step in translation instead of or in addition to any transport from the nucleus. And Gillespie *et al.*, not to be outdone, speculate that the particularly large amount of poly A in tumour virus RNAs may reflect some failure in cleavage maturation processes which result from infection by tumour viruses.

Obviously until more data about the function, origin and sequence of poly A tracts in messengers of cell and viral origin are forthcoming these speculations will abound. But with so many groups turning their attention to the hunt for poly A tracts it should not be long before at least some of these ideas can be eliminated. Determination of the sequence of a poly A tract would be particularly instructive and might throw much light on the central question of whether or not these tracts are genetically coded.—From our Cell Biology Correspondent.

MAGNETOSPHERE

Data from Imp 5

from our Magnetosphere Correspondent

THE parts of the Earth's magnetosphere above the polar caps are almost unexplored. It has long been expected that magnetosheath plasma would enter geomagnetic field lines passing near the "neutral point" which appears in theoretical models that ignore the existence of an interplanetary field. This may be even more significant when the interplanetary field is taken into account. Such plasma was reported last year and named the "cusp". The ESRO satellite HEOS 2 is the first spacecraft to have a highly eccentric orbit with its apogee at a high latitude and should give a systematic survey of the neutral point which it passes closely. Meanwhile, some magnetic measurements near the neutral point have been obtained from the satellite Imp 5 (Fairfield and Ness, *J. Geophys. Res.*, **77**, 611; 1972).

Imp 5 was launched in June 1969 and although its apogee is at quite a low latitude it has a near polar inclination. It is on the day side of the Earth in northern summer and its inbound passes have high northern latitudes at the magnetopause. Only data "confidently felt to be within the distorted geomagnetic field" are included in Fairfield and Ness's report, but these measurements fit theoretical predictions with a degree of variability which might be reasonably expected. Outbound passes are at low latitude and show the well known compression of the dipole field. Inbound passes at high latitude show weakening of the field and more variability in its direction, the average direction being roughly that for the dipole. Fairfield and Ness published detailed data for parts of four orbits and they mark the boundaries found by Frank (*ibid.*, **76**, 5202; 1971) from his plasma and energetic particle detectors.

Orbit 5 is characteristic of middle latitudes and resembles observations at low latitudes. The plot suggests, however, that magnetosheath plasma and turbulence extend within the boundary exhibited by the magnetic data, and this situation possibly indicates day side reconnexion.

The magnetometer was saturated in the cusp on this orbit, but the other orbits shown include the cusp and "polar cap" given by Frank. In the magnetic data the polar cap is characterized by quiet, the cusp by turbulence and the field strength is usually depressed more in the cusp than in the neighbouring polar cap. Large fluctuations were observed in the cusp on orbit 4 in spite of a low *Kp* value of 0+. On orbit 9 Frank finds a transition from magnetosheath to cusp, but the magnetic data show no marked change though they are noisy. The changes in magnetic field direction occur in the middle of the cusp.

Orbits 7 and 9 each show a large spike in declination located in the cusp. Fairfield and Ness interpret this in relation to a double layer of field aligned current and compare it with observations on a low altitude satellite (Armstrong and Zmuda, *ibid.*, **75**, 7122; 1970). They find good agreement between the magnitudes of the field perturbations, but the Imp 5 spikes should map into narrower layers than that studied by Armstrong and Zmuda. The signs of the perturbations agree, the current being downward at the higher latitude, so that the electric field in the ionosphere should correspond to an electric potential which is higher on the field line entering the ionosphere at the higher latitude.

FORENSIC SCIENCE

Microscopes and Crime

from a Correspondent

THE forensic scientist's most basic instrument is the microscope. Advances and techniques in forensic microscopy were the subject of a symposium on the microscope in crime detection at Micro 72, the international meeting organized by the Royal Microscopical Society at Oxford Polytechnic on April 10–14.

