

On the way down, the landers also measured the upper atmosphere winds. M. K. Rozhdestvensky of the Moscow Physical and Technical Institute points out that this could not be done with the anemometers that measured the surface winds, since the parachutes by which the landers descended partook of the winds' motion. The measurement by Doppler shift of radio signals between lander and orbiter required large corrections, but still indicates upper atmosphere winds up to 100 meters per second.

What was most surprising in the findings? Everything, says Avduvsky, but especially the lower limit of the cloud cover (at 49 kilometers above the surface, higher than anyone had expected), the surface illumination and the surface pictures.

Marov has a slightly different list. He

agrees about the Venera 9 picture. The Venera 10 picture, he says, is what one would have expected: It looks something like sandy regions on earth. He also thinks the transparency of the Venus clouds is a big surprise. Everyone had expected them to be dense. But he adds the "quite interesting and unexplained spectra of Venus." There is no indication of hydroxyl or oxygen bands that one would expect from studies of Earth and Mars, nor even the known bands of carbon dioxide. There is quite another system of bands, possibly carbon dioxide in some strange state in the upper atmosphere of Venus. Finally Marov mentions the interaction of Venus with the solar wind. The planet has no measurable magnetic field and so no magnetosphere, and the way the solar wind flows around it is quite strange. □

## Recombinant DNA: Impacts and advances

The new techniques of recombinant DNA engineering have rarely been out of public view since the Asilomar conference convened 18 months ago to discuss the safety of the work. Last week at Massachusetts Institute of Technology, the subject was again in view. This year's annual Miles International Symposium, sponsored by the Miles Laboratories, focused on the impact of recombinant molecules on science and society.

While the three-day program's emphasis was more science than society, the symposium was held in what is probably the strongest center of resistance to the new field, and thus offered a wide divergence of opinion on social issues. The science was diverse, as well, from synthetic gene splicing to plant genetics.

A morning program on societal impacts, chaired by University of Edinburgh biologist Ken Murray, produced the symposium's most passionate discussion. Science for the People, the Cambridge-based group of radical scientists and students, provided a steady presence throughout the meeting, opposing the impending National Institutes of Health guidelines on recombinant DNA research, due later this month. The morning session on impacts covered issues from human genetics to a rather heated discussion of the public role in guideline formulation. Science for the People eventually drafted a petition to NIH director Donald Fredrickson, calling for increased community participation and stringent safety precautions. The petition found few willing signers.

Reports of significant scientific advance garnered far more sustained interest among the 500 conference attendees. One important report was the first demonstration of a synthetic DNA sequence that will work in a living cell, described by Herbert Boyer of the University of California at San Francisco.

Boyer, in 1972, discovered the class of

enzymes called restriction endonucleases that have made recombinant "gene splicing" possible. Boyer's research group, along with Arthur Riggs's group at the City of Hope Hospital in Los Angeles, used such restriction enzymes to achieve this first insertion of functional synthetic DNA.

The group chose to synthesize the operator region of the so called lac-operon. This operon is essentially a group of genes found on the circular chromosome of the bacterium *Escherichia coli* that produce three enzymes needed to break down the carbohydrate lactose. The operon has a structural gene to build the enzymes, a regulator gene to control enzyme production and an operator gene to switch off the entire operon. Together, the genes form a repressible enzyme system that, with elegant energy economy, will make enzymes to break down lactose only when the sugar is present and the cell needs it.

The team synthesized an operator sequence of nucleic acid base pairs, then "glued on" two short DNA regions called restriction sites—the chemical equivalents to dotted lines where restriction enzymes can attack. They then snipped "holes" in small, circular chromosomes called plasmids and spliced in the operator region with restriction enzymes, one region per plasmid. Using the recombinant technique called cloning, they produced many copies of the plasmids in *E. coli* cells, then grew the cells on special dye indicator plates to test for functioning of the artificial DNA. The colonies turned blue, an indication that the synthetic operators were functioning.

The technique of attaching synthetic restriction sites to synthetic DNA, then using recombinant DNA techniques to insert the region into living cells, "will give great flexibility to our technology," Boyer told a symposium session. It means, too, he said, that in the future, important proteins such as insulin or antibodies might

be produced in living cells from inserted synthetic genes.

