GENERAL SCIENCE

Science and Scientists

People everywhere are becoming increasingly aware of the way science affects their lives but complaints about the lack of recruits for applied science can still be heard.

Excerpts from the inaugural address of Sir Cyril Hinshelwood, OM, FRS, new president of the British Association for the Advancement of Science, at Cambridge, England, Sept. 1, 1965.

➤ SCIENCE, which was once a private affair, has now become a public concern . . . everyone has become increasingly aware of the power of applied science to affect our lives.

Apart, however, from a desire for practical benefit, something of the romance of science has spread widely, and here, not only inexpensive literature, but radio and television, themselves the children of applied science, have greatly contributed to what can very nearly be called a revolution.

There is nevertheless not much doubt that more general interest centers on applied science than on pure science. Governments are anxious for economic advantages from technology, so too is industry, and so, on the basis of what he is told, is the ordinary man. . . .

Why then do we hear complaints about the lack of recruits for applied science? This is a very complex problem with no short and simple answer, but I think that two influences have been important. The traditional second class status of science in the establishment tended to deter all save the minority with a real vocation for it. . . .

There is also another very significant facet of the situation. Great technological advances are made not necessarily by those with profound insight into the secrets of nature but by those with alert, enterprising, ingenious but quite unacademic minds. . . . In the past our educational system would largely have diverted young people of this sort from any kind of science, pure or applied, and their talents would have flowered in other fields, where the rewards were greater.

Few Ignorant of Science

Since men with the talents and the temperament for turning knowledge to practical use may turn up anywhere, in any social stratum, in any academic discipline and with any general intellectual background, we should see that far, far fewer of them any longer remain ignorant of science and perhaps even proud of their condition, and that those who respond should not find themselves relegated to a subaltern status.

Again and again the key to a great discovery has been an unexpected observation, but generally speaking if it is to be quickly fruitful it must have been made in the context of a well-defined pattern of thought and effort. The famous Fleming mould would not have meant much to an administrator or even a nuclear physicist.

We hear a good deal of talk about speeding up the advance of discovery and application. We all hope this can be done. But let nobody suppose it can be done by mere administrative elaboration or by the imposition of political doctrines. . . . Scientific research of a creative kind is a very difficult business and its application is both adventurous and laborious, calling not only for courage and skill but for that old fashioned commodity known as faith.

The creative scientist is in fact usually more concerned with the relations of things to one another than with the precise verbal analysis of what these things are. He seeks a representation of the world which continually grows by an extension or transformation of what is there already. Thus what many scientists are really after is the adventure of discovery itself.

Oldest Questions Most Absorbing

The questions which still remain the most absorbing are the oldest of all: the nature of the cosmos, the nature of matter, the nature of life.

What is already known about the structure of the universe is surprising enough: thousands of millions of stars forming galaxies; countless galaxies rushing apart from one another with velocities which appear to have increased with the distance from some assumed center. This last fact has suggested, as everyone knows, that at some cosmic zero hour a vast central agglomeration might have exploded, the parts which then received the greatest velocity having by now travelled furthest. . . . If this singular moment actually occurred it must have represented some sort of model point in a process on a still vaster scale, and of this we know absolutely nothing.

The whole idea of a unique origin of things has its rival in that of a continuous creation of matter fed into the known universe steadily in the form of hydrogen, so that what we observe now may have persisted for all time (whatever the phrase "for all time" may mean.)

Meanwhile nature whispers warnings against over simplification by revealing in very remote places the possibility of agglomeration of matter quite different from anything hitherto known, including what have been called "quasi-stellar radio sources." According to previous ideas these are much too far away for their brightness and are fantastically more energetic than they should be in the emission of radiation.

If gravitation is the major force, or apparent force, acting across the stellar universe, it has little to say about the structure and properties of matter itself, which has its own special mysteries in plenty.

Ordinary terrestrial life is very much an affair of chemistry, the whole panorama of which can be interpreted, on the whole very satisfactorily, in terms of the simple set of particles, proton, neutron, electron. But ordinary terrestrial life is an affair of low energies. In the stars and nebulae, nature provides temperatures of fantastic sounding magnitude and the great accelerating machines of modern laboratories provide, at fantastic sounding cost, energies which transcend many millions of times those met in ordinary chemistry. In this strange world of energy-affluence and violence, a bewildering collection of new particles appear. . . . The particles differ in mass and charge: they differ in life time and in the intensity with which they appear to act upon one another. Powerful forces exist which are neither electrical nor gravitational.

Genetic Code

One of the greatest concentrations of recent effort has been on the physics and chemistry of living matter. There is now an essential understanding of the complex molecular patterns which, repeating themselves in endless permutations, can store information in the sequence of their units and in this way constitute a genetic code. . . . All this is a triumph of structural chemistry and of X-ray analysis.

It would be fallacious, however, to suppose that the major code-bearing molecules, the nucleic acids, can as a matter of pure structural chemistry, replicate themselves in isolation. They do so only in the integrated organization of a living cell. The manner of this organization and the way in which it determines the characteristics of life is gradually being pieced together . . . the next step is to ask how cells can group themselves to form tissues and organisms. How the morphology of organisms is established and maintained is also a matter of chemistry and physics which is gradually yielding to patient search and thought. Great advances have been made in understanding the working of the nervous system and we have a rough idea of how that most subtle and elaborate of all computers, the human brain, performs its functions.

But what remains utterly incomprehensible is how and why the brain becomes a vehicle of consciousness. Great heat has sometimes been generated by debates about whether scientists will ever, as it has been crudely expressed, be able to make life in a test tube. The heat at least is wasted. It need change little in our conception of things if they did. . . . Suppose that two suitable cells are made and unite and, in an appropriately controlled environment, develop into a man.

The inscrutable mystery of the relation between this piece of chemistry and physics and the conscious mind remains precisely the same as if the cells were formed by the biochemical processes of human bodies.

If men of science are at all as I depict them, they are not perturbed by the limitation of their possible understanding. There seems, at any rate, to be no foreseeable terminus of their own adventure.

• Science News Letter, 88:162 September 18, 1965