the cuticle in transverse view attained a thickness of 10μ. Stomata are found here and also a scattering of glandular and non-glandular hairs.

2. A cortex of varying thickness, depending upon the age of the portion of stem examined, and consisting of more or less tangentially elongated cortical parenchyma cells with simple pored walls and small to moderate sized, angular intercellular-air-spaces. The cortex cells become larger then smaller as the pericycle is approached.

3. A pericycle consisting for the most part of an irregular, interrupted circle of sclerenchyma fibers with strongly lignified walls, varying at different points in thickness from one to two or three layers of cells.

4. A phloem composed of sieve tubes, companion cells, and phloem parenchyma, but no bast fibers. Narrow, thin walled medullary rays separate this region into numerous patches.

5. A cambium of meristematic cells, forming an irregular circle.

6. A xylem about three and a half times as broad as the phloem region and composed of closely set radially arranged groups of wood fibers and spiral and pitted tracheae, separated by narrow medullary rays (1 cell wide) whose walls, like those of the wood fibers and tracheae are strongly lignified. The outer region of the xylem arms is composed for the most part of woody fibers with but few tracheae. The tracheae gradually increase in number until the inner portions of the arms show more of those structures than wood fibers.

7. Conjunctive tissue composed of cells having lignified, pitted walls separates the xylem from the next region or,

8. Pith, a broad central zone of more or less isodiametric to elongated parenchyma cells with pitted walls. Some of these cells, especially in the outer region, have lignified walls.

HISTOLOGY OF THE ROOT.

This organ, in its secondary growth, shows the following structural peculiarities, passing from periphery toward the center:

1. Several layers of tabular cork cells with brownish walls.

2. A cork cambium of meristematic cells.

3. A secondary cortex of numerous layers of tangentially elongated more or less parallel phloem patches, composed of sieve tubes, phloem cells and companion cells, alternating with narrow phloem medullary rays.

4. A cambium of irregular circular outline, composed of meristematic cells.

5. A xylem, comprising a broad central porous cylinder of numerous narrow xylem arms alternating with medullary rays, one cell wide. Each xylem arm is composed of many spiral and pitted tracheae, wood fibers with oblique slits in their walls, and wood parenchyma cells. All of the xylem elements have lignified walls.

MAINTAINING FROGS FOR TEST PURPOSES.*

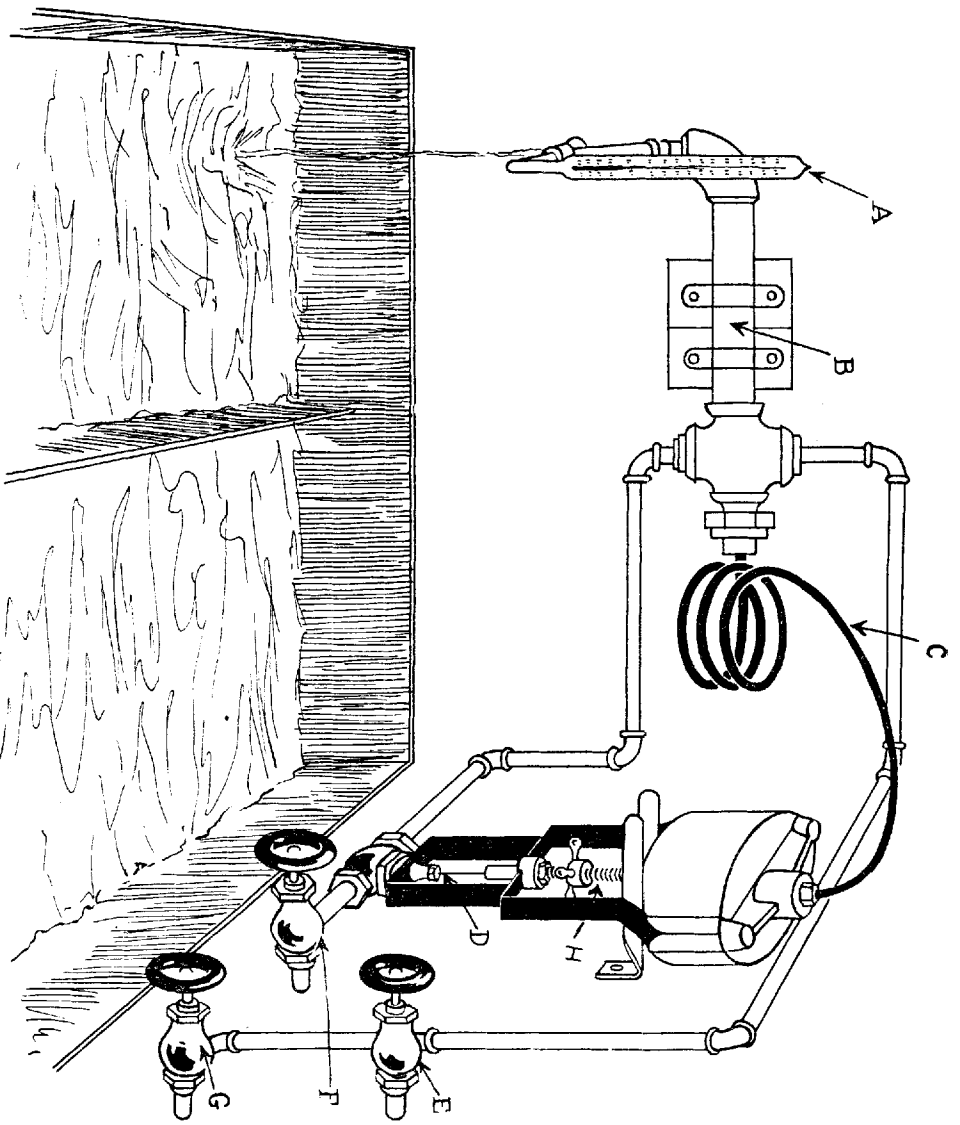
BY L. W. ROWE.

