

of the same age who have not. This confirms one of the findings of the earlier paper.

Secondly, the table enables comparisons to be made between girls at the four groups of schools. Both before and after the menarche there are interesting differences in mean height and weight. The greatest values occur throughout at the boarding-school in Dorset and the lowest (with one or two minor exceptions) in the Dorsetshire day schools. These findings suggest that there may be differences, due to social factors, in adolescent height and weight as well as in the attainment of the menarche. There appear to be two possibilities to investigate. The first is that there is an inherent relation between the attainment of the menarche and absolute height and weight, which might account for the social pattern. The other is that no such relation exists, and that differences in physique between social groups arise independently of any differences in the onset of menstruation. The present study offers some further evidence on this matter.

TABLE III.—Mean Heights and Weights in Two Groups of Day Schools According to Age When Measured and Recollected Age at the Menarche

Age at Menarche (Years)	Age when Measured (Years)	Group of Schools	No. of Girls	Mean Height (in.)	Mean Weight (lb.)
12-	13-	Dorset	78	62.3	112.5
		Oxford and Oxon	63	63.3	118.8
	14-	Dorset	46	62.9	119.0
		Oxford and Oxon	51	63.6	122.9
13-	13-	Dorset	57	62.3	110.1
		Oxford and Oxon	56	62.7	117.8
	14-	Dorset	116	63.1	115.6
		Oxford and Oxon	92	63.5	115.4
	15-	Dorset	66	63.9	119.8
		Oxford and Oxon	68	64.6	124.0
14-	15-	Dorset	59	63.4	117.8
		Oxford and Oxon	39	64.5	116.1

The age groups included in this table are those containing the largest numbers of children.

It will be noticed from a comparison of Tables I and II that in the schools with the taller and heavier girls the menarche tends to occur later than in the schools where the girls are shorter and lighter. This is just the opposite of what would be expected if girls who grow rapidly attain sexual maturity earlier—the usual suggestion. But although this correlation supports the view that there is a relation between the attainment of the menarche and absolute height and weight, the analysis in Table III indicates that there is no causative connexion between the two sets of figures. In this table are compared the height and weight of Oxford and Dorset girls who were at the same stage of sexual development—that is, who had the same recollection of their age at the menarche and were the same age at the time of study. The comparisons show that the Oxfordshire girls are superior in height and weight; these differences in physique must therefore be independent of the attainment of the menarche. In other words, the second possibility is the correct one: absolute height and weight are not determining influences upon the age of the menarche.

Second Investigation

The data for the second part of the study were recorded by the medical officers of two boarding-schools, one in Sussex and the other in Yorkshire. They consist of serial measurements of height and weight, made at the beginning and end of each school term, together with a note of the occurrence of the menarche. Records were available for 202 pupils who left the Sussex school in the years 1936 to 1948, and for 87 who left the Yorkshire school in the years 1947 to 1949.

The advantage of serial records is that they enable the changes in height and weight of the *individual* to be studied in relation to the age of the menarche. The years particularly worthy of study are those immediately preceding the menarche, during which time marked height and weight changes occur. Such a study would probably suggest a method of predicting at what age a girl will attain the menarche, and this would be of great value to parents and others concerned with education in health and sex. Unfortunately the majority of the present series of measurements are post-menarcheal because of the age range covered by the schools. It was therefore decided to study the four years after the menarche. Even over this limited period of time it was not possible to follow an unchanging set of individuals, since some girls entered school after the menarche and others left within four years of its attainment. But despite these drawbacks the data do reveal certain points of interest about growth during this period.

There are considerable differences between the girls at the two schools. The mean ages of attainment of the menarche, with their standard errors, were 13.11 ± 0.09 years among the girls from the Sussex school and 13.82 ± 0.14 years among the girls from the Yorkshire school. This difference is statistically significant. Further, the girls at the Sussex school were at each age taller and heavier than those at the Yorkshire school (Tables IV and V). It is worth noting in passing that these findings cast doubt upon the suggestion that the age of the menarche tends to be greater in children of the more favoured social and economic groups. At the Sussex boarding-school the average age of the menarche is in fact less than at any day school included in this study, while the social status of the girls there is certainly no lower than at either of the other boarding-schools, in each of which the average age of first menstruation is later by about nine months.

