

## TUNA FISH TREE<sup>i</sup>

*TUNA FISH.* Insatiable water calves searching for shadows<sup>ii</sup>. Seafarers, whose destination is marked by magnets<sup>iii</sup>. Salty eyes distilling fear<sup>iv</sup>. Heat in the cold on admirable net<sup>v</sup>. Shoals that mix with herds of dolphins<sup>vi</sup>. Thick blood catching metals<sup>vii</sup>. Torpedoes<sup>viii</sup>.

*DISTRIBUTION COEFFICIENT<sup>ix</sup>.* Bottles from a castaway in an inner sea<sup>x</sup>. Tectonics of gel on plate<sup>xi</sup>. Dynamics of fluids and systems in the complexity of electric love<sup>xii</sup>. Delirium of solvents and run distances<sup>xiii</sup>. Navigation into the shadows<sup>xiv</sup>. Precious fog<sup>xv</sup>.

*GENETIC DISTANCE.* Fragments that dance in an agarose magma<sup>xvi</sup>. Races involving agoraphobic equals, looking for each other in the desolate continuity of the landscape on plate<sup>xvii</sup>. Matrix of equalities or confluences<sup>xviii</sup>. A taxis that leads to follow inherited instincts<sup>xix</sup>. Noise that advances slowly, but does not stop<sup>xx</sup>.

*PHILOGENETIC TREE<sup>xxi</sup>.* From the common ancestor the flux diverges in the xylematic labyrinth of the branches<sup>xxii</sup>. All is fidelity until a shoot pops up, until a branch takes a lateral flight<sup>xxiii</sup>. Conflict exists where parallel lives were sensed<sup>xxiv</sup>. Bark in divergence<sup>xxv</sup>.

*Corollary<sup>xxvi</sup>.* The fragmented tuna essence spreads in the agarous gel, following unprecedented affinities. The jellyfish tentacles filter essences and then love has its distribution coefficient. Pattern poems are traced in the gel, although only experienced scribes can decipher the codes.

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Notes from A to Z:

- i With this text the author does not exclusively expect to please ('with a nice story'), as he considers that it is not an artist's or a scientist's function, the fact of repeating expressions or experiments until the exhaustion of senses. Research, development and innovation (R+D+I) are so necessary both in the arts and science fields. Thus, a text is constructing as a 'glossary' of terms, with the intention of summarizing the impression caused by the scientific work which gives rise to it.
- ii Tuna fish swim with open mouths devouring everything they find on their way (Insatiable). They need constant feeding in order to get the energy that allows them to maintain their speed. The term 'calves' is used in a figurative sense, both because of their size (the maximum weight published of the red tuna is 684 kilos, in J.G. Collette and C.E Naven (1983) "FAO species catalogue. Volume 2. Scombrids of the world" FAO Fish. Synop (125) vol. 2), and by the fact that people make use of all their flesh, even their viscera and bones. On the other hand, 'searching for shadows' refers to the tendency they have to gather underneath oscillating objects.
- iii Tuna fish follow migrations that are not only in relation to the temperature of the water body in which they move, but to other phenomena related to the Earth's axis movement (which indirectly affects the ocean currents and, therefore, the water bodies).
- iv Tuna fish are 'wet-eyed' animals, in comparison to the 'dry-eyed' animals. Aristotle, in his treatise "Historia naturalis" describes crustaceans (volume IV, chap. 2, 526-9) and insects (volume IV, chap.10, 537) as 'dry-eyed' animals. When they are brought on board, their expression, with permanent opened eyes and no eyelids ('salty-eyed'), reveals a mixture of astonishment, panic and deep aversion.
- v Contrary to what happens to most of fish, which are cold-blooded (poikilotherms), tuna fish get to adjust their own temperature with a blood circulation system, crosscurrent, through a series of blood vessels which have received the name of 'rete mirabili' (admirable net).
- vi It is not very usual, mainly in the Pacific Ocean, such a phenomenon of mixing yellowfin tuna shoals with herds of dolphins. There are many types of dolphins, such as the spinner dolphin (*Stenella longirostris*) and the spotted dolphin (*Stenella attenuata*). A phenomenon of 'commensalism' occurs, where none of the two species is damaged.
- vii Tuna fish blood, due to its temperature and its cellular composition (hematocrit), is more viscous than other fish's. In its blood, as it happens to other scombrids like the mackerel, or to oceanic fish like the swordfish or the sailfish (the animal character in "The Old Man and the Sea", by Ernest Hemingway), it occurs a phenomenon of concentration of heavy metals which are detrimental to the health of those eating its flesh.
- viii Some species of tuna can achieve a swimming speed of up to 260 kilometres a day, as it is referred in C. S. Wardle, et al. (1989) "*The muscle twitch and the maximum swimming speed of giant bluefin tuna, Thunnus thynnus L.*" Journal of Fish Biology 35 (1), 129-137. For that fact, and due to its hydrodynamic design, they are referenced here as 'torpedoes'.
- ix The difference in 'height' between one end and the other, which the samples of genetic material reach on the plate, is called 'distribution coefficient'. If we consider the maximum height as a measure unit, every sample situated at a distance 'x' from the starting point runs a fraction (coefficient 1/x) of that distance.
- x When the samples are deposited on the gel plate, one can not know in advance the action they are going to have. This behaviour is, therefore, similar to the 'bottles from a castaway', about which the one who throws them knows the coordinates of origin but not the final ones. The gel expands on a glass plate, hence, due to its delimited nature, the reference to an 'inner sea'.
- xi When the gel is placed, it moves on the glass plate, similarly to the tectonic plates with different density on the earth's surface, what is known as tectonic movement.

