

Chemically, the meteorite is remarkable for its high percentage (6.3) of chromium sesquioxide. Dr. Farrington suggests that a small portion may be present as a constituent of the olivine, and the rest as part of the chromite. The author next enters into a discussion of the relations of the various meteoric stones which have been found in Ness County and other parts of north-western Kansas; he infers that Prairie Dog Creek, Long Island, Oakley, Jerome, and Franklinville belong to distinct falls, and that Wellmanville may be part of the Franklinville fall, and Kansada part of either the Franklinville or the Jerome meteorite. Another meteorite described is one from Los Reyes, forty miles from Toluca; this is an iron, and its characters are similar to those of other masses found nearer Toluca; there is no reason to believe that the mass has been transported by man from the latter locality. The Los Reyes mass may belong either to a distinct fall or indicate a wide spreading of the Toluca shower. In the same paper an account is given of the structure of the meteoric iron found in the Hopewell Mounds of Ohio; one of these is a small, unwrought mass weighing about five ounces, the others are worked specimens, namely, a part of a head and ear ornament, some celts, and a number of beads; they were all found associated with a single human skeleton near an altar of one of the mounds; the iron, when etched, shows Widmanstätten figures, which have been bent and distorted by hammering. Finally, Dr. Farrington states that the tænitæ extracted from the Kenton County meteorite was found on analysis to consist of 80.3 parts of iron and 19.7 parts of nickel (and cobalt).

### THE BRITISH ASSOCIATION.

#### SECTION F.

##### ECONOMIC SCIENCE AND STATISTICS.

OPENING ADDRESS BY EDWARD W. BRABROOK, C.B., F.S.A., V.P.S.S., PRESIDENT OF THE SECTION.

It is a coincidence, which has great interest for me personally, that the honour of being President of this Section has fallen to me in the last year of my engagement in the public service. I am now in the sixty-fifth year of my age and the thirty-fifth of my connection with the Registry of Friendly Societies, and in a few months the guillotine of the Order in Council will fall, and the Department and its present head will be severed. The consequences are not so tragic as they sound, for the Department will at once find a new head, and the old head will contrive to maintain a separate existence. I therefore meet the stroke of fate with cheerfulness; for I am strongly of opinion that the arrangements for retirement from the Civil Service of the country are as wise as they are liberal. It is a good thing that the place of a man whose ideas have grown old and become fixed, and whose long service indisposes him to entertain new ones, should be taken by a younger man anxious to make his own mark on the administration of his department. Again, the prospect of promotion opened up by the limited term of service of the older men is a distinct inducement to able and ambitious young men to devote themselves to their country's service. I have lately had occasion to give minute and careful attention to one branch of this important question, and the study of the whole subject which has thus been rendered necessary has strongly confirmed the conviction I previously entertained that the system of retirement which now prevails greatly tends to promote the efficiency of the Civil Service and the interests of the country. I do not apologise for saying this much on a subject into which I was led by an observation that concerns me personally, for the means of securing efficiency in the public service is an important economic question.

The coincidence to which I refer tempts me to choose as the principal subject of the Address which I am permitted and enjoined to deliver to the Section on this occasion that small corner of the great field of Economics in which I have been a day labourer for so long, and I am not able to resist the temptation. My piece of allotment ground, if I may so call it, is that which is devoted to the cultivation of thrift, or of economy in the popular rather than the scientific sense. The temptation is strengthened by the

circumstance that that subject has rarely been treated by my predecessors. Sir Robert Giffen in his Address of 1887 referred to it, and Sir Charles Fremantle in 1892 treated it at somewhat greater length. In old times, when the Chair of this Section was more frequently occupied by the practical statesman than by the professed economist, there were passing allusions to it by Henry Fawcett in 1872, William Edward Forster in 1873, and Sir Richard Temple in 1884; but in more recent years the accomplished economists who have presided over this Section, notably my immediate predecessor, have delivered luminous and memorable Addresses on the broad principles of Economics, the application and potency of its doctrines, and their serviceableness to mankind, with a comprehensiveness of view that is only attainable as the result of deep study, and a brilliancy of exposition that belongs to philosophic insight. I may here, in passing, express the satisfaction we all feel that at Cambridge, where we are to meet next year, proficiency in Economics and Political Science is now fully recognised as qualifying for academical honours.

I have spoken of Thrift as a small corner of the great field of Economics; and relatively to the broad field itself it is so; but it is a subject that deals with large figures and intimately affects large numbers of people. The 2000 Building Societies in Great Britain and Ireland have 600,000 members and sixty-two millions of funds; the 28,000 bodies registered under the Friendly Societies Act have 12,000,000 members and forty-three millions of funds; the 2000 co-operative societies have 2,000,000 members and forty millions of funds; the 600 trade unions have more than a million and a half members and nearly five millions of funds; in the 13,000 Post Office and other savings banks there are more than 10,000,000 depositors and more than 200 millions invested; so that upon the whole in nearly 50,000 thrifit organisations with which the Registry of Friendly Societies has, in one form or other, to deal there are twenty-seven millions of persons interested and 360 millions of money engaged. These figures, however, possess no significance other than that they are very big. Many individuals are necessarily counted more than once, as belonging to more than one society in one class, or to more than one class of societies. Some portion of the funds of Friendly Societies is invested in savings banks, and therefore is counted twice over. Some of the co-operative societies, as, for example, the wholesale societies, have for capital the contributions of other societies, which thus are also counted twice over. On the other hand, the aggregate, large as it is, is necessarily defective. It includes only bodies which are brought into relation with the Registry of Friendly Societies in one or other of the functions exercised by that department. It does not include, therefore, many co-operative and other bodies which are registered under the Companies Act, nor the Industrial Assurance Companies which are regulated by the Assurance Companies Act, nor does it include the great body of Friendly Societies which are not registered at all. Among these shop clubs hold a prominent position, and these are very numerous. The Royal Commissioners of thirty years ago thought that the unregistered were then commensurate with the registered bodies; and as one result of the legislation which the Commissioners recommended has been to diminish the applications for registry made by such societies as are subjected by it to the necessity of a periodical valuation of assets and liabilities, there seems no reason to think that unregistered societies are relatively now any fewer than they were then.

It would seem, then, that the figures we have cited are well within the mark, and that, used for the mere purpose of indicating the magnitude of the interests involved, they may be relied upon as not over-estimating it. The observation just made leads to the question, why should there be so many unregistered societies? Why, indeed, should there be any unregistered societies? The National Conference of Friendly Societies, which consists wholly of registered bodies, has just passed a resolution recommending the enactment of a law that all societies should be compelled to register. Why not? I think it will not be difficult to find the real answer to these questions. It was given as long ago as 1825 by a Committee of the House of Commons in these wise words:—"It is only in consideration of advantages conferred by law that any restrictive interference can be justified with voluntary associations established for lawful

and innocent purposes. It is for the individuals themselves to determine whether to adopt the provisions of the statute, which offers them at the same time regulation and privilege, or to remain perfectly unfettered by anything but their own will, and the common or more ancient law against fraud or embezzlement," which common or more ancient law was strengthened in 1868 by the Act known as Russell Gurney's Act. "For your Committee apprehend that although the Act of 1793 appears to begin by rendering lawful the institution of Friendly Societies, there neither was at that time nor is now any law or statute which deprives the King's subjects of the right of associating themselves for mutual support."

Upon this principle the Legislature has hitherto proceeded. Registration is voluntary. The subscriptions of the members are voluntary. The conditions of membership are such as the rules framed by the members themselves impose. They have full authority to alter those rules from time to time. Those conditions may, if the members so please, imply that the subscriptions are to be small and the benefits large. They may provide for investment of funds on any security they think fit so long as it is not personal security. They may provide for the periodical division of the funds so long as they make it clear that all claims existing at the time of division are first to be met. Up to this point the registered society and the unregistered are hardly distinguishable. What, then, are the obligations consequent upon registry? There is the making an annual return and the making a quinquennial valuation; but the action to be taken by the society upon the result of the valuation is wholly in the discretion of the members. The valuer may demonstrate beyond doubt that the society in order to save itself from disaster must increase the subscriptions of the members or diminish their benefits; but neither he nor the Registrar can enforce the recommendation. The society has its destinies wholly in its own hands. Then, again, the Act contains certain provisions for the protection of members. Individual members have the right to inspect the books of the society, to receive copies of its balance sheets and valuations, and so forth. A certain number of the members have the right to apply to the Registrar to appoint an inspector into the affairs of the society or to call a special meeting of the members. The inspector can only report—there is no action which the Registrar can take upon his report if the members disregard it. The special meeting will in no way differ from an ordinary meeting called by the society itself, except that it may choose its own chairman. The Registrar cannot in any way control its proceedings. Even these things he cannot do of his own motion without being set in action by a competent number of the members. If a society becomes insolvent, members may in like manner apply to him to wind it up: he may see that a readjustment of contributions and benefits would set the society on its legs again, and may suspend his award of dissolution to enable the society to make that readjustment, but he can do no more. If the society refuse to make it, he has no option but at the end of the period of suspension to issue the award. Here again he may have the fullest knowledge that a society is hopelessly insolvent, yet he can do nothing unless a competent number of the members call in his aid. I confess that I think the Legislature might have gone further in this respect and conferred upon the Registrar, or at any rate upon some public authority, the power to deal compulsorily with cases of hopeless insolvency, and if necessary to appoint a receiver, as such cases are not infrequently complicated with fraud carried on in circumstances which make it difficult for a competent number of the members to join in an application to the Registrar. However that may be, taking the legislation as it stands, it embodies to the fullest extent the principle laid down by the Committee of 1825.

