Symmetries in foundations: from Mathematics to Natural Sciences

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Abstract. Since the work of E. Noether and H. Weyl in the first half of last century, physics is largely governed by symmetries and by the geodesic principle, a consequence of symmetries. Herein, we briefly review the role of the latter by a "backwards" reading also of Euclid's axioms in terms of symmetries and hinting to their role in moving from classical to relativistic and quantum physics (by means of symmetry changes). We then introduce our ongoing theoretical analysis in biology and show that symmetries play a radically different role in this discipline, when compared to those in current physics. We posit that the dynamics of biological organisms, in their various levels of organization, are not "just" processes, but permanent (extended, in our terminology) critical transitions and, thus, "continual" symmetry changes. Within the limits of a relative structural stability (or interval of viability), biological variability and diversity are at the core of these transitions.

References (see downloadable papers in http://www.di.ens.fr/users/longo)

Bailly F., Longo G. **Mathematics and the Natural Sciences. The Physical Singularity of Life.** *Imperial College Press*, London, 2011.

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