deed, a notable non-feature of the workshop was the absence of any attempt to propose a genuine bifurcation scheme for elliptical versus disk-like galaxies. P. Schechter (Institute for Advanced Study, Princeton), W. Press (Princeton University), Gott and Geller all discussed aspects of the multiplicity and luminosity functions for galaxies. The multiplicity function for the Gott-Turner groups of galaxies seems to be consistent with an initial Poisson density fluctuation spectrum (Schechter), although, as with the covariance function, an initial $n=-1$ spectrum gives a slightly better fit (Gott).

B. Jones (IOA, Cambridge) reviewed turbulence theory for the origin of primordial density perturbations, and discussed the effect of the recombination process on the covariance function derived from both the cosmic turbulence theory and the adiabatic density perturbation theory. This, and a later more specialised discussion by S. Bonometto (University of Padua), emphasised some of the difficulties inherent in both these theories for the origin of primordial density inhomogeneities.

The discussion then moved on to the topic of galactic evolution. It was argued that galaxies evidently originate from a single protogalactic cloud, since the globular clusters display a range of properties that vary systematically through the Galaxy, and from one galaxy to another (S. van den Bergh, University of Toronto). But this "monolithic" unit may have increased in size as a result of infalling material, as suggested by measurements of stellar metalicities in the solar neighbourhood (D. Lynden-Bell, IOA, Cambridge). Direct calculation of the collapse of a turbulent protogalactic cloud led to fragmentation into 10^{6-7} $M_{\odot}$ clouds, with the formation of a massive central star in each cloud fragment, inhibiting further star formation (B. Jones, and S. Weber, University of California, Berkeley). It is not clear how further evolution would proceed from this point. At any rate, the two theories of galactic evolution presented at the workshop each included an assumed star formation rate without regard to the detailed physical processes involved. The first model by Gott and T. X. Thuan (CalTech) took as its starting point a rotating protogalactic cloud, and assumed that star formation occurred over some characteristic timescale, T_{sf}. If this were short compared with the collapse timescale of the galaxy, T_{ff}, then the result was an elliptical system, and if long ($T_{sf}>T_{ff}$) it formed a disk system. The second model (R. Larson, Yale University) began with a turbulent protogalactic gas cloud, in which star formation took place at an assigned rate during collapse. If the cloud had low angular momentum an elliptical system was formed, and if high angular momentum, a disk system formed, though some additional adjustment of other parameters was required in the latter case.

Neither model is perfect. Evidently, elliptical systems are easier to make than spiral ones, though even here there were some notable discrepancies. Gott's model being dissipationless produced a majority of EO systems though it had the nice property that the maximum flatness produced was E7 (Gott and Thuan). Observations suggest however that E3 is the most common type. Conversely Larson's model tended to produce too much flattening. In each case, flattening was said to have derived from rotation.

But both models gave the observed luminosity profile for elliptical galaxies, assuming a constant mass to light ratio. Various studies suggest, however, that the mass to light ratio may vary; it is early days yet for the galaxy builders.

The situation as regards the formation of spiral galaxies is even less satisfactory. There seems to be some difficulty in producing a clear division of type between ellipticals and spirals when starting with the same initial conditions and continuously varying parameters. Van den Bergh pointed out that SOs were not truly intermediate in type between the two classes, their ellipticity and luminosity profiles both being characteristic of spirals. He emphasised the value of the bulge/disk ratio as an indicator of spiral type and it was even suggested (Ostriker and Faber) that all galaxies could be classified by means of their elliptical component, going from large ellipticals, through spirals, to dwarf elliptical systems. But the mechanism by which the disk is produced is not clear.

Faber suggested that the bulge/disk ratio may be a factor in the removal of gas, arguing for the presence of a galactic wind in spheroidal systems; however, van den Bergh pointed out that this could not be the only factor involved in gas loss, since ellipticals and SOs are predominantly found in clusters. He therefore supported the idea that gas is stripped from galaxies by the ram pressure of an intergalactic gas. This process was proposed by G. R. Gisler (IOA, Cambridge) to explain the very low gas content found in most elliptical systems, where population synthesis studies indicate that more gas is being lost by stars than is evidently consumed by new star formation (B. Tinsley, Yale University, and W. O'Connell, University of Virginia). This assumes a normal stellar mass function, since there is no obvious way to manufacture only low mass stars. But since the ram pressure effect could not easily account for the variations in gas content in spiral systems it seems likely that more than one process is operating to influence the gas content of galaxies in general.

The last problem to be considered was the possible detection of galaxies in the process of formation. An argument based on free-fall times suggested that galaxies would have formed between a redshift of 50 and 5, and perhaps as recently as $z=3$ (Larson). An elegant study by D. Meier (University of Texas, Austin) based on the models of Larson and Tinsley, predicted a possible spectrum for a newly formed galaxy, and indicated that its nucleus could be visible as a QSO. He proposed two candidate objects worthy of further investigation in this field: OH471 and 4C05.34. The principal argument against Meier's work is that it neglects the effect of dust. This is a significant omission, since if most of the radiation were absorbed by dust and re-emitted in the infrared, it may be difficult or impossible to detect (M. Rowan-Robinson, Queen Mary College, London). But what is particularly unfortunate for those engaged in the task of galaxy making is that there are apparently no reasonable candidates for galaxies in the process of formation now (W. L. W. Sargent, CalTech). Presumably, this implies that either there are no more suitable protogalactic clouds around, or that conditions are no longer right for turning them into galaxies, or both. In the words of Sidney van den Bergh: "Galaxies are like people: they depend on both genetics and environment". This, indeed, was the theme of the workshop. □

NATURE

A hundred years ago

A UNIVERSITY is to be founded at Tomsk, one of the chief towns of Siberia. The new establishment will have only two faculties, one of Law and the other of Medicine. The want of doctors in Siberia may be inferred from the fact that there are only fifty-five of them in a country which is as large as the whole of Europe, and whose population amounts to more than 6,000,000 inhabitants. The Russian Minister of Finance has granted a credit of 40,000*l.* on the revenue of the State for the new establishment, which will raise the number of Russian Universities to eight.

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