

Exercise 2: Sentence length

Determine the distribution of words per sentence.

The field of molecular evolution comprises the analysis of patterns and causes of change in DNA and protein sequences over evolutionary time. Understanding molecular evolution is central to the new discipline of genomics, to many aspects of genetic and infectious disease, and to industrial applications of directed evolution and synthetic biology. A central component of the field of molecular evolution is the neutral theory, as developed by Kimura in the 1970s. Much of the sequence variation on the molecular level seems to be neutral or nearly neutral, and Kimura developed the mathematical framework to describe the accumulation and maintenance of neutral and nearly neutral variation. The neutral theory has had tremendous success, but an important component is missing from this work: neutral protein sequences form non-regular graphs, so-called neutral networks, and the structure of these graphs can shape the dynamics of neutral evolution.

(Abstract of a grant proposal)

Green plants have at least two kinds of RNA polymerases: a phage-type nuclear encoded polymerase (NEP) and a prokaryotic type plastid-encoded polymerase (PEP). PEP is thought to be responsible for transcription of functional photosynthetic genes. Like its bacterial ancestors, PEP is composed of alpha, beta, gamma, and delta subunits. *rpoA* encodes the alpha subunit. Previous work in our lab has shown that the *rpoA* gene of *Pelargonium hortorum*, a geranium, is fragmented and incomplete. Without the subunit encoded by *rpoA*, the PEP would not function. The photosynthetic genes of *P. hortorum* are functional. Fragmentation of *rpoA* is unusual in angiosperms, but it is the norm in mosses. Moss *rpoA* is located in the nuclear genome and the protein is targeted to the chloroplast. We set out to determine whether *P. hortorum* still possesses an *rpoA* gene, and if so, whether it is functional. We have found evidence of a successful relocation of *rpoA* to the nucleus, never before seen in angiosperms.

(Student paper)

Hanging chads. Ballot stuffing. Gerrymandering. Such dirty tricks enfeeble democracy. But the security of the votes cast in Geneva during Switzerland's general election on October 21st is guaranteed. The authorities will use quantum cryptography---a way to transmit information that detects eavesdroppers and errors almost immediately---to ensure not only that votes are kept secret but also that they are all counted.

In quantum cryptography, as in most long-distance data transmission, the information is carried by photons, the particles which compose light and other sorts of electromagnetic radiation. These particular photons, however, are manipulated in a special way. The simplest example is when the sender (whom cryptographers usually call Alice) dispatches a stream of them to the receiver (who is known as Bob). These photons will have one of two modes. In the first, a photon is polarised either vertically or horizontally. In the second, it is polarised diagonally---plus or minus 45°. In the first mode, a photon polarised vertically represents a “0” and one polarised horizontally represents a “1”. Similarly in the second mode polarisation at +45° represents “0” and at -45°, “1”.

(Heisenberg's certainty principle. “Economist”, October 20, 2007)