Because of the differences between the Sussex and Yorkshire schools the data for each had to be analysed separately,

TABLE IV.—Average Weights (in lb.) of Children at Two Schools According to Age at the Menarche

Interval Since Menarche (Years)	Age at Menarche					
	Yorkshire School			Sussex School		
	9-12	13-	14-17	9-12	13-	14-17
0 ..	*	105.2	113.3	99.5	112.9	114.2
1 ..	110.3	114.6	121.7	114.0	118.3	123.1
2 ..	117.0	121.4	127.4	121.3	126.8	129.2
3 ..	122.7	125.7	131.4	126.9	131.3	130.8
4 ..	125.8	126.7	129.1	129.7	129.8	*
Actual Age (Years)						
13- ..	112.1	105.2	98.8	116.8	112.9	102.7
14- ..	118.7	114.6	108.5	123.7	118.3	111.8
15- ..	124.5	121.4	117.3	127.8	126.8	119.1
16- ..	128.9	125.7	126.0	131.3	131.3	124.5
17- ..	132.0	126.7	131.0	131.5	129.8	131.1

* Fewer than 10 measurements—average omitted.

TABLE V.—Average Heights (in in.) of Children at Two Schools According to Age at the Menarche

Interval Since Menarche (Years)	Age at Menarche					
	Yorkshire School			Sussex School		
	9-12	13-	14-17	9-12	13-	14-17
0 ..	*	61.5	63.2	61.1	63.4	64.2
1 ..	62.4	62.8	63.9	62.5	64.1	64.7
2 ..	62.7	63.3	64.2	63.8	64.6	65.3
3 ..	63.0	63.8	64.9	64.2	65.0	65.4
4 ..	63.1	63.7	65.3	64.4	65.0	*
Actual Age (Years)						
13- ..	62.2	61.5	61.3	63.0	63.4	61.5
14- ..	62.8	62.8	62.4	64.0	64.1	63.5
15- ..	62.9	63.3	63.6	64.3	64.6	64.2
16- ..	63.7	63.8	64.2	64.4	65.0	65.1
17- ..	64.7	63.7	64.7	64.3	65.0	65.5

* Fewer than 10 measurements—average omitted.

despite the small numbers of pupils involved. At each school the children were divided into three "maturation" groups according to age at the birthday before the menarche (9-12, 13, or 14-17 years). The progress of each group in height and weight (and also in an index of body-build based upon these two measurements) was then followed, first, according to the interval in years from the menarche, and, secondly, according to actual age. Each average was based upon as many measurements as were available in the records.

Weight

The findings on weight are summarized in Table IV. As might be expected, the mean weights for each "maturation" group rise both with increasing interval from the menarche and with increasing age, and by the end of the period of study the weights are approaching a stable level.

But the most interesting information in Table IV is obtained from a study of its rows. The upper half of the table permits a comparison of girls at the same stage of sexual maturity, but of different ages, while the lower half enables girls to be compared who are the same age but differ in sexual maturity. At the Yorkshire school, for example, the mean weights one year after the menarche were 110.3 lb. in the first maturation group, 114.6 lb. in the next, and 121.7 lb. in the last group—that is, in the girls who were measured at the oldest age. Thus weight at this stage of maturity is influenced by age. On the other hand, the comparison of girls aged 14 shows that the mean weight was 118.7 lb. in the first maturation group, 114.6 lb. in the next, and only 108.5 lb. in the last group—that is, in the girls who were measured at the earliest stage of sexual maturity. Thus weight in girls of this age is influenced by the stage of sexual maturity. These examples are typical of the experience in each school, with

slight exceptions towards the end of the period of study. Thus, so far as girls are concerned, weight in adolescence depends not only upon age but also upon the stage of sexual maturity.