Another report, this one concerned with plant and bacterial genetics, presented evidence of the first natural example of a long-term genetic crossover between primitive and advanced cells. If confirmed, it could have, as well, potential significance for a costly agricultural problem and for the safety of recombinant genetic engineering.

Eugene W. Nester, a microbiologist at the University of Washington at Seattle, has for several years studied the genetics of crown gall disease, a tumor-forming condition in several plant species caused by the bacterium *Agrobacterium tumefaciens*. Nester and his colleagues now have suggestive evidence that DNA from *A. tumefaciens* plasmids is present in the plant tumor cells. This DNA, moreover, remains in cultured tumor tissue for several decades, and if these data are confirmed, would represent the first long-term natural coexistence of genetic material from prokaryotic cells (the bacteria) and eukaryotic cells (the plant tissues).

Such natural coexistence could have impact on the recombinant engineering safety question. One biochemist, Robert Sinsheimer of Caltech, warned recently against tampering with the natural barrier to genetic exchange between the two great classes of cells. But the new evidence shows that barrier could be flimsy, indeed.

Nester, as well as other researchers, continues to study crown gall tumors with hopes of determining precisely which *A. tumefaciens* genes are transferred to the plant's genome, and how they lead to tumor formation. When the transfer mechanism is clearer, Nester says, it might be used to introduce other foreign genes into plants. □

## Lyme arthritis: Insect vectored?

One day last October, a concerned mother in Lyme, Conn., placed a call to the State Department of Health in Hartford. Her daughter, she told David Snyderman of the department's Division of Preventable Diseases, had suddenly and inexplicably become ill with what seemed to be a form of juvenile rheumatoid arthritis. What, she asked, was this strange form of arthritis that had recently afflicted her daughter and more than a dozen other children, and some adults?

To date, 51 persons—39 children and 12 adults—have been diagnosed as suffering from a similar type of arthritis not seen before. They all wanted answers.

The truth is that no one yet knows what causes the mysterious malady now known as "Lyme arthritis." But the unusual geographical and temporal clustering that seems to characterize it finally led Snyderman to question "whether it was really

an unusual variant of juvenile rheumatoid arthritis or an infectious arthritis," and to realize "that at that point it became clear that it was beyond my realm of expertise." He called for reinforcements.

The pieces of a puzzle were becoming evident. He needed help to try to find more pieces before an attempt could even be made to fit them together. Stephen E. Malawista, Chief of Rheumatology and Allen C. Steere Jr., postdoctoral fellow in Rheumatology, both of Yale, were presented with the clues: Three to four weeks before the initial swelling, which is usually mild and intermittent, a semi-circular skin lesion or a rash appears, the kind previously associated with tick bites. The outbreaks have been clustered temporally (appearing in the summer or early fall) and geographically (Lyme and nearby towns). Though there were several cases within one family and among neighbors, they sometimes started in different years, making it unlikely that the disease was transmitted from one person to another. "Most of those with the illness lived in sparsely wooded areas," commented Steere. "Half of those affected in Old Lyme lived on two adjoining roads as did half of those affected in East Haddam."

Studying these hit-or-miss epidemiological patterns led the Yale researchers to believe that Lyme arthritis might be caused by a virus transmitted by insects or arthropods. Ticks, mosquitoes and black flies are under suspicion.

Infectious forms of arthritis are not new. Over the last three years mosquitoes have been shown to transfer several different kinds of arthritis. Among them are the chikungunya and o'nyong'nyong arthritides in Africa. A kind of arthritis called Reiter's syndrome often follows an attack of dysentery.

But according to Steere, Lyme arthritis does not follow the usual form. It looks and acts as though an infection is involved, but so far, laboratory tests have ruled out all agents known to cause arthritis symptoms, and other infectious agents. Communal sources of infection such as food, drinking water and shared swimming places have also been ruled out.

Lyme arthritis may be the first form of the disease in America to be transmitted by an insect. Malawista sees the symptoms of the enigmatic disease as giving researchers "the opportunity of seeing in the laboratory, arthritis, which we think is caused by an infection, from the very beginning. That rash might be the tip-off for exactly when this thing is occurring. The general value," he says, "is getting to see the patients at the onset of the disease . . . that's the time when we'll be most likely to find the agent."

