for science fair projects? The variety of projects using them would be limited only by the imaginations of you and your students.

I suspect that most high school teachers are still plagued with excessive non-teaching duties in addition to heavy instructional loads, and this prevents many of them from providing a variety of interesting instructional materials and student activities. But why not try our little six-footed poachers as laboratory animals? Some of your students will find them interesting, the farmers and grain dealers will be glad *you* have them, and the grain insects, particularly, will appreciate the opportunity to spend the winter inside.

The author wishes to express appreciation to Dr. William L. Butts and Dr. H. D. Pratt for granting permission for the use of their picture keys.

References Cited

Cotton, Richard T. 1963. Pests of stored grain and grain products. Burgess Pub. Co., Minneapolis. 1963. 306 p.

Mills, Robert B. 1965. Apparatus for studying feeding and oviposition by Angoumois grain moth adults. J. Econ. Entomol. 58(1): 117.

Solomon, M. E. 1951. Control of humidity with potassium hydroxide, sulphuric acid, or other solutions. Bull. Entomol. Research 42(3): 543-554.

Wilbur, Donald A. 1962. Stored grain insects, p. 466-494. *In* Robert E. Pfadt (ed.), Fundamentals of applied entomology. Macmillan, New York.

Inorganic Growth

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Using some inorganic chemistry, the author describes a "growth" process which is not biological.

A popular misconception among biology students is the belief that only living things are capable of growth. The following should lead to interesting discussions as to what is meant by biological growth.

The formation of metal trees (crystals) made of lead (Arbor Saturnii) (1), copper, and tin, in a silicic acid gel, is a convenient method for demolishing this shibboleth.

Basically, the metal tree growth process involves the continuous simple displacement of a less active metal, (tin, lead, copper), in

solution, by a more active one (zinc). More detailed descriptions of the chemistry of this reaction are available. (2, 3)

The silicic acid gel, formed by the acidification of water glass, (sodium silicate), acts as a support for the metal trees.

Prepare the following solutions:

Prepare the following solutions:

(1) Sodium silicate ($d = 1.06$)
This solution is made by the aqueous dilution of commercial 40° Baumé water glass ($d = 1.40$). The use of a hydrometer is recommended.

(2) Acetic acid (1.1 M)
Dilute 66 g of glacial acetic acid with water until the total has a volume of one liter.

(3) Tin (1V) chloride solution (0.5 M)
Dissolve 175 g of $Sn\ Cl_4 \cdot 5\ H_2O$ in sufficient acetic acid (1.1 M) to make a total of one liter.

(4) Copper (II) sulfate solution (0.5 M)
Add 125 g of $Cu\ SO_4 \cdot 5\ H_2O$ to enough acetic acid (1.1 M) so that the final volume is one liter.

(5) Lead (II) nitrate solution (0.1 M)
Dissolve 33.0 g of $Pb\ (NO_3)_2$ in enough acetic acid (1.1 M) to produce a total of one liter.

To prepare a metal salt gelling solution, mix equal volumes of sodium silicate solution ($d = 1.06$) and one of the metal salt—acetic acid solutions. Slowly add the sodium silicate solution to the metal salt solution, while stirring. Pour this gelling solution into test tubes. Keep covered. This mixture will gel within 8 hours.

After gelation, a cleaned zinc metal strip is inserted until it is almost entirely submerged below the surface of the gel, (Fig. 1).

Within 24 hours distinct metal crystal growth, of a few centimeters in length, will be observed. When the metal tree has attained a satisfactory length remove the zinc metal strip. This will prevent further growth of the metal tree. The tree may be preserved in this state almost indefinitely.

The author has found the growing of metal trees to be a superb student activity!

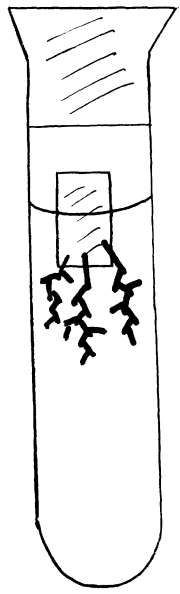

Fig. 1. Metal tree formation.

Suggestions for Further Activity

(1) Prepare a sketch of the various shapes assumed by metal trees. Contrast these pictures with prints made from actual leaves.

(2) How does gravity influence the direction of metal crystal growth? Do living plants respond the same way?

(3) Try growing a lead tree in a petri dish. Examine the lead crystals using a hand lens, microscope, overhad projector. Is it possible to actually see the crystals grow?

(4) What other types of inorganic crystals may be grown in a silicic acid gel? (4)

Note

The author would enjoy hearing from readers who have had experiences growing crystals in gels.

Bibliography

(1) Stone, C. H., J. Chem. Educ. 6 355 (1929)

(2) Taft, R. and Stareck, J., J. Chem. Educ. 7 355 (1930)

(3) Lauren, P. M., Chemistry 37 23 (1964)

(4) Strong, C. L., Scientific American 1962, March, 155.