The surrender of freedom which a Friendly Society is called upon to make in order to obtain the privileges of registry, which are not inconsiderable, is therefore exceedingly small; yet it is sufficient, as we have seen, to keep out of the registry office a large number of societies. It seems not improbable, looking back on the history of legislation on the subject—and the observation is a curious one—that unwillingness to register has been closely connected with actuarial considerations. Thus, in the year 1819, an Act was passed which provided, among other things, that

the justices should not confirm any tables or rules connected with calculation until they had been approved by two persons at least known to be professional actuaries or persons skilled in calculation; but that was repealed in 1829. Again, in 1846 an Act was passed which provided, among other things, that every registered society should make a quinquennial valuation; but that was repealed in 1850 before a single quinquennial period had arrived. It was not until a quarter of a century after 1850 that this most salutary provision again found a place in the statute book, and the experience of the last twenty-eight years has shown how valuable it is, and how much it is to be regretted that the Act of 1846 was not allowed to remain in force. Again, the Act of 1850 provided for the discrimination of societies into two classes: those which were simply registered and those which were certified. These latter were to obtain the certificate of a qualified actuary that their tables of contribution were sufficient for the benefits they proposed to insure. Very few certified societies were established, and that Act was repealed in 1855. The experience of the Legislature has not been favourable therefore to endeavours to impose upon Friendly Societies by Act of Parliament conditions of actuarial soundness.

If, however, the voluntary principle is abandoned, and all societies are to be compelled to register, it is obvious that there must be a recurrence to the policy of imposing such conditions. At present a registered society may be as unsound as it pleases, and so may an unregistered society. Unless registry is to imply something more than that, there can be no reason for any compulsion to register. For what does compulsion mean? It means prosecuting, fining, and sending to prison all persons who associate themselves together for the lawful and innocent purpose of mutual support in sickness and adversity without registration; and that, obviously, cannot reasonably be done unless abstinence from registration is shown to be a moral offence; that is to say, unless the conditions of registration are such that a registered society shall be necessarily a good one, and an unregistered society necessarily a bad one. We must begin, at any rate, by devising model tables and insisting that every society shall adopt them. Are they not ready to hand? Did not my lamented colleague, Mr. Sutton, prepare a Blue Book of 1350 pages full of them? That is true; but it is also true that in the brief introductory remarks which he addressed to me at the beginning of that report he observed, with great force, that the adoption of sufficient rates of contribution is not enough to secure the soundness of a society. Those rates are derived from the average experience of all classes of societies—some exercising careful supervision over claims for sick pay, others lax in their management—and it is upon care in the management, rather than upon sufficiency of rates, that the success of a Friendly Society mainly depends. If the members administer the affairs of their society with the same rigorous parsimony and watch over the claims for sick-pay with the same vigilance which a poor and prudent man is compelled to exercise in the administration of his own household affairs, the society will be more than solvent, even though they do not pay as high a contribution as the model tables exact. If they neglect these precautions, there is no model table which will rescue them from ultimate insolvency. In Mr. Sutton's happy phrase, it is the personal equation of the members and of their medical adviser that tells the most on the prosperity or the failure of a society. Your compulsory registration will impose unfair conditions on the well-managed societies, and will do nothing to prevent the inevitable collapse of those which are badly managed. Registration tells for a great deal while it is voluntary and free; but if you make it compulsory, and add to it conditions that you suppose will tend to soundness, you will inevitably do more harm than good. It is, of course, of vital importance that adequate rates of contribution should be charged for the benefits proposed to be ensured; but if these are imposed by authority, the management of the societies must also be undertaken by the same authority. It is a curious observation, which has been borne out by experience, that in poor societies the claims for sickness are relatively less than in rich ones. M. Bertillon, the eminent French statistician, has shrewdly remarked: "The truth is, that friendly societies, when they grant sick-pay, attach less weight to the text of their rules than to the state of their funds. If the society is rich, it grants relief

more freely than if it is poor. Thence, and thence only, it comes that the great English societies, which are often very old and generally rich, give more days' pay than the French societies, for example, which are bound to a rigorous economy." Without necessarily assenting to all that M. Bertillon says, it is easy to see that if the State were unwise enough to say that such-and-such rates would be sufficient, it would encourage laxity of management, and accept a responsibility that does not belong to it.

I may now proceed to show that the present voluntary system, unscientific as it may be supposed to be, works very well on the whole. Its most useful feature is the valuation, for a society which disregards the lessons of one valuation, finds itself pulled up sharply by the results of a second. A deficiency that is frankly faced by an increase of contributions, a reduction of benefits, or a levy, or by all three together, will probably not only disappear, but be succeeded by a surplus; but a deficiency that is disregarded not only grows at compound interest, but increases by the continued operation of the causes which produced it. It is to be remembered that a valuation deficiency or surplus, as the case may be, in a Friendly Society is always hypothetical. It means this in the case of deficiency—if you go on as you are going and do not modify your contracts you will ultimately be in a deficiency of which this is the present value. In the case of surplus it means—if you go on as you are going and do not allow your prosperity to tempt you to recklessness you will probably have enough to meet all your engagements, and this much over together with its improvements at interest.

When Friendly Societies are considered in their economic aspect, they appear to be an excellent application of the principle of insurance to the wants of the industrial community. Sickness may come upon a working man at any time, and may disable him from work for an indefinite period. In such an event, if he had nothing to rely upon but his own savings accumulated while he was at work, they would before long be exhausted, and he would be left in distress. By combining with a number of others who are exposed to the same risk, he can fall back upon the contributions to the common fund which have been made by those who have escaped sickness. It is an essential part of every contract of insurance that the contributions of all who are exposed to an equal contingent risk are equal; but the benefits are only derivable by those of the number in whose experience the contingent risk becomes actual, and they receive more than they have paid, the deficiency being made up out of the contributions of those who have escaped the contingent risk.

This really seems too elementary a proposition to be worth stating, but it is the fact that the principle of insurance is so little understood that many members of Friendly Societies look upon themselves as having performed an altruistic and charitable act in joining a society when they have been fortunate enough not to make claims upon it through sickness. Several intelligent witnesses before Lord Rothschild's Committee on Old-age Pensions, representing large and well-managed societies, actually urged upon the Committee that the members of Friendly Societies were more deserving of old-age pensions than other people because they subscribed for the benefit of others and not of themselves.

Another economic point of view in which Friendly Societies call for consideration is that of their relation to the Poor Law. The old Act of 1793, which was the day of elaborate preambles to statutes, affirmed that the protection and encouragement of such societies would be likely to be attended with very beneficial effects by promoting the happiness of individuals, and at the same time diminishing the public burthens. The public burthen at which this was pointed was no doubt the Poor Law, which was then administered in a very different manner from that which has prevailed since the great reform of 1834, and one of the items of encouragement which the Legislature provided for the societies was that their members should not be liable to removal under the Poor Law until they had actually become chargeable to their respective parishes. This exemption was no doubt of great value at that time, when the law of settlement bore very severely upon the poor.

It appears to me that the proper relation of the Friendly Societies to the Poor Law is a negative one. The main object of the societies should be, as indeed it is, to keep

their members independent of the Poor Law. They have done so with great success. The returns which have more than once been presented to Parliament of persons receiving relief who are or have been members of Friendly Societies have frequently been shown to be untrustworthy. The number of actual members of such societies who seek relief is small absolutely, and still smaller relatively to the population. It was therefore not without regret that I observed the passing of an Act in 1894 which empowered Boards of Guardians to grant relief out of the poor rates to members of Friendly Societies, and if they thought fit to exclude from consideration of the amount of relief to be granted the amount received by the applicant from his Friendly Society. That Act has just been followed in the natural course of events by a bill for taking away from the Guardians their discretion in the matter, and requiring them to grant full relief to the applicant in addition to the weekly sum, not exceeding five shillings, which he receives from his Friendly Society. In other words, they are to provide a pauper who is a member of a Friendly Society with a free income of five shillings a week more than they would grant as adequate relief to a pauper who was not a member of a Friendly Society, however deserving in other respects that pauper might be. Poor-law relief, instead of being a painful and deplorable necessity, is elevated into a reward of merit in the one case, in which that merit has been displayed by joining a society. A kind of old-age pension is provided for the member, but instead of being an old-age pension without the taint of pauperism, it is a condition of obtaining it that the man must become a pauper. This seems to me to be topsy-turvy legislation. The very bodies the aim and proud boast of which it should be that their members never are paupers have been contented to claim for their members the rank of privileged paupers.

