Science and Technology

The geometry of life: nonlinear spectroscopy

by Ned Rosinsky, M.D.

The spectral characteristics of DNA and chlorophyll, the particular frequencies of light and other radiation which these substances absorb and emit, hold the promise of helping scientists penetrate deeply into the question of what is the crucial difference between the living and the inorganic state. We need an understanding of this crucial difference if we are to make any real headway in the battle against cancer and other diseases of aging, as well as in the effort to understand basic biological processes such as the functioning of chromosomes, cell division, and the differentiation of tissues within the development of the embryo.

Before looking at spectral properties, we have to step back briefly and develop a context in which we can interpret what is important about these findings.

Confronted with the enormous amount and apparent complexity of biological data, we need to begin with a principle of biological function which is definitive of the overall process. This is simpler than it sounds, if we start with the right methodology.

The crucial feature defining any process is some sort of transformation in which work is done. What is important is not a self-evident entity, but a change, a transformation. Significant transformations involve changes which increase the potential to do work, to make more transformations. These changes of increasing work potential are termed negentropic.

The simplest pictorial representation of such a transformation is a self-similar spiral on a cone **(Fig. 1).** Each turn of the spiral represents a transformation to a higher potential of doing work. The actual performing of work can be represented by two conical spirals **(Fig. 2),** in which one process does work on another. This double spiral geometry represents the kernel of any work process, and we would look for such underlying geometries as the basis for the functioning of crucial transformations in biology.

In addition to conical action in which work is done, work potential can be simply propagated and this can be indicated by a spiral on a cylinder, that is, a spiral which does not enlarge as it propagates. The propagation of light is an example of this type of action.

FIGURE 1
Cone with self-similar spiral

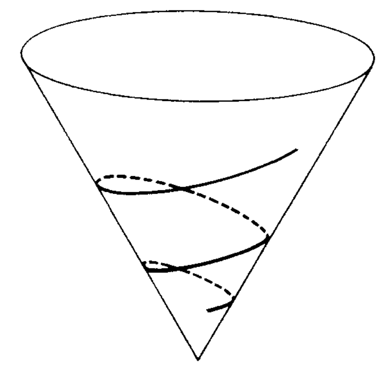
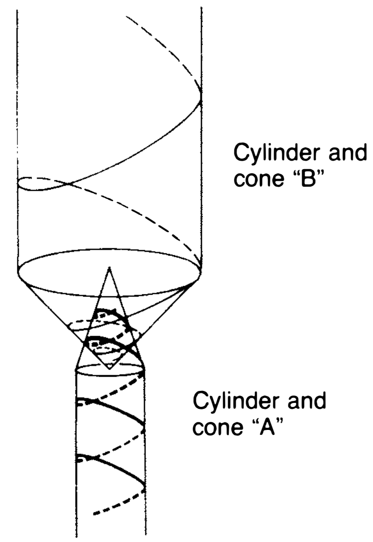


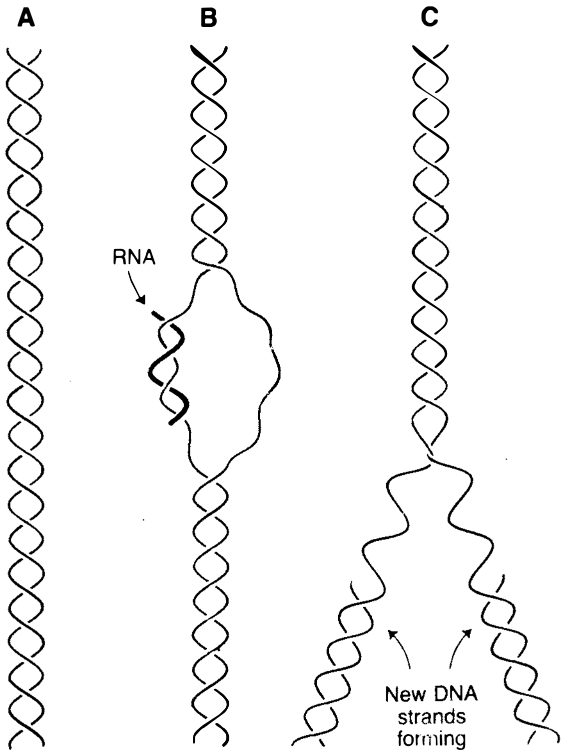
FIGURE 2
Transformation of frequency



We can then see **Fig. 2** as involving the propagation of work potential in a cylindrical form, which then changes to a conical form as it drives the potential in the second cone, resulting in a second spiral of higher frequency, which then propagates on a cylinder larger than the first. Thus the crucial process is an *upshifting of frequency* of the spiral work function.

