BRITISH MEDICAL JOURNAL

LONDON SATURDAY AUGUST 4 1956

THE NATURE OF GENIUS*

BY

ERNEST JONES, M.D., D.Sc., F.R.C.P.

Consulting Physician, London Clinic of Psycho-analysis

One hundred years ago there came into life a being whose long years of work and insight were to make such contributions to knowledge as profoundly to influence the civilization of every country. And we may safely say that the full impact of that influence has yet to be experienced. Whoever stands in my place in another hundred years from now will in his commemorative speech—and I am confident there will be one—be able to report further progress in the assimilation and application of Freud's discoveries to an extent which it is impossible for us now to predict.

I chose the title of my lecture for its brevity, but it would have been more modest and more accurate had I entitled it "Some of the Factors Conditioning the Workings of Certain Forms of Productive Thinking." You will allow me to rectify it in this sense.

There is a quite stupendous literature on the subject of what Ostwald called "geniology," which would necessitate a large volume merely to summarize. This is certainly not the place to attempt any such compilation, but it is worth while commenting on the relative fruitlessness of so many of the attempts to solve the problem of genius. I should attribute that largely to the emotional ambivalent attitude so commonly shown in the approach to the topic. It has been well said that "there is a sort of doom overshadowing the very conception of genius: everyone who approaches it is drawn into a murky orbit of adoration and contempt, idolatry and scorn, profundity and shallowness." On the one hand, there are the writers who display a dithyrambic narcissistic identification with geniuses which allows the authors to praise their own glory under the guise of adoration. The Marquis de L'Hôpital asked: "Does he eat, drink and sleep like other men? . . . I represent him to myself as a celestial genius, entirely disengaged from matter." Such writers indignantly deny that genius has any relation to mere talent. De Quincey, for instance, maintained that the two are "not merely different, but are in polar opposition to each other." One author even regarded genius as "a psycho-biological mutation," from which it is only a step to contemplating the future selective breeding of geniuses.

On the other hand, more envious writers have laboured to find various ways of directly or indirectly disparaging men of genius and their achievements. The most popular one, from the time of Lombroso and Nordau onwards, is to insist that geniuses are psychopaths and mostly tainted with insanity, their achieve-

ments being lucky and more or less accidental by-products. The literature on this aspect of the problem is very extensive, but I have not found it illuminating. One can also detract from any credit due to the genius by asserting it was the result purely of heredity, so that we owe him no praise. One of the most original writers on the topic, Lange-Eichbaum, goes so far as to maintain that what constitutes a genius is the height of fame to which his worshippers raise him, this being the reason why the decision of who precisely is a genius varies from one period to another. But perhaps he did not sufficiently distinguish here the matter of subjective recognition from that of the actual objective achievement.

In the first place we may ask whether there really is such a thing as genius—that is to say, any attribute that differs essentially in its very nature from those present in all human beings. It is a question that has been often debated, but I propose to answer it from the start with a decided negative, and in doing so I find myself in agreement with such a high authority as Kant. All Freud has taught us concerning the regular laws of mental development goes to confirm the view that the manifold differences between various individuals, and indeed between the various races of mankind, are quantitative rather than qualitative, and this conclusion is only slightly modified by the reflection that a quantitative difference may on occasion be so striking as to give the impression of something qualitative and absolute. The question seems to me to resemble that concerning the presence in mankind of something qualitatively different from anything present in other animals—namely, the divine gift of a soul—and I need hardly say that this also finds no support in either biological or psychological researches. Indeed, the original meaning of the word "genius" was a designation for a semi-divine spirit who on appropriate occasions visited certain fortunate mortals and inspired their creations, after which it could presumably wander forth in search of other habitats. We still retain this sense of a discarnate spirit when we speak of a *genius loci* or of the "genius of a language" which institutes changes independently of any individual volition. It was only in 1700 that the term began to designate the actual person who was thought to be inspired by something mysterious within.

We apply the term "genius" more often to artists, particularly poets, whose intuition at times seems to border on the miraculous, than to men famous for more purely intellectual achievements. It is very possible that the conditions of creative genius are not identical in these two groups. At all events I am so much less at home

*Address delivered at the Royal Society of Medicine on the occasion of the centenary of the birth of Sigmund Freud.

with the former that I propose here to refrain from any consideration of its nature, and will refer you to Ernst Kris's masterly study of artistic creativeness. Even the intellectual group itself is by no means homogeneous. We speak of the genius of Napoleon, for instance, because of the degree in which both his military and his administrative capacities transcended those of the average being. I will therefore narrow my field still further to that of scientific production of the highest order.

