It will be noted from the tables that,

16 samples of Belladonna leaf varied in strength from 121.0% to 200.0%.
22 samples of Belladonna root varied in strength from 91.1% to 155.5%.
10 samples of Cinchona yellow varied in strength from 105.8% to 182.6%.
14 samples of Cinchona red varied in strength from 136.6% to 203.0%.
10 samples of Coca leaf varied in strength from 118.8% to 230.0%.
6 samples of Colchicum seed varied in strength from 115.5% to 222.2%.
8 samples of Gelsemium varied in strength from 85.5% to 164.5%.
14 samples of Hyocyamus varied in strength from 47.7% to 137.5%.
15 samples of Ipecac, whole, varied in strength from 54.2% to 135.0%.
8 samples of Ipecac, powdered, varied in strength from 76.6% to 144.0%.
13 samples of Jalap varied in strength from 72.4% to 132.0%.
18 samples of Nux Vomica varied in strength from 36.8% to 106.4%.
4 samples of Pilocarpus varied in strength from 60.6% to 189.6%.
8 samples of Podophyllum varied in strength from 66.7% to 132.0%.
11 samples of Sanguinaria varied in strength from 131.2% to 273%.
11 samples of Stramonium leaf varied in strength from 121.6% to 208.0%.
6 samples of Veratrum varied in strength from 130.0% to 214.0%.

According to the tables, it would appear that Cannabis sativa is no more variable than many of the other drugs of the Pharmacopoeia.

A detailed outline of the methods which were employed for physiologically standardizing Cannabis and its preparations is given on pages 97 and 102 of the volume mentioned.

It is needless to say that any effort to discontinue a drug or remedial agent will be of little avail if that drug proves itself useful and important in the hands of physicians who obtain favorable clinical results from its use.

Drugs are sometimes useful to those only who know how and when to use them, and, those who have had favorable experience with them as "tools," in the treatment of disease cannot be dissuaded from their use by the mere dictum of any medical or pharmaceutical body.

A BIOLOGICAL TEST FOR ARSENIC*

ALBERT SCHNEIDER.

The test for arsenic about to be described is not new as it has been used in Germany and other European countries for some time. It is, however, quite new to American laboratory workers and is hereby given for the benefit of those who are not familiar with it.

Arsenic is widely distributed in nature and is extensively used in the arts and industries. Medicinally it is a popular tonic and it is also much used as an insecticide in the form of sprays and washes. Animal hides are frequently preserved by arsenic, which accounts for the presence of this powerful poison in glues and gelatins made from such hides. Fruits and vegetables which have been sprayed with arsenical compounds for the purpose of destroying insect pests, may contain enough of this substance to produce symptoms of poisoning. Arsenic is occasionally added to alcoholic beverages to give them a tonic effect. It has been demonstrated that very minute amounts of arsenic are normally present in various organs of the human body, as the thyroid gland, the thymus

* Presented in Scientific Section A. Ph. A., San Francisco meeting.

gland and liver, although some investigators question the correctness of this claim. However these somewhat problematical traces of arsenic in organs of the human body and also in the organs of other animals need not concern the routine laboratory workers.

As a rule, the tests for arsenic outlined in the majority of texts are chemical and hence this work is usually relegated to the chemical laboratory. Within recent years attempts have been made to employ biological tests for determining the presence of arsenic in food substances based upon the discovery that certain molds when growing in substances containing arsenic will give rise to garlic-like odors.

Gosio demonstrated that certain molds grown in and upon media containing very minute quantities of arsenic gave rise to gaseous compounds characterized by a garlic-like odor. Seven different species of molds are said to have this power, more especially *Penicillium brevicaule*, which Gosio isolated from the air and which he frequently found on decomposing paper. Crumbs of bread (wheaten) form the best culture medium for this mold and the incubation is done at a temperature of from 28° to 32° C., a vigorous growth being produced within 24 hours. In the presence of not more than 0.00001 gram of arsenic in such culture there will be noticeable a distinct and very characteristic garlicky odor which may persist for months, if the culture is not killed. These arsenic molds do not produce garlic odors with sulphur, phosphorus, antimony, boron and bismuth compounds but they do have the power of converting selenium and tellurium compounds into volatile substances having the garlic-like odor. The following is the method of procedure in making the test:

If the material to be examined is liquid, let the dry bread crumbs (either white or graham) absorb it to saturation, and then scatter a small quantity of fine crumbs over the surface. If the material to be tested is solid, grind or cut it into small pieces and mix with an equal amount of bread crumbs and then moisten with a little sterile distilled water. Place the prepared material in sterile flasks of suitable size and plug with sterile cotton. Sterilize the flask and contents by the usual fractional method at 100° C., or for 30 minutes in the autoclave. Absolute sterilization must be secured. There is no danger of volatilizing the arsenic at these temperatures. As soon as the flask and contents are cold, inoculate with the mold, as follows: The mold cultures may be grown on bread or on pieces of potato. Remove a small quantity of the mold in the spore-forming stage and mix with peptone salt solution or sterilized water. Add enough of this mold suspension to moisten the bread in the flask. Do not add more of the spore-bearing material than the mass (bread and arsenical substance) in the flask will absorb, as too much moisture will retard the growth of the fungus. Cover the inoculated flask with a rubber cap and incubate at a temperature of 37° C., although the ordinary room temperature will answer the purpose. As soon as the growth is clearly visible to the naked eye, which may be within 24 hours, the characteristic garlic odor will be noticeable on opening the flask. If no odor is appreciable, again seal and incubate for another 24 hours or longer. In case the substances to be tested are strongly acid, they may first be neutralized by means of calcium carbonate. It must be kept in mind that *Penicillium brevicaule*, as well as other molds, will convert tellurium

and selenium compounds into volatile substances having a garlic-like odor. The arsenic and tellurium odors are closely similar but that from selenium is somewhat different in quality, more like that of mercaptan. The test is extremely delicate, 0.00001 gram of arsenic can be recognized with certainty. A solution of 0.00001 gram of potassium tellurite in 10 cc. of mold infested gelatin medium, in a cotton plugged test tube, gave out a strong odor of garlic for several weeks.

Biginelli ascertained that the gases formed by *Penicillium brevicaule* in arsenical cultures were completely absorbed by solutions of mercuric chloride with the formation of a double compound of mercuric chloride and diethyl arsine which is quite easily decomposed, accompanied by the reappearance of the garlic odor. The test is unlimited in its application and will respond in the presence of all manner of organic substances and bacterial contamination. It is far more delicate than any of the chemical tests for arsenic and can be carried out in much shorter time.

FRANK. H. FREERICKS,
Chairman of Section on Education and Legislation.

H. P. HYNSON,
Chairman House of Delegates.

In the October issue, page 1167, error was made in announcing Mr. R. S. Lehman instead of Mr. Freericks as Chairman of the Section on Education and Legislation. Mr. Lehman is Chairman of the Section on Commercial Interests.