willingness to provide technological assistance to developing countries, a recognition of the need for a "prudent" system of food reserves, hopes for better cooperation from the Soviet Union in providing crop estimates, and unspecified measures to help the immediate situation.

But neither the government representatives nor the swarm of special interest groups surrounding the conference showed any sign of yet coming to grips with the practical problems that must be faced before resolution of the present crisis can be achieved. The Rome Forum avoided making any recommendation on population control, lest the issue "polarize" the conference. Butz insisted that agricultural production could only be increased by having "reasonable" prices for crops, but failed to say how those who could then not buy food would be fed or why so many American farmers can't seem to make ends meet. And no one at all wanted to talk about how to divert some of the money now flowing toward the Middle East into channels for producing more food in developing countries of the world. □

Plant cell wall material synthesized

The most abundant organic compound on earth—cellulose—literally supports most of the living things on earth, which happen to be plants. Cellulose is a major constituent of plant cell walls, the unique component missing in animal cells that allows plants to grow stiffly upright, away from the earth and toward the sun. All plants, from lacy ferns to towering redwoods, have this common unit of support. The fungi, including mushrooms and yeasts, are considered plants, and have cell walls, too, but in most species the walls are made of chitin, not cellulose.

Being abundant does not automatically make a substance abundantly understood, however, and plant physiologists still are unclear about how a plant manufactures its all-important cell walls. They now have come a big step closer though, with achievement of the first artificial synthesis of cell wall material.

University of California at Riverside plant physiologists Jose Ruiz-Herrera and Salomon Bartnicki-Garcia report the synthesis in the Oct. 25 SCIENCE. They were able to synthesize chitin microfibrils like those found in fungi cells. These microfibrils are tiny strands which enmesh in the living plant to form the cell wall. The team homogenized yeast cells and extracted an active fraction that contained a soluble chitin-forming enzyme. They combined this enzyme with the sugar building blocks of chitin, and microfibrils formed.

The artificial synthesis tells plant physiologists several new things about cell wall formation. Most important, says Bartnicki-Garcia, the findings demonstrate that chitin microfibrils can be formed in the absence of membranes. Many scientists had believed until now that chitin and cellulose microfibrils were formed in tiny membrane sacs in the cell's interior. These sacs, they believed, traveled to the cell wall and there deposited the newly formed strands which enmeshed with the existing cell wall structure. Because the team was able to synthesize microfibrils in a disrupted, cell-free fraction containing the chitin-forming enzyme and the sugar substrate, it is clear the enzymes need not be membrane-bound, Bartnicki-Garcia says.

Ruiz-Herrera and Bartnicki-Garcia

Plant cell wall fibers (× 64,000).

A second important insight, he says, is the confirmation that the Leloir pathway is involved in microfibril formation. The Argentine Nobel laureate chemist Luis F. Leloir several years ago proposed a pathway for polysaccharide (long-chain sugar) synthesis, that included the transfer of a sugar unit from a nucleotide-sugar complex to the growing sugar chain. Many did not believe this to be a pathway involved in microfibril formation, Bartnicki-Garcia says. But, by successfully using as a substrate the nucleotide-sugar complex Leloir predicted, the team proved "unequivocally" that the Leloir pathway is involved in microfibril synthesis.

The next steps, Bartnicki-Garcia says, will be to learn more about the structure and function of the soluble chitin-forming enzyme (which is as yet unnamed) and to try to synthesize cellulose microfibrils using similar laboratory techniques. □

A safer road to engineering genes?

One of the goals of modern research is to eliminate the causes of disease at the genetic level. Researchers still are far from this goal, however, and already have hit some snags. The manipulation of genes in mammalian and bacterial cells may hold great dangers as well as great promise for medicine. The techniques now used could, some think, result in the spread of dangerous and resistant forms of disease.

Now a new technique is fostering some hope that "genetic engineering" efforts can proceed without some of the dangers associated with existing techniques. Scottish molecular biologists Moreen and Kenneth Murray from the University of Edinburgh report in the Oct. 11 NATURE the use of a bacterial virus called phage lambda instead of bacterial plasmid DNA as a vehicle for transferring genes from a donor cell to a bacterial recipient.

Plasmids are small circular strands of DNA that multiply alongside the much larger DNA ring in a bacterium like *Escherichia coli* (strains of which live in the human intestine). They have proven useful as vehicles in genetic recombination experiments, for transferring genes from mammalian, amphibian or bacterial donors into bacterial cells lacking the genes. But plasmids often can carry genes for resistance to antibiotic drugs and establish them in bacterial hosts, rendering them potentially impossible to destroy with some antibiotics such as penicillin or tetracycline.

The dangers involved in using plasmids for some types of recombinant experiments were outlined this summer when a group of molecular biologists, with the backing of the National Academy of Sciences, appealed to the scientific community to limit certain types of genetic research (SN: 7/27/74, p. 52). A recently discovered class of enzymes called "restriction enzymes" has made gene insertions possible, but, the group stated, has also created potential biohazards. Gene manipulations could result in the bacterial production of deadly toxins, dangerous amounts of cancer-causing agents or diseases which can't be controlled because of bacterial drug resistance. The group called for the voluntary deferment of several types of experiments until a committee can meet at a conference next February to study the risks. Their appeal has been met with attitudes ranging from complete sympathy and voluntary deferment to nose-thumbing disagreement (SN: 11/2/74, p. 277).

The Murrays were aware of the potential dangers of using plasmids when

they began to investigate phage lambda as an alternative vehicle, and found themselves up against difficult problems. Although only one site normally is used to insert a new gene in a vehicle, phage lambda has five sites where restriction enzymes can attack. The team was able to produce a mutant phage with only two sites, and this made it possible for them to insert a gene for tryptophan biosynthesis. The phage vehicle containing the new gene was then introduced into a strain of *E. coli* cells that lacks the ability to form tryptophan. Some of the cells began to form the amino acid, and thus the successful transfer of the gene through the phage vehicle was demonstrated.

