has a marked inhibitory effect on the growth of this fungus on culture media. Further investigations are being carried out to determine its spectrum of antibiotic activity and its relationship to the fungus in the field.

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Rutin in Tobacco grown in a Greenhouse

IT has been reported[1-3] that leaf from tobacco grown in a greenhouse contains no rutin and in general much less polyphenolic material than leaf from plants grown in the field, and it has been concluded that the filtering action of the greenhouse glass to ultra-violet irradiation is responsible for certain of these differences. However, Frey-Wyssling and Bäbler[1] were able to show that when greenhouse plants were irradiated with ultra-violet light the chlorogenic acid content of the leaves was increased, but that rutin was still absent, which implies that the apparent absence of rutin is not due to limited ultra-violet irradiation.

We have recently experimented in this Department with the flue-cured tobacco variety Hicks in order to see if satisfactory leaf can in fact be grown under glass. The plants were grown both in clay pots and polyethylene buckets containing washed quartz sand using the nutrient solution developed by McEvoy[4] supplied by means of a drip-feed system. The plants were handled in a similar manner to tobacco grown in the field; they were topped at sixteen leaves and suckers were removed as they appeared. The leaves were harvested as they became mature and cured in a small cabinet. After curing, the leaves had the appearance of tobacco grown in the field, and comparable plant yields were obtained.

Aqueous extracts of the green and cured leaves were examined for polyphenols by means of one- and two-dimensional paper chromatography[5], and in agreement with other workers it was found that the total amount of polyphenolic compounds was less than in field-grown tobacco. However, rutin (quercetin-3-rhamnoglucoside) was present in the extracts. No other flavonols or flavonol glycosides could be detected on the chromatograms. A useful spray reagent for the detection of flavonols consists of a freshly prepared mixture of equal volumes of boric acid (1 per cent in acetone) and citric acid (10 per cent in acetone). With this reagent the rutin spot turns yellow and shows a greenish-yellow fluorescence under ultra-violet light.

The rutin contents of several samples of cured greenhouse-grown tobacco were determined using a modification (Weaving, A. S., unpublished method) of the methods proposed by Wilson[6] and Guseva and Nestyuk[7]. It may be mentioned here that the method used by Turner[8] was not suitable owing to the interference by chlorogenic acid. The results obtained are given in Table 1 and are expressed on a moisture-free basis.

Table 1. RUTIN CONTENTS OF GREENHOUSE-GROWN TOBACCO

	Clay pot (per cent)	Polyethylene bucket (per cent)
Third harvest	0·24	0·23
Fourth harvest	0·24	0·24
Fifth harvest	0·29	0·28
Sixth harvest	0·37	0·33
Seventh harvest	0·39	0·43

These rutin contents are much lower than those of field-grown flue-cured tobacco, for which we have found values ranging from 1·0 to 1·7 per cent (Weaving, A. S., unpublished results).

It has been shown by Penn and Weybrew that cultural and curing practices can greatly influence the polyphenol content of tobacco grown in the field, and this aspect is now under investigation with greenhouse plants.

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HISTORY OF SCIENCE

Inertial Navigation

THE recent voyage of the submarine *Nautilus* below the polar ice has caused interest to be focused on the subject of 'inertial navigation'. This recalls to mind a communication which was published in *Nature* (7, 483; 1873). A correspondent, Joseph John Murphy of Co. Antrim, discounted the idea that "the instinct of direction in animals is of the same kind as the faculty by which men find their way" and suggested instead a mechanical analogy basically identical with 'inertial navigation', namely:

"If a ball is freely suspended from the roof of a railway carriage it will receive a shock sufficient to move it, when the carriage is set in motion: and the magnitude and direction of the shock . . . will depend on the magnitude and direction of the force with which the carriage begins to move . . ." ". . . every change in . . . the motion of the carriage . . . will give a shock of corresponding magnitude and direction to the ball. Now, it is conceivably quite possible, *though such delicacy of mechanism is not to be hoped for* [my italics, D. C.], that a machine should be constructed . . . for registering the magnitude and direction of all these shocks, with the time at which each occurred . . . from these data the position of the carriage . . . might be calculated at any moment."

Murphy went on to detail the possible mechanism by reference to the recording anemometers of his day, and even suggested dial indication of instantaneous distance and direction from the starting point.

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