The standard error of the difference between the two groups is 0.12, and it is considered that destruction of the beta cells in the islets of dog pancreas does not significantly alter the rate of production of elastase.

Group 1c (experiment). Twenty-four assays of pancreatic tissue in which both alpha and beta cells had been destroyed (method 2) showed no elastolytic activity, suggesting that destruction of the alpha cells is responsible for the failure of elastase production.

Group 2a (control). Seven assays of normal pancreatic tissue provided by experimental method 3 showed an average elastolytic activity of 0.36 mg per hour (S.D. = 0.12).

Group 2a (experiment). Seven assays of fibrosed pancreatic tissue from the same experiments showed no elastolytic activity, against the same elastin preparation.

Group 2b (control). Fifteen assays of normal pancreatic tissue showed an average elastolytic activity of 0.24 mg per hour (S.D. = 0.06).

Group 2b (experiment). Fifteen assays of fibrosed pancreatic tissue showed no activity against the same elastin preparation as in the control.

It appears, as described by Lansing, Rosenthal, and Alex (7) in teleost fishes, that the dog pancreas produces its elastase in the alpha cells of the islets. If the observation (2) that human atherosclerosis is associated with lowered elastase production by the pancreas is confirmed, it may be that atherosclerosis is a function of alpha islet cell failure.

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Occurrence of 2-Hexenal in the Cockroach Eurycotis floridana

Eurycotis floridana (Walker), a large wingless cockroach, has been recorded in Georgia, Florida, and Mississippi, occurring in outdoor sheltered areas such as stumps, under signs, and the bark of dead trees (*1*). When alarmed, the adults, but not the nymphs, emit a secretion that has an odor which Hebard (*1*) has likened to that given off by the hemipteron, *Brochymena annulata* (Fabricius).

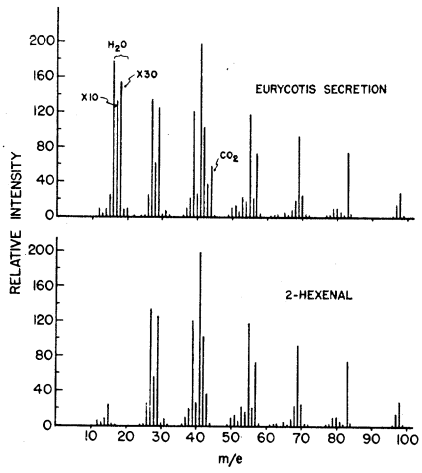

Fig. 1. Comparison of the mass spectra of 2-hexenal and the *Eurycotis* secretion.

In *Eurycotis,* the chemical is secreted by glandular cells into a large bilobed sac, where it is stored as a yellow liquid. The sac opens to the outside of the body medially in the intersegmental membrane between the sixth and seventh abdominal sternites. The location of this gland is similar to that found in *Blatta orientalis* (*2*).

When ejected, the volatile secretion from *Eurycotis* issues as a fine spray or as droplets that may be thrown for a distance of several inches. The secretion is toxic to the cockroaches if the insects are confined without suitable ventilation and made to emit the material. A similar toxicity occurs with the beetles *Tribolium* which are killed by their own odorous secretions (*3*), consisting mainly of ethylquinone (*4*). The *Eurycotis* secretion may be irritating if it gets on sensitive skin areas.

By means of mass spectrometry and infrared spectrophotometry, and the preparation of a chemical derivative, the *Eurycotis* secretion has been identified as 2-hexenal (*trans*). The sample, first analyzed in a Consolidated 21-103B analytic mass spectrometer, was prepared by simply dissecting out the reservoirs from adult males and females; some fatty tissue and parts of the sternites were also included. The sample was placed in a small tube that was attached directly to the inlet system of the mass spectrometer. The tube was cooled to – 180°C to condense the volatile components present, and then it was evacuated. The coolant was removed from the tube, and the condensed material was volatilized directly into the inlet system of the mass spectrometer. The first fraction collected at a pressure of 100 μ (volume of inlet system was 3 lit) was analyzed, as were a middle cut and the material present in the system at room temperature.

Structural analysis of the fragmentation pattern of the secretion showed that the material is a hexenal. Comparison of the spectrum of the secretion with the spectrum of various hexenals identified the secretion as pure 2-hexenal (Fig. 1). The secretion was contaminated only with CO_2 and H_2O, which condensed during the initial freezing from the air and from other tissues that were dissected with the glands. No trace of other impurities could be found. The CO_2 and H_2O may be mathematically removed from the spectrum of the *Eurycotis* secretion; the residue has a spectrum identical with that obtained from 2-hexenal. The spectra of the glandular secretions from male and female *Eurycotis* were identical.

The sample for infrared analysis was obtained by holding several males and allowing them to eject their secretion into carbon tetrachloride. The curve obtained was similar to that of synthetic 2-hexenal (Fig. 2) and further indicated the secretion is the *trans* form of the compound (*5*).

The 2,4-dinitrophenylhydrazone was prepared by allowing the cockroaches to eject their secretion into freshly prepared reagent (*5*). The melting point of the derivative was 139.5°–141.5°C, uncorrected (compare mp of 2,4-dinitrophenylhydrazone, 141°–142°C, *6*).

2-Hexenal was found to be one of the several carbonyl compounds responsible for the odor of whale oil (*6*). Other natural sources of this aldehyde are found in the plant kingdom. It is one of the constituents that make up the odor of Java citronella (*7*) and lavender oil (*8*). It forms part of the flavor of green tea (*9*), and the aroma of tea is primarily this compound (*10*). It has also been isolated from mulberry leaves (*11*).