The discussion of the subject of old-age pensions which has now been proceeding for the last twelve or thirteen years has had one good effect in bringing under the consideration of the Friendly Societies the practical methods by which they can obtain these pensions for themselves. The impression that some day and somehow the State would provide pensions for everybody, or at least for everybody who is thrifty, has had a bad effect; but the wiser members of the societies have seen that it would be a good thing to substitute for their present plan of continuing sick-pay to the end of life a plan of insuring a certain annuity after a given age. For this purpose they have had to overcome a natural reluctance on the part of the members to lock up their savings in the purchase of deferred annuities, and they have done so with some success, several thousands of persons having agreed to subscribe for these benefits. It is anticipated that the report of Mr. Alfred Watson on his investigations into the sickness experience of the Manchester Unity of Oddfellows will add force to this movement by showing how great a burden old-age sickness at present is, and how slight an additional sacrifice would secure a deferred annuity. It need hardly be said that it is more desirable that the members generally should do this for themselves than that they should get the State to do it for them.

Registered Friendly Societies are becoming more popular and more wealthy under the present system. The number of returns from societies and branches increased from 23,998 on December 31, 1891, to 26,431 on December 31, 1899, and 27,005 on December 31, 1901; the number of members from 4,203,601 to 5,217,261 in eight years, and to 5,479,882 in ten years; the amount of funds from 22,695,039*l.*, or 5*l.* 8*s.* per member, to 32,751,869*l.*, or 6*l.* 5*s.* 6*d.* per member, after eight years, and 35,572,740*l.*, or 6*l.* 9*s.* 9*d.* per member, after ten years. It is necessary to observe, however, that some of the numerical increase is due to greater completeness in the later returns. The increase in ratio is not affected by this. It may be worth noting that, on the average, the proportion of members under fifty years of age to those above that age is as 8*1* to 19; and that of the total aggregate receipts per annum, 73 per cent. goes in benefits, 11 per cent. in management, and 16 per cent. is added to capital. The average annual contribution per member is 1*l.* 1*s.* 6*d.*

Up to this point I have referred merely to the Friendly Society of the ordinary type, the sick club and burial fund. Societies of the collecting group, while registered under the

Friendly Societies Act, are also regulated by a separate Act, and it is convenient therefore to consider them apart. They insure burial money only. They are only 46 in number, having increased from 43 in 1891. They have as many as 6,678,005 members, an increase from 5,922,615 in 1899 and 3,875,215 in 1891; but among these each individual above the age of one year in every family is counted separately, and the majority, therefore, are young children. Their funds are 5,973,104*l.*, or 17*s.* 1*d.* per member, having increased from 5,207,686*l.*, or 17*s.* 7*d.* per member, since 1899, and from 2,713,214*l.*, or 14*s.* per member, since 1891. These societies therefore show progress like the others.

The collecting societies do a similar business to that of the Industrial Assurance Companies, of which the Prudential is the type. Their ostensible reason for existence is to answer that instinct of human nature which makes even the poorest desire that the burial of the dead should be attended with some degree of ceremony; but strong as that instinct may be, it does not prompt the poor to seek out the office of the society and pay their premiums there. They have to be solicited by canvassers and waited upon by an army of collectors at their own homes; and the maintenance of this army and the general cost of management absorb nearly half the contributions, so that the poor insurer pays double the net price for his insurance. There is reason to believe, moreover, that these societies are largely used for speculative insurances by persons who have no real insurable interest in the lives insured. So long ago as 1774 an Act was passed for the purpose of checking this sort of gambling in human life; but as it only makes the policy void, the insurer takes the risk of the society repudiating the contract, knowing that its doing so would discredit it and spoil its business.

A number of other classes of societies are capable of being registered under the Friendly Societies Act, such as cattle insurance societies, benevolent societies, working men's clubs, and societies for any purpose the registry of which the Treasury may specially authorise. The formation of cattle insurance societies on a large scale was contemplated by an Act of 1866, when the cattle plague was at its height; but in practice only small pig clubs and similar societies in Lincolnshire and the neighbouring counties have been registered under this head. Benevolent societies are defined as societies for any benevolent or charitable purpose, and might therefore comprise all the charitable institutions of the United Kingdom, but in fact the registered benevolent societies are few. Working men's clubs—frequently called working men's clubs and institutes—were first brought under the operation of the Friendly Societies Act of that day by Sir George Grey as Secretary of State in 1864, and were then societies for purposes of social intercourse, mutual helpfulness, mental and moral improvement, and rational recreation. They are still so defined by law; what they are in fact has been revealed by the provisions of the Licensing Act, 1902, as to the registration of clubs. Rules have been submitted to the Registry Office, and we have been advised that we have no discretion to refuse to register them as rules for carrying out the excellent purposes just defined, providing for the supply of intoxicating liquors to members and their friends at hours when the ordinary licensed houses are compulsorily closed, for keeping the club open every night until midnight, and on nights when there are balls until six o'clock in the morning, and for other incitements to intemperance. I hope that it will not be long before an enactment is passed that the registry of a club under the Licensing Act shall vacate its registry under the Friendly Societies Act. Such clubs have nothing to do with thrift or with insurance; they are rather instruments of extravagance, improvidence, and dissipation.

Some of the specially authorised purposes are also wide of the mark, which upon the *eiusdem generis* rule should, I think, be pointed with strictness in the direction of provident insurance; but there has always been a desire liberally to extend the benefits of the Friendly Societies Act with a view to the encouragement of societies having praiseworthy objects which for want of means or some other reason are not registered as companies. The large majority of specially authorised societies are Loan Societies, and though these may in some cases be fairly good investments for those who lend, they are of doubtful benefit to those who borrow. An exception must be made to this statement with respect to the Agricultural Credit Societies,

many of which have been established in Ireland by the exertions of Sir Horace Plunkett, and have been pecuniarily assisted by the Congested Districts Board. It is a feature of these societies that they not only lend money to the small farmer, but see that he spends it on improvements to his farm; and also that there is no division of profit among the members.

The returns from all societies under the Friendly Societies Act other than Friendly Societies proper increased from 557 in 1891 to 1308 in 1899, and 1449 in 1901; the number of members from 241,446 in 1891 to 610,254 in 1899, and 649,591 in 1901; and the amount of funds from 594,808*l.* in 1891 to 1,528,064*l.* in 1899, and 1,686,656*l.* in 1901. Here, again, great allowance has to be made for the want of completeness in the returns of the earliest date.

Allied to Friendly Societies, but having special regulations under other Acts, are shop clubs and workmen's compensation schemes. In a vast number of large industrial establishments the men have their own sick club, sometimes assisted by the employer; and in a few the employer makes it a condition of employment that every workman shall join the club. Where this is done it is now enacted, not only that the club shall comply with the requirements of the Friendly Societies Act as to registry, but also with other conditions of more stringency. As yet only a few clubs have been able to satisfy all the requirements of the Shop Clubs Act, 1902. The workmen's compensation schemes provide an alternative to the general scheme of compensation to injured workmen contained in the Act of 1897, and have enabled the employers and workmen in several large industries to enter into mutual arrangements by which the workman gains an equivalent to the compensation which the Act would give him, and enters into partnership with the employer for obtaining other benefits. According to the returns, these schemes have hitherto resulted very favourably to the workmen, and it seems a pity there are not more of them.

The sentiment of which I have spoken, that it is desirable to extend the benefits of the Friendly Societies Acts to societies for good objects, even though those objects may not be purposes of provident insurance, is expressed in the statute of 1834, which allowed of "any purpose which is not illegal," and in that of 1846, in which the definition of a Friendly Society was made to include the frugal investment of the savings of the members for better enabling them to purchase food, firing, clothes, or other necessaries, or the tools, implements, or materials of their trade or calling, or to provide for the education of their children or kindred. Under these Acts the Rochdale Equitable Pioneers and a number of other Co-operative Societies were registered, and in 1852 an Act was passed specially dealing with these bodies under the name of Industrial and Provident Societies. They were made corporate bodies by an Act of 1862, and are now regulated by the Industrial and Provident Societies Act, 1893. The societies that may be registered under that Act are societies for carrying on any industries, businesses, or trades specified in or authorised by their rules, whether wholesale or retail, and including dealings of any description with land.

This definition indicates pretty clearly the manner in which Co-operative Societies have worked out their own evolution. The expression "Industries" denotes the productive form of society, a form which has always embodied the ideal of co-operation when the combined labour of the members should be engaged in the production of commodities. The expression "Businesses" indicates the recognition of the Legislature that Co-operative Societies ought to cover a wider range than was allowed by the words "labour, trade, or handicraft" in the Act of 1876, and includes banking, assurance, and the like. The expression "Trades" denotes the distributive form of society, a form in which co-operation has gained its greatest successes. The permission to carry on these functions "wholesale" as well as retail points to the system of super-association, or co-operation between societies, which has attained phenomenal proportions in the co-operative wholesale societies of Manchester and of Glasgow, and exists in a smaller degree of development in other societies. The authorising of "dealings of any description with land" relates not merely to a considerable number of land societies, but is also an indication of the great extent to which societies for other purposes have applied their profits and

some of their capital to the excellent work of providing homes for their members. It is also to be observed that many societies are both distributive and productive.