One well-known Cambridge University molecular biologist, G. G. Brownlee, in the same issue of NATURE, calls the Murrays' work a significant development in the field of genetic engineering, and says it may help to reduce the dangers of genetic manipulation. He points out that unlike certain plasmids, phage lambda is sensitive to antibiotics and that there is also some evidence it does not infect the strains of *E. coli* that inhabit the human gut.

A member of the NAS group that urged the research moratorium, microbiologist David Baltimore of the Massachusetts Institute of Technology, approaches the finding with some caution. He told SCIENCE NEWS the Scottish team is not abridging the appeal with their experiments. "They are studying in an area which we consider too valuable to ban on the basis of the knowledge we have now." But, he says, "I do not know, and I suspect no one knows, whether or not this new technique will be safer." Baltimore is suspending judgment until scientists at the February conference in Asilomar, Calif., "can come to a collective judgment about this and other techniques." □

Alpha waves and anxiety: No link?

The alpha wave, one of the several waves produced by the brain in a conscious state, has been exciting psychiatrists, psychologists and the public in recent years. There is now widespread use of alpha feedback machines to modify the level of alpha waves in one's head. Consciously increasing alpha waves purportedly erases anxiety and leads to relaxation (SN: 11/6/71, p. 315).

Research reported in the Nov. 1 SCIENCE now challenges the value of alpha feedback training for controlling anxiety.

A number of investigators have reported that worry results in a lessening of alpha waves. And Martin T. Orne and David A. Paskewitz of the Institute of the Pennsylvania Hospital and the University of Pennsylvania have found that persons can increase their output of alpha waves by feedback. So they reasoned that if alpha waves accompany anxiety, then increasing alpha waves via feedback efforts should reduce anxiety. They set up a study to test this theory.

They selected 25 college students, measured their usual alpha wave production and taught them how to use alpha feedback machines. Twenty-two of the students were then asked whether they would be interested in returning for another alpha experiment involving harmless but painful electrical shock. Ten of the subjects agreed to return for the second session. This time they were again put in command of their alpha waves, and shock electrodes were identified and attached to the lower leg of each subject. Once the subjects had engaged in alpha feedback trials they were told that in addition to the usual alpha tone and no-alpha tone given off by their feedback machines, a third tone would also buzz if they were in danger of being shocked. And this jeopardy tone would sound only if they didn't produce enough alpha waves. So the more alpha waves they were able to produce the less likelihood they would be shocked.

The subjects were then given five feedback trials divided into shock and nonshock segments. Orne and Paskewitz expected that the subject's anxiety over participating in the shock segment would initially lessen their alpha wave production, but once the subjects learned they could escape shock by producing alpha waves, they would increase their alpha waves by feedback control. What happened was just the opposite. Neither the students' initial apprehension, nor their intense concern following shock instructions, nor even their acute fear of being shocked during the shock sessions resulted in any significant drop in alpha waves, so naturally their attempts to increase alpha waves to avoid shock didn't work either.

One might argue that these results are invalid because the subjects really weren't apprehensive. But the subjects said they were, and physiological measurements during the experiments underscored their subjective claim. "Our most striking observation," Orne told SCIENCE NEWS, "is that, contrary to previous research, alpha density is not linked with arousal of anxiety. The fact that they were not able to increase alpha through feedback doesn't really matter anymore once you recognize that alpha and anxiety are not concurrent phenomena." □

Four in a balloon: Short but sweet

For all the current attention being paid to lighter-than-air craft as future sources of transport, free ballooning (unaided by propellers or other driving forces) remains an uncertain endeavor, ever at the mercy of the fickle winds. Yet it is these same weather-linked responses, plus the lack of vibrating, polluting engines, that make the free balloon in many ways an ideal laboratory for studying the subtleties of the atmosphere. Thus, at 8:45 MST on the night of Nov. 1, a 70-foot plastic balloon carrying 150,000 cubic feet of helium gently lifted four people and more than a ton of scientific instrumentation into the air from Las Cruces Municipal Airport in New Mexico.

Known as Project da Vinci (SN: 9/21/74, p. 182), the flight had been delayed four times from its original Oct. 12 launching date—once for technical reasons and three times due to the vicissitudes of the weather. Aloft, the weather continued to leave no doubt about who was in charge, notably outrunning ground crews with winds of more than 45 miles per hour at the balloon's maximum altitude of 13,100 feet and finally blowing in an ominous thunderhead from the West. With that, safety-conscious officials chose to end the mission (formerly envisioned as lasting up to 36 hours), 11 hours 55 minutes after it began.

Yet, says Harold Ballard of the U.S. Army Electronics Command's Atmospheric Sciences Laboratory, chief ground-based scientist for the project, the flight was largely a scientific success. A longer mission would have given larger data samples, including more daylight observations, but at least 20 of the 25 experiments aboard performed exactly as planned, probing temperature, humidity, wind-shear patterns, electrical fields, atmospheric pollutants, and other phenomena.

A plan to release a score of small, helium-filled "tetroons" was abandoned when it turned out that air blowing through the 85-foot gap between the main balloon and the gondola beneath it would whip the tetroons away too fast for their assigned task of following the diffusion of atmospheric turbulence. There were problems with an infrared radiometer intended to measure the thermal brightness of objects on the ground, and a radar altimeter was muzzled when its frequency interfered with work at nearby White Sands Missile Range. Sensors to monitor the balloon's skin temperature were omitted before launch for fear that they might possibly damage the frail polyethelene fabric, and communications problems