pet-washing. Drs. W. W. Duecker and C. R. Payne on the multiple fellowship on sulfur have found that acid-resistant cements, made by combining sulfur with an aggregate, can be improved by the addition of certain olefine polysulfides, and that such modified cements are valuable bonding agents and protective coatings in structures subjected to acids or corrosive solutions. On the shaving fellowship E. J. Casselman has been studying safety-razor guard-bar design and razor-blade quality; he has developed a procedure that has resulted in the advancement of the technique of controlling factory methods for sharpening blades as well as enabling the manufacturer to specify the correct quality of blade steel. The multiple fellowship on organic synthesis (Dr. E. W. Reid, senior fellow) has been remarkably successful in preparing new, commercially valuable compounds for a wide variety of uses: glycol ethers, novel plasticizers, new types of vinyl resins, triethylene tetramine, and morpholine derivatives. Two new strained foods (a cereal and apricots) have been developed by the food varieties fellowship, and E. R. Harding, the senior fellow, and Miss Helen B. Wigman have continued their study of vitamin C. On the sugar fellowship Dr. G. J. Cox and Miss Mary L. Dodds attained in 1934 results that suggest the existence of a factor which, if present in the diet during a critical period of tooth formation, will aid in the construction of teeth resistant to decay. The useful chemicals that this fellowship demonstrated could be produced from sugar, such as sucrose octa-acetate, calcium levulinate and the ethers of levulinic acid, are now being manufactured by an industrial organization.

Seven new fellowships began operation during the fiscal year—starch, stone, closure, zymology, demulcent, laboratory and thread. Another fellowship, on soya bean, started work on March 1, 1935. The following fellowships concluded their research programs during the year: cleaning, velvet, vanadium, sugar, phosphates and paper finishing.

It is announced that the new building of the institute will be gradually occupied during 1935. The chemical engineering quarters are practically finished and many of the new laboratories will be ready for occupancy within the next few months. It is planned to have the building completed by the end of 1935. The first use of the edifice was to house the Science Exhibition held in connection with the Pittsburgh meeting of the American Association for the Advancement of Science. More than 25,000 persons visited this exhibition, which was open from December 27 to 30, 1934.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

PARADICHLOROBENZENE, AN EFFECTIVE HERBARIUM INSECTICIDE[1]

THE plants in an herbarium must be kept free from pests. This is commonly done by periodic fumigation with hydrogen cyanide or carbon bisulfide. Such methods require either an airtight case in which to carry on fumigation or the general herbarium cases sufficiently airtight to retain the fumes within the case. Both methods may have serious after-effects if the substances are not adequately cleared out of the air. In our case with neither a fumigating case and far from airtight herbarium cases, neither of these methods could be used. Routine poisoning of new specimens checked the introduction of new pests but did not free the old plants.

Taking a tip from the entomologists, we decided to try out paradichlorobenzene. We have found it an immense success. In practice a small unsealed envelope with about a heaping teaspoonful of paradichlorobenzene is put somewhere in the herbarium case. In our practice one such envelope is put at the bottom of the case and does for two columns of 17 pigeonholes each. The chemical volatilizes in the course of two or three weeks. The fumes penetrate the compartments and in a few days diffuse out around the doors. We have done this for our whole herbarium towards the close of the school year for the past two years. In the first fall following this treatment, we were able to find living pests in a bulky specimen of Asclepias, a few pupae in other Asclepiases and in one legume. Thousands of dead larvae and pupae scattered through the herbarium were mute testimony to the action of the paradichlorobenzene. Following the second year of such treatment, we have been able to discover no living pests anywhere in the herbarium.

The same substance may be employed in fumigating duplicates or in recent accessions which have not yet been mounted. The simple practice is to put a small amount in an envelope in the ordinary pasteboard boxes that plants are stored in and allow it to remain until one is ready to use the plants. No effort is made to keep these boxes airtight, but they are usually tied up. In thus treating one group of plants

[1] Contribution No. 346 from the Department of Botany and Plant Pathology, Kansas State College of Agriculture and Applied Science, Manhattan, Kansas.

which we knew to be very badly infested with larvae, we closed the box with gummed paper except for one corner where a small hole about 2 mm wide was left. When this box was opened up a month later, hundreds of dead larvae were found in the immediate vicinity of this hole in the box and still more hundreds were in the plants in the sheets from which they had been unable to escape.

