Chapter 4

Chargaff’s Second Parity Rule

Poetry’s unnat’ral; no man ever talked poetry ‘cept a beadle on boxin’ day, or Warren’s blackin’ or Rowland’s oil, or some o’ them low fellows.

Mr. Weller. Pickwick Papers [1]

Information has many forms. If you turn down the corner of a page to remind you where you stopped reading, then you have left a message on the page (‘bookmark’). In future you ‘decode’ (extract information from) the bookmark with the knowledge that it means “continue here.” A future historian might be interested in where you paused in your reading. Going through the book, he/she would notice creases suggesting that a flap had been turned down. Making assumptions about the code you were using, a feasible map of the book could then be made with your pause sites. It might be discovered that you paused at particular sites – say at the ends of chapters. In this case pauses would be correlated with the distribution of the book’s ‘primary information.’ Or perhaps there was a random element to your pausing – perhaps when your partner wanted the light out. In this case pausing would be influenced by your pairing relationship. While humans not infrequently get in a flap about their pairing relationships, we shall see that flaps are useful metaphors when we observe DNA molecules in a flap about their pairing relationships.

Information Conflict

The primary information in this book is in the form of the linear message you are now decoding. If you turn down a large flap it might cover up part of the message. Thus, one form of information can interfere with the transmission of another form of information. To read the text you have to correct (fold back) the ‘secondary structure’ of the page (the flap) so that it no longer overlaps the text. Thus, there is a conflict. You can either retain the flap and not read the text, or remove the flap and read the text.
In the case of a book page, the text is imposed on a flat two-dimensional base – the paper. The message (text) and the medium (paper) are different. Similarly, in the case of our genetic material, DNA, the ‘medium’ is a chain of two units (phosphate and ribose), and the ‘message’ is provided by a sequence of ‘letters’ (bases) attached at intervals along the chain (Fig. 2.4). It will be shown in Chapter 13 that, as in the case of a written text on paper, ‘flaps’ in DNA (secondary structure) can conflict with the base sequence (primary structure). Thus, the pressures to convey information encoded in a particular sequence, and to convey information encoded in a ‘flap,’ may be in conflict. If it is possible to recognize that one form of information (e.g. flap) is in some way higher than another form (e.g. text), then hierarchical levels can be assigned, and it can then be said that there is a conflict not only between different forms of information, but also between different levels of information. In biological systems where there is competition for genome space, the ‘hand of evolution’ has to resolve these intrinsic conflicts while dealing with other pressures (extrinsic) from the environment.

Prose, Poetry and Palindromes

Primary information can be conveyed in Pidgin English. “Cat sat mat” can convey essentially the same primary information as the more formal “the cat sat on the mat.” It is known that the act of sitting is something cats frequently do, and that mats usually occupy lowly places where they are vulnerable to being sat upon. An important function of the syntax of formal prose – the form the primary information would take in normal human discourse – is that it can suggest the possibility that there has been an error in the primary information. The sentence “The cat sat on the mat” is syntactically correct, and on this basis we might judge that the author had really written what he/she had meant to write. However, this comes at a price. “Cat sat mat” takes less time to write or speak, and occupies less space. Definite articles and prepositions can be considered as redundant information. Provided we know that it is cats that do the sitting, the less formal prose of Pidgin English has certain efficiencies.

To those whose first language is English this may not be obvious. Like Monsieur Jourdain in Molière’s Le Bourgeois Gentilhomme, we discover that we have been speaking and writing a high level formal prose quite effortlessly all our lives [2]. But, in fact, it has not been all our lives. As infants we began by stringing single words together in forms not too different from “cat sat mat,” and had to acquire, slowly and laboriously, the modifications that led to a higher level of discourse.

An even higher level of discourse would be poetry. The error-detecting function would then be considerably increased. In this case the ear and eye would, from childhood, have been so accustomed to meter and rhyme that, if