apparent rotation curve masses; that is that these galaxies contain substantial mass outside the last measured point of the rotation curve. Bahcall and Gilmore told the conference that such a haloe in our own Galaxy could not be made of low-mass main-sequence stars without violating the observed star counts. D. Burstein (NRAO) presented rotation curves for a large sample of spiral galaxies and demonstrated that they fall into three distinct classes, which correlate roughtly, but not exactly, with Hubble type. In each class, however, the rotation curves of different galaxies are very similar except for a transformation of scale.

Disturbed motions and structures in galaxies were discussed by D. Lynden-Bell (University of Cambridge), P.O. Lindblad (University of Stockholm) and R. Hook (RGO). Lynden-Bell suggested that the dwarf spheroidal galaxies Leo I, Leo II, Sculptor and Fornax, which are satellites of our Galaxy, could be part of a second stream (along with the Magellanic stream) made by a swallowed galaxy. Lindblad discussed evidence of streaming motions in our Galaxy and along the minor axis of M31. R. Hook presented Taurus observations of a ring-shaped galaxy (the Cartwheel) which showed the ring to be rotating and expanding in a regular manner. Hook suggested a model in which the system was formed by a companion galaxy passing through the larger galaxy.

A final possible constituent of galaxies is cosmic rays, and the γ rays produced by interactions of cosmic rays with the interstellar medium. γ-ray data from SAS-2 and COS-B (A.W. Wolfendale, University of Durham) indeed seem to suggest a galactic, rather than an extragalactic, origin. The flux density is greater towards the Galactic Centre, and in particular correlates with the observed density of H II regions. □

Methylation of chloroplast DNA in *Chlamydomonas*

from T.A. Dyer

METHYLATION of DNA appears to have very important biological functions. In prokaryotes, one of its roles is to protect the organism's DNA from cleavage by sequence-specific nucleases which degrade incoming foreign DNA[1], while in the nuclei of eukaryotes, changes in DNA methylation patterns may help regulate gene expression[2]. Although organelle DNA is generally unmethylated, some of the cytosine residues of the chloroplast DNA of the unicellular green alga *Chlamydomonas reinhardtii* are modified in this way. The methylation of chloroplast DNA is of particular interest because of the ambivalent nature of chloroplasts. They are part of eukaryotic organisms, but they have many prokaryotic features and are thought to have evolved from free-living prokaryote-like ancestors. Over the years an impressive body of evidence has been built up by Ruth Sager and her colleagues[3-8] to suggest that, as in prokaryotes, the methylation of chloroplast DNA in *Chlamydomonas* has a protective role. However, the recent findings of Gillham, Boynton and their associates[9] raise doubts about this.

The interest in methylation of the chloroplast DNA of *Chlamydomonas* currently centres on the way in which this DNA is inherited when haploid gametes of opposite mating types (*mt*$^+$ and *mt*$^-$) are mixed. Following cell fusion of the cell walls of the gametes, the chloroplasts also fuse. But in over 90 per cent of the zygotes formed, the surviving chloroplast DNA is of the *mt*$^+$ parental type only. This 'maternal'-type inheritance is found in many plants, and in higher plants it is apparently because the 'paternal' chloroplasts are excluded from the zygote[10]. Sager suggested that in *Chlamydomonas*, methylation of the chloroplast DNA of the *mt*$^+$ parent prevents its degradation, while DNA of the *mt*$^-$ parent is destroyed. Considerable circumstantial evidence supported this hypothesis. For example, the gametic *mt*$^+$ chloroplast DNA contains 2 per cent 5-methylcytosine but this modified base could not be found in the *mt*$^-$ gametic DNA[4]. The difference in level of methylation can be detected using restriction enzymes which are inhibited by methylation of bases in their recognition sequences[5]. Furthermore, a nuclear mutant, *mat-1,* which causes extensive gametic methylation and is tightly linked to the *mt*$^-$ allele[6], increases *mt*$^-$ transmission of chloroplast genes to more than 50 per cent[7]. Finally, a DNA methyltransferase which produces 5′-methylcytosine was found only in *mt*$^+$ gametes, gametes of the *mat-1* mutant and in zygotes[8].

Recent findings of Gillham, Boynton and their associates[9] cast considerable doubt on this hypothesis. They showed that a different nuclear mutant, *me-1*, which causes extensive cytosine methylation in the chloroplast DNA of the gametes, does not increase the transmission of *mt*$^-$ chloroplast DNA in crosses with wild-type *mt*$^+$ stock. Indeed, the levels of methylation may be considerably

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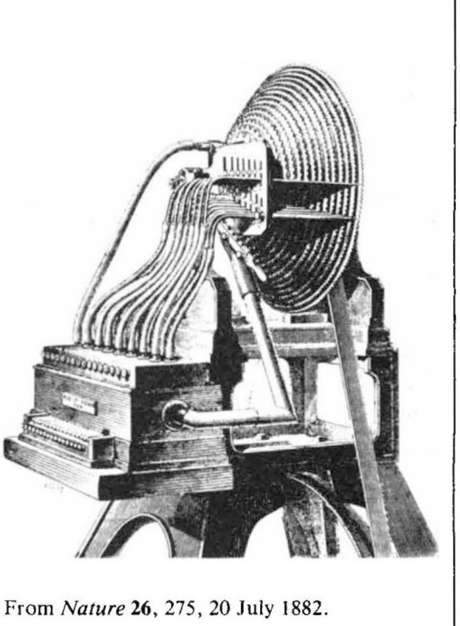
100 yrs ago

Koenig's Experiments in Acoustics

In a preceding article it was recounted how Kœnig has applied the principle of the wave-siren to prove by direct experiment the influence which *phase* has upon the quality of a sound. In order to carry out these researches more fully, Kœnig has constructed a very large and complete apparatus on the principle of the wave-siren. Its mode of operation will be best understood by reference to Fig.5, taken by Dr Kœnig's permission from his work, "Quelques Expériences d'Acoustique." Upon a strong stage about 4 feet high is mounted a series of 16 brass disks, cut at their edges into sinusoidal wave-forms, all fixed upon a common axis, and capable of being rotated by a band and treadle. The wave-forms cut against the contours of these 16 disks represent a harmonic series of 16 members of decreasing amplitude, there being just 16 times as many sinuosities on the largest as on the smallest disk. Against the edge of each of these wave-disks wind can be blown by a special mouth-piece in the form of a horizontally-placed slit connected by a tube to a powerful wind-chest mounted upon the stand of the instrument. When the axis is rotated the wave-disks pass in front of the slits through which the wind is blown, and throw the issuing streams of air into vibration. Each wave-disk thus sets up a perfectly simple tone. It is clear that any desired combination can be made by opening the appropriate stops on the wind chest. In order to vary at will the *phase* in which these elementary tones are combined, a very ingenious arrangement is adopted. The brass tubes which terminate in the fifteen mouth-pieces are connected by flexible caoutchouc pipes to the wind-chest. The mouth-piece tubes are mounted upon a plate in such a way that they can slide up and down in curved slots concentric with the disks. By the aid of templates cut out in comb-fashion, and screwed to a lever handle, the mouth-pieces, or any set of them, can be displaced at will; thereby introducing any required difference of phase.



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