Although nothing is known of the ene-

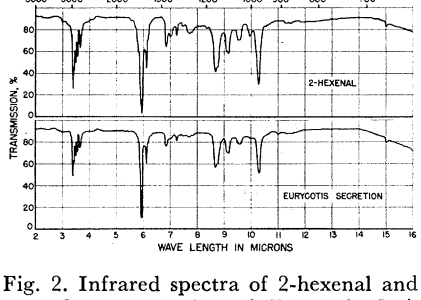

Fig. 2. Infrared spectra of 2-hexenal and the odorous secretion of *Eurycotis floridana.* Baird spectrograph with NaCl prism; samples in carbon tetrachloride solution; cell thickness, 0.1 mm and 0.418 mm, respectively.

mies of adults of *Eurycotis*, it is possible that 2-hexenal functions as a repellent or deterrent if the insect is attacked by a predator. Derivatives of 2-hexenal have been investigated as possible insecticides or insect repellents by the Orlando laboratories (*12*), and it is interesting to note that *Eurycotis* was using this compound long before man recognized a need for insect repellents.

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Ultraviolet Absorption Spectra of Lichen Depsides and Depsidones

The two largest groups of aromatic lichen substances are classified as the depsides and depsidones. They consist of orcinol (5-methyl-1,3-benzenediol) and β-orcinol (2,5-dimethyl-1,3-benzenediol) derivative carboxylic acids joined by an ester linkage (depside) similar to digallic acid or by an ester and an ether linkage (depsidone) that binds the two rings. These unique metabolic products of lichens constitute 1 to 5 percent of the dry weight of the plant body, from which they may be extracted by ordinary chemical methods and purified by recrystallization (*1*).

In preparing the extracts for spectroscopy, it is difficult to find a suitable solvent. Depsides and depsidones are insoluble or barely soluble in many common nonpolar and polar organic solvents. Although acetone dissolves all of them, it is unfit as a solvent in ultraviolet. The substances could, however, be dissolved in 95-percent ethanol in concentrations of $10^{-4}M$, although not without danger of alcoholysis when prolonged heating was necessary. The absorbancy of the alcoholic solutions was measured on the Beckman model DU spectrophotometer (*2*).

The orcinol depsides have a characteristic bimodal spectrum of molar absorbancy in the range 240 to 330 mμ (Fig. 1*A*), which is shared even by orseillic acid, a common hydrolytic product of depsides, and the tridepside gyrophoric acid. Absorption maxima occur at about 270 and 307 mμ. Substitutions on the phenyl rings, as methoxyl in place of hydroxyl radicals, or the length of the alkyl side chains (CH_3— to C_7H_{15}—) have little effect on the position of λ_{max}. The β-orcinol depsidones also have bimodal spectra (Fig. 1*B*) with maxima near 238 and 312 mμ; absorbancy is much higher in shorter than in longer wavelengths. Curves of the β-orcinol depsides resemble those of β-orcinol depsidones although the absorption bands are not as sharp. The orcinol depsidones have poorly defined curves with a maximum at 245 to 255 mμ and a slight peak or leveling at 310 to 320 mμ (Fig. 1*C*). As a rule, increasing numbers of substituents, especially carboxyl or carbonyl radicals, exert a dampening effect on the absorption bands.

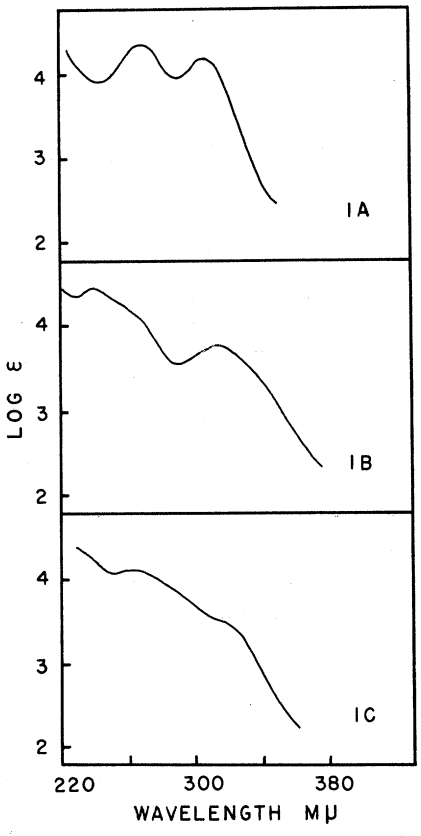

Fig. 1. Log molar absorption spectra for three lichen acids dissolved in 95-percent ethanol: (*A*) lecanoric acid, a common orcinol depside ($\lambda_{max.}$ 270 and 307 mμ); (*B*) salazinic acid, a common β-orcinol depsidone ($\lambda_{max.}$ 239 and 312 mμ); (*C*) physodic acid, an orcinol depsidone ($\lambda_{max.}$ 256 mμ).

These absorption spectra have provided a valuable means of identifying unknowns that are eluted from chromatograms and that are available only in minute quantities. Spectra of other lichen substances, such as the dibenzofuranes (*3*), quinones (*4*), and fatty acids, are completely dissimilar. Spectrophotometry will undoubtedly be an indispensable tool for analyses of precursors to the depsides and depsidones in pure cultures of the lichenized fungi (*5*) as well as for assays of the substances in chemotherapy (*6*).

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17 October 1955

The design of a computing device with intelligence enough to make mistakes and make a fool of itself, like a human being, is one ultimate goal in modern electronic computor design.—ROBERT K. PLUMB, *New York Times*, 24 Mar. 1955.