What have these societies done for their members? They have reduced the price of the necessaries of life and have thus enabled persons of limited means to enjoy some of its luxuries; they have provided a remunerative investment for small savings; they have done much to put an end to the practice of giving and taking long credit; they have done as much as in them lies to ensure the purity of commodities; they have disconcerted (though, perhaps, not with all the success that might have been hoped for) the practice of taking commissions and commercial bribery generally; they have raised the standard of comfort and have helped many members to obtain the coveted possession of a house of their own; they have devoted a share of their profits to educational purposes with excellent results. Some of the productive societies, by the practice of giving a bonus to labour, have improved the economic position of the workman and contributed to the efficiency of his work. On the other hand, co-operative societies generally have not been so successful as was expected in realising some of the aspirations of the founders of co-operation; commercial failure has not been unknown among them; losses have occurred, though the simple organisation of the societies has made it easy to deal with them by adjustments of the capital account; they have not always had the best of managers, and have sometimes failed to give their confidence where it was deserved, and given it where it was not. In many places they have had to contend with opposition from the traders to whose business and profits their success was unfavourable. Taking all things into consideration, the progress they have made is surprising.

Comparing the returns for the United Kingdom for the years ending December 31, 1891, and December 31, 1901, the increase in number of societies was from 1597 to 2175; in number of members from 1,136,907 to 1,929,628; in amount of funds from 16,545,138L to 40,824,660L.

It has been observed that the Co-operative Societies are largely undertaking the work of providing houses for their members; and to that it may be added that the Friendly Societies are more and more tending to adopt the practice of lending money to members on mortgage as one of the most remunerative forms of investment open to them. The Building Societies, which were established for that purpose only, are still carrying on the same work, and the combined operation of all three ought to produce a material effect on the prosperity and well-being of the industrial population. Building Societies alone advance as much as 9,000,000L a year on mortgage.

Building Societies have passed through a crisis. The incorporated societies reached their highest point of prosperity in 1887, when their capital amounted to fifty-four millions; by 1894 it had fallen to below forty-three millions. The Building Societies Act, 1894, required of societies a fuller disclosure of the real state of their affairs than had previously been called for. The result was to show that, apart from the special scandal caused by the fraudulent proceedings of the Liberator Society, there were hitherto undisclosed elements of weakness in the management of Building Societies that justified the withdrawal of the public confidence that had been reposed in them. The properties in possession before the passing of the Act of 1894 were not less than 7,500,000L; they are now less than 3,000,000L. This points to the fact that the early prosperity of Building Societies had led to the establishment of more societies than the public demand called for, with the consequences that societies competed against each other, and that in the stress of competition and the anxiety to do business they accepted unsatisfactory securities, which must lead to loss upon realisation. From this point of view the effect of the Act of 1894 has been wholly salutary. Year after year the societies have reduced their properties in possession. The evils which they dreaded from the disclosure of the facts have not arisen. At this day it may be said that the societies as a whole have regained the position they held in public confidence, for the members now know the worst. They know, too, that where the blight of properties in possession still infests the business the managers are resolutely endeavouring to diminish its effect.

I need hardly repeat what has so often been said of the economic value of a sound Building Society. The man who

by its means gets a stake in the country mounts many steps on the social ladder. When he has paid off the mortgage on his own dwelling-house, and so liberated himself from the obligation to pay principal and interest, either in the form of repayment annuity or of rent, what is to prevent him from buying in the same manner, as an investment, another house with the income thus set free, and so on?

There are still sixty-eight Building Societies which remain under the operation of the Act of 1836, having been established before 1856, and not having availed themselves of the option of taking upon themselves the responsibilities and the privileges of the Acts of 1874 and subsequent years. One society (the Birkbeck) stands by itself, as, although its business as a Building Society is considerable—the new advances granted on mortgage last year having been for 120,000L—its main operations are those of a deposit bank, and it keeps the far greater part of its funds in investments on liquid securities. The other societies are pursuing the even tenor of their way, just as they have done for the last fifty years, and show on the average an increase of business from year to year. But the great body of Building Societies are those which are incorporated under the Acts of 1874 to 1894, exceeding 2000 in number. They have so far recovered from the effects of the depression that their assets are now forty-eight millions, being midway between the low-water mark of 1894 and the high-water mark of 1887. That and the fact that they have in about seven years reduced their properties in possession by about 60 per cent. leads to the inference that they are now, speaking generally, in a fairly healthy condition, and that many years of usefulness are still to be expected for them.

The Friendly Societies Registry also registers and receives returns from trade unions. These useful and necessary bodies have, I think, been rather cruelly treated, not only in past days, but also in more recent times. Without going back to the bad old times when six poor agricultural labourers were sentenced to seven years' transportation for forming a trade union, or even to the time when they were refused the protection of the law for the funds they had accumulated, because, forsooth, they were for an illegal purpose, it will be sufficient to mark the unexpected change that has been worked in their position since the Act of 1871 purported to render them legal. Registry under that Act authorised the trustees of a trade union to hold land not exceeding one acre, vested the property of the union in them, authorised them to sue and be sued on behalf of the union, limited their liability, made the treasurers and officers accountable to them or to the members, and enabled them to take summary proceedings against any person misapplying their funds. But it did not create the unions corporate bodies, and did not enable any Court to entertain legal proceedings for enforcing their contracts with their members, recovering contributions due from a member, or recovering from the union benefits due to a member or other person, or for enforcing any agreement between one trade union and another, even where any such contracts or agreements were secured by bond. It was commonly thought that the effect of all this would be that the unions, having none of the privileges of incorporation, would escape the liabilities which affect corporate bodies; and so much was this the general opinion that the Duke of Devonshire and other members of the Royal Commission on Labour made a minority report in which they suggested that the law in this respect should be altered.

It has recently been determined that, although unions are not corporate bodies, they are responsible for the acts of their agents as much as if they were. I do not presume to question the propriety of this decision as a matter of law, nor even to say that it is a decision which is contrary to equity; but only to point out that its result upon the individual member of a trade union, who gave no mandate to its agents to do any illegal or injurious act, but handed over his savings to the trustees of the union, relying on the stringency of the provisions of the Act as to misapplication of funds, is very serious and was unexpected. The contributions of workmen to their trade union represent an amount of self-sacrifice and self-denial that is not readily gauged or measured or understood by persons in easier circumstances of life. Their object, which is primarily to provide the sinews of war in any conflict that may be necessary to secure their material welfare, and secondarily to provide sick and funeral and pension and out-of-work

benefits against the ordinary ills of life, is one that ought to appeal most strongly to the sympathies of the economist. If it is the fact that trade unions make mistakes, as most people do, those mistakes will be much fewer and less mischievous when full legislative recognition and protection are afforded them than they were under the old régime of suspicion and repression.

Loan Societies under the Act of 1840 are societies for lending sums of money not exceeding £15. to the industrious classes upon terms of a deduction of interest at the time of granting the loan and a corresponding weekly repayment fixed to commence at such a time that the rate of interest earned by the society shall be about 12 per cent. per annum; another instance of the experience which always faces the poor man that he has to pay for any small accommodation he wants a higher relative price than the man who wants more. These societies are of two types: the Friends of Labour Loan Societies, existing mainly in the metropolis, having two classes of members, investing and borrowing, but limiting the subscriptions of the one class to the £15., which is the statutory limit of the loans to the other class; and what may be called the proprietary loan societies, existing mainly in Yorkshire, making their loans to non-members, and consisting of a small number of persons who contribute the whole of the capital, the holding of each proprietor sometimes amounting to several hundreds of pounds.

The Registry of Friendly Societies has for one of its functions that of granting to societies which are exclusively for purposes of science, literature, and the fine arts certificates exempting them from local rating. Though there can be no question that these certificates are of great value to many excellent institutions, such as public libraries, picture galleries, museums, and scientific and learned societies, which would find the liability to pay rates, in these days when rates have increased and are increasing so largely, a serious deduction from the scanty means at their command for maintaining their useful operations, yet I have very grave doubts whether on economic grounds any such exemption from rates is capable of being defended. The benevolent people who subscribe to maintain these buildings for the public good increase the burden upon the small ratepayer to the extent to which they fail to contribute their share. The Act of 1843 has more than once been scheduled in Bills for repealing exemptions from rating, but those Bills have not been passed, and the Act is still in force.

