the children already born may have begun to have some influence on the family size. It is perhaps worth noting that in one family, made up of five girls, the last two born were named Robertina and Adamina, which suggests a little wishful thinking on the part of their parents.

The fourfold table was again used in both the present and the parents' generations to divide the families with respect to the first three children (Table III), but

TABLE III.—*Families of the Present and Parents' Generations Divided as Before With Respect to the First Three Children Born. There is no Significant Difference Between the Two Groups in Each Generation. It Appears that in a Family of This Size it is the Number of Children Rather than the Sex Pattern of the Family which is More Important*

First Three Children	Present Generation		Parents' Generation	
	Stop	Go On	Stop	Go On
Sex same	10	8	15	70
Sex different	36	30	35	159
	$\chi^2 = 0.034 \quad P = 0.86$		$\chi^2 = 0.0062 \quad P = 0.94$	

no significant differences appeared. This could be interpreted as meaning that when a family has reached a total of three the decision whether or not the family should be increased is made independently of the sex of the children already born.

Discussion

The pitfalls involved in attempting to deduce human motives from such statistical data are well known, and it may be that an inquiry on a larger scale than the present one is necessary to yield reliable conclusions. It may even be that the motives for increasing the size of the family which we have selected are not the real ones, but the statistical examination of the data is not against those ideas. This small inquiry shows that there is a tendency for the size of a family to depend on the sex of the children already born. It is well known that in order to maintain the level of the population it is necessary for parents to have a family larger than two in number. According to these results, where a family consists of a boy and a girl, in the present social circumstances, there is less chance of another child being born than is the case when the family consists of two boys or two girls. Details of the size of families resulting from marriages which took place in 1925 are given in the Royal Commission on Population Report (Table 17, p. 26). These families form the present generation; 14% of these marriages resulted in a family of three children and 25% in a family of two children. The data obtained in the student survey suggests that in some cases at least of these 25% of parents the number of children stopped at two because the parents were satisfied with the sex pattern of their families.

The critical moment, from the point of view of the size of the future population, is at the birth of the second child. The sex of this child will, I think, decide for a certain number of parents whether their ideal family has been reached, or whether a state of disappointment exists which may induce them to have another child. If I may be permitted a long-distance glance into the future I might quite properly ask what the parents of the future would do if sex determination became possible. If the motives which appear to have been exposed by the analysis of our data continue

to influence parents, the family size of the future may be somewhat smaller than it is at present, as many parents will choose to have a boy and a girl.

Although the time has not yet come for us to be concerned by this apparently remote contingency, it is suggested that the influence of the composition of the family in deciding family size, quite apart from any consideration of motivation, is worthy of consideration now. In the population surveys which have so far been made no attention has been given to the possibility of such an effect.

I wish to express my thanks to Professor G. H. Bell for his considerable help and advice.

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BLOOD FLOW IN GOUT

BY

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Professor Wood Jones (1950) has written an account of gout based on observation on a single patient—himself. Emboldened by this precedent of my former teacher, I record here some observations of the peripheral blood flow in a case of this disease. The opportunity of making this study was fortuitous, and was aided by the fortitude of the sufferer, who would have been expected to shun an instrument such as a plethysmograph as he would the torture rack.

Case History

The patient, a sergeant aged 55, was first seen by me on June 8, 1950, at another hospital, where he was admitted for investigation of pain in his right leg induced by exercise. He stated that he first noticed a slight ache in his right calf after taking part in the Victory March in 1945. The symptom recurred after long walks and became more pronounced in the following year, at which time he could walk two miles (3.2 km.) before experiencing discomfort. During the 12 months before his admission to hospital his walking distance before feeling pain had decreased gradually to 100 yards (91 metres). On stopping, the pain disappeared in three to four minutes, after which he could again walk a similar distance. After much walking the calf muscles became tender to pressure.

On examination he was seen to be a well-nourished middle-aged man. His blood pressure was 150/95 mm. Hg. Apart from the changes noted in the arterial system, routine clinical examination revealed no abnormality. The brachial and radial arteries were not clinically thickened, and they pulsated normally. Normal pulsation was felt also in both femoral and left popliteal arteries. No pulsation was noted in the right popliteal or the dorsalis pedis and posterior tibial arteries of either foot. Oscillometry showed good pulsation in his left calf but no pulsation in his right calf.

Electrocardiographic tracings were normal; x-ray examinations showed the heart outline to be within normal limits and provided no evidence of vascular calcification in either leg.

Arrangements were made for the patient to be sent to the Alfred Hospital for plethysmographic study. Whilst awaiting this move he suddenly developed severe pain, redness, and slight swelling in the region of the metatarsophalangeal and first interphalangeal joints of his left great toe. A week later a similar condition occurred in his right

great toe. This pain was relieved by colchicum. When the patient arrived for the tests, both feet presented the picture of acute podagra, the medial aspects of the first metatarsophalangeal regions being red, swollen, hot, and excruciatingly tender. However, by virtue of the stoicism of an old soldier, the investigation was carried out.

