

## Radio Waves Found to Affect Cell Behavior

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The discovery that radio waves can influence the behavior of cells has been reported by a team of scientists. It is believed that the discovery may have far-reaching effects in medicine and in the understanding of basic life processes as well as in industry. The findings, published in two technical journals, have to do with the behavior of many living and non-living substances in fields of radio energy.

The scientists are Dr. John H. Heller, Dr. A.A. Teixeira-pinto and Dr. John L. Cutler of the New England Institute for Medical Research in Ridgefield, Conn. They have found that a variety of substances - including carbon, silver, starch, polystyrene particles, red blood cells and several types of living microscopic organisms - can be oriented by pulsed radio-frequencies.

Perhaps the most significant factor in this work so far is the discovery that the new technique apparently permits the scientists to affect structures inside living cells. The use of the pulsed radio frequency of about twenty seven megacycles on cells in the growing root tip of a garlic plant, for example, created some abnormal cells and killed others by interference with the heredity carrying elements.

At present the scientists cannot explain the phenomenon. The possibility that particles under an impressed radio-frequency tend to fine up so there is minimal distortion of the field is as close as they can come to guessing how it works, but this leaves many questions unanswered.

The scientists, however, are predictably able to reproduce the effect. For example, randomly swimming groups of tiny, cigar-shaped organisms known as Euglena can be made to swim in an east-west direction, along the lines of force in the impressed radio frequency field. They all move in straight lines as though obeying the lanes in a swimming meet. This analogy is extended by the little "flip turns" the Euglena make when they reach the end of a "lane" and swim back along their original paths.

Even more astonishing things happen when the radio-frequency is increased a certain amount. The little organisms suddenly flip 90 degrees and all start swimming in a north-south direction. Dr. Heller said that this ability to "play these things like a piano" has so fascinated his team that lights have been burning in the laboratory practically every evening and weekend since the work began last November. "Visiting physicists and biologists usually don't believe it until they see it work," he said. "Then the first thing they say is 'I'll be damned!'"

Dr. Heller and Dr. Cutler demonstrated the effect on several other things, including staphylococcus germs, amoebae and polystyrene particles (tiny synthetic particles of uniform size). All except the staphylococci behaved as predicted, lining up east-west under one radio frequency and north-south under another. Dr. Heller explained that each substance seemed to have a favored frequency for lining up with or against the field. Euglena, for example, line up east-west at six megacycles and north-south at about fifteen megacycles. Staphylococcus north-south frequency, presuming it has one, appears to be one out of the range of the institute's present equipment, according to Dr. Heller.

Radio signals in the medium frequency range are being used, roughly between five megacycles and forty megacycles. The scientists are at work on equipment that will take them into radar range, or somewhat above 100 megacycles. The present equipment consists of a radio-frequency source that permits pulsation of the signal at various rates and powers. Pulsing is necessary because a constantly applied signal would fry any living material. Wire leads from the power source end in electrodes of silver paint on the underside of the microscope slide that is covered with still another microscope slide on which the material to be examined is placed. In this way the experimental material is insulated from the electrodes by two thicknesses of glass and thus exposed only to the radio field and not directly to any current carrier. Preliminary results from work with this equipment are carried in *Nature*, a British scientific publication, and the *RES Bulletin*, the *American Journal*.

The New England team got into this work by being dissatisfied with explanations offered for the reported development of cataracts and germ-cell damage in persons who worked in radar, a radio-frequency considerably higher than that being used in the Ridgefield laboratory. Some investigators suggested that the alleged damage was caused by the heating of tissue in the radar beams. Dr. Heller did not like this theory and set out to explore other possibilities.

#### Alteration of Genetic Material Induced in Plant Test

"Four reports of the peculiar behavior of fat globules in radio-frequency fields had been made since 1927", he said, "and we decided to see if we could get similar reactions from other things." He added that a number of other substances that lined up and strung together under pulsed radio frequencies were soon found. One of their experiments stands out as an important turning point. Working with a microscopic animal known as paramecium they noted that a tiny particle within the cell of a trapped organism flipped back and forth according to the impressed field. This meant, Dr. Heller explained, that it was possible to reach inside cells and affect many internal structures.

That new possibility led to an experiment in which cells in the growing tip of a garlic plant were exposed to the field for five minutes and then examined twenty-four hours later. The scientists reported finding several changes in the cell's chromosomes, the heredity-controlling structures. Virtually all the classical aberrations known to be caused by ionizing radiation and certain poisons were noted, Dr. Heller explained. This finding suggests that radio-frequencies appear to constitute a powerful new tool for studying the growth and genetic development of organisms.

Work along this line has already resulted in the creation of both lethal mutations and viable new strains of vinegar flies and certain bacteria, the scientists said. They speculated that this research might find application in cancer treatment if it turned out that radio-frequencies could be used to scramble chromosomes in malignant cells, thereby preventing their further growth. In addition, because each substance seems to have a preferred radio frequency to respond to, mixtures of different ones might be separated with the new technique.

In support of this possibility Dr. Heller cited experiments that showed how foreign substances could be made to flow over aligned polystyrene particles and how two different strains of penicillin spores were differentiated by the radio-frequency fields. Dr. Heller also remarked that interest in his experiments had been expressed by the oil industry. Behind this interest, he explained, is the thought that particles can be aligned before they are chemically strung together into fibers. Extremely long strands of the material probably can be created.