the production of free radical or activated molecules in material being radiated. Ionizing radiation produces free ions on portions of stable molecules; these free ion radicals in turn may recombine with molecules to which they were not previously attached, forming new chemical compounds.

Radiation in the frozen state is proposed as method to decrease the diffusion rate of free radicals produced by ionizing radiation. In the frozen state the free radicals do not have as much freedom to combine randomly with other molecules and produce undesirable compounds. Radiation in an inert atmosphere, devoid of oxygen, reduces the potential number of free radicals and thus cuts down on the degree of side reactions.

The third approach is one of adding compounds before radiation of the food which will preferentially combine with the free radicals. These chemical compounds, called free radical acceptors (FRA), are added as "expendables" to be inactivated by free radicals produced during radiation. The basic criterion for a FRA is that it have a greater affinity for the free radicals produced than that of the compounds present in food which are to be protected. Ascorbic acid is one compound which has been proposed as a FRA.

The problem of side reactions has also stimulated as yet unsupported speculation that radiation could produce new compounds within foods which are not only unpleasant but harmful to health. As yet no materials of this type have been reported; however some workers believe that theoretical possibilities of production of antimetabolites by radiation of such normal metabolites as vitamins must be extensively investigated.

Further study of the fundamental chemistry of the compounds produced in foods by ionizing radiation may open new approaches to the off flavor problem. Meanwhile the FDA has adopted an unofficial attitude that the radiation researchers will have to find the degree of radiation which is capable of producing harmful side effects or categorically prove that materials harmful to health cannot be produced by radiation of foods, before there will be any consideration by the FDA of commercial applications of cold sterilization.

Based on present knowledge there do seem to be some areas of application which might find use in the relatively near future. These applications are not based on sterilization, but rather on cutting down bacterial populations. The term "radiation pasteurization" has been coined to describe this technique, analogous to heat treatment of milk which kills the majority of bacteria present and increases the storage life of the product.

Surface sterilization of foodstuffs, frankfurters for example, is seen as a possible application in the not too distant future. Much lower levels of radiation could be used than those necessary for sterilization, yet the shelf life of the product could be greatly increased.

A. M. Doty and his coworkers at the American Meat Institute have demonstrated the practicality of increasing the shelf life of meat five fold by exposure to radiation at levels about one tenth of those necessary for sterilization. This pasteurized meat is claimed to be relatively free from offensive "off flavor."

Participants in the symposium were rather strongly of the conviction that the public should not be led to believe that the era of commercial radiation sterilization is just around the corner. It may be someplace around the block, for there are still a vast number of problems to be solved. It seems certain that the solution to the problems of the various corners will reside primarily with the food chemists and food technologists.

Evaluation of Surfactants in Fertilizers Calm Enthusiastic Claims

Experimental testing indicates benefits of surfactant addition not revolutionary

NEW YORK.—Optimism over the use of surfactants in fertilizer manufacture rose to a high peak two years ago. Claims included speedier curing of superphosphates and ammoniated goods as well as improved physical condition of the product even after short storage periods. By the beginning of 1954 further study had cooled the enthusiasm. A group of papers at the recent National Meeting of the AMERICAN CHEMICAL SOCIETY appears to have assessed the value of surfactants objectively with claims at a moderate level.

Selected surface active agents were used at Battelle Memorial Institute in large-scale acidulation and ammoniation runs. The effect on curing, in terms of P-205 conversion appeared negligible. Physical condition may have been improved to some extent, but recommendation of use in replacement of inert conditioners depends on effectiveness of the latter and relative costs of the inert and surface active materials.

No reduction in caking tendency in bagged fertilizer can be expected from incorporating surfactants into mixed fertilizers according to William Tucker, of GLF Soil Building Service, if they are to be bagged within a week of manufacture and stored for more than three weeks. He concluded that no reduction in caking tendency can be expected from the presence of an anionic surfactant if the fertilizer has been cured for four weeks prior to bagging.

USDA work at Beltsville, Md., has

Edwin Cox, vice president in charge of research for Virginia-Carolina Chemical Corp. (center) poses with G. L. Bridger, Iowa State College (left), and J. D. Romaine, American Potash Institute at the luncheon of the Division of Fertilizer and Soil Chemistry. Cox, the speaker, proposed revolutionary and not evolutionary philosophy as the most effective means of advancing agriculture and helping it to meet the ever growing demands of an increasing population. New approaches to such basic phenomena as photosynthesis and soil microbiology are typical examples

brought out some indication of possibilities and benefits. Kumagai and Hardesty got their best results with the use of nonionic surfactants in superphosphate manufacture. With the addition of proper amounts of nonionic surfactants there is a lower density of product, moderate increase in ammonia absorption capacity, and slightly better condition of bagged fertilizer.