Attributes of Genius

The number of those whose claims to belong to this Olympus are universally recognized is very small. After listing such names as Newton, Darwin, and Einstein we begin to enter a more debatable territory. "The genius of Freud" is a phrase that has been used so widely that I think we must subscribe to a truth contained in it. Characteristically enough, Freud himself vehemently dissented from its being applied to him. Even as far back as 1886, when he was 29, he wrote to his betrothed: "There was a time when I grieved that Nature had not, in one of her gracious moods, impressed on me that stamp of genius as she sometimes does. Since then I have long known that I am no genius, and I no longer understand how I could have wished to be one. I am not even very talented; my whole capacity for work probably lies in my character attributes." On one occasion in later life when it was applied to him he burst out with the protest: "Geniuses are unbearable people. You have only to ask my family to know how easy a person I am to live with. So I cannot be a genius." This disclaimer, however, was based on a very partial definition of genius, so we need not take it too seriously. But to ask in what sense the term can properly be used of Freud leads us into the heart of our subject and raises a number of difficult problems.

The numerous attempts to define genius have not proved very helpful. On one occasion some thirty definitions were listed, but for present purposes we may be content with that offered by the *Encyclopaedia Britannica* as "the highest conceivable form of original ability, something altogether extraordinary and beyond even supreme educational prowess." One notes here what is certainly a characteristic attitude of the beholder, that of astonishment or even amazement, one that is doubtless the source of the intense admiration the productions of genius so often evoke. It gives rise to the notion of mystery about the achievements of genius, and hence to that of its supernatural nature. Of all their characteristics Révész selects this one of *surprise* as being the most central, to which all others are accessory, and he perspicaciously remarks that it is typical for this feeling to be repeated, however often one contemplates the achievement.

Intuition; Spontaneity; Periodicity

This seems to accord with the frequency with which geniuses often receive their inspiration in a sudden flash that startles the recipient himself. It is a feature that has always been recognized. Both Plato and Aristotle commented on it, and they associated it with the divine source of the inspiration. The description of Apollo in the third book of *Hyperion* seemed to Keats to have come by chance or magic—to be, as it were, something given to him. He said also that he had often not been aware of the beauty of some thought or expression until after he had composed and written it down. It had then struck him with astonishment and seemed rather the production of another person than his own. Alfred Russel Wallace wrote: "Finally both Darwin and myself, at the critical period, had our attention directed to the system of *positive checks* as expounded by Malthus in his *Principles of Population*. The effect was analogous to that of friction upon the specially prepared match, producing that flash of insight which led us immediately to the simple but universal law of the 'survival of the fittest.'" This is, however, a feature by no means always present. The flash of insight which Wallace de-

scribed did presumably happen to him, but Darwin himself seems to have reflected on the suggestion more calmly. No one can have accepted revelation more tardily and gradually, even cautiously and very timidly, than Darwin, whose dawning vision came only as the result of many years of hard work.

In a disquisition on this element Lessing wrote: "How many conclusions would seem theoretically irrefragable had not genius succeeded in demonstrating the contrary," a statement that applies peculiarly aptly to much of Freud's work. In describing a recent discovery in physics Dr. Gabor made the interesting remark: "This statement has that touch of offending common sense which is the hallmark of every truly important scientific discovery." Freud's discoveries satisfied this criterion in full measure. Many philosophers and psychologists have shown conclusively that in theory there can be no such thing as unconscious mental processes, and our common sense fully agrees; yet, as Charcot said in a phrase Freud was fond of quoting, "*ça n'empêche pas d'exister*." I think we shall agree that there was enough of this element of surprise with which Freud's work has been greeted to warrant our attaching at least this one to the attributes needed to qualify for the title of genius.

Allied to this feature of intuitive inspiration is the characteristic spontaneity with which the productions of genius appear. They can never be brought about by a deliberate effort of will, and nothing can ever force them. Lowell has wittily said that "talent is that which is in man's power; genius is that in whose power man is," and Voltaire with equal wit expressed it thus: "The works of genius are to compilations what love is to marriage; Hymen comes when one calls and Cupid when it pleases him." Most writers on the subject are agreed that the achievements of a genius are out of his power. Goethe, who could speak from personal experience, laid it down that "all productivity of the highest kind, every significant piece of insight, every discovery, every great thought that proves fruitful and leads to further consequences, stand in the power of no one, and are beyond all earthly might. A human being has to regard them as un hoped-for gifts from above which he has to receive and revere with joyful thanks." Another poet put it in this way: "Genius does what it must and Talent does what it can." It is clear that this attitude of passive surrender towards the flowing in of the valuable ideas must be significant for the psychology of the productive process.

