detected in RNA preparations by its ability to direct the synthesis of ovalbumin in cell-free protein synthesis systems. This method has now been superseded, however, by preparing a 'probe' for ovalbumin mRNA by transcribing the messenger with reverse transcriptase to obtain a radioactively-labelled complementary DNA. The cDNA is used to measure the concentration of mRNA sequences in immature chick oviduct cells before, during and after stimulation with oestrogen (Harris, Rosen, Means and O'Malley, *Biochemistry*, **14**, 2072; 1975). Before stimulation, ovalbumin mRNA was undetectable in oviduct cells, whereas several days' administration of oestrogen resulted in tubular gland cell formation and a build-up of ovalbumin mRNA to approximately 50,000 molecules per cell. Ovalbumin mRNA synthesis stops when the hormone is withdrawn and within 12 days the level of mRNA has dropped to 0-10 molecules per cell. These results have been used to suggest that the primary regulation of ovalbumin synthesis by oestrogen occurs at the level of mRNA transcription, that is, that the oestrogen–receptor complex on binding to the chromatin activates or 'derepresses' the ovalbumin gene so that it can be transcribed. Other interpretations of these data are possible however. Cox *et al.*, for example, have pointed out the possibility that the effect of oestrogen could be to prevent the very rapid degradation of ovalbumin mRNA (Cox, Haines and Emtage, *Eur. J. Biochem.*, **49**, 225; 1974).

To investigate further whether the oestrogen–receptor complex has a direct effect on transcription, O'Malley's group have measured the number of RNA polymerase initiation sites on chromatin isolated from oviduct nuclei at various stages of oestrogen treatment (Tsai *et al.*, *Proc. natn. Acad. Sci. U.S.A.*, **72**, 4228; 1975). They have shown that during primary stimulation the number of RNA polymerase initiation sites increases, whereas withdrawal results in a drop in the number of initiation sites.

And now O'Malley and his coworkers have asked whether the RNA synthesised *in vitro* from isolated chromatin has the same tissue specificity as the RNA isolated from whole cells over the range of ovalbumin stimulation conditions. Using a cDNA probe for ovalbumin mRNA they were able to show that in their *in vitro* system only RNA transcribed from chromatin isolated from ovalbumin target cells contained ovalbumin mRNA sequences. They have also shown that RNA polymerase was necessary to produce RNA to which the cDNA would hybridise. (This is the usual control to eliminate the possibility that ovalbumin mRNA in the cell has been isolated as a contaminant in the chromatin preparation.) Their results indicate that in general the presence of sequences transcribed *in vitro* which contain ovalbumin mRNA mimics the pattern of *in vitro* transcribed RNA with respect to hormone dependence. The authors do point out one difference however. During withdrawal there are between 0–10 molecules of ovalbumin mRNA per tubular gland cell but the chromatin isolated from the oviduct of withdrawn chicks could support the transcription of up to 5,000 molecules per cell. The authors suggest that the cells may fail to do this *in vivo* because of deficiencies in the RNA polymerase (or associated factors). Alternatively it may be (as Cox *et al.* also suggest) that low levels of mRNA are produced but are rapidly destroyed in the absence of post-transcriptional stabilisation which is in some way brought about by oestrogen.

O'Malley and his colleagues plan to use this *in vitro* system—to separate it into its components and reconstitute it —in order to study more directly how the oestrogen receptor interacts with chromatin. The continuation of this series (this latest paper is number eleven) will be awaited with interest.

Jovian magnetotail stretches past Saturn

from John Gribbin

In one of those surprising discoveries that, with hindsight, should not have been a surprise at all the Pioneer 10 sensors have detected the influence of Jupiter's magnetotail some 690 million km behind the planet, beyond the orbit of Saturn. This is just about the same distance from Jupiter as the Sun is on the other side—but since the magnetosphere surrounding Jupiter has a diameter of more than 14 million km it is not so surprising that the magnetotail stretches so far—about 50 magnetospheric diameters. After all, the Earth's magnetotail has been detected 500 planetary diameters 'downstream'.

Pioneer 10 passed through this extended magnetotail in mid-March, taking a full 24 h to complete its passage through the region of space influenced by Jupiter's magnetic field, according to NASA reports. Having passed the orbit of Saturn early in February, Pioneer 10 is now well on its way out of the Solar System, while its sister craft, Pioneer 11, re-targeted by its swing past Jupiter, is crossing the Solar System to encounter Saturn in three years time. The evidence for the presence of Jupiter's magnetotail beyond Saturn's orbit comes from the Pioneer 10 solar wind detector, which registered zero during the time that the Jovian field 'shut out' the solar wind; the possibility that a genuine lull in the solar wind coincided with the spacecraft being exactly in Jupiter's magnetic shadow remains, but hardly looks plausible.

On the face of things, the observations imply that there is a roughly cylindrical volume of space influenced by Jupiter's magnetic field stretching across a sizeable fraction of the Solar System, and probably expanding slightly at greater distances from the Sun, since the solar wind density decreases as the square of the distance from the Sun. One of the most intriguing implications is that Saturn itself must pass through Jupiter's magnetotail every 20 yr, the next occasion being in April 1981 (unfortunately, just about 18 months after Pioneer 11 reaches Saturn). John Wolfe, Pioneer project scientist at NASA's Ames Research Center, comments that "this should produce some interesting magnetic phenomena".

One puzzle is that Pioneer 10 is now six degrees above the plane of Jupiter's orbit, and if the solar wind blows radially the magnetotail should be a couple of degrees, at least, below the spacecraft. But as earlier data from both Pioneer 10 and Pioneer 11 have shown, the solar wind blows gustily even at the distance of Saturn, and this turbulence could explain the tail being blown 'upwards' by six degrees temporarily.

The continuing irony of the new discoveries about Jupiter is, of course, the way in which space probes have shown that in many ways the most similar planet to the Earth is not Venus or Mars but the giant of the Solar System, a planet which contains three-quarters of all the Solar System's planetary material and which just missed, on some theories, becoming a star. □

Nations and numbers, 1975

from Robert M. May

For the past few years, the Environmental Fund in Washington DC has published an annual chart giving a country-by-country summary of the best contemporary estimates of population magnitudes, growth rates, and other demographic parameters. Some of these figures are familiar to most people, and some are not.

Because of the many sources of uncertainty and delay in obtaining and reducing census data, the figures for

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