Working on the theory that "every contact leaves its trace", a common application in forensic science is the comparison of material found at the scene of a crime with material found on, or connected with, a suspect. The types of "material" include hair, fibres, blood, wood, paper, glass, paint and bullets. It was the problem of comparing the firing marks on bullets that led to the construction of the first split-field comparison microscope in the United States in the early nineteen-thirties and commercial production by Leitz from 1935. The two objects are presented to the two halves of the field of view and can be manipulated on separate stages, enabling an immediate comparison to be made of size, colour and structure. The various marks found on fired ammunition were described by Mr J. D. McCafferty (Metropolitan Police Laboratory). Assigning a bullet to a barrel depends on a comparison of the unique rifling marks, which are usually constant over many hundreds of rounds fired from the same barrel.

Mr B. R. J. Morgan (Home Office Forensic Science Laboratory, Cardiff) spoke of the problems of comparison microscopy on other materials. Here the value of the evidence often lies in a positive match between a large number of specimens, which individually may be quite common. With certain speci-

30 Doradus Observed in the Infrared

INFRARED observations which provide a clue to the structure of the 30 Dor nebula in the Large Magellanic Cloud (LMC) are reported by I. S. Glass in next Monday's *Nature Physical Science* (May 1).

The 30 Dor nebula is the most conspicuous object in the LMC at both optical and radio frequencies; Glass has found that infrared radiation from the same region comes from a source 1 arc min across centred on the nebula, which is 25 arc min in diameter. The equivalent radio source seems to be associated with a thermal source 4 arc min in diameter within a non-thermal source 24 arc min wide and an HII region of 45 arc min full width at half maximum. The whole complex is similar at radio frequencies to the centre of our own Galaxy, and the new observations at 1.2 to 3.5 μm provide further support for this idea.

So observations at radio frequencies and at a few microns both now show that 30 Dor and the Sgr A complex at the centre of the Galaxy contain similar thermal and non-thermal sources. If similar results can be obtained at intermediate frequencies there will be considerable justification for regarding 30 Dor as the centre of the LMC, and hopefully further studies will reveal characteristics of 30 Dor and the LMC which will lead to a better understanding not just of that galaxy but also of galaxies in general and our own Galaxy in particular.

mens, a match means the identity of a number of physical properties which can be measured under the microscope. Mr R. Cook (Metropolitan Police Laboratory) showed how this applied to the range of natural fibres. Fluorescence, refractive index, birefringence and melting point can all be measured and compared, followed by infrared spectroscopy and even chromatography of the dye if the samples are still indistinguishable. In the case of natural fibres such as jute, hemp, sisal and coir, such tests cannot be applied and straight microscopy is all-important. Mr C. G. Jarman (Tropical Products Institute) stressed the importance of sound knowledge and experience for the worker in this field if reliable identification is to be achieved. Another example of tests performed under the microscope is the series of microcrystal tests which are highly specific and sensitive for drugs. Although long established, these tests are somewhat neglected in Britain and Professor E. G. C. Clarke (Royal Veterinary College) urged forensic scientists to consider the advantages of the microcrystal tests particularly in distinguishing closely similar compounds.

The interpretation of pictures from the scanning electron microscope, and their relation to optical micrographs of the same object, sometimes proves difficult for those applying the scanning electron microscope to forensic problems. Mr M. E. Taylor (Home Office Forensic Science Laboratory, Birmingham) warned against expecting too much too quickly from the instrument: as experience is gained, the value will increase. The Birmingham laboratory and the Metropolitan Police Laboratory are the only forensic science laboratories so far in Britain to have their own scanning electron microscopes, but the availability of cheaper instruments could increase sales. The leader in this field is undoubtedly the Cambridge Scientific Instruments' 'Stereoscan 600', sister to the big 'Stereoscan S4', but the two British rivals were also on view at the trade exhibition. Both Vacuum Generators and the confusingly-named Cambridge Scanning Co. offer scanning electron microscopes at prices which one could pay for an optical microscope.

All these small scanning electron microscopes can be used as electron microprobes by the addition of energy-dispersive X-ray analysis equipment. This seems particularly useful for the forensic scientist because the analysis for elements can be performed on particles or regions down to a few microns across, and is rapid, non-destructive and often quantitative. Here the problem of interpretation does not arise because the results can be related directly to conventional chemical analyses.