A third feature which has often been noted is that of periodicity. Moebius, for example, made a study of the cycles of productivity displayed by Goethe, and the same feature has been noted with Beethoven and many other geniuses. Freud himself often maintained that his productivity was at its maximum in cycles of seven years, though he had to strain the evidence somewhat to make it fit this precise span. Still, his most original productions are only a year or two out from his estimate: "Cocaine"; *Aphasia*; *Interpretation of Dreams*; *Theory of Sexuality*; *Totem and Taboo*; *Beyond the Pleasure Principle*; *Inhibitions, Symptoms and Anxiety*; and the *New Introductory Lectures* make a series that approximate to this observation. As might be expected, the notion of periodicity has been interpreted in clinical terms of cyclothymia, but with only occasional evidence in support of this. Freud, for instance, despite plenty of external grounds for despondency, suffered from only one mild and transitory attack of depression in his whole life, and his variation in moods never transcended the normal ambit. It seems to me that most of these cycles in productivity are sufficiently explained by the natural rhythm of life, particularly the variations in libidinal tension that belong to this.

The features just described may be encountered indiscriminately with all forms of genius, and I shall now consider three or four further ones which are much more characteristic of scientific production than of artistic inspiration. The most obvious of these is the indispensable one of absolute honesty. It was Goethe who laid down the law that "the first and last task required of genius is love of truth."

Originality

Then we come to the somewhat vexed matter of originality. It is certainly a more frequent occurrence for a man of science to make a new discovery than for a poet to invent an entirely fresh theme or even phrase, but, on the other hand, the title of genius is only very occasionally bestowed on the discoverer of new facts or ideas in science. W. H. George, in his interesting book *The Scientist in Action*, has drawn what impresses me as a very valid distinction here between what he calls the *new* and the *essentially new*. The simply *new* concerns discoveries of a new fact which may never have been known before. Or it may concern a theory which modifies a previous one by adding some new consideration or factor. The *essentially new*, however, signifies an entirely fresh and different way of looking at things. Wordsworth shortly defined an act of genius as "the introduction of a new element into the intellectual universe." Thus Einstein's theory of relativity, although it modifies and adds to Newton's theory, was not evolved out of it as an extension; it came about from looking at certain physical phenomena in a radically new way.

George gives two examples to illustrate his point, and they are worth quoting. As a result of Sir Joseph Thomson's classical experiments, the phenomena of atomic physics were for 30 years described in terms of a particle of electricity, the now familiar electron. This concept served admirably to account for a wide range of phenomena, but certain optical ones caused a difficulty. Then de Broglie, in 1925, introduced an entirely different way of regarding an electron—namely, in terms of a wave—and to this day both these concepts have to be used for different purposes without any conclusion having been reached about which of the two is the more fundamental. Then, again, for aeons—in fact, until the turn of this century—all disease had always been regarded as being due to something which was not present in health attacking the body, whether this was a malignant demon, a draught of cold air, or an infectious agent. Drugs and other forms of treatment were simply designed to counteract the harmful things that were producing the illness. It was not until within living memory, in observations on scurvy culminating in Gowland Hopkins's brilliant experimental work, that it occurred to anyone that various diseases could be due merely to the *absence* of something in the body. That was an essentially new way of looking at the matter, and it has resulted in our present mass of complex knowledge about the various vitamins.

Darwin's doctrine of natural selection is another good example of an entirely new way of regarding the complex phenomena of living creatures. This feature has been commented on in respect of Freud. I will quote from a recent writer: "From time to time men of outstanding gifts alter our outlook on the world in one relatively restricted field or another. But changes in the fundamental categories in terms of which we interpret the world and each other, in the very framework of our thought and language, are rare in history; and more rarely still can we attribute such a change to one man. But about Sigmund Freud there can be no doubt."

