Information in Biology:
from the mathematical model to the discreet charm of the metaphore.

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The major observables in Physics are largely, if not exclusively, based on or derived from energy (conservation properties as symmetries, geodetic principles as least action principles...). Biology forced us to think in the novel terms of "organization" and, even, of inherited organization; an organization whose "complexity" grows, against energy degradation in Physics (entropy). Then, with World War II, the age of coding, decoding and information started. Information Theory and Cryptography became well defined scientific displines, with their own principles and remarkable applications. Can we borrow for the analysis of life phenomena any relevant principle or precise result from these scientific areas?

Many justify the reference to information "just" as methaphor, but while the model simplifies, the metaphor complicates. It adds a track for mind, it refers to a (another) impregnating conceptual framework, a universe of methods and of knowledge that one transfers onto the intended one. As suggested in [Nouvel, 2002] :« When a model functions as metaphor, the model becomes an object of seduction for thought. If we then use it as a suggestion for the solution of a philosophical question, we will manage, abetted by this confusion, to make this metaphor appear as a 'philosophical consequence' » of mathematical modelling.

We will then discuss of the structure of determination proper to the coding-decoding techniques; of Shannon entropy and its mathematical unsuitability to understand embryogenesis; of the (exclusive) role of digits and bits in modern information theory and their conceptual incompleteness in understanding life. The rigor in the treatement of quantum-information and qu-bits in Quantum Information Theory may provide a stimulating comparison with a autonomous and well-founded use of the word in an other discipline.

Nouvel P., "Modèles et métaphores" *dans* **Enquête sur le concept de modèle**, Nouvel P. (ed.), Presses Univ. de France, 2002.

Bailly F., Longo G., **Mathématiques et sciences de la nature. La singularité physique du vivant,** Hermann, Paris, 2006.

Bailly F., Longo G., "Biological Organization and Anti-Entropy". Second part of the concluding lecture at the Conference "From Type Theory to Morphological Complexity: A Colloquium in Honor of Giuseppe Longo" to appear, 2008 (downloadable).

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