of quantum physics, including those governing the electron, are confirmed; if the fundamental laws of quantum physics are correct, then both the electron and a twin particle, the positron, have equal logical claims to existence; hence, either the physical existence of the positron can be confirmed by experiment—or the fundamental laws of quantum physics must be supplemented by an additional principle or law which will have the logical effect of excluding the possibility of a particle like the electron.

A third spectacular example is Einstein's theory of relativity. Then there is Einstein's equation between mass and energy, deduced as a logical consequence of the physical principles of the special theory of relativity and published as long ago as 1905, which received experimental confirmation only a few years ago—and just now in 1945 received experimental and practical confirmation on so vast a scale as to become a matter of life-and-death interest to all the people of the world.

In a fundamental way mathematics is responsible for the atomic bomb. We cannot thoroughly understand the all-pervasive influence of mathematics upon the advance of other branches of science and technology by fixing our attention just upon the heroic achievements. Rather we must look to the more work-a-day relations, so little advertised, between mathematics and the different parts of scientific theory and practice. An adequate review would require more time than we have, so a few suggestive examples will have to suffice. It is, of course, in the great profession of engineering that we find the most practical and most familiar expression of modern science—and, at the same time, the commonest and most nearly indispensable applications of mathematics, particularly of its most anciently developed branches: geometry, algebra, and calculus. If we were to trace in detail the developments of the modern airplane, we should find it linked with the elaboration of a theory of flight, highly mathematical in character, which enables us to calculate the most useful shapes for wings, propellers, and other air-foils, and thus allows us to avoid expensive random experimentation in favor of well-directed experimental study of skillfully selected initial models.

Let's glance for a moment at the science of genetics, and we see the guiding influence of mathematical statistics at work upon the detailed development of those basic principles first noted by Gregor Mendel. By multiplying such illustrations we can fill in a picture in which the contributions of mathematics would be highlighted in almost every aspect of science. There are inner, natural reasons why mathematics is so inextricably woven into the development of science and technology. Nature, however mysterious, is at least not illogical, a principle which clearly encourages us to remain unsatisfied with mere observations upon the world about us and to proceed instead to reason about the facts established by observation. The application of reason or logic to the factual material derived from observation involves us at once in the use of mathematics, which is, after all, nothing more nor less than the art of precise, formal reasoning. The exhaustive study of the logical implications of the factual material of science marks out for us the limits between the possible and the impossible. Nature is in harmony with logic, and thus assists us through the refinements of mathematics to concentrate the costly efforts of experimental science and technology upon those enterprises which are calculated to be most promising or advantageous.

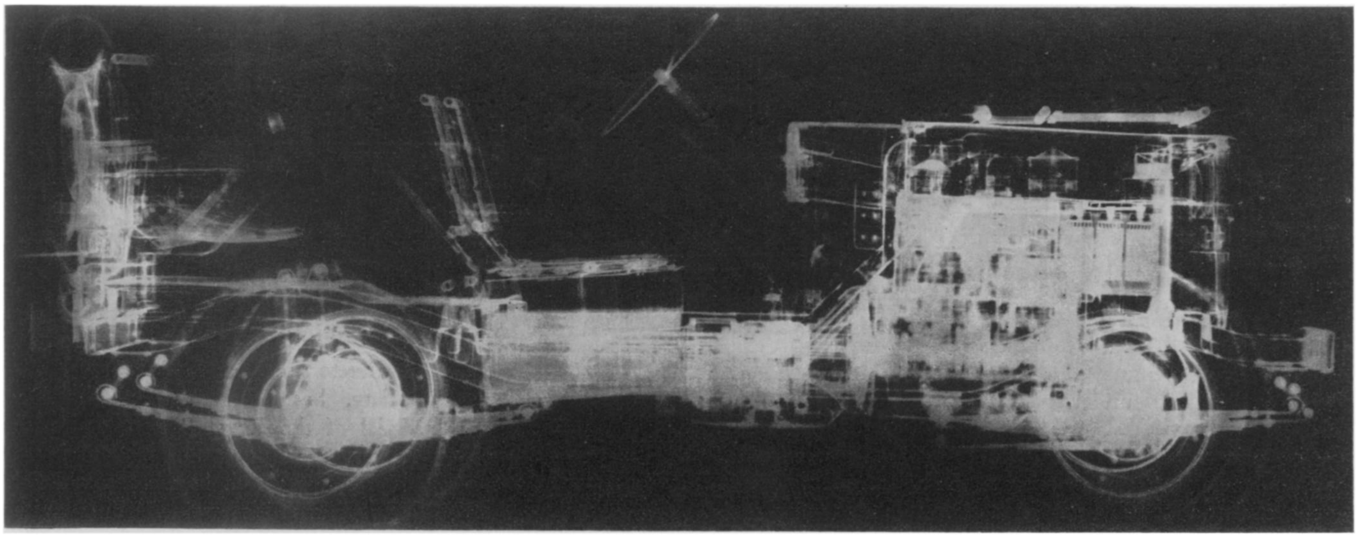
Science News Letter, March 9, 1946

MEDICINE

German Measles Danger to Unborn Babies Questioned

➤ FEAR THAT when an expectant mother has an attack of German measles, her baby may be born with cataracts, heart disease, deaf-mutism or other deformities may be relieved if further statistical studies bear out one reported in the *Journal of the American Medical Association* (March 2).

The fear arose from Australian reports, backed up by reports from American physicians, of the frequency of congenital malformations in the children when the mothers had German measles early in pregnancy. (*Turn to page 156*)



GHOST JEEP—This is the first radiograph of an entire automobile and was made by the Eastman Kodak Company and the University of Rochester. During a ninety-minute exposure, the X-rays had to penetrate the closed door of the laboratory, the atmosphere, and the jeep to record the image on film. The results show that almost every part of the jeep is visible, from the headlight filaments to the fuel level in the gas tank.