CYTOCHALASIN

Points of View

from our Molecular Biology Correspondent

IT is seldom that two approaches to a problem come to such uncompromisingly opposed conclusions as those of Spudich and Lin (*Proc. US Nat. Acad. Sci.*, **69**, 442 ; 1972) and Forer, Emmersen and Behnke (*Science*, **175**, 774 ; 1972). The subject is important: it concerns the action of cytochalasin B, an alkaloid, which has the property of inhibiting a wide variety of contractile processes.

It seems to be generally agreed that the alkaloid operates by exerting some unwholesome influence on microfilaments. The drift of thinking in the field is that these microfilaments are often, and may turn out to be invariably, actin-like, for the composition and physical properties of the major protein constituent have been examined in a variety of cases and found to correspond closely to those of muscle actin. In many instances the capacity to bind heavy meromyosin (proteolytically truncated myosin) all along the filaments, in the characteristic arrowhead geometry found in muscle actin–heavy meromyosin complexes, has been demonstrated. It therefore seems by no means unreasonable that cytochalasin B should bind to F-actin filaments, with some detriment to their structure or function. This Spudich and Lin seem to have shown.

The evidence looks clear enough: actomyosin, in conditions of ionic strength at which it is soluble, has a high viscosity, which falls sharply on addition of ATP. Spudich and Lin show an almost equally dramatic drop in viscosity when cytochalasin B is introduced. Likewise the addition of cytochalasin to myosin before the actin leads to an actomyosin of low viscosity. There is no detectable effect on myosin (or rather heavy meromyosin) alone, the intrinsic ATPase activity being unchanged. By contrast, the ATPase activity of actin–heavy meromyosin is inhibited to a maximum of 60 per cent. The cytochalasin thus apparently interacts with the actin, and indeed Spudich and Lin find that the viscosity of polymerized actin (F-actin) drops in the presence of the alkaloid. The monomeric G-actin is still able to polymerize in solutions containing cytochalasin, but only attains a viscosity equal to the relatively low final value observed in F-actin after addition of cytochalasin. Spudich and Lin also infer from the very rapid effect of cytochalasin on the actomyosin viscosity, compared with

Fingerprints of Maturing Ribosomal RNA

THE series of cleavages and methylation steps which result in the maturation of ribosomal 28S and 18S RNAs in mammalian cells have been exhaustively investigated, in particular by Penman and his collaborators who have followed the flow of radioactive label through the various RNAs associated with the nucleolus in HeLa cells and have drawn up a maturation pathway. Penman's group envisage that a 45S RNA, the product of transcription, is converted by a series of stepwise cleavages and methylation reactions to a 41S RNA, a 32S RNA which matures into the ribosomal 28S RNA and a 20S RNA which matures to the smaller ribosomal RNA.

Direct proof of this putative maturation pathway derived from convincing but nevertheless circumstantial evidence depends, of course, on determining the nucleotide sequences of the ribosomal RNAs and their putative precursors. That is a mammoth task, but as Maden, Salim and Summers report in *Nature New Biology* next Wednesday (May 3), enough partial sequence data can be obtained from fingerprints of nuclease digests of these various RNAs to confirm the pathway.

To cut a long story short, Maden and his associates have shown that the fingerprint of a digest of 45S RNA from HeLa cell nucleoli is virtually identical to a fingerprint of a mixture of 28S and 18S ribosomal RNAs. There can be no doubt therefore that the 45S precursor not only includes the base sequences of both 28S and 18S ribosomal RNAs but also that all the methylated bases in the 45S precursor occur at sites which survive the maturation process and remain in the mature ribosomal RNAs. Similarly, 41S nucleolar RNA contains the sequences of both the mature ribosomal RNAs. By contrast 32S nucleolar RNA contains only the sequence of the 28S mature RNA and the fingerprint of nucleolar 18–20S RNA is almost identical to that of mature ribosomal 18S RNA.

One noticeable difference between the mature 18S RNA fingerprint and the 18–20S nucleolar RNA fingerprint is the presence of a methylated spot in the first but not the second. This indicates that the dimethylaminopurine in mature 18S RNA is formed after the RNA has left the nucleus. Zimmerman, who reported in 1968 a methylation step late in the maturation of 18S RNA, thought it occurred in the nucleolus, but these new data suggest it occurs in the cytoplasm. But, that aside, these fingerprint analyses fully confirm the proposed maturation pathway for HeLa ribosomal RNA.