

Evidence for transfer of leukemia immunity

Leukemia, cancer of the white blood cells, causes about 400,000 deaths a year. Leukemia in many animals is caused by a virus, and scientists suspect that human leukemia is also caused by a virus. Three researchers reported last week at the annual meeting of the Federation of American Societies for Experimental Biology in Atlantic City that mother rats inoculated with a virus found in leukemic cells can transmit immunity to their offspring.

Harry L. Joachim, Steven Keller and Martin Gimovsky of Lenox Hill Hospital and Columbia University's College of Physicians and Surgeons have, in the laboratory, been growing tissue cultures of leukemic cells that contain a virus. This virus, when injected into rats, produces leukemia "entirely similar to that in humans," they say. They had observed that infant rats were very susceptible to the virus, while adult rats seemed naturally resistant. The problem was to protect the infants during the few weeks when they were susceptible.

The researchers injected a number

of adult female rats with the virus and then mated them to normal male rats. The newborn rats from those pairs, as well as rats born to uninjected mothers, were then injected with a lethal dose of the virus. All rats born of non-immunized mothers died; none of those whose mothers had been injected showed any sign of disease. These results, say the researchers, indicate that "the immunized mothers are able to transmit to their offspring the resistance to the disease which they have acquired." They theorized that the immunity could have been transmitted from mother to offspring by two possible routes: circulation through the placenta (the structure by which the embryo is attached to the wall of the uterus) during intrauterine development, or through the milk during nursing.

Either way, says Joachim, the immunity must be of a humoral type, in which antibodies circulate in the body fluids. In the other type of immunity, cellular immunity, the antibodies are anchored to certain cells in the body. These cells cannot pass through the placenta; humoral antibodies can.

To pin down the transmission

route, the pathologists repeated the previous experiment, except that after the newborn rats were injected with the virus, some, of those born to immunized mothers were placed for nursing with non-immunized mothers, and some born to non-immunized mothers were given to immunized mothers. Leukemia developed in 35 percent of the rats born to immunized mothers and nursed by non-immunized mothers, and in 11 percent of rats born to non-immunized mothers and nursed by immunized mothers. None of the rats born and nursed by immunized mothers developed leukemia; those born and nursed by non-immunized mothers developed the disease.

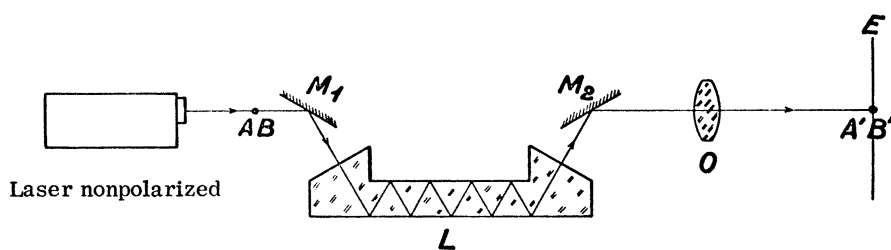
The team concludes that immunity to leukemia can be transmitted to offspring through both placental circulation and milk, but that the milk route is more efficient. "It is quite possible that cancer in humans is also induced at a very early age when the resistance to carcinogenic agents is minimal due to immunologic immaturity. Protection during this critical period could then conceivably be achieved by immunization of mothers with specific or non-specific vaccines."

Photons: An experiment that may show mass

One of the basic principles of modern physics is the so-called wave-particle duality. Material particles, protons, neutrons, electrons, etc., are in some ways also waves; waves, such as light, are also particles. Experiment has repeatedly shown that the principle, difficult as it may be to accept or understand, is quite true. Appreciation of the wave-matter duality settled a three-century-old dispute over whether light was a train of waves or a stream of particles by saying it was both.

The man who 50 years ago first wrote down the idea of matter-wave duality, Louis de Broglie, and another French physicist, Jean Pierre Vigier of the Institut Henri Poincaré in Paris, now suggest that certain experiments on the reflection of laser light give indirect evidence that the photon or light particle has a small rest mass. If true, this contradicts the developed theory of optics and electricity and magnetism, which assumes that the photon rest mass is exactly zero.

The experiments, conducted by A. Mazer, C. Imbert and S. Huard, dealt with total internal reflection of laser light at the boundary between a dielectric material and vacuum. It is a well-known optical principle that a light beam proceeding through a medium



C. Imbert

Imbert's arrangement to study total internal reflection of laser light.

with relatively high refractive index (the dielectric in this case) and striking the boundary with a medium of lower refractive index (the vacuum) will be totally reflected if it strikes the boundary at an angle less than a certain critical value. What happens in detail is that the oncoming beam actually exits from the dielectric medium into the vacuum, loops around and reenters the dielectric. The difference between the points of exit and reentry causes a lateral displacement in images made with the light, and it was the relation of these lateral displacements to the linear polarization of components of the laser beam that the experiment of Imbert and collaborators was studying.

The results came out in contradiction to predictions based on both classical and quantum physics. In the April 10 PHYSICAL REVIEW LETTERS de Broglie and Vigier suggest that they can be interpreted as due to relations between

the polarization of the electric fields in the light wave and the spins of photons associated with the wave, provided one assumes that the photons have a finite mass. The amount, they figure, should be equal to or less than 10^{-48} grams.

A number of physicists have done experiments to look for a photon mass without so far finding evidence of any (SN: 7/17/71, p. 46). They carry on the search not because such a tiny mass would have any practical effect in electrical or optical technology, but for the philosophical, intellectual and esthetic character of physical theory. If photons have rest mass (and then by implication neutrinos do too), all particles and their associated wave fields are on the same footing. One no longer has to worry about the infinities and indeterminate results produced by doing arithmetic with zeroes. Also, de Broglie and Vigier point out, a small photon rest mass would make Einstein's fa-