There only remains to consider the case of Savings Banks, which are brought in connection with the Registry of Friendly Societies by the Acts which confer upon that office exclusive and final jurisdiction in the settlement of disputes, and effectually oust the jurisdiction of the Courts of Law. Under these Acts many thousands of disputes have been settled by my predecessors, my colleagues, and myself, and at the present time an average of three appointments every week during the busy time of the year has to be made to hear the parties. We see much of the seamy side of life in these cases—many family and other quarrels of a sordid character are brought to light—and it has been noted as a curious fact that persons guilty of fraud or embezzlement seem frequently, but most unwisely, to select the Savings Bank as the securest receptacle for their ill-gotten gains. On the other hand many pathetic and touching instances of thrift and self-sacrifice have been brought under our notice, and much evidence has been accumulated as to the great value to the poor of these excellent institutions. As compared with the several self-governing bodies to which I have already directed attention, the Savings Bank may not unfairly be described as the elementary form of organisation for thrift. The depositor entrusts his money to it for mere safe custody and accumulation, and has no voice in the application of it or control over its managers. All he asks is that he may run no risk of losing it. Savings Banks are of three classes: the 230 Trustee Savings Banks of the old type which still remain, and have to their credit an undiminished amount of funds, though there were at one time more than twice as many banks; the Post Office Savings Bank, which is one of the many monuments still extant to the financial genius of Mr. Gladstone, and not less to the administrative skill of the public servants who settled the lines upon which it works, and which has increased the savings of the people more than threefold by

bringing almost to every man's door the opportunity of making deposits. I hope that it may meet in its new and splendid home at West Kensington with a continuance and increase of the marvellous success which has hitherto attended it. Thirdly, there are the Railway Savings Banks, which have collected from the workmen employed and from their families nearly five million pounds. It is right to observe that they give a rate of interest exceeding by about 1 per cent. that given by the Trustee and Post Office Savings Banks. It is also to be borne in mind that the deposits in Savings Banks are not drawn wholly from the industrial population, but that many, especially women and children, belonging to other classes make use of the banks. Indeed, the Postmaster-General, in an approximate estimate made some years ago, calculated that women and children constituted 56 per cent. of the whole number of depositors. School Savings Banks and Penny Savings Banks are also to be mentioned as feeders of the ordinary Savings Banks, and as greatly increasing the opportunities of saving afforded to the young, and instilling into them valuable lessons of thrift.

Such is the story the department I am about to leave has to tell of the free and spontaneous efforts of the industrial population to better their condition by means of thrift and economy. It is, I venture to think, one which speaks well for the general body of that population and has great promise for the future of the country. In times of depression, as well as in times of prosperity, the gradual increase of the funds of these various bodies has been maintained; the members have not been compelled by the one, nor tempted by the other, to relax their efforts and their sacrifices.

I ask forgiveness for having detained you so long on so small a branch of the great subjects with which this Section has to deal, and which will be well illustrated in the important papers and discussions that are set down on its programme. The course of events has given to one group of subjects, that has often been considered in this Section, a new and unexpected prominence; and we await with keen interest the teaching which economic science has to offer on the questions of the day.

## SECTION H.

### ANTHROPOLOGY.

OPENING ADDRESS BY PROF. JOHNSON SYMINGTON, M.D., F.R.S., F.R.S.E., PRESIDENT OF THE SECTION.

It is now nearly twenty years since Anthropology attained to the dignity of being awarded a special and independent Section in this Association, and I believe it is generally admitted that during this period the valuable nature of many of the contributions, the vigour of the discussions, and the large attendance of members have amply justified the establishment and continued existence of this Section.

While the multifarious and diverse nature of the subjects which are grouped under the term Anthropology gives a variety and a breadth to our proceedings, which are very refreshing in this age of minute specialism, I feel that it adds very considerably to the difficulty of selecting a subject for a Presidential Address which will prove of general interest.

A survey of the recent advances in our knowledge of the many important questions which come within the scope of this Section would cover too wide a field for the time at my disposal, while a critical examination of the various problems that still await solution might expose me to the temptation of pronouncing opinions on subjects regarding which I could not speak with any real knowledge or experience. To avoid such risks I have decided to limit my remarks to a subject which comes within the range of my own special studies, and to invite your attention to a consideration of some problems arising from the variations in the development of the skull and the brain.

Since the institution of this Section the development, growth, and racial peculiarities of both skull and brain, and the relation of these two organs to each other, have attracted an ever-increasing amount of attention. The introduction of new and improved methods for the study of the structure of the brain and the activity of an able

band of experimenters have revolutionised our knowledge of the anatomy and physiology of the higher nerve centres.

The value of the results thus obtained is greatly enhanced by the consciousness that they bear the promise of still greater advances in the near future. If the results obtained by the craniologist have been less marked, this arises mainly from the nature of the subject, and is certainly not due to any lack of energy on their part. Our craniological collections are continually increasing, and the various prehistoric skull-caps from the Neanderthal to the Trinil still form the basis of interesting and valuable memoirs.

While the additions to our general knowledge of cerebral anatomy and physiology have been so striking, those aspects of these subjects which are of special anthropological interest have made comparatively slight progress, and cannot compare in extent and importance with the advantages based upon a study of fossil and recent crania. These facts admit of a ready explanation. Brains of anthropological interest are usually difficult to procure and to keep, and require the use of special and complicated methods for their satisfactory examination, while skulls of the leading races of mankind are readily collected, preserved, and studied. Hence it follows that the crania in our anthropological collections are as numerous, well preserved, and varied as the brains are few in number and defective, both in their state of preservation and representative character. It may reasonably be anticipated that improved methods of preservation and the growing recognition on the part of anthropologists, museum curators, and collectors of the importance of a study of the brain itself will to some extent at least remedy these defects; but so far as prehistoric man is concerned, we can never hope to have any direct evidence of the condition of his higher nerve centres, and must depend for an estimate of his cerebral development upon those more or less perfect skulls which fortunately have resisted for so many ages the corroding hand of time.

I presume we will all admit that the main value of a good collection of human skulls depends upon the light which they can be made to throw upon the relative development of the brains of different races. Such collections possess few, if any, brains taken from these or corresponding skulls, and we are thus dependent upon the study of the skulls alone for an estimate of brain development.

Vigorous attacks have not unfrequently been made upon the craniometric systems at present in general use, and the elaborate tables, compiled with so much trouble, giving the circumference, diameters, and corresponding indices of various parts of the skull, are held to afford but little information as to the real nature of skull variations, however useful they may be for purposes of classification. While by no means prepared to express entire agreement with these critics, I must admit that craniologists as a whole have concentrated their attention mainly on the external contour of the skull, and have paid comparatively little attention to the form of the cranial cavity. The outer surface of the cranium presents features which are due to other factors than brain development, and an examination of the cranial cavity not only gives us important information as to brain form, but by affording a comparison between the external and internal surfaces of the cranial wall it gives a valuable clue to the real significance of the external configuration. Beyond determining its capacity we can do but little towards an exact investigation of the cranial cavity without making a section of the skull. Forty years ago Prof. Huxley, in his work "On the Evidence of Man's Place in Nature," showed the importance of a comparison of the basal with the vaulted portion of the skull, and maintained that until it should become "an opprobrium to an ethnological collection to possess a single skull which is not bisected longitudinally" there would be "no safe basis for that ethnological craniology which aspires to give the anatomical characters of the crania of the different races of mankind." Prof. Cleland and Sir William Turner have also insisted upon this method of examination, and only two years ago Prof. D. J. Cunningham, in his Presidential Address to this Section, quoted, with approval, the forcible language of Huxley. The curators of craniological collections appear, however, to possess an invincible objection to any such treatment of the specimens under their care. Even in the Hunterian Museum in London, where Huxley himself worked at this subject, among several thousands of skulls, scarcely any

have been bisected longitudinally, or had the cranial cavity exposed by a section in any other direction. The method advocated so strongly by Huxley is not only essential to a thorough study of the relations of basi-craniial axis to the vault of the cranium and to the facial portion of the skull, but also permits of casts being taken of the cranial cavity; a procedure which, I would venture to suggest, has been too much neglected by craniologists.

Every student of anatomy is familiar with the finger-like depressions on the inner surface of the cranial wall, which are described as the impress of the cerebral convolutions; but their exact distribution and the degree to which they are developed according to age, sex, race, &c., still remain to be definitely determined. Indeed, there appears to be a considerable difference of opinion as to the degree of approximation of the outer surface of the brain to the inner surface of the cranial wall. Thus the brain is frequently described as lying upon a water-bed, or as swimming in the cerebro-spinal fluid, while Hyrtle speaks of this fluid as a "ligamentum suspensorium" for the brain. Such descriptions are misleading when applied to the relation of the cerebral convolutions to the skull. There are, it is true, certain parts of the brain which are surrounded and separated from the skull by a considerable amount of fluid. These, however, are mainly the lower portions, such as the medulla oblongata and pons Varolii, which may be regarded as prolongations of the spinal cord into the cranial cavity. As they contain the centres controlling the action of the circulatory and respiratory organs, they are the most vital parts of the central nervous system, and hence need special protection. They are not, however, concerned with the regulation of complicated voluntary movements, the reception and storage of sensory impressions from lower centres, and the activity of the various mental processes. These functions we must associate with the higher parts of the brain, and especially with the convolutions of the cerebral hemispheres.