A New Idea

Freud's genius is peculiarly interesting in that it has led to looking at mankind in an essentially new way, although what he actually discovered was not in itself so very new. It has been possible to trace most of Freud's ideas to earlier sources; whether he actually obtained them in that way or only from his personal investigations is another matter. That holds goods for the division of the mind, with a moral conflict between its two halves; the importance of sexuality in human life and even its specific connexion with the psychoneuroses; the significance of repression, and so on. In fact, so far as I know, there was only one idea he discovered which had never been previously recorded. It was a very important one: the universal fear of castration among men. Dr. Henri Ellenberger, who has devoted some years

of research to the matter, extending through mediaeval to classical times, assures me that in spite of the age-old custom of castration in various communities he has not been able to find any mention of the *fear* of it in the writings of any historian, philosopher, or even psychiatrist. I have, however, recently come across the record of a patient who suffered from complete impotence as the result of his dreading castration at the hands of his father as a small child, and who was restored to complete potency when that fear was removed. The episode took place some three thousand years ago, and the gentleman was given the name of Iphiclus, "famous might," so the cure was very thorough. Psychotherapists received high fees in those days. The particular one who effected this cure, Melampus, who was reputed to antedate Aesculapius as the first physician, received a third of a kingdom and the king's daughter for his wife as a reward for curing her of a frenzy. In those days marriage with an ex-patient was not frowned on.

That for three thousand years this dread fear was never mentioned is a testimony to the desperate efforts we make to prevent ourselves from becoming aware of it. Freud may of course have been cognizant of the story in Greek literature, but if so it would afford one more illustration of the peculiar nature of his genius. For this consisted not so much in the discovery of new things but in the fearless and pioneering exploration of them. Through his detailed investigations, and not at all by personal propaganda, he compelled a section of the community, those with ears to hear, to accept a number of unwelcome but extremely important truths. He took seriously what had previously been hinted at, often merely whispered, and there is no doubt that an unusually high courage was an essential element in the achievement of his genius. Furthermore, although some achievements of genius have an unmistakable relation to the atmosphere of the period when they were accomplished, so that one feels someone else would surely have done the same thing, this was assuredly not true of Freud. One may legitimately doubt if anyone else would have come forward had Freud not done so. We might well have had to wait another hundred years or more for someone of his stature.

Sense of the Significant

Closely akin to this mysterious feeling for what is true seems to go a sense of the really significant. This enables a genius, or compels him, to generalize a finding where a lesser mortal would have cautiously gone on collecting more evidence before venturing on a general statement. Freud, although he would be accounted a man of sober and reflective judgment, afforded several instances of this kind of superlative boldness and sureness. When he discovered in himself the fear of castration he felt instinctively that the same must be true of all men, and when he also came across the Oedipus complex he did not hesitate to hold it valid not only for all those now on this earth but also for those who populated it many thousands of years ago. These were breath-taking generalizations, and it is not surprising that so many have balked at accepting them or have tried to limit them to certain societies only.

This remarkable capacity for perceiving with somnambulant sureness what is absolutely and universally true is of great interest. It transcends the simple love of truth itself, essential though this may be. I think it must occur at special moments when there is an unusual, and often only temporary, fusion of all the elements in the mind in a peculiar degree of harmony. The sureness arises from the completeness with which the ego is receiving in an unquestioning fashion the message from the preconscious. At that moment there is a complete coincidence between the striving of the id, the permission of the super-ego, the acceptance by the ego, and the external perception of the problem being studied. Emerson well said that "to believe your own thought, to believe that what is true for you in your private heart is true for all men—that is genius." Schopenhauer made a similar point when he said: "Always to see the general in the particular is the very foundation of genius."

Power of Concentration

The third attribute worthy of mention here is that of the power of concentration. There is no doubt that in the majority of instances important scientific discoveries have meant a great deal of hard work as well as intense concentration. Buffon, the great naturalist, considered that genius was nothing else than a greater aptitude for patience than that possessed by other men, which is rather like Carlyle's well-known dictum that "genius is first of all a transcendent capacity of taking trouble." Ramón y Cajal, the distinguished neurologist, described the process of scientific discovery as follows: "The ideal case would be that of a scientist who during his period of mental incubation would pay no heed to any thought that is extraneous to his problem, like a somnambulist who listens only to the words of the hypnotizer." And another writer, referring to "the self-surrender so familiar to creative minds," says: "The concentration of such a state may be so extreme that the worker may seem to himself or to others to be in a trance." In that connexion there comes to my mind an account Freud's daughter gave me of the time when he was composing the great final chapter of *The Interpretation of Dreams* in the summer of 1899. She recollected that when he was interrupted by being called to a meal he walked as if in a trance, oblivious of his surroundings.