Contributing to the efforts of those trying to define Lyme arthritis are Yale entomologists. Conducting a formal taxonomic study of insects prevalent in the areas affected will enable them to formulate an extract from the ground-up insects. This

sludge will be added to tissue cultures, and if any viruses or suspicious organisms grow out of that, they will test the sera of persons who had Lyme arthritis and who would presumably have antibodies. If the sera of infected persons respond, the infectious agent can then be isolated.

Malawista stresses that the Yale group's first responsibility is to the patients. Although the evidence is still inconclusive, "the fact that we haven't gotten it yet doesn't discourage us," says Malawista. Hoping to identify the disease beyond a doubt, they say they will continue to seek ways of isolating the agent until all of their questions have answers. □

---

## New compound for male contraception

---

The discovery of potent antispermato-genic activity from a group of synthesized drugs marks the latest thrust in efforts to find an effective male contraceptive. Although the female has long been the focus of most contraceptive development research, a decade ago scientists began directing their studies toward her masculine counterpart (SN: 11/4/67). A major part of the argument for this redirection of efforts is that the male systems for producing the sex hormones and sperm cells are essentially separate. This means that a drug inhibiting a man's ability to produce sperm needn't also affect his libido or masculine traits.

Research in the field has produced numerous schemes for repressing the intended mission of the male sperm, and they are generally results of two distinct philosophies of approach. On the one hand there are scientists seeking to prevent the sperm's penetration into the egg (SN: 2/24/73, p. 124), and then there are those trying to disable the production of sperm altogether. It is with the latter intent that the recent discovery reported in the June issue of the JOURNAL OF MEDICINAL CHEMISTRY was made.

G. Corsi, G. Palazzo, C. Germani, P.S. Barcellona and B. Silvestrini from the F. Angelini Research Institute in Rome studied the effects of numerous 1H-indazole-3-carboxylic acids and their derivatives on male rats. Some of the compounds interfered with sperm production by mutilating and destroying the spermatocytes and spermatids, immediate precursors to the actual semen. Furthermore, the activity occurs without apparent damage to the sperm-transporting tissues.

The authors claim that a significant advantage to these compounds is their relatively high potency and selectivity. While previously discovered agents often require large and repeated doses to work and still others are indiscriminate in their effect, the recently found chemicals initiate their specific effect after a single dose. They report that even with the largest doses administered to the rats, toxic effects re-

mained minimal.

"There have been many other compounds which looked all right in the rat," but which later proved ineffective or worse in the human, says Gabriel Bialy, chief of the contraceptive development branch of the National Institutes of Health. Although he cautions that many past ideas which "excited the research community" have since been discarded, "I wish that what they say [for rats] turns out to be true."

Among the questions left unanswered by this study is whether the drugs' effects are permanent. Many encouraging ideas of the past suffer in this one crucial respect. Some methods that induce infertility by applying heat in the form of microwave, infrared and ultrasound radiation directly to the testes (SN: 5/11/74, p. 309) produce effects lasting up to seven years. Over 2.5 million men, however, have acquiesced to one of the most permanent forms of contraception, a vasectomy.

Since no antispermato-genic activity has ever been observed in this chemical class before, the scientists claim that in addition to the possible social applications, "a completely new field of chemical research has been opened." □

---

## TM: Understanding the rest of it

---

Stress has become a common word and a common worry in recent years because of its association with heart disease, ulcers and psychological problems. TM (transcendental meditation) has become a common practice for almost one million people in the United States because, among other things, it seems to relieve stress. But early this year, researchers reported that the beneficial effects of TM might be the result of sleep during meditation, rather than meditation itself (SN: 1/24/76, p. 54). Now it is reported that rest (being seated quietly with the eyes closed) may be responsible for the physiological changes that accompany TM. This conclusion is based on measurements of catecholamines, body chemicals associated with stress.

Trained meditators (most of whom were qualified TM teachers) were compared with control subjects unfamiliar with the techniques of TM. Blood samples were taken before, during and after meditation periods, which lasted from 20 to 30 minutes. Control subjects went through the same procedure, except they sat quietly with their eyes closed instead of meditating. R. R. Michaels, M. J. Huber and D. S. McCann of the Wayne County General Hospital and the University of Michigan report in the June 18 SCIENCE that "essentially the same results were obtained for the two groups." The small changes noted in catecholamine levels could,