virus in Britain has now been established[3], it seemed desirable to investigate the degree of infestation by this flea of the rabbits on Skokholm, which still continue to remain unaffected by the present epidemic of myxomatosis. In the summer of 1954 the warden of Skokholm Bird Observatory examined for me thirty rabbits taken there; but could find only one flea—this was not identified and may have been a bird flea (numerous puffins and shearwaters nest in rabbit burrows on Skokholm). In March 1955 I visited Skokholm and examined a further thirty rabbits, as soon as taken alive, without finding a single flea. (Mainland rabbits show an infestation of between 0 and 270 fleas per individual.)

It seems clear that the failure of myxomatosis to spread at Skokholm was, and is, due to this absence of the virus-carrying *Spilopsyllus* flea. The absence or scarcity of this flea on Skokholm (240 acres) is in contrast with conditions on the neighbouring island of Skomer (750 acres), where on May 25, 1954, I examined three adult rabbits carrying 3, 12 and 12 fleas respectively. Myxomatosis arrived naturally on Skomer (probably via fleas carried on carrion-eating gulls which were feeding on rabbits dying of the disease on the mainland, and which were roosting the same night on Skomer—as these gulls also roost at Skokholm) in the autumn of 1954, and has since almost completely destroyed the Skomer population of at least six thousand rabbits.

As a vector, the European rabbit flea seems to be more effective in temperate climates than the various species of mosquitoes, which spread the virus in warm humid regions or weather. In Australia the European rabbit flea is unknown, and the native stickfast flea, *Echidnophaga* (from marsupials), which attaches itself to rabbits, is a much less effective vector, often perhaps in chain-transmission with the mosquito. In New Zealand, where there are no rabbit or marsupial fleas[4], introductions of the myxoma virus have generally failed in spite of numerous indigenous biting mosquitoes and sandflies[5].

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Effect of 'Tobacco Leaf-Curl' and Tobacco Mosaic Virus on the Amino-acid and Amide Content of *Nicotiana* sp.

The results of Martin, Balls and McKinney[1], Meneghini and Delwiche[2], Commoner *et al.*[3] and others have shown that virus synthesis is associated with a remarkable increase in the soluble protein content of *Nicotiana* leaves infected with tobacco mosaic virus. Takahashi and Mamoru[4], and Commoner *et al.*[5], have resolved and isolated a new protein from virus-free extracts of mosaic tobacco leaves, which was not detected by Wildman, Cheo and Bonner[6], by electrophoresis. A study of free and hydrolysed protein of both healthy and virus-infected leaves, by a modified technique of horizontal paper chromatography, has revealed the absence of a ninhydrin-reacting substance (present in healthy leaves) from the water extract of leaves infected with tobacco mosaic virus and leaves infected with tobacco curl virus. Further, the water-soluble extracts of diseased leaves revealed the presence of two new bands corresponding to asparagine and histidine–lysine.

The leaves were extracted with hot water, and the hydrolysate prepared by hydrolysing the residue of the plant material with 6 *N* hydrochloric acid and autoclaving at 15 lb. pressure for 2 hr. The solutions were centrifuged at 2,000 revolutions per minute and the clear supernatant liquid was spotted on their respective places for the separation and identification of the amino-acids.

To eliminate any overlapping of the adjacent bands[7], thus making quantitative estimations[8] more reliable, and also to keep a number of solutions on the same paper[9], a modification made by Ranjan *et al.*[10] proved to be the most successful one. Whatman filter paper No. 1 of 40 cm. diameter having sixteen equal sectors separated by sixteen radial cuts was used in the present investigation. Reference solutions were placed at four different points to facilitate identification of the bands. The method used incorporates the advantages of both circular paper chromatography and strip-paper chromatography. A single sector may be compared to a strip; radial flow of the solvent is maintained and the amino-acids appear in arcs instead of spots.

The chromatogram was run with butanol/acetic acid/water (4 : 1 : 5) for 8 hr. using a single paper wick (2 cm. × 4 cm.) in the centre. The solvent front was marked, the paper dried at room temperature (24° ± 1° C.) and sprayed with 0·1 per cent ninhydrin in acetone. Bands were allowed to develop for 4 hr. at room temperature and then at 70° C. for 10 min.

The acid hydrolysate of both healthy and diseased leaves revealed the same range of amino-acids: leucine and *iso*leucine (R_F 0·83), phenylalanine (0·76), valine and methionine (0·69), tyrosine (0·62), alanine (0·50), glutamic acid and threonine (0·44), glycine and aspartic acid (0·34), arginine (0·24), and histidine and lysine (0·20). Tryptophan could not be detected as it is destroyed by hydrochloric acid.