At this point we enter the realm of depth psychology, and numerous problems throng upon us. What is the significance of this extraordinary concentration and intensity? What powerful impulses are driving their way at such moments? For there is every reason to suppose that men of genius are characterized by possessing exceptionally strong emotions and usually a correspondingly strong capacity for containing them. The tension induced by the preceding efforts to find a solution gradually mounts until it reaches a climax. The great mathematician of genius, Henri Poincaré, in describing how he made his own discoveries, said: "One is struck by these appearances of sudden illumination, obvious indications of a long course of previous unconscious work. . . . These sudden inspirations are never produced except after some days of voluntary efforts which appeared absolutely fruitless." Einstein has given a very similar description, and in the Fliess correspondence there are numerous allusions to the exhausting stress and strain Freud experienced in the continuously hard work of attaining his various pieces of insight. Kretschmer speaks of the great scientists' "passionate emotions developing which drive their thought constantly in the same direction, producing the utmost tension until at last a short-circuit occurs: somewhere a spark leaps to a new spot where up till then no human thought had ever passed."

What is the relation of the conscious interest in a particular problem to the unconscious forces that have produced so much tension? Müller-Freienfels maintains that what is characteristic is the being thrilled and gripped by the problem in some mysterious way that transcends in strength the mere desire to know, but perhaps he underestimates here the strength of just that desire in the unconscious. It is, however, noteworthy that he compares the thrill in question with the emotion of passionate love, and we are familiar enough with the connexion between the sexual instinct and the desire to know; it is a matter that Freud expounded fully in his work on Leonardo. Evidently there must be a special coincidence between the unconscious impulses and some essential feature of the objective problem. In the preliminary cogitation various shiftings and similar mechanisms are going on in the unconscious, the purpose of which is to achieve a sufficient degree of harmony with the censoring functions of the super-ego by means of which the accompanying guilt is kept in abeyance. At the successful moment there must have been achieved a quite remarkable degree of integration between the ego, the super-ego, and the id. It is no doubt this successful degree of synthesis, the overcoming of all barriers, that accounts for the sense of elation at the final moment of triumph. As is well known, such a complete synthesis is rarely more than a temporary one. The

super-ego which has been circumvented soon resumes its sway, and elation is followed by self-criticism, disparagement, and even doubt about the solution reached. I have described at some length these phases which Freud underwent during and after one of his most difficult achievements: the composing of *Totem and Taboo*.

Prerequisites of Genius

I now come to a modest contribution which I think could be made to our knowledge of the conditions governing the productivity of genius. It had long struck me that an essential prerequisite of such productivity must lie in a particular scepticism on the part of the genius. He must have refused to acquiesce in certain previously accepted conclusions. This argues a kind of imperviousness to the opinions of others, notably of authorities. Furthermore, he often has the capacity of seeing the existence of a problem where others have passed it by; he has refused to take something for granted as being either without meaning or too insignificant to bother about. This aloofness sets him free to speculate and investigate. The classical example of scepticism being deliberately employed is of course that of Descartes, who tried to start by doubting everything. The task, however, proved harder than he had expected, and his scepticism did not prevent him from indulging in rather wild speculations in his theory of vortices.

I once asked Freud what he thought was the explanation of the extremely free thinking that scientific pioneers and discoverers must have. He did not answer the question directly, but he pointed out that such freedom is always obtained under the condition that another aspect of mental functioning is inhibited. The example he took was that of Forel. In the face of the puritanical atmosphere with which he was surrounded in Switzerland, Forel ventured to publish a book on sexual problems which at that time was considered shockingly outspoken. On the other hand, he became an extremely bigoted opponent of the custom of imbibing alcohol in any form. His fanaticism in this respect was so intense as to leave its mark on the present-day Zurich with its flourishing *Alkoholfreier Verein* that is to be seen nowhere else. He infected his successor Bleuler with the same fanaticism, and Jung attributed Bleuler's breach with him to the circumstance of Freud having induced Jung to depart from the faith and to taste the forbidden liquor.

It may well be that the compensatory inhibition of which Freud spoke is the explanation of a feature often remarked in men of genius—namely, a certain naïveté, marked simplicity, and ignorance of the ways of the world. One writer even commented on what he called the *scheinbare Dummheit* (apparent stupidity) often found in such men, though this must surely apply only to a small minority. I note, however, that Thomas Mann, in his famous description of Goethe, comments on "the union in one human being of the greatest intellectual gifts with the most amazing naïveté."

