public health screening. More testing and development will be necessary before the blood test and vaccine are available clinically, he says.

Another group, Dolores G. Evans and Doyle J. Evans Jr. and colleagues from the Veterans Administration Hospital in Sepulveda, Calif., studied the pili of *Escherichia coli*. This organism normally resides in the large intestine but can sometimes colonize the small intestine and release a toxin that causes a severe diarrhea. *E. coli* can contaminate cheese, milk and other foods, and, particularly in developing nations, where food handling conditions are unsanitary and refrigeration is lacking, such contamination and subsequent diarrhea is a major health problem.

The group found that pili were necessary before *E. coli* could colonize the small intestines of rabbits and that these animals form antibodies which can prevent recolonization. They also found that the traits of colonization and toxin release are directed by separate rings of DNA called plasmids. Knowing this might give the team a handle on a better way to detect virulent strains in food and feces. The team is also working on an experimental vaccine.

Although pili don't figure in the study of dental caries, other surface proteins do. Ronald Gibbons of the Forsyth Dental Infirmary in Boston has found a surface protein in the guilty party, *Streptococcus mutans*, that helps the organism attach to the tooth surface and begin to destroy it. Most persons develop a natural immunity to the streptococci that inhabit the throat. These organisms are able only to colonize mucous membranes, and the physiology of both colonization and natural immunity are now being studied. Gibbons and others have succeeded in immunizing hamsters, rats and some monkeys against dental caries with preparations of surface proteins, and Gibbons sees promise in the development of a human vaccine. □

Food: 'A good moment for stocktaking'

If the weather holds, 1975 could prove to be the bumper-crop year so badly needed to replenish the world's dwindling stocks of food and avert, at least temporarily, an impending famine. "It is a good moment for stocktaking," writes editor Philip H. Abelson in his introduction to a special issue of SCIENCE (May 9) devoted entirely to reassessing the critical period just past and examining alternatives for the future.

What emerges is a stern indictment of the way governments and private planners have faced a challenge that was essentially expected and inevitable—expected because of regular variations in harvest yields, inevitable because of carelessly neglected reserve supplies. Fred H. Sanderson of the Brookings Institution calls the crisis "The Great Food Fumble," and says the whole thing could have been avoided if the United States and other grain-exporting countries "had been more prudent in maintaining grain production and adequate stocks."

This judgment of bureaucratic ineptitude is carried over into analyses of future options. The principal bottlenecks over the short-term to increased agricultural yields will not be the lack of adequate technology, says Pierre R. Crosson, director of the Latin American Program, Resources for the Future, Inc., but rather "those institutions affecting farmers' incentives to innovate." Thomas T. Poleman, professor of international food economics at Cornell University, says that even the seemingly insoluble problem of population control can be overcome more quickly than previously thought if only nations would cooperate more in a full-scale development program for poorer countries. But at present, "somewhere between a quarter and a half of the population is being bypassed by the forward march of development," and these are likely to become a massive burden on the rest of humanity: "The noble peasant is a rich man's delusion."


USDA

Some current shibboleths of nutrition planners are also called for reexamination. Derrick B. Jelliffee and E. F. Patrice Jelliffee of UCLA condemn the decline in breast feeding in many developing countries, due to "forceful and unrealistic advertising of unaffordable formulas by modern motivational techniques." Human milk, they contend, "should be recognized as a national resource in economic, agronomic, and nutritional planning." Substitution of formulas in poor countries can lead to unnecessary infections in infants, due to unsanitary conditions, and since lactating women seem to be less likely to become impregnated, the importance of breast feeding toward population control should not be ignored, say the authors.

Though the short-term problem of feeding the world appears to rest on implementing existing technology and establishing food reserves to protect against inevitable emergencies, the long-term solution of the food crisis is development of new, productive crop hybrids and the spread of modern agricultural technology throughout the developing world. Perhaps the most forceful statement of this issue is made by Michigan State's Sylvan H. Wittwer, who chairs the National Academy of Sciences Board on Agriculture and Renewable Resources. His article is an unabashed plea "for instituting a massive program in agricultural science and technology" complete with a "Manhattan Project on the bioconversion of solar energy." The current lack of commitment to such a project, he says, "is a travesty of the times."