Height

The mean heights are summarized in Table V. As with mean weight, the measurements tend to reach a stable level by the end of the period studied.

However, the comparisons of the three maturation groups show a rather different pattern. The measurements in the upper half of the table indicate that at each stage of maturity height is influenced by age. Those in the lower half suggest that at the beginning of the age-period 13 to 17 years there is a slight tendency for those maturing early to be tall, and at the end a slight tendency to be short, in comparison with those maturing late; but this pattern is much less clear-cut than that in the upper half of the table. Thus between the ages of 13 and 17 the height of girls is influenced almost exclusively by age; the stage of sexual maturity exerts little additional influence.

Body-build

So far height and weight have been considered in isolation, but together they can give a rough indication of body-build. The measure used here is the height (in inches) divided by the cube root of the weight (in lb.). It is accurate enough for the purposes of this study to calculate this fraction for each group of measurements from the mean height and the mean weight, and this avoids the laborious procedure of calculating the measure of build for each pair of measurements and then averaging the results. The figures are presented in Table VI.

TABLE VI.—*Body-build (Mean Height in Inches Divided by Cube Root of Mean Weight in lb.) of Children at Two Schools According to Age at the Menarche*

Interval Since Menarche (Years)	Age at Menarche					
	Yorkshire School			Sussex School		
	9-12	13-	14-17	9-12	13-	14-17
0	*	13.03	13.06	13.20	13.12	13.24
1	13.03	12.92	12.89	12.89	13.06	13.02
2	12.82	12.80	12.76	12.89	12.84	12.93
3	12.68	12.73	12.78	12.77	12.79	12.88
4	12.59	12.67	12.94	12.72	12.85	*
Actual Age (Years)						
13-	12.91	13.03	13.25	12.88	13.12	13.11
14-	12.77	12.92	13.09	12.85	13.06	13.17
15-	12.60	12.80	13.00	12.75	12.84	13.06
16-	12.61	12.73	12.80	12.80	12.79	13.05
17-	12.72	12.67	12.74	12.63	12.85	12.89

* Fewer than 10 measurements—value omitted.

The values at the Sussex school are slightly higher than those at the Yorkshire school. For each maturation group the measure of build falls with increasing age and with increasing interval since the menarche. That is to say, girls become progressively heavier for their height during this period—a finding which would be expected from the outward physical changes in girls in the course of sexual maturation. It would be of interest to know if the same is true of boys. In the valuable study by Richey (1937), records for boys as well as girls were available, but unfortunately no analyses analogous to those in the upper half of Tables IV, V, and VI were made.

When a comparison is made as before between the three maturation groups of children in each school, a pattern different from that of height or weight is revealed. In the first two years following the menarche there is no apparent

relation between build and age. For example, one year after the menarche the measure of build is approximately 12.9 or 13.0 at each school, whatever the age of the children when measured. In the third and the fourth year after the menarche there is a slight tendency for those who matured early to be shorter for their weight than those who matured late. But on the whole, body-build in the first few years after the menarche is not influenced by age. The lower half of the table confirms that the stage of sexual maturity in girls of the same age exerts a considerable influence on build. Among those observed at 14 years of age in the Yorkshire school, for example, the measure of build varied from 12.8 in those who matured early to 13.1 in those who matured late. The figures thus make it clear that at the time of the menarche build is independent of age, and that, during the following two years at least, girls become heavier for their height to an extent which is also independent of their age.

These analyses indicate that it is convenient to regard growth in the adolescent girl as being of two types. One is the normal physical growth with age, and superimposed upon it are changes specifically arising from the processes of sexual maturation. The findings of this study suggest that between the ages of 13 and 17 height is practically unaffected by the processes of sexual development as such; on the other hand, as a consequence of weight changes, body-build (as measured in this study) seems to be determined solely by the processes of maturation for at least two years after the menarche.

Summary and Conclusions

This paper describes two separate studies into the onset of menstrual periods in relation to height and weight.