One month later, x-ray examination of the region of the great toe revealed an irregular rarefaction of the head of the first left metatarsal, and the blood uric acid was 4.7 mg. per 100 ml.

Two months later the acute gout in his left foot had completely subsided, but there was still some tenderness to pressure over the first metatarsophalangeal region. A plethysmographic study was repeated at this time.

Plethysmographic Findings

The peripheral blood flow was measured by my modification of the technique of venous occlusion plethysmography (Barnett, 1950). Briefly, the foot, at heart level, is sealed by means of a combination of rubber sheeting and surgical jelly in a gas-tight box, the air in which is maintained at the desired temperature by means of an outer water-jacket. Venous occlusion is produced by a pneumatic cuff applied to the limb just proximal to the plethysmograph and inflated for periods of a few seconds at a pressure of 70 mm. Hg. Changes in volume of the enclosed portion of the limb result in proportionate changes in pressure in the plethysmograph box, and these are recorded by means of a Wigger type of manometer and optical system.

The room temperature was kept between 22 and 24° C., and the temperature of the air in the plethysmograph between 34 and 35° C. Before recordings were made the patient rested for 45 minutes on the bed in the room in which the investigation was carried out.

In addition to determining resting blood flow, arterial occlusion reactive hyperaemia tests were done in order to determine the increase of blood flow in response to the accumulation of metabolites. In these tests a cuff applied above the knee was inflated to a pressure above the systolic arterial blood pressure for 10 minutes, and the blood flow was recorded each quarter-minute following deflation until reactive hyperaemia had occurred.

The plethysmographic findings are recorded in the Table. Illustrative tracings are shown in Figs. 1 and 2.

Blood Flows, Recorded as ml./100 ml. Limb Volume/Minute

	Left Foot		Right Foot	
	Gout	No Gout	Gout	Gout Subsiding
Resting	5	1	1.7	2.2
After reactive hyperaemia test	7.2 (1½ minutes after release)	5.3 (1½ minutes after release)	*	2 (2½ minutes after release)

* The reactive hyperaemia blood flow in the right foot during the attack of gout could not be recorded owing to the patient's restlessness.

Comment and Discussion

The resting blood flow of 5 ml./100 ml. of limb volume/minute from the left foot on the first examination was extremely high (the value in a normal foot being usually 0.5 to 2 ml./100 ml. of limb volume/minute), and the increase to 7.2 ml./100 ml. of limb volume/minute with the reactive hyperaemia test was less than would normally occur, suggesting that the vessels of the foot were already under the influence of a powerful vasodilator. This was confirmed by the finding, on the second examination (after the subsidence of the attack of acute gout), that the resting blood flow was only 1 ml./100 ml. of limb volume/minute, and the reactive hyperaemia test produced an increase to 5.3 ml./100 ml. of limb volume/minute.

FIG. 1.—Plethysmograms on June 27. Blood-flow curves from: A, left foot, resting; B, left foot, following reactive hyperaemia test; C, right foot, resting. Vertical line marked 6 ml. represents standardization; time markings in tenths of second. Note the presence of pulse waves on the plethysmogram from the left foot and their absence in that from the right foot.

FIG. 2.—Plethysmograms on August 22. Blood-flow curves from left foot: A, resting; B, following reactive hyperaemia test. Blood-flow curves from right foot: C, resting; D, following reactive hyperaemia test. Vertical line marked 8 ml. represents standardization. Time markings in tenths of second.

The somewhat late appearance of the maximum reactive hyperaemia (which normally occurs in less than one minute) and its somewhat low value suggest that there was some obliterative arterial disease in the left leg.

The resting blood flow in the right foot on both examinations was approximately 2 ml./100 ml./minute (this being in the higher range of values obtained in normal individuals), and no increase was obtained by the arterial occlusion reactive hyperaemia test, indicating that the blood flow to the foot was already maximal.

The demonstration of the increased blood flow in feet affected by acute gout is in accordance with Professor Wood Jones's contention that gout is a syndrome associated with some disturbance of the vasomotor nerves, being a condition kindred to erythromelalgia. Whether this is indeed the mechanism or whether the agent concerned acts directly on the vessels cannot be decided from the present observations. In either case the pain and the tenderness would be expected to be maximal in the region of the medial

aspect of the first metatarsophalangeal joint in the area of the large collection of superficial veins, so well demonstrated by Professor Wood Jones. However, the usual localization of the syndrome to one foot during an attack would favour a nervous basis.

Whatever the site of its action, the agent causing the syndrome of acute gout would seem to be one of the most powerful peripheral vasodilators known, and has the advantage that it acts locally. However, even if it were isolated, after reading Professor Wood Jones's graphic description of the agonies of the victim of podagra one would hesitate to give it a therapeutic trial.

