In the case of pore formation, it would be expected that once a pore has been formed, the change of state of the lipid hydrocarbon chains would be relatively unimportant unless it brought about a drastic change in antibiotic solubility. Thus one explanation of the results of Krasne *et al.* is that all three antibiotics form pores but on "freezing" the membrane the solubilities of nonactin and valinomycin are drastically reduced whereas that of gramicidin is unaffected. A simpler and more attractive interpretation, however, is that nonactin and valinomycin act as carriers whereas gramicidin forms pores.

It is generally accepted that gramicidin associates to form dimers in BLM and, early last year, Urry (*Proc. US Nat. Acad. Sci.*, **68**, 672; 1971) proposed that the conformation of the gramicidin molecules in this state was that of the unusual π (L,D) helix. More recently, Urry, Goodall, Glickson and Mayers (*ibid.*, **68**, 1907) have extended this work by chemically coupling the α-amino groups of two deformyl gramicidin A molecules and have examined the effect of the resultant malonamide dimer on BLM. Dimerization in the membrane seems to be an important step in the mechanism of action of gramicidin, but in the case of the malonamide dimer this step should be eliminated. The effect of the malonamide dimer on the kinetics of the development of membrane conductance, the form of the dependence of this conductance on lipid composition and the absence of autocatalytic behaviour are all consistent with this view. Urry *et al.* have thus obtained more evidence that gramicidin dimerizes in the membrane to form conducting pores. Whether in so doing it adopts the proposed π (L,D) helical structure is open to doubt, because Urry has not yet presented any convincing spectroscopic or other evidence to confirm this structure.

CHROMOSOMES

Drosophila dAT

from a Correspondent

ONE of the most challenging problems in cell biology at present is without doubt the role and behaviour of DNA with highly reiterated nucleotide sequences. Be they density satellites as in mouse, or of the same overall base composition as in rat, the very large amounts of this DNA in each cell signify its importance. There is no clear evidence that this DNA is ever transcribed, but several groups have shown that there is a strong association with the heterochromatic regions of the cell nucleus. In the mouse, where the satellite DNA represents about 10 per cent, or four chromosomes-worth of the nuclear DNA, Jones and others have shown by hybridization *in situ* that much of it is associated with the chromosomal centromeres. With the possible exception of the *Y* chromosome, each chromosome seems to carry some of the light satellite DNA.

Perhaps the most bizarre of all the reiterated DNAs is the family of dAT copolymers first found by Sueoka in *Cancer borealis* (*J. Mol. Biol.*, **3**, 31; 1961), where it comprises more than 30 per cent of the nuclear DNA. In this crab each strand of the DNA double helix is almost exclusively the alternating copolymer d(AT), whereas in *Drosophila melanogaster* 4 per cent of the nuclear DNA is the apposed copolymer dA.dT. Furthermore, *Drosophila* possesses incomparably better genetics. With this tool at hand Blumenfeld and Forrest have recently reported (*Proc. US Nat. Acad. Sci.*, **68**, 3145; 1971) an investigation of the chromosomal location of the *Drosophila* dAT.

Using several genetic tricks, Blumenfeld and Forrest have constructed a series of flies with extra *Y* chromosomes or extra pieces of the *Y* chromosome. They have analysed the proportion of dAT in each of their strains and have discovered that the more *Y* chromosome pieces they have, the higher the proportion of dAT satellite. Although the *Y* chromosome is not the sole genetic element involved because *XO* flies contain 2 per cent dAT, it is nevertheless striking that the dAT content of the fly can be increased by increasing the *Y* dosage. There are clearly two chief alternative explanations: the *Y* chromosome either carries a control element which governs the synthesis or survival of an extra dollop of dAT, or it itself is particularly rich in dAT.

These alternatives can obviously be distinguished by the use of hybridization *in situ*; if the second alternative is correct it will be another example of a reiterated sequence being located on a particular chromosome; if the first

Understanding the Hadron Era

THE big-bang theory of cosmology, which postulates that the universe exploded from an infinitely dense state according to the laws of general relativity, has been successful in predicting several features of the universe, notably its expansion, the relative abundance of elements and the black-body background radiation. A remarkable, yet unexplained, feature is the tendency of matter to coagulate in large clumps—not stars, the formation of which by mutual gravitational attraction of diffuse matter is understood, but galaxies.

At one time it was hoped that cosmological theories might promote the idea of galaxy formation in a way similar to star formation. If that had been the case, the evolution of the universe, through a state dense enough to make radiation the predominant contribution to pressure into the diffuse condition of the present, might have included an epoch during which small statistical fluctuations from completely homogeneous density had a tendency to grow, both in size and in degree of inhomogeneity, to galactic dimensions and densities. This hope has not been realized, and the existence of galaxies is often ascribed nowadays to primaeval conditions, to large non-statistical inhomogeneities from before the big-bang.

It is still important to check that there is no tendency for fluctuations to be damped out and to disappear. The article by Mészáros in next Monday's *Nature Physical Science* (January 17) shows that there is no such tendency during what is called the hadron era. The hadron era is the time when the density of the universe was comparable with that of an atomic nucleus. This was a very short era and it ended when the universe was 10^{-1} seconds old. Such densities now exist on a large scale only in neutron stars.

A difficulty in understanding such conditions is that the equation of state is not known. In the early universe the equation of state is more complicated even than inside neutron stars, for the matter is hot: that is, the kinetic energy of the constituent particles is comparable to their rest masses. Constraints can, however, be put upon the equation of state by the requirements of causality; the velocity of sound in the material must not exceed that of light if cause is to precede effect for every observer. Moreover, there are records of the equation of state derived from nuclear physics.

Mészáros investigates the problem and disproves a conjecture that the pressure–volume relationship should be that of a cool monotonic gas, which had been suggested as a model stable against any tendency for statistical density fluctuations to collapse into an infinitely dense condensed state. Mészáros gives reasons for restricting the discussion to two equations of state: which should actually be used depends on whether or not the universe initially contained as many anti-particles as particles.

Mészáros uses these equations of state to investigate the fate of density fluctuations, and shows that galaxies cannot have evolved from statistical fluctuations during the hadron era.