- xii The reference to 'electric love' makes sense if we think that the liquids move in gel thanks to electric affinity or polarization.
- xiii The unpredictable character of the movement of the samples of fluid placed into the gel justifies the name of 'delirium', because one knows the beginning but not the course of the movement, sometimes erratic. Besides, the distribution distance of a sample on the plate can vary depending on the concentration and the solvent (a drug that causes delirium) used.
- xiv The process is made in darkness, out of our sight. Only at the end of said process the final position of the sample, its route, is revealed.
- xv The mark each sample shows on the plate is not normally sharp, but a blurred smudge. The marks are normally stained or fluorescent in order to facilitate their visualization. That is why talking about 'precious fog' sends us to the aesthetics of the final result, a group of marks more or less softened on a whitish plate of gel.
- xvi The gels most traditionally used for the electrophoresis techniques on a plate come from agarose, a substance that can be extracted from certain kinds of seaweeds. 'Magma' is identified with an amorphous substance in which the genetic material fragments, which we want to separate, move ('dance').
- xvii The genetic materials are to spread on the geography of the plate according to their affinities (resemblance). The final result tends to concentrate the samples (they are agoraphobic because they reject the empty ways and flee from random distribution), remaining the biggest part of the plate with a lack of genetic material ('desolate').
- xviii The genetic distance (degree of 'dissimilitude') will be reflected on the plate by a matrix of rows and columns depending on the affinities (proximity) or differences (remoteness) of the marks on the agarous plate.
- xix A metaphorical play to justify the attraction (taxia=reactive movement to a stimulus) as a reaction to the intrinsic nature of the sample (the inherited instinct).
- xx A reference to the permanent character of the evolution of species from common ancestors. The 'noise' would represent the diversity (biodiversity) with a sense of 'confusion', caused by the ignorance of what is going to happen, noting the idea of 'no one way', of possible 'evolutionary radiation', as it will be seen later. The fact of 'slowly' advancing reflects the unhurried character of evolution (it is true that 'jumping' many times, but rarely at great speed).
- xxi It is a common place, since the times of Linnaeus, to establish the map of affinities amidst species following an arboreal logic, reflection, perhaps, of the common use of the family trees in order to define a relationship among humans.
- xxii The xylem defines the plant's architectural structure. There would be a common trunk (ancestor) from which the branches (species) would diverge. The not-always-regular structure of the xylem would determine the place from where the branches rise up (hence its reference to « labyrinth »)
- xxiii The xylem channels go in parallel (identification of 'parallelism' with the balance of distances and hence its 'fidelity' to a marked guideline) until a shoot pops up (structure that gets away from the parallel lines) and a branch appears. If in two similar samples (parallel), one suffers a mutation (a shoot appears), a different evolutionary branch can arise, that is to say, other species. It can be known by intuition – simplifying - that the mechanisms of creation of species can be similar to the process of formation of a branch.

- <sup>xxiv</sup> Here, it is seen as a « conflict » what the mathematician René Thom knew as a 'catastrophe', due to a change of state. « Change of genetic state » in this case, transition from a genetic code to another, even when the morphology still did not reflect a radical change, what would happen during the first times of a genetic differentiation (that is why the text refers to 'where parallel lives were sensed').
- <sup>xxv</sup> The changes in genetic material precede those observed externally, but only when different morphological external characteristics are observed (when bark changes), we can talk about the appearance of new species.
- <sup>xxvi</sup> Following the previous notes, there is an exercise left for the readers (scientists or not), in order to interpret the corollary or to draw their own conclusions.