

km). On the other hand, a "pancake" effect operates, whereby the radiating region from a high-altitude bomb forms a huge, flattened disc; as a result, the heat on the ground immediately below the explosion is relatively less fierce, but that at the periphery of the target zone is worse, compared with a low-altitude explosion.

A general picture of the arrival of heat at the ground from a high-altitude explosion, given at the end of the report, shows ten per cent forming a sharp pulse of "direct fluorescence" within the first 10 milliseconds, about half the remaining energy coming within a second, and the rest over a longer period. What determines the likelihood of fire is largely the rate of arrival of energy, but when this rate is very fast, as it can be in the case of a high-altitude burst, there is no information to show over how wide an area fires would be started. Thick cloud could markedly reduce the effect of the bomb.

Russians unwrap their pocket powerplant

THE Americans at least have no cause to love "Daisy", whose sultry charms caused such a stir at the "Atoms for Peace" conference in Geneva last week. For this "direct-conversion" reactor—Romashka in her native Russian tongue—proved to be a significant advance on US achievements in a field that the Americans believed they had to themselves.

The SNAP (system for nuclear auxiliary power) programme was moving briskly until Mikhail Millionshchikov and his 24 colleagues introduced the Romashka. The SNAPs embrace both nuclear reactors and isotopic generators (even numbers for the former, odd for the latter), and prominent on the American exhibit was the 10A, a reactor whose cone of silicon-germanium thermoelectric elements converts 33.5 kilowatts of thermal energy into 500 watts of electricity at 28 volts, to supply a spacecraft. Altogether the Atomic Energy Commission now has nine major contractors engaged on its SNAP programme—a measure of the importance with which the Commission invests the programme.

But Romashka, also using silicon-germanium elements, operates at 800°C compared with SNAP 10A's 580°C—no mean advance. She began to generate power just in time for the conference, on 14 August, at the Igor Kurchatov Atomic Energy Institute. Her core, built of plates of uranium carbide and graphite, is controlled by four rods to generate the same power, 500 watts, continuously.

The heat released by fission of uranium-235 is transferred by conduc-

isotopes, let alone reactors, must surely heed its value now.

How a hormone activates a gene

HORMONES are secreted by ductless glands into the bloodstreams and are carried to cells elsewhere in the body whose activities they modify. A good deal is known about the effects on tissues of the hormones so far discovered, but very little about the mechanisms achieving these effects. A paper recently presented in New York by Dr S. J. Segal, of the Rockefeller Institute, provided evidence that at least one important hormone acts by uncovering or activating a portion of the genetic material in the target cells.

All cells in a body contain a full set of genes, but in any particular type of cell only a part of the available genetic material is active. All mammalian cells, for example, contain the instructions necessary for the synthesis of muscle proteins, but only muscle cells actually produce the stuff. In another paper on the same theme, Dr V. G. Allfrey, also of the Rockefeller Institute, suggests that in the average

there is no contradiction between causality as understood in physics, the Darwinian principle of natural selection by fighting for life, and the requirements of ethics. These requirements are the creation of social man and claim validity only in the sphere of human relations. Darwinian selection—as with the physical sphere—is based on causality, with the difference, however, that in the biological field the main role is taken by sensual perception and nervous processes. In no case can Darwin's principle be applied without modification to human activities because of the important role played by tradition and purposeful action in the field of human relations. In this respect much confusion was caused by the liberal school of political economy.

With kind regards,
yours,
Albert Einstein.

A fortnight later Einstein received another letter from Mr Kolačný. This one contained more questions and doubts, and once again Einstein went to some pains to help his unknown correspondent. On 11 February, 1952 he wrote:

Dear Mr Kolačný,

I shall attempt to explain my views briefly and, where possible, clearly, without touching upon the refinements which physics is adding to the problem at present through the statistical concept of the atomic phenomena.

The central point of the entire question is the problem of free will, of freedom, which Schopenhauer rejected—rightly in my view. From the viewpoint of natural philosophy, or, as Spinoza would have said, from God's point of view, everything including human actions and emotions, takes a strictly causal course. There can be no question of any freedom.

From man's point of view, however, things are different. Here an illusion of freedom of choice and decision does exist. This corresponds to a sense of pressure of responsibility and duty and the feeling that we should subordinate ourselves to this pressure. Man has nothing but the illusion of his freedom of decision to keep him from being disturbed by his own thoughts and actions.

This view, on the whole, accords with the recognition of an unconditional causality, since the influence of moral valuation itself on tradition and education is a substantial factor in the causal chain of events—as far as this concerns human existence.

If when considering the human sphere, we take into account only the primitive mechanistic aspects (hunger, hate, sexual urge) we are introducing a fallacy into the causal interpretation by ignoring motives of a social character, which are equally important from the point of view of the theory of evolution.

Thus you can see that the two aspects are complementary and not contradictory, provided we do not make the mistake of omitting the psychic factor in the causal connection, or of not respecting it sufficiently.

With kind regards,
yours,
Albert Einstein.

Einstein letters on free will

TWO letters written by Albert Einstein have recently come to light in the small Moravian township of Uherské Hradistě. They illustrate the patient courtesy which never deserted their author even when his fame had become worldwide. The letters were addressed to Mr V. Kolačný, a confectioner and pastry cook who is an amateur philosopher. In his search for truth, Mr Kolačný, having read a book, is in the habit of writing directly to the author to take up a particular point which he feels needs clarifying. His collection of replies to his queries includes letters from Alfred Adler and Karel Capek, the Czech author and playwright, as well as the couple from Einstein.

The Einstein letters were written within a month of one another in 1952. They are in German and were typed on Princeton University notepaper. A translation of the first (dated 15 January, 1952), reads:

Dear Mr Kolačný,

Many thanks for your letter which this time has reached me. In my view