The keys to improving tropical agriculture include new means of pest control, better management of fragile soils, and novel ideas for storing water. A group of staff scientists from the Agricultural Research Service write that losses of crops due to pests could be reduced by 30 to 50 percent, resulting in a 10 to 20 percent increase in the world food supply. P. A. Sanchez and S. W. Boul of North Carolina State University argue that solution of the world food crisis will remain in doubt unless ways are found to better utilize the leached-out soils that cover more than half the tropics. They suggest breeding hardy new crop and pasture strains to make these soils more productive.

Roger Revelle of Harvard and V. Lakshminarayana of the Indian Institute of Technology propose a novel plan to drain aquifers along the Ganges River basin during the dry season so that they will collect more water during the monsoons. They say the annual cost of irrigating crops with this water would be about $40 to $45 per hectare, but the annual return might be as high as $500 per hectare.

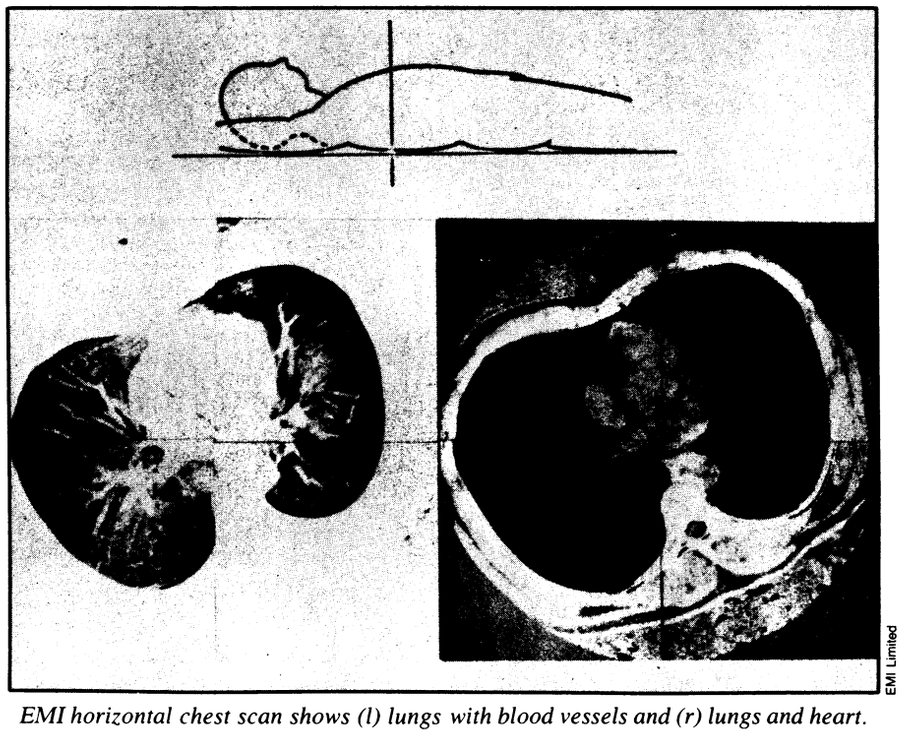
The final section of the special issue summarizes the current status of basic biology experiments that promise a new green revolution through tailoring crops to fit specific conditions (SN: 10/5/74, p. 218). Peter S. Carlson of Michigan State University and Joseph C. Polacco of the Connecticut Agricultural Experiment Station report on progress in genetic manipulation and mutant selection of plant cells in tissue culture and regeneration of these cells into entire plants. Israel Zelitch of the Connecticut Agricultural Experiment Station says that tropical plants that use sunlight more efficiently in photosynthesis than most temperate-zone plants do so because of specialized cells that inhibit wasteful photorespiration. Rather than cross-breeding these plants with less efficient varieties as some have suggested, Zelitch concludes the easier approach would be to inhibit photorespiration more directly in those plants. Finally, R. W. F. Hardy and U. D. Havelka of Du Pont report on their own recent work demonstrating that a major limiting factor for

nitrogen fixation in soybeans is an inadequate supply of photosynthate in the root nodules. This leads them to an important conclusion: "Improved photosynthate production by cereals such as wheat and rice may be a prerequisite for the useful extension of any biological nitrogen-fixing system to these crops." This is one goal of current research.