The additional observation that surfactants may help in keeping plant machinery clean, appears to sum up the concrete benefits recognized at present from the use of these additives in fertilizer manufacture.

Revolution Needed in Plant Food Research

"We should not think of ourselves as God's frozen people, continuously talking to ourselves, reiterating other proofs of established facts—but we should become dangerously radical and even engage in hypothesis."

Taking off from this summary of George Scarseth's shot-in-the-arm address before the 1953 luncheon of the ACS Division of Fertilizer and Soil Chemistry, Edwin Cox, Virginia-Carolina Chemical Co. gave this year's session of the same meeting, more of the same kind of talk. Some of Cox's views:

Evolution must be replaced by revolution if plant food research is to make the progress needed to feed mankind. The lodestar is the photosynthesis reaction. We have a very low efficiency rating in our use of it—overall efficiency of use of solar energy he placed at 0.001%.

Plant food research cannot stop with restoration or replenishment of needed chemical elements to the earth. The "adequate and balanced" ration must be delivered to the digestive organs of the plant in digestible form.

No other country in the world spends so much money gathering, tabulating, and printing statistics as does the U. S. This is not enough. It is time we adopted most postulation and speculation in pursuit of knowledge to support the reaction of photosynthesis upon which depends our food, fiber, and fuels.

"The 'phenomenal' advance of nitrogen utilization in agriculture from 1938–39 to 1950–51 in these United States was 156%. In the same period with a heavier war load, Britain increased its agricultural consumption 264%. In 1950–51, the U. S. consumption of nitrogen per arable acre was one-fourth that of France; one-seventh that of England; one-tenth that of Germany; and one-thirtieth that of Holland. Nitrogen fixation is a half-century old. Evolution is a term more apt than revolution. Revolutions are 'sterner stuff' "

A portion of the enthusiastic SRO audience to which the Symposium on Chemical Aspects of Flavor and Odor played tries out phenylthiocarbamide. This chemical, according to Arthur L. Fox of Colgate-Palmolive, separates the tasters from the nontasters

Insects Favored over Humans as Taste Testers

Divergent opinions offered to explain taste and odor mechanisms . . . 10 different classes of tasters a factor in human food preferences

NEW YORK.—Although man has been eating, tasting, and smelling for millions of years, no one yet has offered an adequate explanation of how it is done. The object of the Symposium on Chemical Aspects of Flavor and Odor Perception was to present some of the divergent opinions offered as explanations for taste and odor mechanisms. The symposium presented the talents of a number of nonchemists who are active in the field of taste and odor perception, and it was generally agreed that there was an unusual opportunity for a general exchange of new ideas on the problem.

One of these nonchemists is Hubert Frings, an insect physiologist from Pennsylvania State University. As a result of taste studies originally conducted on the cockroach, Dr. Frings believes that the concept of sweet, sour, bitter, and salty as the primary tastes may be a misleading oversimplification.

Dr. Frings says that insects are ideal experimental panels for taste studies and most of his work has been concerned with the taste preferences of such usually overlooked animals as the caterpillar of the cecropid moth, and the American cockroach.

One advantage of insects over humans for this work which Dr. Frings cited is the fact that the insect is relatively free from imagination, and is usually much more cooperative than human subjects. The four major classes of tasters, based on the two chemicals, are: bitter-salty, bitter-sweet, bitter-bitter, and tasteless-salty. The tasteless-salty class, comprising about 14% of the population finds phenylthiocarbamate tasteless and sodium benzoate salty.

As a result of the taste perception studies Dr. Frings proposes a "taste-spectrum" hypothesis in place of the usually accepted theories on sweet, sour, bitter, and salty. For man he believes that the tongue has a population of taste receptors of varying sensitivity, not to taste but to ionic concentrations. The taste interpretation by the brain is based on the number, not the kinds of these perceptors which are stimulated. If only a few of the receptors on the tongue are stimulated, the brain interprets the taste as sweet; as the number of receptors stimulated increases, the taste interpretation by the brain runs up through salty, bitter, and sour.

In the insect studies Dr. Frings plotted the threshold concentrations of various salts to find the levels at which his cockroaches would not eat through them.