The scepticism and imperviousness to opinion of which I have spoken were prominent features of Freud's personality, and they extended over a wide field. Not long after getting to know him, however, I was struck by an exactly opposite feature, one which, it is true, operated in a far more limited field. I refer here to a curious credulity, a willingness to believe what he was told, whether it was really likely or not. To it I would ascribe his well-recognized difficulty in forming an accurate estimate of personal character, a deficiency of which he himself complained. In my biography I have given many examples of this credulity, which at times bordered on superstitiousness, but it is worth while commenting on what is perhaps the best-known example of it, since it was that feature which ultimately led him to make one of his very greatest discoveries. I refer to the years when he accepted as true the seduction stories of his patients, which I am sure the vast majority of physicians would have doubted at once and regarded as one more example of the unreliability of hysterics and their tendency to fabrication.

In relating this experience in later years Freud spoke of how despondent and baffled he felt when he found how

deceived he had been and that most of the stories were quite untrue. Baffled he doubtless was, but contemporary evidence in his letters to Fließ reveals that, so far from being despondent, he felt a quite inexplicable elation. He wrote the memorable words: "Can these doubts be only an episode on the way to further knowledge? . . . Between ourselves I have the feeling more of a triumph than of defeat." He could not know at that moment, though his unconscious evidently did, that he was on the brink of one of his most momentous discoveries—the significance of incestuous wishes in infancy.

Pascal pointed out that greatness is never at one extreme but consists of the union between two extremes, an idea which Sainte-Beuve later labelled the theory of the *entre-deux*. My own suggestion is a particular application of this.

In a proper scientific spirit I then wondered whether this observation I had made concerning Freud's personality could have any more general validity as a condition for the productivity of scientific men of genius, and the studies I have made of many of them encourage me to think that it may be so. Allow me to relate a few examples. I will start with the earliest in point of time, Copernicus. His work revolutionized our conception of man's place in the universe and reduced his glorious habitation to an insignificant speck of matter in space, so that Sir Arthur Balfour in one of his cynical moments could describe the story of mankind as "a disreputable episode in the history of one of the minor planets." Actually it is not certain that Copernicus was really convinced that the earth revolved round the sun, but he evidently ventured to doubt whether the sun went round it. So much for his scepticism. His reputation and the immortalizing of his name rest on that alone. But there is another side to the story, which throws light on the motives impelling him to his new conception.

It will be remembered that, starting from the Greek doctrines of perfect heavenly orbits, Ptolemy had constructed an extremely ingenious geometrical scheme of the universe as then known. He found it necessary, however, to introduce a number of what are called epicycles, and moreover to give some of them the form of an ellipse. The scheme worked fairly well for many centuries, but the progress in astronomical knowledge gave it what might be called increasing fits of indigestion which could be cured only by introducing more and more epicycles, so that ultimately the picture became one of bewildering complexity. Many attempts were made in the sixteenth century to simplify matters, including that by Copernicus. Now what really stirred Copernicus was a feeling of dismay and reprobation at Ptolemy's impiety in daring to depart from Aristotle's dictum that all the heavenly orbs and orbits must have the form of a perfect circle to conform with the perfection of the Divine Creator. Copernicus had an absolute belief in Aristotle's infallibility. Therein lay his credulity. And it drove him to search for methods of remedying Ptolemy's irreverence. He then found that by imagining the sun as the centre of the solar system he could devise a scheme, however faulty it afterwards proved to be, that could be built up with the desirable perfect circles. So he died a happy man. He was not the first to do the right thing for a wrong reason—Columbus had given an even more spectacular example not long before. Nor was he by any means the last.

