In this issue

Animating nematics

Rayleigh–Benard cellular convective flow is well known in liquid layers subjected to an adverse temperature gradient. In binary fluids these instabilities occur as travelling waves and this phenomenon is well understood. In a paper beginning on **page 506**, V. A. Raghunathan *et al.* predict another type of instability of the propagating variety in nematic liquid crystals under certain special circumstances.

Nematic liquid crystals are anisotropic fluids characterized by the orientational ordering of the molecules having shape anisotropy. The local orientation is described by the unit vector (the director) which can vary from point to point in the medium. When an electric field is applied to such a liquid crystal, space charges can form, since the electrical conductivity is anisotropic. If the field is strong enough, an instability similar to that of Rayleigh–Benard flow is set up. One can actually observe the domain pattern optically because the convection flow distorts the director.

Nematics are not ferroelectric. Even so a macroscopic polarization is induced if there is a distortion of the director field. This phenomenon is known as the flexoelectric effect—a phenomenon analogous to piezoelectricity in crystals. Flexoelectricity plays a vital role in the electrohydrodynamic instability of nematics.

Travelling-wave instabilities at low frequencies of the external electric field have been observed experimentally recently. The electrohydrodynamic pattern moves in a direction normal to the convection-roll axis. The current theories of electrohydrodynamic instabilities have not been able to account for this travelling-wave instability.

The propagating instability predicted by the authors occurs when the symmetry of the nematic layer is broken by having a pre-tilt of the director at the bounding plates—an effect caused again by the flexoelectric torque acting on the director. The propagation direction reverses when the field is reversed. The authors convincingly demonstrate experimentally the existence of this effect.

Clarifying the causes of opacity

Cataract is the cause of more than half of cases of visual impairment and blindness in India. A third of the world's cataract sufferers are in India. Although surgery to remove a cataractous lens is one of the more successful surgical procedures, widespread use of the better and safer extracapsular cataract extraction procedure (with intraocular lens implantation for satisfactory restoration of vision) is restricted by economic considerations. Because cataract affects mainly the elderly, any means of delaying onset or progression of cataract can have a large effect. According to one estimate, if development of cataract could be delayed by 10 years, the number of cataract operations world-wide would decrease by a remarkable 45%. Clearly, understanding cataractogenesis is vital for any large-scale plan to combat blindness. In any case, prevention of cataract or delaying its onset or progression sufficiently so as to prevent total visual loss would represent a major medical advance and human-welfare effort.

Epidemiological analysis offers one approach to identification of aetiologic factors of disease. Several epidemiological studies have indeed suggested a number of possible risk factors that predispose to cataract. The most extensive study so far is an Indo-US hospital-based case–control study of 1441 patients and 549 controls, conducted at the Dr Rajendra Prasad Centre for Ophthalmic Sciences in New Delhi between August 1984 and December 1987. The study examined associations between types of cataract and more than 50 physiological, biochemical, behavioural and environmental variables. In the article beginning on **page 498**, D. Balasubramanian (a biophysicist), K. Seetharam Bhat (a nutrition scientist) and Gullapalli N. Rao (an ophthalmologist) provide an account of the anatomy and physiology, and molecular features of the human lens, and comment on the risk factors identified by the Indo-US study. The authors take advantage, though 'guardedly', of the emphasis of the Indo-US study on specific types of cataract, and speculate on the molecular features of the different types.

One interesting risk factor is the use of cheap cooking fuels such as wood and cowdung. While such fuels might be expected to be 'smoky' and hence contribute in some way to cataractogenesis, the finding makes better sense, as the authors point out, in the context of association between socioeconomic variables related to educational achievement and cataract: lower educational level usually means lower socioeconomic status (hence lower likelihood of use of a more expensive cooking fuel), lower quality of living, and lower level of nutrition.

Roots to culture

Mycorrhizae are associations between fungi and roots of higher plants. Mycorrhizal fungi often benefit the host plant in various ways: in specific situations, they increase the absorption of certain nutrients, enhance drought resistance, and increase resistance to root-infecting pathogens. Not surprisingly, there have been attempts to exploit the beneficial effects of mycorrhizae in agriculture and forestry. The widespread use of mycorrhizae in agriculture has been limited by the lack of a simple method of culture and propagation. Axenic, or contaminant-free, culture is particularly important if host specificity is seen (cf. the rhizobia). K. K. Janardhanan *et al.* report success in culturing and maintaining a vesicular-arbuscular mycorrhizal fungus on synthetic medium (**page 509**). Outgrowth of the fungus from root pieces transferred to synthetic medium was induced by axenic root pieces placed in close proximity; at a later stage, the fungus was isolated free of host root. This success is an important breakthrough in mycorrhizal research.