The proper maintenance of a supply of normal frogs throughout the year, when fresh supplies are not available daily, requires special facilities to avoid excessive losses and to insure uniform results when standardizing preparations of heart tonics of the digitalis series by the frog methods.

The chief source of trouble lies in the variation in temperature of the water in which the frogs are stored. In the summer the tap-water in the mains rises to 24° and 27° C., which is too warm, causing epidemics of disease to flourish among

*Read before Scientific Section, A. Ph. A., New York meeting, 1919.

the frogs. In the winter the temperature of the tap-water goes as low as 4° C. and at this temperature the frogs are too sluggish. Furthermore, in the winter the sudden change of the frogs from the very cold water to that in which the tests are conducted is not uniformly responded to even if they are placed in the warmer water an hour or two before injections are made.



Apparatus and Tank for Maintaining Frogs for Test Purposes.

It was, therefore, thought desirable in our laboratory to control the temperature of the water entering the frog tank so that it would be the same during the entire year. The task becomes more complicated when it is realized that the tap-water must be artificially cooled in the summer and warmed in the winter.

The sketch represents the arrangement of the apparatus and the tank. The tank itself is made of copper and placed in a chamber 4 ft. × 4 ft. × 4 ft., five

sides of which are sealed and insulated from room temperature by a thick layer of cork board. The sixth side is a tight fitting refrigerator door with three spaced panes of glass. Since the door is opened only two or three times a day the air in the chamber is maintained at approximately the same temperature as the incoming water. From the sketch it can be seen that three pipe lines, for hot water (E), tap-water (G), and ice-cooled water (F), respectively, supply the tank. The refrigerator for cooling the water is located below the sealed chamber. The thermometer (A) shows the temperature of the water entering the tank.

The apparatus which controls the temperature of the water which enters the tank, is known as the Sylphon Tank Regulator and is made by the American Radiator Co. A bulb containing a liquid with a high coefficient of expansion is situated in a metal jacket (B) through which the final mixture of warm and cold water must pass. This metal jacket is connected by pressure tubing (C) with a needle valve (D) in the ice cooled line. The expansion or contraction of the liquid in the bulb controls the amount of cold water which is admitted by opening or closing the valve. A spring (H) connected with the needle valve can be tightened or loosened so that any desired temperature will be necessary to open or close the needle valve.

In summer the hot water is not used at all but enough ice-cooled water is let in by the needle valve to cool a small stream of tap water to the desired temperature. In winter the temperature of the tap-water is raised to a point a little above that required, by opening the hot water valve slightly, then the needle valve lets in enough water from the cold water line (which in the winter is equivalent to a tap-water line since no ice is placed in the refrigerator) to cool the stream to the desired temperature.

To comply with specifications in the U. S. P., frogs must be kept at 15° C until wanted for immediate use.

It has been found in this laboratory that this temperature (15° C) is well suited to the proper storage of normal frogs and with the apparatus described above and the arrangement of it in the sealed chamber we are able to maintain this temperature to within about 1° C throughout the entire year, if necessary. While very sensitive to improper handling it is equally susceptible to proper adjustment and has been found satisfactory for maintaining an even temperature at all seasons.

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PHARMACEUTICAL EDUCATION AND OPPORTUNITIES.*

BY HENRY J. GOECKEL.

The entrance of the United States of America into the "World War" no doubt, brought before the educators and other leaders in pharmacy the fact that our colleges have not prepared graduates along certain lines within the legitimate fields of the profession. The war requirements of the United States Army in particular have brought this to the fore.

To those who have looked upon pharmacy and practiced the same as an im-

* Read before Section on Education and Legislation, A. Ph. A., New York meeting, 1919.