Credulity of Great Men

We then come to the greatest genius of all times, Sir Isaac Newton. It would need an extremely expert mathematician indeed to elucidate the elements of scepticism and credulity entering into his great discoveries in science, nor is it likely that the data for doing so exist. On the other hand, it is easy to show that both these attributes were prominent in Newton's personality. His published scientific work is marked by a rigid objectivity, and it was he who proudly proclaimed the famous sentence, "*Hypotheses non fingo*" (I never manufacture hypotheses). He resolutely refused even to speculate on the actual nature of light or of gravita-

tion, but contented himself with studying their mode of operation. Yet he had in earlier days spent much fruitless time in conducting experiments in alchemy, in the search for the philosopher's elixir, and the means of transmuting metals into gold, and this at a time when alchemy had long passed its prime. Most of Newton's biographers have suppressed the important fact that throughout his life theology was much more important to him than science, and, moreover, theology of a peculiarly arid and bigoted order. There was an astonishing contrast between the extreme credulity he displayed concerning the literal statements of the Old Testament and the scepticism he evinced concerning the cardinal doctrines of the New. He followed Bishop Ussher in dating the Creation from 4004 B.C., and on that basis and the data about the long lives of the patriarchs spent years in conjuring up a chronological history of all the nations of the world, in the course of which he came to unbelievably fantastic conclusions. He was especially engrossed in unravelling the obscure symbolism of the Books of Daniel and of Revelations. From the former he deduced that the tenth horn of the fourth beast must refer to the Roman Catholic Church and confidently predicted its downfall in the year 2000. Similarly, Halley's comet would probably after five or six revolutions fall into the sun so that the earth would be burnt up. He was also a devotee of Jacob Boehme's mysticism. Yet, on the other hand, although he was a constant adherent of the Church of England, he subscribed to the Arian doctrines which deny that of the Trinity and even went further in doubting the divinity of Jesus.

Newton had a markedly irritable and suspicious temperament, and much of the controversy that disfigured his life arose from his credulous belief in the statements of over-candid friends. In later life these qualities deteriorated for a while into paranoid delusions of persecution; perhaps in this connexion it is not irrelevant to remark that Newton never fell in love and never married.

Faraday, the supreme physicist of the nineteenth century, had also his vein of credulousness. He said: "In early life I was a very imaginative lively person who could believe in *The Arabian Nights* as easily as in the *Encyclopaedia*, but facts were important to me and saved me." Throughout his life he was an adherent of the obscure sect of Sandemanians, followers of the religious prophet Robert Sandeman, and for three years regularly preached sermons before them. One must place this in contrast with Faraday's exceptional intelligence in other spheres, since it would be commonplace otherwise.

Darwin was a man of far more placid temperament, and it is probable that any turmoil of emotions found their expression in the psychosomatic afflictions to which he was a martyr. Although destined for the Church, he came gradually to doubt the truth of the official religious doctrine that mankind had been created in God's image for the edification and glory of the Lord of the Universe; in this he was influenced by Lyell's work in geology and perhaps also by his grandfather's teaching on evolution. But his scepticism was tempered by a credulous attitude towards other authorities. Even after his great discovery of the operation of evolution through natural selection he still believed in Lamarck's doctrine of evolution through the inheritance of acquired characters, a doctrine his own work had rendered superfluous and indeed erroneous. It was because of it that he developed his extraordinary theory of pangenesis, according to which minute gemmules in the blood convey the acquired alterations to the germ cells, cells which we know now to be impervious to any such influence.

His friend and contemporary Huxley offers a very interesting contrast to the genius Darwin. Although possessing a wider knowledge than Darwin, and gifted with more originality and a greater intellectual daring, Huxley's actual achievements are of a different order. On first reading Darwin's theory he exclaimed: "How extremely stupid of me not to have thought of that." Now, Huxley was endowed with any amount of scepticism, of indeed a rather pugnacious brand. It has been said of him: "He allowed

himself no prejudice, no sentimentalities, no illusions." But there is no record in his life of any evidence of credulousness to match it and, according to my view, to enable him to make really great discoveries.

Perhaps it is worth mentioning in the present connexion the remarkable epidemic of belief in the cruder aspects of spiritualism that infected several of the leading English physicists early this century: Sir William Barrett, Sir William Crookes, Sir Oliver Lodge, and Sir George Stokes. The number of times the mediums in which they trusted were exposed as frauds made no difference to the tenacity of their beliefs.

Psycho-Analytical Considerations

It would not be out of place on this occasion if I concluded with a reference to some psycho-analytical considerations. The only point I wish to bring forward here is the suggestion of a possible correlation between the credulousness on which I have been laying stress and the characteristically receptive nature of genius. A credulous attitude betokens an uncritical, excessive open-mindedness towards environmental stimuli, and this must go hand in hand with a similar uncritical open-mindedness towards the ideas pressing forward from the preconscious and ultimately from the id. It can afford to be uncritical here because of the relaxing of the inner censorship when harmony is established for the moment between the three mental institutions, ego, super-ego, and id. All this, however, represents only the preliminary stage of the process—an essential one, it is true. It is followed by a far more critical stage during the final act of formulating the new theory or conception. In this stage there is a strict criticism of the incoming ideas combined with an exclusion or even oblivion of the outer world when outer stimuli are regarded as a hostile interference, as in the case of Archimedes they certainly were. The intense concentration of this stage may culminate in the state of trance mentioned earlier.

