transmitter). Nor is there any indication that dopaminergic dendritic elements form synaptic connections with other cells. However, several authors have suggested, on the basis of morphological evidence, that amine neurotransmitters in the brain can be released nonsynaptically (Chan-Palay *Cerebellar Dentate Nucleus* 418–425, Springer Verlag, Berlin, 1977, and references therein). This mode of secretion could be aimed at more distributed targets, and might represent a form of communication intermediate between the exclusive addressing of synapses and the broadcasting of hormones.

Giant molecular clouds

from M. G. Edmunds

A workshop on Giant Molecular Clouds in the Galaxy was held at Gregynog Hall, Newtown, Wales from 8–13 August 1977. It was organised by University College, Cardiff.

THE recent rapid growth in knowledge of the distribution of the carbon monoxide (CO) molecule in the Galaxy by observation of its line radiation at millimetre wavelengths has led to the discovery of a new and very significant component of galactic structure; the Giant Molecular Cloud. The importance of CO is as an indicator of the otherwise virtually unobservable hydrogen molecule H_2. Where CO forms, it is expected that H_2 will also form, and since hydrogen is by far the most abundant element in the Galaxy, the CO maps can trace the overall density of the interstellar medium. The result of surveys such as those outlined by P. M. Solomon (Stonybrook, New York) suggest that there exist very large 10–80 pc clouds of molecules with masses which are typically 10^5 solar masses and may even reach as high as 10^7 solar masses. Of particular importance have been new maps in ^{13}CO radiation which do not suffer from the severe optical depth uncertainties of ^{12}CO but confirm the large masses of the clouds. The densities are high in these clouds, on average about 700 molecules per cubic centimetre, compared with a value of perhaps one atom per cubic centimetre in the general interstellar space between the clouds.

The importance of the clouds lies not only in their being easily the most massive individual objects in the galactic disk, but also because they are regions of very active star formation.

The actual number of these clouds in the Galaxy was a matter of some contention, depending to some extent on whether the giant clouds are regarded as a single gravitationally bound system, with complex subcondensations, or as a superposition of smaller independent subunits as proposed by M. Gordon (US National Radio Astronomy Observatory). Most participants were content to accept that each cloud really is a single large complex, and the probable number would then be of order 1,000–4,000, constituting the major part of the mass of interstellar material in the Galaxy. The clouds are not uniformly distributed, showing a very marked 'ring' structure with a concentration of the clouds between 4 to 8 kpc from the centre. It is interesting that the distribution of clouds has not yet been shown convincingly to indicate spiral structure in the disk, although A. Pedlar (Jodrell Bank) claimed some slight evidence from a formaldehyde molecule survey. The Galactic Centre itself is the other major concentration of molecular clouds, a fascinating complex reviewed by N. Scoville (University of Massachusetts) containing as much as 10^7 to 10^8 solar masses, with recent data indicating that a model with an expanding spiral pattern extending right in to the centre may be more attractive than previously proposed expanding disk models.

The formation of stars in the molecular clouds is clearly demonstrated by the existence of infrared sources, caused by the inevitable heating of gas and dust as it collapses under its mutual gravitational interaction, and further heating once the stars have started nuclear energy generation. One obvious site for star formation in the clouds is the characteristic small 'cores' where higher than average temperatures and densities indicate that collapse may be taking place. Much evidence was presented that although low mass stars may form throughout the clouds, the high mass stars over about 12 solar masses form only near the edge of the clouds. B. Elmegreen (Harvard University) and C. Lada (Center for Astrophysics, Cambridge, Massachusetts) claimed this as good evidence for a mechanism of inducing the collapse of further protostars at the edges of the clouds by the effect of compression between shock and ionisation fronts driven into the clouds by radiation, once one bright massive star has formed. The existence of ionised hydrogen regions at the edge of molecular clouds seems very common, and F. Israel (Caltech) presented evidence that most bright, dense regions are of this type, with ionised radiation eating its way into the cloud.

But the mechanism which actually drives the typical subcondensation of a cloud into a state where it will collapse into a star, or cluster of stars, was the subject of much discussion. The effects of the shock wave from a supernova explosion was championed by G. Assousa (Carnegie Institution, Washington), and shocks induced by stellar winds from massive stars maintained as a possibility by L. Blitz (Columbia University) when presenting CO maps of many local molecular clouds. P. Woodward (Leiden) described his extensive numerical calculations of the collapse of clouds induced by the passage of the large-scale density-wave pattern which is believed to maintain a spiral structure in the Galaxy. He received some support from

M. G. Edmunds is in the Department of Applied Mathematics and Astronomy at University College, Cardiff.

Infectious provirus synthesised *in vitro*

from Robin Weiss

ON page 122 of this issue of *Nature* Ellen Rothenberg and her colleagues describe the *in vitro* synthesis of infectious DNA of murine leukaemia virus. Although this feat of high fidelity reverse transcription was first announced more than a year ago, and this paper comes as no surprise, it does mark the culmination of several years investigation of reverse transcriptase activity *in vitro*. The successful transfection of a retrovirus by DNA extracted from infected cells was first achieved by Hill and Hillova (*Nature new Biol.* **237**, 35; 1972) and it constituted a formal proof of Temin's DNA provirus hypothesis. Now the MIT laboratory's improved techniques have yielded complete DNA transcripts *in vitro* which show single-hit dose response for infectivity.

The infectivity of the transcripts is resistant to protease and ribonuclease but is completely destroyed by deoxyribonuclease. The structure of the infectious DNA molecule is curious. It appears that a full-length negative strand is synthesised and shorter segments of positive-strand DNA are formed in duplex with it. Transcripts synthesised in the presence of actinomycin D are not infectious; whether this is attributable to the absence of positive-strand DNA or to incompleteness of the negative-strand transcripts is not clear. The data and their significance are so clearly presented that any further commentary here is superfluous.