In this issue

Nucleic acids: New linkages

The much celebrated Watson–Crick structure of DNA has provoked several, almost heretical, attempts to provide alternative structural models. The double helix is compelling testimony to Nature's skills in shaping molecules, exquisitely tuned to functional requirements, during the course of chemical and biological evolution. Can the chemical structure of DNA be altered significantly without functional impairment? Can the chemistry of the constituents be changed without affecting the double helical scaffold? These questions have attracted the attention of chemists and theoreticians over the years. The former can indeed create synthetic DNA bearing new and novel bases, enlarge the sugar ring to hexoses and indeed discard the phosphodiester backbone altogether, in creating analogues in the laboratory. The latter can, of course, more comfortably and with less effort, create and assess new structural variants on computer screens. The modelling exercises serve as a useful starting point for evaluating whether a transformation can have interesting consequences, before a vast investment of effort is made in the laboratory. V. Lalitha and N. Yathindra (**page 68**) describe one such attempt in this issue.

The sugar-phosphate backbone of the nucleic acids uses the 3′ and 5′ hydroxyl groups of ribofuranose sugars for forming the phosphodiester links on the polymeric chain. What are the consequences of a 2′,5′ linkage, which is rarely found in nature but does occur under conditions simulating prebiotic environments? The authors establish that 2′,5′-linked nucleic acids can form double helices which are structurally similar to the conventional 3′,5′-linked helices. Evolutionary selection may therefore be unrelated to stereochemical preferences. The higher nuclease stability of 2′,5′ structures has important implications in designing nucleic-acid-based therapeutics.

P. B.

Whither turbulence?

How does one describe turbulent flow? The classical view is that turbulent fluid motion belongs to a harmonic world – the world of random waves, eddy viscosities and Gaussian distributions. This is what Taylor, Wiener, Khintchine, Kolmogorov and others told us in the early part of this century, and, indeed, this is what most textbooks tell us to this day.

The reason is not hard to see. As long as turbulence was considered to be that 'random, highly chaotic phenomenon' there seemed no better way to describe it than by using generalized harmonic analysis – and playing around with spectra and correlations. To be sure, one felt uncomfortable with such an approach (is it right to use statistical theories to solve a deterministic set of equations? Is it right to suppose that turbulence is homogeneous and isotropic in the light of our failure to even 'manufacture' such turbulence in a laboratory? Is it really wise to discard phase information? Don't we all know that eddies are finite?). And, as the years went by, one also started worrying that this approach was not leading to any real solution of the problem.

One way out was to look at the problem differently: to look, for instance, at the behaviour of real life turbulent flows (flows encountered in technological applications, in the ocean and in the atmosphere). It turns out that such flows possess *shear*, display strong coherence (so turbulence is not so disorderly after all) and are essentially characterized by their eddy momentum flux. Fluxes (a flux is basically a transfer; of either matter, energy or momentum) therefore might well hold the key to understanding turbulent motion. Now these fluxes can be enormous – the big ones are known to be really big! So perhaps a more natural approach to describe turbulent motion should be episodic, i.e. in the language of flux *events* instead of *waves*. The episodic view has the added advantage of being able to embrace non-local transport, fat or long tailed distributions and violent fluctuations. Such a view would also appear to be eminently sensible to observers of atmospheric motion (which is really turbulent flow on a gigantic scale) long accustomed to the language of events: gales, cyclones, squall's, etc.

In his presidential address delivered at the Diamond Jubilee Meeting of the Indian Academy of Sciences, R. Narasimha (**page 33**) dwells on the wave versus event question at considerable length. He talks of the different studies carried out by his team to represent flux time series as a kind of stochastic process, explains how to look for patterns in flux signals; is first enthusiastic and then pessimistic about the likely role of wavelet analysis; makes compelling allusions to 'heavy' Mexican hats and finally concludes that atmospheric flux events, rather like human beings, are 'idle' about 50% of the time!

But does Narasimha settle the wave versus event controversy? He apparently does, literally in the 'last reel' of the narrative, when he remarks that turbulence is probably both waves and events: 'an attractive possibility is that passive motion is best described in the language of waves, whereas the active motions are best seen as a series of events'. In his other writings, Narasimha has speculated that the relation between the episodic and harmonic descriptions could perhaps be modelled in terms of stochastic corrective processes. But that's another story.

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