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.

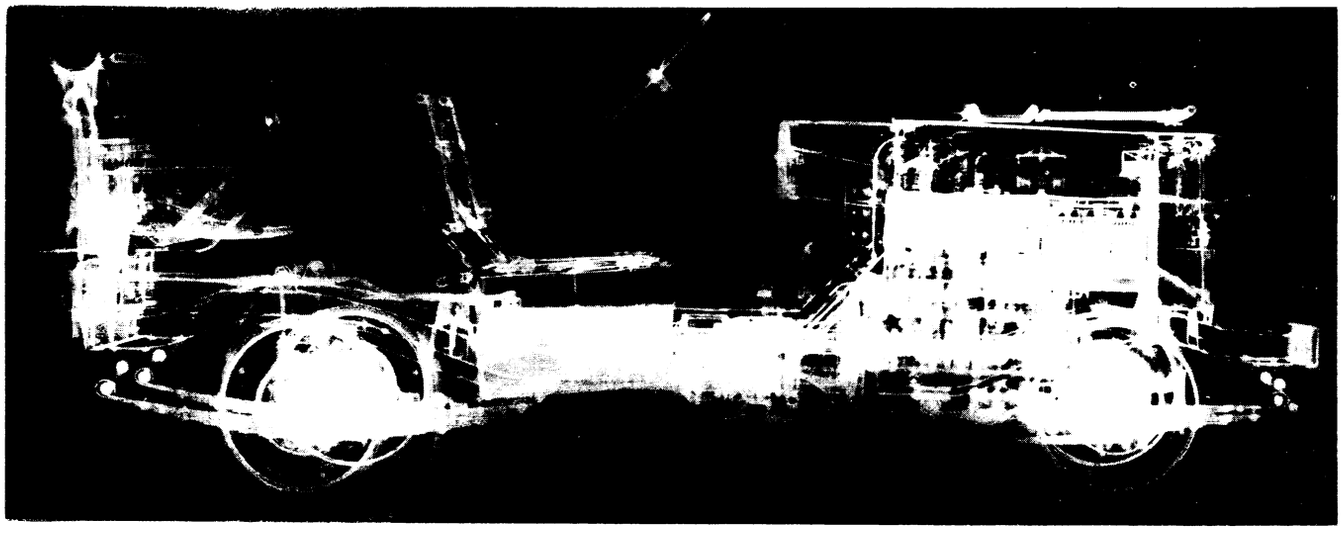
Science News Letter, March 9, 1946

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.*

Do You Know?

Penicillin is now used in veterinary medicine.

The melting point of an *organic compound* is used to identify it and determine its degree of purity.

True *pheasants,* now abundant in the United States, are not indigenous to this country but are natives of Asia, especially of India and Indo-China.

Menhaden is an important fish in the paint industry because its oil is used in the manufacture of insulating varnishes and ship bottom paints.

Starch sponge, used in foods and absorbable surgical dressings, is made by mixing commercial starch in water, heating the mixture to form a paste and then slowly freezing the paste; when thawed it retains its sponge shape.

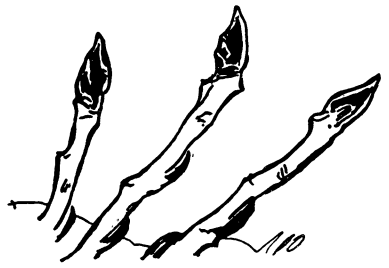
Synthetic rubber is said to be superior to natural rubber in the printing industry for inking rollers, printing plates, press blankets, and other rubber printing materials because it resists the chemicals in ink.

About half the qualified *psychologists* in the United States are employed normally in colleges and universities; the others are in clinics, penal and mental institutions, hospitals, government, state and other services.

Quick-frozen, precooked, ready-to-serve *complete meals,* in individual cardboard plates that resist water, heat and grease, will soon be available in retail stores; 20 minutes in a hot oven and they are ready for the table.

BOTANY

NATURE RAMBLINGS by Frank Thone



Dry, But Not Warm

➤ JUST ABOUT NOW, or in a couple of weeks more at most, trees and shrubs will be unwrapping their buds and getting ready for another season of green growth. The varnished scales that have enclosed them for months have served their turn and are now discarded; they litter the ground at the base of the trees.

Almost inevitably, some one will liken them to garments that have kept the young leaves and flowers dry and warm all winter long and can now be shed. Warm-blooded egocentrists that we are, we think of plants in human terms.

We would be nearer the facts if we stopped at the halfway point in our nursery metaphor. For bud-coverings keep the buds dry—but not warm. The tight-packed beginnings of leaves and flowers within the closely shingled roofs of scales become zero-cold when the outside air drops to zero. Thanks to the condensed state of the little sap that is in them, resembling syrup or mucilage more than it does water, they do not actually freeze. If the cold should become so intense as to cause the formation of ice crystals in the buds, their delicate tissues would be torn and burst, and they would probably die. But this extreme state of affairs seldom comes to pass.

The real job of the bud scales is to keep outside water out, and inside water in. Wet snow may fall until every twig is "ridged inch-deep with pearl," freezing rain may sheathe all the trees and bushes with ice, but within the tight little houses of the buds the coming spring's leaves and flowers reck nothing of it. The scales are waterproof so that moisture cannot penetrate; they are tenacious against outside pullings and buffetings. Only the pressure of swelling new life within will serve to push them open and finally break them off.

Probably even more important than their function in keeping the buds dry is their opposite task of keeping them from drying out. Although the sap in over-wintering buds is considerably thicker and less watery than the sap in summer leaves, there is a limit to its tolerable concentration. Evaporation can kill buds. And evaporation can go on even in the coldest of winter weather: some of the driest deserts in the world are cold deserts, like the Gobi, and our own Great Basin area. Winter drought can be even crueller than drought in summer, for roots and stems are unable to replace evaporation losses with fresh moisture from the soil. Highly essential, therefore, is the role of the bud coverings in conserving the necessary minimum of water in the unborn leaves and flowers.

Science News Letter, March 9, 1946

From Page 151

It was even suggested that an abortion might be justified in case of German measles, or rubella as it is technically named, in an expectant mother.

These conclusions are not justified, Dr. Max J. Fox and Dr. Mortimer M. Bortin, of Milwaukee, Wis., state. They base this on investigations of cases of German measles recorded at the Milwaukee health department. Among 22,226 cases reported in 1942, 1943 and 1944, eleven were expectant mothers. One of these subsequently had a stillborn child and one had twins, both normal. The others presumably gave birth to normal babies. One gave birth to a child with congenital cataracts following a normal pregnancy, but when she had German measles while pregnant the baby was normal.

A well-organized survey from other health department records should be conducted, the Milwaukee physicians advise.

Science News Letter, March 9, 1946

The *drum of the ear* is only about 0.004 inch thick, yet it vibrates millions of times every day with sound waves hitting on it.

Aluminum is being recovered chemically from obsolete airplanes; caustic soda dissolves out the aluminum in the scrap, leaving bolts, nuts and other foreign materials untouched and reducing the alloying metals to a sludge that may be separated out.