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## EPILOGUE

Polarity has been considered as “the directional arrow of Evolution” leading from the primordial, *intrinsic* electro-bipolarity born in the abiotic phase and amplified in the prebiotic phase through the electro-structural polarity of macromolecules, to the induced, newly called *extrinsic* biopolarizations achieved in the biotic phase (see Addenda **III**).

In this evolutionary view of Polarity, the advent of progressively complexified developmental polarities, capable of overstepping elementary self-assembly processes, has been achieved by the *take-over* of a positional genetic information increasingly competent in its gradiential expression of morphogenetic molecules. However, in this genetic take-over, the intrinsic electrical bipolarity could be conserved through its fruitful exploitation of the unique dipolar and vectorial electrostatic proprieties of hydrogen bonding, prototyped in the H<sub>2</sub>O network, developed in the first biomolecules and the intra- or inter-molecular H bonds of  $\alpha$ -helical -  $\beta$ -sheet proteins respectively, and finally amplified in the informational base sequence of DNA coding for the most complex polar bioaxiations. Endowed with both electro-structural and informational polarity contents, the H bonding can thus be considered as the unifying principle of continuity in the evolutive complexification of Polarity from its intrinsic, physico-chemical fundamentals to its extrinsic, genetically-controlled but epigenetically, environmentally-modulated polar bioaxiations as sequentially summarized in the following synopsis:

## SCALE OF POLARITY COMPLEXITY

- 1) electrical (-magnetic) bipolarity:
  - a) subatomic asymmetries (+/- electric charges, N/S magnetic poles),
  - b) atomic (H), molecular inorganic (H<sub>2</sub>O, etc.) and organic (amino acids, etc.) dipoles, and H electrostatic bonds;
- 2) electrical-structural bipolarity:
  - a) informational (nucleic acids),
  - b) translational macromolecules (polypeptides - proteins, etc.);
- 3) structural bipolarity:
  - a) cytoskeleton (actin, myosin, tubulins),
  - b) viral self-assemblies.

- 4) physical-chemostructural polarizations:
  - a) physical effectors (light-induced charge separation, etc.);
  - b) chemostructural effectors (crystals → light polarization, semi-superconductors → electric fields).
  
- 5) electrical-structural pericellular biopolarizations:
  - a) transversal (“perpendicular”) through  
     plasma and organellar membrane (a<sup>1</sup>) conformations,  
     (a<sup>2</sup>) energy transduction and (a<sup>3</sup>) electric potentials;
  - b) tangential (“planar”) along  
     (b<sup>1</sup>) apical-basolateral, epithelial and  
     (b<sup>2</sup>) longitudinal, axonal membranes (action potentials);
  
- 6) structural-functional intracellular biopolarizations:
  - a) monopolar (a<sup>1</sup>) molecular intermembranar targetings,  
     (a<sup>2</sup>) vesicular traffics and (a<sup>3</sup>) energetic motors;
  - b) bipolar (b<sup>1</sup>) homo-symmetric mitoses,  
     (b<sup>2</sup>) hetero-asymmetric cell divisions;
  
- 7) genetical-developmental biopolarities:
  - a) apical (a<sup>1</sup>) monopolar and (a<sup>2</sup>) bipolar growth patterns;
  - b) axial (b<sup>1</sup>) anterior-posterior, (b<sup>2</sup>) dorsal-ventral,  
     (b<sup>3</sup>) bilateral (chiral) differentiation patterns;
  
- 8) environmental polar movements:
  - a) cellular tactisms (chemo-, photo-, etc.)
  - b) organismic tropisms (chemo-, photo-, gravi-, galvano-, polaro-).

From now on, we expect to use this first integrating frame to further select “New Trends in Polarity” from the ground-line of the encyclopedic information assembled since 1989 in our Survey and its Addenda.

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