The substance paradichlorobenzene kills not only the larvae and pupae, but also the eggs. It, of course, takes longer exposure to kill the eggs, but entomologists feel that the presence of a highly saturated atmosphere for two weeks will do this. It is our experience that this is undoubtedly the case.

In summary, paradichlorobenzene has been found to be an inexpensive, very proficient means of carrying on herbarium fumigation *in situ*, as it kills all forms of the pests with a minimum of caretaker's discomfort and is not a fire hazard.

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AN IMPROVED METHOD FOR SEED GERMINATION

IN germinating seeds on either wet blotting paper or towelling paper, certain difficulties are often encountered. Chief of these is the development of root hairs into the surface of the substrata and subsequent difficulty in removing the germinated seeds without injury. A second problem is met with in keeping the seeds in a humid atmosphere most conducive to germination. The method described was designed to eliminate these problems.

Number 300 Cellophane (thin wrapping Cellophane), previously soaked in distilled water for a period of an hour or more to remove the glycerine, is placed wet upon a saturated pad of several sheets of blotting paper, or paper or cloth towelling. The Cellophane presents a very smooth surface to which the root hairs do not adhere.

The seeds are placed on the Cellophane and the blotting pad is placed in the bottom of a miniature greenhouse or other suitable enclosure, such as a bell jar. Thus a moist atmosphere is provided and excessive evaporation from the blotting pad is prevented.

In case seeds are to be germinated for planting purposes, sterilized wet fine sand may be used in place of the Cellophane and blotting pad. In this case, the seeds should be oriented for planting, the radicle in a vertical position. Seeds as large as those of pea, bean and corn may be germinated successfully in this manner.

A particular advantage of using glass-topped boxes or bell jars lies in the fact that the process of germination may be observed without disturbing the seeds. This procedure is good for preparing germinated seeds for the demonstration of root hairs.

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SPECIAL ARTICLES

MENINGITIS IN MAN CAUSED BY A FILTERABLE VIRUS

DURING December of 1934 two adult males, W.E. and R.E.S., developed an illness characterized by headache, vomiting, stiff neck and a high cell count, 1,700 and 720 per c.mm., respectively, in the spinal fluid. The cells in the fluid were practically all mononuclear elements. Both patients made a slow uneventful recovery and are now well.

The clinical pictures presented by the patients were almost identical and suggested a virus meningitis. Consequently, spinal fluid from each of them was inoculated intranasally, intraperitoneally and intracerebrally into 6 Swiss albino mice.

Of the 6 mice that received W.E.'s spinal fluid, one died on the third day of a streptococcal infection and was discarded. The remaining 5 mice became sick 6 or 7 days after inoculation. One of them died and was discarded, 2 were allowed to recover and 2 were killed in order to prepare a brain emulsion for intracerebral inoculation of other mice. The second lot of mice became sick about a week after inoculation and some of them were sacrificed for passage. By means of emulsions of bacteriologically sterile brain material injected intracerebrally into mice the active agent has been passed serially through 10 lots of mice and at present small amounts of a 10 per cent. emulsion of infectious brain material kill practically all the mice in 7 days.

In a similar manner an active agent free from bacteria was obtained by the inoculation of R.E.S.'s spinal fluid into Swiss mice. The virus has been passed through 9 sets of mice and reinoculation experiments clearly show that the W.E. and R.E.S. strains are immunologically identical.

Mice inoculated intracerebrally with either strain of virus become sick within 5 to 7 days and lose weight rapidly. Their fur is ruffled. Only a few of them develop signs referable to the central nervous system which consist of irritability and convulsions. No paralyses have been noted. The virus is in the brain, liver, lungs and blood. Mice inoculated intraperi-