If a cast be taken of the cranial cavity and compared with the brain which had previously been carefully hardened *in situ* before removal, it will be found that the cast not only corresponds in its general form to that of the brain, but shows a considerable number of the cerebral fissures and convolutions. This moulding of the inner surface of the skull to the adjacent portions of the cerebral hemispheres is usually much more marked at the base and sides than over the vault. Since the specific gravity of the brain tissue is higher than that of the cerebro-spinal fluid, the cerebrum tends to sink towards the base and the fluid to accumulate over the vault; hence probably these differences admit of a simple mechanical explanation. Except under abnormal conditions, the amount of cerebro-spinal fluid between the skull and the cerebral convolutions is so small that from a cast of the cranial cavity we can obtain not only a good picture of the general shape and size of the higher parts of the brain, but also various details as to the convolutionary pattern. This method has been applied with marked success to the determination of the characters of the brain in various fossil lemurs by Dr. Forsyth Major and Prof. R. Burckhardt, and Prof. Gustav Schwalbe has made a large series of such casts from his craniological collection in Strassburg. The interesting observations by Schwalbe<sup>1</sup> on the arrangement of the "impressions digitatae" and "juga cerebralia," and their relation to the cerebral convolutions in man, the apes, and various other mammals, have directed special attention to a very interesting field of inquiry. As is well known, the marked prominence at the base of the human skull, separating the anterior from the middle fossa, fits into the deep cleft between the frontal and temporal lobes of the brain, and Schwalbe has shown that this ridge is continued—of course in a much less marked form—along the inner surface of the lateral wall of the skull, so that a cast of the cranial cavity presents a shallow but easily recognised groove corresponding to the portion of the Sylvian fissure of the brain separating the frontal and parietal lobes from the temporal lobe. Further, there is a distinct depression for the lodgment of the inferior frontal convolution, and a cast of the middle cranial fossa shows the three external temporal convolutions.

We must now turn to the consideration of the relations

<sup>1</sup> "Über die Beziehungen zwischen Innenform und Außenform des Schädels," *Deutsches Archiv für klinische Medicin*, 1902.

of the outer surface of the cranium to its inner surface and to the brain. This question has engaged the attention of experts as well as the "man in the street" since the time of Gall and Spurzheim, and one might naturally suppose that the last word had been said on the subject. This, however, is far from being the case. All anatomists are agreed that the essential function of the cranium is to form a box for the support and protection of the brain, and it is generally conceded that during the processes of development and growth the form of the cranium is modified in response to the stimulus transmitted to it by the brain. In fact it is brain growth that determines the form of the cranium, and not the skull that moulds the brain into shape. This belief, however, need not be accepted without some reservations. Even the brain may be conceived as being influenced by its immediate environment. There are probably periods of development when the form of the brain is modified by the resistance offered by its coverings, and there are certainly stages when the brain does not fully occupy the cranial cavity.

At an early period in the phylogeny of the vertebrate skull the structure of the greater part of the cranial wall changes from membranous tissue into cartilage, the portion persisting as membrane being situated near the median dorsal line. In the higher vertebrates the rapid and early expansion of the dorsal part of the fore-brain is so marked that the cartilaginous growth fails to keep pace with it, and more and more of the dorsal wall of the cranium remains membranous, and subsequently ossifies to form membrane bones. Cartilage, though constituting a firmer support to the brain than membrane, does not possess the same capacity of rapid growth and expansion. The head of a young child is relatively large, and its skull is distinguished from that of an adult by the small size of the cartilaginous base of the cranium as compared with the membranous vault. The appearance of top-heaviness in the young skull is gradually obliterated as age advances by the cartilage continuing slowly to grow after the vault has practically ceased to enlarge. These changes in the shape of the cranium are associated with corresponding alterations in that of the brain, and it appears to me that we have here an illustration of how the conditions of skull growth may modify the general form of the brain.

Whatever may be the precise influences that determine skull and brain growth, there can be no doubt but that within certain limits the external form of the cranium serves as a trustworthy guide to the shape of the brain. Statements such as those by Dr. J. Deniker ("The Races of Man," p. 53) "that the inequalities of the external table of the cranial walls have no relation whatever with the irregularities of the inner table, and still less have anything in common with the configuration of the various parts of the brain," are of too general and sweeping a character. Indeed, various observers have drawn attention to the fact that in certain regions the outer surface of the skull possesses elevations and depressions which closely correspond to definite fissures and convolutions of the brain. Many years ago Sir William Turner, who was a pioneer in cranio-cerebral topography, found that the prominence on the outer surface of the parietal bone, known to anatomists as the parietal eminence, was situated directly superficial to a convolution of the parietal lobe of the brain, which he consequently very appropriately named "the convolution of the parietal eminence." Quite recently Prof. G. Schwalbe has shown that the position of the third or inferior frontal convolution is indicated by a prominence on the surface of the cranium in the anterior part of the temple. This area of the brain is of special interest to all students of cerebral anatomy and physiology, since it was the discovery by the illustrious French anthropologist and physician, M. Broca, that the left inferior frontal convolution was the centre for speech, that laid the scientific foundation of our present knowledge of localisation of function in the cerebral cortex. This convolution is well known to be much more highly developed in man than in the anthropoid apes, and the presence of a human cranial speech-bump is usually easily demonstrated. The faculty of speech, however, is such a complicated cerebral function that I would warn the "new" phrenologist to be cautious in estimating the loquacity of his friends by the degree of prominence of this part of the skull, more particularly as

there are other and more trustworthy methods of observation by which he can estimate this capacity.

In addition to the prominences on the outer surface of the cranium, corresponding to the convolutions of the parietal eminence and the left inferior frontal convolution, the majority of skulls possess a shallow groove marking the position of the Sylvian point and the course of the horizontal limb of the Sylvian fissure. Below these two other shallow oblique grooves indicate the line of the cerebral fissures which divide the outer surface of the temporal lobe into its three convolutions, termed superior, middle, and inferior. Most of these cranial surface markings are partially obscured in the living body by the temporal muscle, but they are of interest as showing that in certain places there is a close correspondence in form between the external surface of the brain and that of the skull. There are, however, distinct limitations in the degree to which the various cerebral fissures and convolutions impress the inner surface of the cranial wall, or are represented by inequalities on its outer aspect. Thus over the vault of the cranium the position of the fissure of Rolando and the shape of the cerebral convolutions in the so-called motor area, which lie in relation to this fissure, cannot usually be detected from a cast of the cranial cavity, and are not indicated by depressions or elevations on the surface of the skull, so that the surgeons in planning the seats of operations necessary to expose the various motor centres have to rely mainly upon certain linear and angular measurements made from points frequently remote from these centres.

The cranium is not merely a box developed for the support and protection of the brain, and more or less accurately moulded in conformity with the growth of this organ. Its antero-lateral portions afford attachments to the muscles of mastication and support the jaws and teeth, while its posterior part is liable to vary according to the degree of development of the muscles of the nape of the neck. Next to the brain the most important factor in determining cranial form is the condition of the organs of mastication—muscles, jaws, and teeth. There is strong evidence in favour of the view that the evolution of man from microcephaly to macrocephaly has been associated with the passage from a macrodontic to a micromyodontic condition. The modifications in the form of the cranium due to the influence of the organs of mastication have been exerted almost entirely upon its external table; hence external measurements of the cranium, as guides to the shape of the cranial cavity and indications of brain development, while fairly trustworthy in the higher races, become less and less so as we examine the skulls of the lower races, of prehistoric man, and of the anthropoid apes.

One of the most important measurements of the cranium is that which determines the relation between its length and breadth and thus divides skulls into long or short, together with an intermediate group neither distinctly dolichocephalic nor brachycephalic. These measurements are expressed by an index in which the length is taken as 100. If the proportion of breadth to length is eighty or upwards, the skull is brachycephalic; if between seventy-five and eighty, mesaticephalic; and below seventy-five, dolichocephalic. Such a measurement is not so simple a matter as it might appear at first sight, and craniologists may themselves be classified into groups according as they have selected the nasion, or depression at the root of the nose, the glabella, or prominence above this depression, and the ophryon, a spot just above this prominence, as the anterior point from which to measure the length. In a young child this measurement would practically be the same whichever of these three points was chosen, and each point would be about the same distance from the brain. With the appearance of the teeth of the second dentition and the enlargement of the jaws the frontal bone in the region of the eyebrows and just above the root of the nose thickens, and its outer table bulges forwards so that it is now no longer parallel with the inner table. Between these tables air cavities gradually extend from the nose, forming the frontal sinuses. Although the existence and significance of these spaces and their influence on the prominence of the eyebrows were the subject of a fierce controversy more than half a century ago between the phrenologists and their opponents, it is only recently that their variations have been carefully investigated.

The frontal sinuses are usually supposed to vary according to the degree of prominence of the glabella and the supra-orbital arches. This, however, is not the case. Thus Schwalbe<sup>1</sup> has figured a skull in which the sinuses do not project as high as the top of the glabella and supra-orbital prominences, and another in which they extend considerably above these projections. Further, Dr. Logan Turner ("The Accessory Sinuses of the Nose," 1901), who has made an extensive investigation into these cavities, has shown that in the aboriginal Australian, in which this region of the skull is unusually prominent, the frontal sinuses are frequently either absent or rudimentary. The ophryon has been selected by some craniologists as the anterior point from which to measure the length of the skull, under the impression that the frontal sinuses do not usually reach above the glabella. Dr. Logan Turner, however, found that out of 174 skulls in which the frontal sinuses were present in 130 the sinuses extended above the ophryon. In seventy-one skulls the depth of the sinus at the level of the ophryon varied from 2 mm. to 16 mm., the average being 5.2 mm., while in the same series of skulls the depth at the glabella varied from 3 mm. to 18 mm., with an average depth of 8.5 mm. It thus appears that the selection of the ophryon in preference to the glabella, as giving a more accurate clue to the length of the brain, is based upon erroneous assumptions, and that neither point can be relied upon in the determination of the anterior limit of the cranial cavity.