Now in the first stage the passive, almost self-effacing role of the ego in accepting the ideas pressing in from the pre-conscious must surely be associated with the more feminine aspect of the personality or, as Freud preferred to term it, "the attitude of passive aims." It cannot be chance that so many words describing the process are taken from bodily analogies. The very word "inspiration" signifies a taking-in act on the part of the body. Poets often speak of being pregnant with their fancies, and the words "to conceive" and "to produce" equally apply to bodily activities. A writer can describe his mood as being in labour with an idea or actually giving birth to one. Furthermore, it is noteworthy how often, as constantly happened with Freud himself, the fomenting gestation of thought that precedes that final illumination is accompanied by just that kind of bodily discomfort that suggests the pains of labour. That women have more direct means of expressing this instinct would then account for the undeniable fact of major creative thinking being almost a prerogative of the male sex. It is their substitute, the only one available to them, for the gift of bodily creation bestowed on women.

Conclusion

I will conclude by recalling your thoughts to the man in whose honour this address is given. It will probably be generations before all the implications of his ideas are fully worked out and the stimuli he provided for us fully acted on. Revolutions in thought such as he brought about do not happen very often in history, and it may well be long before another similar one takes place. We do not even know in what sphere of psychology to expect it; it might be one in the genetics of the mind or, on the other hand, in the field of social psychology. In the meantime what can we feel but gratitude towards the memory of a man who gave so richly and so generously? Truly one may well say with his favourite prince: "I shall not look upon his like again."

AMNION IMPLANTATION IN PERIPHERAL VASCULAR DISEASE

BY

E. TROENSEGAARD-HANSEN, F.R.C.S.

Charing Cross Hospital

The purpose of this article is to report the effect on intermittent claudication of implanting human amnion into the thigh in 40 cases of peripheral vascular disease. This procedure was adopted because it had been observed (Troensegaard-Hansen, 1950; Shaw and Troensegaard-Hansen, 1952) that amnioplasty carried out for the treatment of leg ulcers in cases of peripheral vascular disease was followed not only by healing of the ulcer but also by a reduction in the severity of intermittent claudication. That such reduction might not be due solely to the healing of the ulcer was suggested by the fact that several patients claimed that their claudication was less than it had been before the ulcer appeared.

Material

The present series consists of 40 male patients. Their ages varied from 35 to 89, with an average of 60 years. They were selected as being in groups 1 and 2 of intermittent claudication (Professor Boyd's classification). The claudication was due to arteriosclerosis in 38 cases and to Buerger's disease in 2. Symptoms had been present for more than six months in the majority (Table I), and conservative treatment had been applied without significant effect in all of them. Three had been subjected to sympathectomy without effect on the claudication.

The pre- and post-operative condition of the patients was assessed by their tolerance to exercise, the presence or absence of rest pain, the radioactive sodium test, oscillometry, radiography, and skin temperature recordings.

Methods of Investigation

Tolerance to Exercise.—The criteria for tolerance to exercise were walking distance and ergometry. By walking distance is meant the distance which the patient can walk under controlled conditions before the onset of pain in the calf. By ergometry is meant controlled exercise on an ergometer. Two types of ergometers were used. In the first type, devised by Mr. N. C. Lake, the patient rhythmically depresses and releases a pedal, so raising a known weight through a standard distance once per second. This frequency was indicated to the patient by a swinging pendulum. The second ergometer was of the bicycle type, and was pedalled at a standard rate against a constant resistance. The patients' tolerance to these exercises was expressed as time (seconds) required to produce pain in the calf, and is referred to in Table I under ergometry as pain threshold in seconds. Rest pain was assessed in terms of severity, frequency, and duration.

Radioactive sodium tests (see below) were done on normals, on claudicants, and on patients having varied treatment.

Oscillometry was carried out, using a Pachon type of oscillometer. The maximum deflections were noted at different pressures and recorded (Table I).

X-ray examination of the patients' legs for evidence of arterial calcification was carried out.

Skin temperature of the limbs was recorded by means of a mercury skin thermometer.