Summary

The history of an attack of gout in a man, the subject of obliterative peripheral arterial disease, is presented.

Measurement of the blood flow during the attack of acute gout showed that the resting flow in the foot of the limb less affected by peripheral vascular disease was very high, and little increased by reactive hyperaemia. When the acute attack had subsided the resting blood flow in this foot returned to normal, and there was a marked increase in the blood flow following reactive hyperaemia.

In the foot of the limb more affected by peripheral occlusive arterial disease, the resting blood flow was in the range of high normal values both during the attack of acute gout and when it had almost subsided, and the flow was not increased by the reactive hyperaemia test.

It is argued that the demonstration of the high blood flow in acute gout lends strong support to the thesis of Professor Wood Jones that the basis of this condition is a vasomotor disturbance akin to erythromelalgia.

Grateful acknowledgment is made to the technical assistants of the Alfred Hospital Clinical Research Unit and of the Baker Medical Research Institute for help in carrying out the plethysmography.

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The flagella of bacteria have recently received fresh experimental attention, in the hope of deciding what they are and how they function. It seems fairly certain that they are in fact swimming organs by which motile bacteria propel themselves, and not the mere lifeless mucous twirls which Pijper believed them to be on the basis of dark-ground illumination of hanging drops under the microscope. Dr. Claes Weibull, of the University of Upsala, one of the workers in this field, reviews present knowledge in *Nature*, (March 31, p. 511). He himself has been able to separate the flagella from the bacterial bodies, and to make chemical studies on pure solutions from which, by the addition of ammonium sulphate, the flagella can be precipitated in aggregates with spirals very like those seen during life. The flagella are found to be protein, belonging to the myosin-fibrinogen group on x-ray analysis, and containing very little cystine but about 8% of lysine, which again is somewhat like the myosin of mammalian muscle. Electron micrographs have revealed that each flagellum is composed of a bundle of adhering long fibrils, and Dr. Weibull describes how if these fibrils alternately contracted and relaxed swimming movements would result. Where the energy for this movement comes from, however, is obscure. Practically no carbohydrate or organic phosphorus has been found in purified flagella, and the very narrowness of a flagellum, taken with its great projection from the bacterial body, makes it difficult to imagine the processes of vertebrate muscle metabolism taking place inside.

POLIOMYELITIS AND DIPHTHERIA IMMUNIZATION IN BELFAST

BY

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We were made aware of the findings of Martin (1950), Geffen (1950), and McCloskey (1950) on the possible association between inoculations and site of paralysis in January, 1950. A retrospective investigation of our previous poliomyelitis epidemic in 1947 failed to reveal any such association. However, this epidemic occurred during the holiday months, when little immunization is done. A careful inquiry was arranged for any future epidemic.

Our first case of poliomyelitis in 1950 was notified on February 13. There were no further cases until March 12. In the next four weeks nine cases were reported, all from within an area of one square mile (2.6 sq. km.) in the city. Except for a boy aged 15 all patients were under 3 years old. Six of these children had paralysis of an arm, alone or in combination with other sites, but no history of inoculations. This fact encouraged us to allow our immunization scheme to continue.

From the middle of April cases began to be notified from all parts of the city. The incidence remained high in young children, but the proportion showing involvement of the arms became smaller. The epidemic wave gradually climbed to a peak in July and then more rapidly descended in August and September. Immunization against diphtheria continued as usual until the holiday closure of the clinics on July 8.

Up to September 19 a total of 98 cases of poliomyelitis confirmed by hospital diagnosis occurred in Belfast; 10 of these were non-paralytic. There were eight deaths—a case fatality rate of 8.2%.

Table I shows the age distribution of the cases: the population shown at each age is calculated from the registered live births and infant deaths. The Registrar-General's office suggests this as the best method available here, and believes that it is reasonably accurate in the lower ages.

TABLE I.—Age Incidence of Poliomyelitis in Belfast

Age:	0—	1—	2—	3—	4—	5—	6—	7—	8—	9 and Over
Population	8,773	9,303	9,973	9,797	9,025	9,529	9,524	8,775	7,658	—
Cases of poliomyelitis	10	27	13	7	6	7	3	5	2	18
Incidence per 1,000	1.1	2.9	1.3	0.72	0.66	0.73	0.32	0.57	0.26	—

All cases were admitted to the Northern Ireland Fever Hospital, and the clinical details were obtainable from Dr. F. F. Kane, medical superintendent, and Dr. Forsythe and Dr. McConnell, medical registrars. The immunization history was obtained from the parents. Accurate dates were supplied by the general practitioner or clinic concerned, except in a few cases in which immunization had occurred some years earlier.

From the information thus obtained Table II was prepared. This is similar to Tables II and III of Hill and Knowelden (1950), but includes all children under 9 years of age. The wider age range was adopted because more children were receiving inoculations in the age