In the case of the water-soluble or free amino-acids, it was observed that the concentration of the amino-acids, and specially of aspartic acid, showed a marked increase in the case of the virus-infected leaves, as judged by the deepness of the bands. In addition, two new bands were present in the water-soluble extracts of the diseased leaves, one corresponding to histidine–lysine (0·20) and the other to asparagine (0·28). The lowest band (R_F 0·065) present in the water-soluble extract of healthy leaves, which could not be identified, was absent in that from the diseased leaves. The other common free amino-acids present in the water-extracts of both healthy and diseased leaves are: tyrosine (0·62), proline (0·54), alanine (0·50), glutamic acid (0·44), aspartic acid (0·34) and serine (0·32).

The absence of threonine and glycine was established by using buffered paper and by running the chromatogram in butanol/acetic acid mixture buffered to *p*H 12.

The absence of the lowest unidentified band from the water-soluble amino-acids of diseased leaves suggests that it is used up in the synthesis of the virus itself, or the virus interferes in its synthesis in the host.

Knight[11] has reported the presence of lysine with other amino-acids in the nitrogen content of tobacco mosaic virus. It is possible that the new band having R_F value 0·20 might be the lysine of tobacco mosaic virus protein. However, the formation of asparagine and the increase in the content of other free amino-acids, specially aspartic acid, in the diseased leaves supports Bawden's view[12] that virus infection leads to the formation of a new range of proteins.

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Extreme Resolution of Infra-Red Absorption Spectra

Rank and Wiggins have constructed an infra-red spectrometer with a plane grating of fine quality and 10-metre optics, double-passed[1].

An ideal subject with which to study the resolution was found in the *l*-doublets of the $\pi \rightarrow \pi$ band of hydrogen cyanide at 1·5μ. The components of these doublets are equal in intensity and their separations are proportional to the J numbers[2]. Moreover, the separations are known, so that a distinction can be made between the conditions 'just resolved' and 'fully resolved'. When a doublet is 'just resolved', the structure is recognized but the apparent separation between the components is smaller than the true value. For example, $P(7)$ was just resolved with a measured separation of 0·072 cm.$^{-1}$ as compared with the actual value of 0·096 cm.$^{-1}$. The closest doublets to be fully resolved were $P(15)$ and $R(9)$, the true separations of which are 0·180 cm.$^{-1}$ and 0·173 cm.$^{-1}$ respectively.

While this performance exceeded that of any other existing grating instrument, it was deemed of interest to investigate the possibility of increasing the resolution even further. Since the limit of resolution was set, not by lack of energy or by insufficient sensitivity of the detectors but by imperfections in the grating itself, nothing was to be gained by additional passes through the optical system. Indeed, since it was unlikely that gratings of substantially better quality would be produced in the near future, it was clear that improvement could not be obtained with any grating instrument alone, no matter what its design.

A method for using a Fabry–Perot interferometer in infra-red absorption studies has already been described[3]. The technique had been developed originally to improve the resolution of small spectrometers; but it was superseded by the device of multiple-passing[4]. It was found to be tedious and impractical by comparison. However, the interferometer is very suitable for our present purpose.

A Fabry–Perot interferometer was crossed with the grating spectrometer. The separation of the interferometer plates was set so that the range of frequency between orders was equal to the spectral slit-width of the spectrometer, which thus served as a primary monochromator the function of which was to remove overlapping orders. If a fraction Δm of a fringe order could be resolved, then under the above conditions the resolution of the combination of the interferometer and spectrometer was as much as $1/\Delta m$ times that of the latter alone. In this way it was possible to resolve fully the doublets $P(3)$ and $R(2)$; the measured separation of $R(2)$ was 0·045 cm.$^{-1}$. This is seen to represent a sixfold improvement if the Doppler width (0·016 cm.$^{-1}$) of the lines is taken into account.

The effective reflectivity of the plates was 65 per cent, produced by zinc sulphide – magnesium fluoride coatings. The plate separation was 28·5 mm.

The purpose of this communication is to direct attention to the fact that it is now possible to attain a full resolving power of well in excess of 200,000 at 1·5μ. This may be near the useful limit at the present time, because of Doppler broadening of the absorption lines. Nevertheless, the system has still not reached its energy limit, and the resolution could be improved further by increasing the separation between the plates of the interferometer. Full details of the instrument will be published elsewhere.

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A Solar Noise Outburst of January 15, 1955

An interferometer-type noise receiver has been operating at the Radio Physics Laboratory of the Research Defence Board, Canada, for more than a year. This receiver has been recording the radiation at a frequency of 50 Mc./s. from the discrete source in the constellation of Cassiopeia. However, the antenna is so constructed that solar noise will be recorded if of sufficient magnitude.

On January 15 of this year a particularly large noise outburst from the sun was observed. The outburst commenced at 9.45 a.m. Eastern Standard Time as a single spike on our record, which lasted approximately four minutes. This was followed at 9.53 a.m. by a large increase in the noise-level lasting until 3.00 p.m. On the following day a very large burst was again observed, commencing at