In an interview with SCIENCE NEWS, Abelson discussed the related matters of energy and food that were covered in two special issues of SCIENCE. He disagrees with the pessimism of NAS President Philip Handler (SN: 11/2/74, p. 278), calling the concept of triage "inhuman" and saying population can indeed be brought under control in time. In his opinion, the United States should continue to provide food aid to those countries suffering the most, without griping too much about the extra cost of producing the food because of rising Arab oil prices. Only a fraction of our energy consumption goes to agriculture, he says—the real problem is "those damn two-ton gas-guzzlers;" all our crops could be raised on a fraction of domestically produced petroleum.

The problem finally becomes one of time, whether developing nations can control population faster than the industrialized ones did. "For reasons Malthus could have hardly foreseen," Poleman concludes, "the misery and vice about which he brooded may yet be visited on much of the world." □

EMI scanner: Now for the body



EMI horizontal chest scan shows (l) lungs with blood vessels and (r) lungs and heart.

Three years ago, a British electronics research firm—EMI Limited of Hayes, Middlesex, England—introduced a brain scanner that has revolutionized neurological diagnosis.

The EMI brain scanner, as it is called, offers views of the brain which are not available or are only poorly available with conventional X-rays, nuclear scans, angiograms and pneumoencephalograms, thus helping neurologists better diagnose brain tumors, blood clots, lesions of the optive nerves and other brain abnormalities.

The brain scanner is safer than conventional diagnostic techniques because it requires minimal exposure to X-rays and radioactive dyes. It is quicker than conventional techniques because it takes only several hours on an outpatient basis compared to three or seven days in the hospital. And it is more economical, costing a patient about $200, versus $1,000. What's more, the brain scanner is painless, which several of the conventional techniques are not, since they require the injection of dyes, air or gas into the brain (SN: 9/1/73, p. 134). Some 80 EMI brain scanners are used in the United States alone.

Now EMI Limited has developed an EMI body scanner based on the same principle as the brain scanner. It promises to revolutionize the diagnosis of various bodily ailments, such as the enlargement of, or changes in bone, organs or tissues caused by cancer, heart disease, lung diseases or other illnesses. Like the brain scanner, it also offers certain advantages to the patient over conventional X-ray diagnosis.

The way the brain or body scanner works resembles this pattern: A device is placed around a patient's head or body. On one side of the device is an X-ray beam source; on the other side is a crystal. The device rotates 180 degrees around the patient's head or body. As it moves, the X-ray beam source shoots 160 different areas of the brain or body. The amount of radiation that passes through the head or body with each scan is then picked up by the crystal on the opposite side of the device.

The crystal digitizes the amount of radiation, and the information is fed into a computer. Thus the computer digests some 160 scans, which consists of solving some 28,000 simultaneous equations. The computer then turns out a three-dimensional picture of the brain or of a certain area of the body. Conventional X-ray diagnosis provides only a two-dimensional picture of the head or body since X-rays are shot through only one place on the head or body.

The EMI brain or body scanner provides a hundred times more information about the brain or body than X-rays and other diagnostic techniques combined. The brain scanner, for example, shows the difference between white and grey matter in the brain; conventional X-rays do not. It also shows up lesions in the optic nerve that have not been visualized before, and it reveals brain tumors and blood clots that are difficult to pick up using conventional diagnostic techniques.

The body scanner shows up bones, organs and tissues that appear fuzzy or do not appear at all on conventional X-ray pictures, because the computerization of data by the scanner picks up extremely small differences in density which are impossible to show with ordinary X-rays. Thus the scanner should provide physicians with valuable information about organs, bones and tissues that otherwise would only be revealed by exploratory surgery.

The full potential of the body scanner is not yet known. Clinical trials with the scanner will be starting shortly in Britain at the Northwick Park Hospital, Harrow, Middlesex, and in the United States at the Mayo Clinic in Rochester, Minn., and at the Mallinckrodt Institute of Radiology in St. Louis.

"This new method of examination is destined to bring about a complete transformation in the use of X-rays in medical diagnosis," declared EMI's research director, W.E. Ingham. "It is as though a doctor can hinge open the patient's body at any point he choses. . . ."

The body scanner also holds certain advantages for the patient over conventional X-rays or exploratory surgery. It can be done on an outpatient basis, so it should be quicker and less expensive. The scanner also exposes the patient to less radiation than conventional X-ray diagnosis because its electronic detection system is more sensitive than X-ray film is. Hence less radiation has to be used. □