alburnum; still others have the same behavior in ray-parenchyma and wood-parenchyma and both elements in the outermost ring of heartwood contain resin only.

The reasons for this marked variation in the behavior of ray-parenchyma cells are as yet unknown. The age of the tree does not appear to be a factor, for we have found both conditions in young and in old trees. Neither is there any sharp correlation with the environment. Trees high on the dry flanks of hills or deep in the canyons of this vicinity may have living ray cells deep in the duramen.

That these cells should survive during the pronounced changes in chemical constitution of the wood, altered composition of the sap and lessened oxygen supply is a remarkable occurrence. The nuclei undergo but little change and a superficial examination suggests consumption of the carbohydrates. The well-known abrupt diminution of starch in the rays occurs in the redwood at the stage of transition from sap to heartwood. The ratio of length of life of these cells to that of their growing period is the highest known. Full size is reached almost at once—within a few days—life may continue for a century or four thousand times the duration of the growing period. In *Carnegiea* medullary cells continue to enlarge for a century; in *Ferocactus* life continues for a period ten or twelve times the growing period which extends over a decade.

It is notable that the known long-lived cells of plants are all of the simple parenchyma type as in contrast with the highly specialized long-lived cells of the brain and heart of vertebrates.

The medullary cells of *Carnegiea* which grow for a century, as might be expected, retain their embryonic character. Those of the medulla and cortex of *Ferocactus* do not. The long-lived cells of the redwood lose their capacity for division at an early stage and play no direct part in the formation of calluses, or other regenerative action so marked in the redwood. In what way the existence of these numerous strips of living cells in the heartwood, which may reach an age of more than a century, affect the pressures and movements of liquids and gases in this tree is yet to be determined. The facts presented seem to constitute the first announcement of living cells in heartwood, as well as an extension of knowledge of the occurrence and behavior of long-lived cells.

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GLUCOSE AS AN ANTAGONIST

FOR some years the senior author has been engaged in the study of the habits and means of control of the onion root maggot (*Hylemyia antiqua* Meig.). Experiments have included extensive investigation of the chemotropic responses of the flies to various substances. Cane molasses has always proved a very satisfactory attractant and NaCN has long been known and used as an effective insect poison. In consequence, a mixture composed of ¼ ounce of NaCN, 1 pint of molasses, and 1 gallon of water, was included among the various poisoned baits it was desired to test.

In the summer of 1925, Mr. K. Stewart, working on the same problem, found that the NaCN-molasses bait gave very satisfactory results, ranking first of all the materials tried in the average daily catch of Diptera. These records were obtained by the use of wire fly-traps of the Minnesota type placed in the onion fields on the College farm, with the various poison baits in glass dishes under the traps.

The NaCN-molasses combination, as one of the most promising of the mixtures under trial, was selected by the senior author for further experimentation in 1926. It continued to give very satisfactory results so far as the catch of flies was concerned, but some doubt was experienced as to the extent to which this mixture was acting as a killing agent. Accordingly, cage experiments were started indoors in order to settle this point. It was found that while the NaCN combination was even *more* attractive to the flies than molasses and water alone, its toxicity was practically nil. Upon uncorking a bottle of the mixture which had been well shaken and then allowed to stand for several days, a distinct odor of ammonia was noticed, while that of HCN could no longer be detected. Moistened litmus paper gave the alkaline color reaction when held near the mouth of the bottle. Apparently, the – CN group had been decomposed, giving rise to ammonia, the evolution of which gas no doubt explains the enhanced attractiveness to the flies of the poisoned bait over that of a simple molasses-water solution.