The difficulties of estimating the extent of the cranial cavity by external measurements and the fallacies that may result from a reliance upon this method are especially marked in the case of the study of the prehistoric human calvaria, such as the Neanderthal and the Trinil and the skulls of the anthropoid apes.

Statistics are popularly supposed to be capable of proving almost anything, and certainly if you allow craniologists to select their own points from which to measure the length and breadth of the cranium, they will furnish you with tables of measurements showing that one and the same skull is dolichocephalic, mesaticephalic, and brachycephalic. Let us take as an illustration an extreme case, such as the skull of an adult male gorilla. Its glabella and supra-orbital arches will be found to project forwards, its zygomatic arches outwards, and its transverse occipital crests backwards, far beyond the anterior, lateral, and posterior limits of the cranial cavity. These outgrowths are obviously correlated with the enormous development of the muscles of mastication and those of the back of the neck. In a specimen in my possession the greatest length of the cranium, i.e. from glabella to external occipital protuberance, is 195 mm., and the greatest breadth, taken between the outer surfaces of the zygomatic processes of the temporal bone, is 172 mm., giving the marked brachycephalic index of 88.21. The zygomatic processes, however, may reasonably be objected to as indicating the true breadth, and the side wall of the cranium just above the line where the root of this process springs from the squamous portion of the temporal bone will certainly be much nearer the cranial cavity. Measured in this situation the breadth of the cranium is 118 mm., which gives a length-breadth index 60.51, and thus represents the skull as decidedly dolichocephalic. The transverse occipital crests and the point where these meet in the middle line to form the external occipital protuberance are much more prominent in the male than in the female gorilla, and the estimate of the length of the cranium in this male gorilla may be reduced to 160 mm. by selecting the base of the protuberance in place of its posterior extremity as the posterior end measurement. This raises the index to 73.75, and places the skull near the mesaticephalic group. At the anterior part of the skull the prominent glabella is separated from the inner table of the skull by large air sinuses, so that on a median section of the skull the distance from the glabella to the nearest part of the cranial cavity is 36 mm. We have here, therefore, another outgrowth of the cranial wall which in an examination of the external surface of the skull obscures the extent of the cranial cavity. Accordingly the glabella cannot be selected as the anterior point from which to measure the length of the cranium, and

must, like the zygomatic arches and occipital protuberance, be excluded from our calculations if we desire to determine a true length-breadth index. The difficulty, however, is to select a definite point on the surface of the cranium to represent its anterior end, which will be free from the objections justly urged against the glabella. Schwalbe suggests the hinder end of the supra-glabellar fossa, which he states often corresponds to the beginning of a more or less distinctly marked frontal crest. I have found this point either difficult to determine or too far back. Thus in my male gorilla the posterior end of this fossa formed by the meeting of the two temporal ridges was 56 mm. behind the glabella, and only 24 mm. from the bregma, while in the female gorilla the temporal ridges do not meet, but there is a low median frontal ridge, which may be considered as bounding posteriorly the supra-glabellar fossa. This point is 22 mm. from the glabella, and between 50 mm. and 60 mm. in front of the bregma.

I would suggest a spot in the median line of the supra-glabellar fossa which is crossed by a transverse line uniting the posterior borders of the external angular processes of the frontal bone. I admit this plan is not free from objections, but it possesses the advantages of being available for both male and female skulls. In my male skull the selection of this point diminishes the length of the cranium by 25 mm., thus reducing it to 137 mm. The breadth being calculated at 114 mm., the index is 83.21, and hence distinctly brachycephalic. The length of the cranial cavity is 118 mm., and the breadth 96 mm., and the length-breadth index is thus the brachycephalic one of 81.36.

I have given these somewhat detailed references to the measurements of this gorilla's skull because they show in a very clear and obvious manner that from an external examination of the skull one might easily be misled as to the size and form of the cranial cavity, and that, in order to determine from external measurements the proportions of the cranial cavity, skull outgrowths due to other factors than brain growth must be rigorously excluded. Further, these details will serve to emphasise the interesting fact that the gorilla's skull is decidedly brachycephalic. This character is by no means restricted to the gorilla, for it has been clearly proved by Virchow, Schwalbe, and others that all the anthropoid apes are markedly round-headed. Ever since the introduction by the illustrious Swedish anthropologist Anders Retzius of a classification of skulls according to the proportions between their length and breadth great attention has been paid to this peculiarity in different races of mankind. It has been generally held that brachycephaly indicates a higher type of skull than dolichocephaly, and that the increase in the size of the brain in the higher races has tended to produce a brachycephalic skull. When the cranial walls are subject to excessive internal pressure, as in hydrocephalus, the skull tends to become distinctly brachycephalic, as a given extent of wall gives a greater internal cavity in a spherical than an oval form. In estimating the value of this theory as to the evolutionary line upon which the skull has travelled, it is obvious that the brachycephalic character of the skulls of all the anthropoid apes is a fact which requires consideration.

Although an adult male gorilla such as I have selected presents in an extreme degree outgrowths from the cranial wall masking the true form of the cranial cavity, the same condition, though to a less marked extent, is met with in the human subject. Further, it is interesting to note that the length of the skull is more liable to be increased by such growths than the breadth, since they occur especially over the lower part of the forehead and to a less degree at the back of the skull, while the side walls of the cranium in the region of its greatest breadth generally remain thin.

Few if any fossils have attracted an equal amount of attention or given rise to such keen controversies as the "Neanderthal" and the "Trinil" skull-caps. According to some authorities both these skull-caps are undoubtedly human, while others hold that the "Neanderthal" belongs to an extinct species of the genus *Homo*, and the "Trinil" is the remains of an extinct genus—*Pithecanthropus erectus* of Dubois—intermediate between man and the anthropoids. One of the most obvious and easily recognised peculiarities of these skull-caps is the very marked prominence of the supra-orbital arches. The glabella-occipital length of the

<sup>1</sup> "Studien über *Pithecanthropus erectus*," *Zeitschrift für Morphologie und Anthropologie*, Ed. i. 1899.

Neanderthal is 204 mm., and the greatest transverse diameter, which is over the parietal region, is 152 mm.—an index of 74.51—while the much smaller Trinil calvaria, with a length of 181 mm. and a breadth of 130 mm., has an index of 71.8. Both these skulls are therefore slightly dolichocephalic. Schwalbe has corrected these figures by making reductions in their lengths on account of the frontal "outworks," so that he estimates the true length-breadth index of the Neanderthal as 80 and that of the Trinil as 75.5. These indices, thus raised about 5 per cent., are considered to represent approximately the length-breadth index of the cranial cavity. A comparison of the external and internal measurements of many recent skulls with prominent glabellæ would, I suspect, show a greater difference than that calculated by Schwalbe for the Neanderthal and Trinil specimens. In a male skull, probably an aboriginal Australian, with a cranial capacity of 1227 c.cm. I found that the glabella-occipital length was 189 mm., and the transverse diameter at the parieto-squamous suture 127 mm., which gives an index of 67.20 and makes the skull decidedly dolichocephalic. The length of the cranial cavity, however, was 157 mm. and the breadth 121 mm. (an index of 77.07 and a difference of nearly 10 per cent.), so that while from external measurements the skull is distinctly dolichocephalic, the proportions of its cavity are such that it is mesaticephalic. It is probable that many skulls owe their dolichocephalic reputation simply to the prominence of the glabella and supra-orbital ridges. An excessive development of these structures is also liable to give the erroneous impression of a retreating forehead. In the Australian skull just mentioned the thickness of the cranial wall at the glabella was 22 mm.; from this level upwards it gradually thinned until 45 mm. above the glabella it was only 6 mm. thick. When the bisected skull was placed in the horizontal position the anterior surface of the frontal bone sloped from the glabella upwards and distinctly backwards, while the posterior or cerebral surface was inclined upwards and forwards. In fact, the cranial cavity in this region was separated from the lower part of the forehead by a wedge-shaped area having its apex upwards and its base below at the glabella.

The cranial wall opposite the glabella is not appreciably thicker in the Neanderthal calvaria than in the Australian skull to which I have already referred, and the form of the cranial cavity is not more masked by this prominence in the Neanderthal than in many of the existing races.

Although the Neanderthal skull is by no means complete, the base of the cranium and the face bones being absent, still those parts of the cranial wall are preserved that are specially related to the portion of the brain which subserves all the higher mental processes. It includes the frontal, parietal, and upper part of the occipital bones, with parts of the roof of the orbits in front, and of the squamous division of the temporal bones at the sides. On its inner or cranial aspect there are markings by which the boundaries between the cerebrum and the cerebellum can be determined. In a profile view of such a specimen an inion-glabellar line can be drawn which will correspond very closely to the lower boundary of the cerebrum, and indicate a horizontal plane above which the vaulted portion of the skull must have contained nearly the whole of the cerebrum.