In the first study data were available for nearly 3,000 school-girls within the age range 9-18 in the South of England. Using only two pieces of information from each girl—her present age and whether or not her periods have started—a standard statistical technique known as probit analysis enables the average age of the menarche to be estimated with a known degree of accuracy. It should be noted that this is a particularly suitable technique for use in surveys of this (and other) aspects of sexual maturation, as it requires a minimum of information and does not depend on the girl's memory of her age when her periods first started. It is suggested that the ages of attainment of the menarche in the 2,590 day-school girls may be regarded as a standard for the South of England. This standard indicates that only one girl in a hundred will start her periods before the age of 10 years 9 months, and only one in a hundred after the age of 16 years 3 months. One-half will menstruate by the age of 13 years 6 months. There were interesting differences in average height, weight, and age at the menarche between different groups of girls. Despite an apparent correlation, it is shown that the differences in height and weight were not a determining influence upon the age of the menarche.

In the second study serial height and weight records were available for 202 girls from one boarding-school and 87 from another, and were studied to see what light they shed upon the processes of growth. The findings show that growth in the adolescent girl may be regarded as of two superimposed types—normal physical development with age, and growth specifically related to the process of sexual maturation. In the age period 13 to 17 years height changes are practically independent of sexual maturation. But because of changes in weight, the body-build, measured as the height divided by the cube root of the weight, develops independently of age for at least two years after the menarche. During this period girls become heavier for their height. It is unfortunate that the records do not permit an analysis at younger ages; a study of the years preceding the menarche would not only give a more complete picture of growth processes but should suggest a method of predicting

when the menarche will occur in an individual. This would be of great value to parents and others concerned with education in health and sex.

We are indebted to the educational and medical authorities in Dorset, Essex, Oxford, and Oxfordshire for their help in obtaining the necessary data for the first part of this study. It is a pleasure to thank Mr. P. H. Leslie for his advice. We also wish to thank the medical officers of the boarding-schools in Sussex and Yorkshire for their readiness to make available to us the medical records of those who had left school, and for their interest in the study.

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FATAL CASE OF ACUTE PORPHYRIA IN A NEGRO

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Acute porphyria has been reviewed in several papers since 1945. Abbott and Evans (1946) found that nearly 300 cases had been described since Günther's first case in 1911. Pyrrole metabolism is reviewed by Dobriner and Rhoads (1940) and by Welcker (1945). The following are the main clinical points.

Porphyria is a disorder of metabolism of the respiratory pigments (haemoglobin, myoglobin, cytochrome oxydase, etc.). "Acute" porphyria is almost certainly a chronic disorder, with acute episodes superimposed (Gray, Rimington, and Thomson, 1948). Barbiturates, sulphonamides, "trional," arsenicals, phosphorus, or lead may precipitate an attack (Dobriner and Rhoads, 1940), but there is no hard-and-fast distinction between the toxic and idiopathic varieties (Discombe and D'Silva, 1945).

Roth (1945) states that psychic episodes may occasionally precipitate an acute attack, and that the siblings of these patients are often hysterical or psychotic. Porphyrins are excreted in abnormal quantities during attacks and often between attacks; the usual finding is uroporphyrin III or coproporphyrin III, but Gray (1950) says, "It has never been possible to correlate the varied clinical features with any definite pattern of porphyrin excretion." He had a case in which the colourless porphobilinogen was predominant. Characteristically the urine is a red or brown colour and darkens further on standing. Hare and Wilmore (1948) quote Waldenström's epithet "la petite simulatrice" and his remark that hysteria is often suspected. Davies (1949) finds that barbiturates are given to the majority of these patients.