The most probable explanation of the production of ammonia in the above mixture appears to be that of interaction between the NaCN and the glucose of the molasses to yield glucose cyanhydrin, which subsequently hydrolyzes, as follows:

$$NaCN + H_2O \leftrightarrows NaOH + HCN$$

$$CH_2OH(CHOH)_4 \cdot CHO + HCN \leftrightarrows CH_2OH(CHOH)_4 \cdot CH(OH)CN$$

$$CH_2OH(CHOH)_4 \cdot CH(OH)CN + H_2O \leftrightarrows CH_2OH(CHOH)_5 \cdot COOH + NH_3$$

Glucose solutions to which NaCN was added were found to give essentially the same results as did the molasses bait, but to a more pronounced degree. Further confirmation of the hypothesis respecting the origin of the ammonia is afforded by the results obtained with a mixture of cane-sugar solution (of the same specific gravity as that of the molasses used) and NaCN in the proportions of ¼ ounce of the latter to 1⅛ gallons of the former. When this mixture was used in cage experiments it was found that the HCN given off usually was sufficient to kill most of the flies without their having the opportunity to start feeding. Sucrose, having no free carbonyl group, would of course not undergo the cyanhydrin reaction.

In connection with the above, it is interesting to recall that Rasputin, the Russian monk who dominated the court of the late Czar, is reputed to have used glucose as a protection against sundry attempts upon his life by means of poison. Such results as have been described would suggest that this precautionary measure was well taken, in the case of NaCN at least. In addition, the findings of Heinekamp[1] respecting the resistance of various types of fowl to strychnine, furnish evidence that here also glucose, or its polymer glycogen, may have a rôle as antagonist in the case of the alkaloids as well as in that of the less complex poisons.

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GEOCHRONOLOGY AS BASED ON SOLAR RADIATION

In this journal of 1920 was mentioned a part of my plan for an investigation of certain laminated clays in North America.

During a previous visit in this country in 1891, I had, at several places, observed laminated clays similar to analogous late glacial melting sediments in Sweden, which I had found, after long-continued investigations, to represent the annual deposition from the melting water along the border of the retreating ice-edge.

By help of a certain graphic method for the comparison of the sharply marked annual layers or *varves,* I had succeeded in identifying such varves from one point to another and ultimately worked out a systematic plan for the elaboration of a continuous time scale. This was in the main carried out in 1905–06 on the basis of field measurements made, for a considerable part, by a great number of able young assistants. During the following years this standard line was completed at many places. I thus succeeded, step by step, in tracing the recession of the ice border and the immediately following transgression of the clay-varves over one region after the other, until the whole line from southernmost Sweden to its central parts had been controlled.

As was to be expected, the lowest and oldest clay-varves were found to be deposited in the southernmost part of the land, while the great ice-sheet still covered the rest. By following the clay transgression step by step, the whole staircase-like series was gradually built up, forming a continuous and exact time scale for the last ice-recession across Sweden up to a certain year when a great ice-dammed lake in central north Sweden was drained off, and a thick annual varve was deposited, which has been chosen as representing the very end of the late Glacial Epoch proper.

For many years I tried in vain to find out any means of determining the length of this Postglacial Epoch, until one of my most successful assistants, R. Lidén, discovered, in the northern parts of Sweden, measurable annual varves which represent that epoch.

Of varves from this epoch, I measured in one section at the Indal River somewhat over 3,000, but it was along the Angerman River that Lidén quite independently succeeded in finding and working out practically the whole of the Postglacial varve succession by a careful and painstaking combination of a long series of sections, showing the total length of the Postglacial Epoch to be about 8,700 years.

What made his work especially important is that there seems to be no other place in the world, not even in Sweden, where there is any possibility of finding such a continuous varves series for the whole of the Postglacial Epoch.

By noting the position of the bottom varves, the ice-recession in Sweden has been determined in detail at certainly more than 1,500 different localities, while sections down to the very bottom varve elsewhere—excepting in Finland—have but rarely determined the front margin of the lowest varve.

Thus, along the Connecticut Valley, according to Antevs' exceedingly interesting and comprehensive varve measurements, the bottom of the clay layers was so seldom exposed that the bottom varve, which marks the stage of the ice-recession, could only be determined at one point along the whole of the southern four fifths of the measured line of ice-recession. Even the remaining fifth part of the line, which is north of a gap in the section not represented by clay deposits, the bottom varve was located at only five points.

[1] Heinekamp, W. J. R., "The Resistance of Fowls to Strychnine." *Jour. Lab. and Clin. Med.* 11: 209–214 (1925).