Schwalbe<sup>1</sup> has devised a series of measurements to illustrate what he regards as essential differences between the Neanderthal skull-cap and the corresponding portion of the human skull. From the inion-glabellar line another is drawn at right angles to the highest part of the vault, and by comparing the length of these two lines we can determine the length-height index. According to Schwalbe this is 40.4 in the Neanderthal, while the minimum in the human skull is 52. He further shows that the frontal portion of the vault, as represented by a glabella-bregmatic line, forms a smaller angle with the base or inion-glabellar line, and that a vertical line from the posterior end of the frontal bone (bregma) cuts the inion-glabellar further back than in the human subject. Prof. King, of Galway, attached special importance to the shape and proportions of the parietal bones, and more particularly to the fact that their mesial borders are shorter than the lower or temporal, whereas the reverse is the case in recent man. This feature is obviously related to the defective expansion of the

Neanderthal vault, and Prof. Schwalbe also attributes considerable significance to this peculiarity.

Another distinctive feature of the Neanderthal skull is the relation of the orbits to the cranial wall. Schwalbe shows that its brain-case takes a much smaller share in the formation of the roof of the orbit than it does in recent man, and King pointed out that a line from the anterior inferior angle of the external orbital process of the frontal bone, drawn at right angles to the inion-glabellar line, passed in the Neanderthal in front of the cranial cavity, whereas in man such a line would have a considerable portion of the frontal part of the brain-case anterior to it.

From the combined results of these and other measurements Schwalbe arrives at the very important and interesting conclusion that the Neanderthal skull possesses a number of important peculiarities which differentiate it from the skulls of existing man, and show an approximation towards those of the anthropoid apes. He maintains that in recognising with King<sup>1</sup> and Cope<sup>2</sup> the Neanderthal skull as belonging to a distinct species, *Homo Neanderthalensis*, he is only following the usual practice of zoologists and palaeontologists by whom specific characters are frequently founded upon much less marked differences. He maintains that as the Neanderthal skull stands in many of its characters nearer to the higher anthropoids than to recent man, if the Neanderthal type is to be included under the term *Homo sapiens*, then this species ought to be still more extended, so as to embrace the anthropoids.

It is interesting to turn from a perusal of these opinions recently advanced by Schwalbe to consider the grounds on which Huxley and Turner, about forty years ago, opposed the view, which was then being advocated, that the characters of the Neanderthal skull were so distinct from those of any of the existing races as to justify the recognition of a new species of the genus *Homo*. Huxley, while admitting that it was "the most pithecid of human skulls," yet holds that it "is by no means so isolated as it appears to be at first, but forms in reality the extreme term of a series leading gradually from it to the highest and best developed of human crania." He states that "it is closely approached by certain Australian skulls, and even more nearly by the skulls of certain ancient people who inhabited Denmark during the stone period." Turner's<sup>3</sup> observations led him to adopt a similar view to that advanced by Huxley. He compared the Neanderthal calvaria with savage and British crania in the Anatomical Museum of the University of Edinburgh, and found amongst them specimens closely corresponding to the Neanderthal type.

While yielding to no one in my admiration for the thoroughness and ability with which Schwalbe has conducted his elaborate and extensive investigations on this question, I must confess that in my opinion he has not sufficiently recognised the significance of the large cranial capacity of the Neanderthal skull in determining the zoological position of its owner, or made sufficient allowance for the great variations in form which skulls undoubtedly human may present.

The length and breadth of the Neanderthal calvaria are distinctly greater than in many living races, and compensate for its defect in height, so that it was capable of lodging a brain fully equal in volume to that of many existing savage races and at least double that of any anthropoid ape.

A number of the characters upon which Schwalbe relies in differentiating the Neanderthal skull-cap are due to an appreciable extent to the great development of the glabella and supra-orbital arches. Now these processes are well known to present very striking variations in existing human races. They are usually supposed to be developed as buttresses for the purpose of affording support to the large upper jaw and enable it to resist the pressure of the lower jaw due to the contraction of the powerful muscles of mastication. These processes, however, are usually feebly marked in the microcephalic, prognathous, and macrodont negro skull, and may be well developed in the macrocephalic and orthognathous skulls of some of the higher races. Indeed, their variations are too great and their significance

<sup>1</sup> "The Reputed Fossil Man of the Neanderthal," *Journal of Science*, 1864.

<sup>2</sup> "The Genealogy of Man," *The American Naturalist*, vol. xxvii. 1893.

<sup>3</sup> "The Fossil Skull Controversy," *Journal of Science*, 1864.

<sup>1</sup> "Ueber die specifischen Merkmale des Neanderthalschädels," *Verhandl. der anatomischen Gesellschaft in Bonn*, 1901.

too obscure for them to form a basis for the creation of a new species of man. Both Huxley and Turner have shown that the low vault of the Neanderthal calvaria can be closely paralleled by specimens of existing races.

If the characters of the Neanderthal calvaria are so distinctive as to justify the recognition of a new species, a new genus ought to be made for the Trinil skull-cap. In nearly every respect it is distinctly lower in type than the Neanderthal, and yet many of the anatomists who have expressed their opinion on the subject maintain that the Trinil specimen is distinctly human.

Important and interesting as are the facts which may be ascertained from a study of a series of skulls regarding the size and form of the brain, it is evident that there are distinct limits to the knowledge to be obtained from this source. Much additional information as to racial characters would undoubtedly be gained had we collections of brains at all corresponding in number and variety with the skulls in our museums. We know that as a rule the brains of the less civilised races are smaller, and the convolutions and fissures simpler, than those of the more cultured nations, beyond this but little more than that definitely determined.

As the results of investigations in human and comparative anatomy, physiology, and pathology, we know that definite areas of the cerebral cortex are connected with the action of definite groups of muscles, and that the nervous impulses starting from the organs of smell, sight, hearing, and common sensibility reach defined cortical fields. All these, however, do not cover more than a third of the convoluted surface of the brain, and the remaining two-thirds are still to a large extent a *terra incognita* so far as their precise function is concerned. Is there a definite localisation of special mental qualities or moral tendencies, and if so where are they situated? These are problems of extreme difficulty, but their interest and importance are difficult to exaggerate. In the solution of this problem anthropologists are bound to take an active and important part. When they have collected information as to the relative development of the various parts of the higher brain in all classes of mankind with the same thoroughness with which they have investigated the racial peculiarities of the skull, the question will be within a measurable distance of solution.

#### UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

DR. DAVID HEPBURN has been appointed professor of anatomy at the University College of South Wales and Monmouthshire, and Dr. T. J. Jehu professor of geology in the University of St. Andrews.

THE distribution of medals and prizes to the students of the Royal College of Science will take place in the lecture theatre of the Victoria and Albert Museum, South Kensington, at 2.30 p.m. on October 8, when an address will be delivered by Prof. Farmer, F.R.S.

EIGHTEEN lectures, open to the public without payment or ticket, will be given at University College, London, during October by professors in the faculties of arts and laws and of science. On October 7 a lecture on "Architectural Evolution," introductory to the work of the School of Architecture, will be given by Prof. F. M. Simpson. Sir William Ramsay will lecture on the gases of the atmosphere, and their connection with radium and its emanations, on October 6.

THE "Education Directory," just published by the Education Committee of the Oxfordshire County Council, shows that the committee has ordered a special survey of the educational conditions of the area over which it has control. Until this inquiry has been held the committee has decided that the higher education of the county shall be carried forward on the lines previously laid down by the Technical Instruction Committee, only modified in so far as last year's Act gives wider powers to the Education Committee.

THE research, statistical and biometric laboratory of University College, London, under Prof. Karl Pearson, offers good opportunities for post-graduate students and research workers in many fields of inquiry. The aim of the

department is to give exact training in both observation and computation. Lectures are provided in both elementary and advanced statistics, and the general theory of statistics is so developed as to be of service not only to "biometrists," but to those who propose in the future to deal with social, economic or vital statistics. The training thus gained is far more profitable than any mere examination curriculum for those professions which require powers of careful observation, of original thought, or of accurate computation.

#### SOCIETIES AND ACADEMIES.

PARIS.

**Academy of Sciences**, September 21.—M. Albert Gaudry in the chair.—Parthenogenesis by carbonic acid obtained with eggs after the emission of the polar globules, by M. Yves Delage. It has been shown in previous work by the author that the eggs of the sea urchin are absolutely refractory to the action of carbonic acid. The effect of heat alone, or of shaking alone, gave also negative results, but moderate shaking at 30° C. in presence of carbonic acid was successful in producing the desired result, segmentation taking place in about 60 per cent. of the eggs.—On the production of sugar in the blood during the passage of the latter through the lungs, by MM. R. Lépine and Boulud. From the experiments described the authors conclude that, during the passage of the blood through the lungs, there is not only a glycolytic, but also a glycogenic process, hitherto unnoticed.—On monodrome functions and differential equations, by M. Edm. Maillet.—On the properties and constitution of the manganese steels, by M. Léon Guillet. The metallographic and mechanical tests are in perfect agreement with each other, and show that there is great similarity between nickel and manganese steels.—The diagnosis of biliary calculi by preliminary radiography, by MM. Mauclaire and Infoit.—The germination of orchids, by M. Noël Bernard.

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