Now let us look at biology. If we broadly scan what is generally known of biological geometries, we see shapes and forms which are vaguely reminiscent of the work functions described above. We would not expect to see direct replicas of the work functions, since the visual appearance of such processes is likely to be severely distorted. However, if we start with the notion of self-similar growth, we can see in many species of plants conical geometries which are the basis for ensuring maximum sunlight exposure, maximum room

FIGURE 3
DNA in three modes



A: Double helix
B: Partial local uncoiling and formation of RNA strand
C: DNA replication

for growth of new leaves at the tip of the plant, and maximum potential for evolution of the plant based on small changes in the growth geometry of the tip (the meristem tissue).

In order to better define this living process, we need to explore the smallest quantum of action of the work of the plant, which is, generally speaking, some aspect of self-development. We therefore turn to photosynthesis, and look at the microscopic level. Immediately we are in the realm of spectroscopy, since the action of photosynthesis involves the absorption of sunlight. Chlorophyll is certainly involved, but probably the exterior layers of the plant are also involved, such as the possibility of pre-polarizing the light by carbohydrates before the light reaches the chlorophyll.

In a series of experiments on the spectrum of chlorophyll, James Frazer, now at the Texas Medical Center, found that chlorophyll absorbs radiation strongly in the microwave region, and after such absorption re-emits in the infrared. This represents approximately a 10,000-fold increase in the frequency of the radiation, and there is evidence that the re-emitted radiation is of a coherent form. Earl Prohofsky of Purdue University is examining the spectrum of DNA, particularly focusing on the microwave region, and has already found some upshifting of re-emitted radiation. His theoretical calculations indicate that a major upshift similar to the one seen in chlorophyll would be expected, and he and others are now attempting to verify this experimentally.

Geometrical interpretation

How can we interpret these results? In the case of DNA, some aspect of double-spiral geometry is evident. Furthermore, the twisting and untwisting of that spiral is a key part of its functioning in producing RNA for protein synthesis, and in self-replication for cell division **(Fig. 3).** Since the smallest quantum of action in the work function is the addition (or subtraction) of one whole turn of the spiral, this fits in nicely with our idea of work in general.

Looking more closely at the area of the intersecting cones in **Fig. 2,** we would like to better understand the form of this crucial part of the process, which we term a singularity. Since one process of a given characteristic wavelength is driving another process of a different wavelength, and these wavelengths can be thought of as representing different efficiencies of propagation, or retarded potentials, we can see this action as similar to a jet plane forming a sonic boom, i.e., a shock wave. The plane goes faster than the speed of sound, causing the shockwave to form. In the DNA, we would look for two areas, or "submanifolds," with differing maximum rates of wave propagation, coupled to each other so that the faster can drive the slower to its maximum point and beyond. In terms of topology, our hypothesis would be that the inner aspect of the DNA may have a different rate than the outer aspect. A shock wave formed under these conditions would cause a rotation of the spiral in such a way that the "inner" surface would separate from the "outer," which would then be related to the types of geometries seen in **Fig. 3.**

The upshifting of frequency is termed nonlinear for obvious reasons. Another aspect of nonlinear spectroscopy is the DNA absorption of microwaves per se. The avidity of DNA for microwaves is orders of magnitude higher than would be expected based on any "component" of DNA, and therefore suggests a long-range resonance of the molecule as a whole, including the water and ions associated with the DNA. The April 1984 issue of *Science News* reported on the work of Mays Swicord in documenting these spectral effects. We can approach this in a manner similar to the hypotheses above, to arrive at a deeper understanding of the functioning of DNA.

By now the usual biologist would be howling, "But DNA is nothing but a passive information tape to carry genetic codes, so all of this is irrelevant, if not impossible!" To which we would reply, it is the statistical, information theory approach which is irrelevant to biology, since life based on statistics should statistically not exist.