The acute form is commoner in women—3:1 (Abbott and Evans, 1946). The age of onset is 20 to 45 (Davies, 1949). Symptoms may be mainly abdominal, or mainly nervous, or combined abdominal and nervous as in the classic type. There may be a prodromal period of lassitude and mental disorder, and the onset is with colicky abdominal pain, nausea, vomiting, constipation, leucocytosis, tachycardia, and a rise in blood pressure; while hypotension is common in the later stages. Sometimes the pain is in the form of dysmenorrhoea. Attacks of jaundice are not infrequent and may obscure the significance of dark urine, and it is worth noting that an apparently positive Ehrlich aldehyde test is given by porphobilinogen in the urine (see below).

In nearly half the cases neurological symptoms occur, which may include confusion, delirium, convulsions, or amaurosis. Characteristically there is a polyneuritis, which may fluctuate in severity, affecting the limbs, especially the proximal segments, with or without cranial nerve and sphincter involvement. Pain and paraesthesias are common, but objective sensation is usually relatively spared. With neurological involvement the mortality is about 75% (Berg, 1945; Petrie, 1948). Subsequent attacks may occur in those who survive (Gray, Rimington, and Thomson, 1948).

Case Report

The patient, a male native of Lagos, Nigeria, aged 30, had been in London for six months preparing for examinations in accountancy. He was admitted on April 13, 1950, with the history of inconstant shortness of breath for some years, related sometimes to physical and sometimes to emotional strain. He was a hard worker, conscientious, and ambitious, but lacked self-confidence. He had worn spectacles for some weeks. Seven weeks before admission he again complained of dyspnoea, and doubted his ability to pass his examinations. After a week he complained of central abdominal pain with nausea, vomiting, and constipation, and was admitted to another hospital from which he went home against advice after three weeks.

A week later a reassuring talk relieved his symptoms, but next day he had anorexia, paraesthesias, and pains in the limbs, followed by hallucinations, insomnia, and irregular behaviour. This sequence of events strongly suggested hysteria, and he was given 3 gr. (0.2 g.) of butobarbitone at night. After this he became clear mentally, but noticed a gradual onset of weakness in all limbs. He became incontinent of urine, and was admitted to this hospital. Specific inquiry later revealed that he had had red urine on occasions for some years and for most of the last six weeks. His parents, two sisters, and three brothers had always been well, and had never mentioned similar discoloration. No siblings had died. He knew of no white ancestry.

On examination he was markedly wasted and dehydrated. He was febrile, 99.6° F. (37.55° C.). There was bilateral conjunctivitis with mucopurulent exudate. His tongue was furred, his mouth was dry, and his breath foul. The buccal mucosa and teeth were normal. The abdomen was lax and retracted, and slightly tender in the right iliac fossa, with a nodule of faeces in the left iliac fossa. The liver and spleen were not palpable. The heart and lungs were normal, the pulse was 130, and the blood pressure 115/75. Although correctly orientated and otherwise rational, he thought that there was "somebody under the bed lifting it up and down." Visual fields were full by confrontation. There was slight weakness of the left fifth cranial nerve, his voice was very weak, and his speech a little slurred and difficult to understand. His neck was normal but the trunk muscles were weak. There was a flaccid tetraplegia, almost complete at the hips, shoulders, knees, and elbows, with very little power at the distal joints and with a coarse irregular tremor when movements were attempted. All tendon-jerks were present, the knee-jerks being very feeble. The plantar responses were normal. Sensation to pin-prick was slightly impaired over the forearms and hands; light touch, position sense, and vibration sense were normal. There was a burn from a hot-water bottle on the right calf; elsewhere the skin was normal. Tenderness was increased in the calves. He was incontinent of urine. The white cells numbered 6,000 (polymorphs 62%, lymphocytes 30%, monocytes 8%).

On the first day after admission his blood pressure was 140/100. Examination of the urine revealed: acid, a trace of protein, no Benedict reduction, no casts, cells, organisms, bile salts, or bile pigments. A blood count showed: red cells, 4,850,000; Hb, 97%; white cells, 21,000 (polymorphs 88%, lymphocytes 12%). On the second day the urine was seen to be brownish red and was then found to contain porphyrins. By this time his voice had sunk to a whisper. The weakness of the fifth cranial nerve had increased; both knee-jerks and