

## Resume - Maël Montévil

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### Currently

<b>CNRS / Paris I</b> Post doctoral fellow IHPST, grant ISC Île de France	Paris june 2013 – -
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### Education

<b>Paris V - ENS de Paris</b> PhD degree in Frontiers in life sciences PhD program (FdV) <i>Supervisor, Giuseppe Longo: "Biological time and extended critical transitions: Towards an objectivization of the living state of matter"</i>	Paris 2011
<b>Paris V</b> MS (Master II) in Interdisciplinary approaches to life sciences (AIV) MS (Master II) in Cognitive Sciences (Cogmaster)	Paris 2008 2007
<b>ENS de Cachan - Paris VII</b> MS (Licence and Master I) in Mathematics	Paris 2006
<b>Paris I</b> BS (Licence) in Philosophy	Paris 2005
<b>ENS de Cachan</b> Élève in Mathematics <i>Not associated to a specific degree, intensive formation</i>	Cachan 2004-2008
<b>Lycée Chateaubriand</b> BS (Classe préparatoire MPSI-MP*) in Mathematics and Physics <i>Intensive formation to enter the "grandes Écoles"</i>	Rennes 2001-2004

### Employment History

<b>CNRS / Paris I</b> Post doctoral fellow IHPST, grant ISC Île de France	Paris june 2013 – -
<b>Tufts University</b> Post doctoral associate Soto and Sonnenschein Lab	Boston fev. 2012 – june 2013
<b>Paris V</b> Pre-doctoral fellowship Research were done in a laboratory of ENS de Paris	Paris Oct. 2008 – Sep. 2011
<b>École Normale Supérieure (ENS) de Cachan</b> Normalien Student of ENS	Cachan Sep. 2004 – Aug. 2008

## Laboratory Experience

**Informatics** Use of L<sup>A</sup>T<sub>E</sub>X, Matlab (and octave), Maple, cran R, imageJ, programming in C and java, ....  
(Allows to perform simulations, images and data analysis, advanced typesetting of texts and figures).

**3 month Internship in Microbiology - Paris V** Paris  
Bi-stability of Lac-operon of E. coli in INSERM-U571, Necker 2008  
*Supervisors: François Taddei et Lydia Roberts*

**Internships in Theoretical biology - ENS** Paris  
*Supervisors: Giuseppe Longo (and unofficially Francis Bailly)*

Turing, le jeu de l'imitation et la morphogénèse in LIENS 2005  
*Turing, the imitation game and morphogenesis.*

Quelle criticité pour l'étude du vivant ? de la criticalité auto-organisée aux situations critiques étendues. in LIENS 2006  
*Which criticality for biology? From self-organized criticality to extended critical situations.*

Aspects thermodynamiques de la complexité biologique in LIENS 2007  
*Thermodynamical aspects of biological complexity*

## Academics

**Organization of international conferences** IAS-IHPST meeting: *Boundaries and levels of biological organization*. 1-2 july 2014, San Sebastian, Spain.

**Referee** for the journal "Frontier in fractal physiology".

**Review Editor** for the journal "Frontier in fractal physiology".

**Webmaster** for the book series vision des sciences, Hermann,  
<http://www.visions-des-sciences.eu/>.

## Publications

Most of these texts can be found at <http://montevil.theobio.org>.

### Book

G. Longo & M. Montévil. 2014. *Perspectives on Organisms: Biological time, symmetries and singularities*. Lecture Notes in Morphogenesis. Springer. ISBN: 978-3-642-35937-8.  
doi:10.1007/978-3-642-35938-5

### PEER REVIEWED ARTICLES

C. Barnes et al. 2014. "From Single Cells to Tissues: Interactions between the Matrix and Human Breast Cells in Real Time." *PLoS ONE* 9, no. 4 (April): e93325. doi:10.1371/journal.pone.0093325

G. Longo & M. Montévil. 2013. "Extended criticality, phase spaces and enablement in biology." Invited Paper, Special Issue, *Chaos, Solitons & Fractals* 55:64-79. ISSN: 0960-0779.  
doi:10.1016/j.chaos.2013.03.008

G. Longo & M. Montévil. 2012b. "The Inert vs. the Living State of Matter: Extended Criticality, Time Geometry, Anti-Entropy — an overview." Invited paper, special issue, *Frontiers in Physiology* 3 (00039). ISSN: 1664-042X. doi:10.3389/fphys.2012.00039

G. Longo, M. Montévil & A. Pocheville. 2012a. “From bottom-up approaches to levels of organization and extended critical transitions.” Invited paper, *Frontiers in Physiology* 3, no. 232 (July). ISSN: 1664-042X. doi:10.3389/fphys.2012.00232

G. Longo & M. Montévil. 2011a. “From physics to biology by extending criticality and symmetry breakings.” Invited paper, special issue: Systems Biology and Cancer, *Progress in Biophysics and Molecular Biology* 106 (2): 340–347. ISSN: 0079-6107. doi:10.1016/j.pbiomolbio.2011.03.005

F. Bailly, G. Longo & M. Montévil. 2011. “A 2-dimensional geometry for biological time.” *Progress in Biophysics and Molecular Biology* 106 (3): 474–484. ISSN: 0079-6107. doi:10.1016/j.pbiomolbio.2011.02.001

G. Longo & M. Montévil. 2011c. “Protention and retention in biological systems.” *Theory in Biosciences* 130 (2): 107–117. ISSN: 1431-7613. doi:10.1007/s12064-010-0116-6

## PROCEEDINGS

G. Longo, M. Montévil & A. Pocheville. 2013. “L’incompressible complexité du réel et la construction évolutive du simple.” In *Autour de la simplicité*, edited by A. Berthoz & J.-L. Petit. Article invité. Odile Jacob

G. Longo & M. Montévil. 2012a. “Randomness Increases Order in Biological Evolution.” In *Computation, Physics and Beyond*, edited by M. Dinneen, B. Khoussainov & A. Nies, 7160:289–308. Lecture Notes in Computer Science. Invited paper, Auckland, New Zealand, February 21-24, 2012. Springer Berlin / Heidelberg. ISBN: 978-3-642-27653-8. doi:10.1007/978-3-642-27654-5\\_22

G. Longo, M. Montévil & S. Kauffman. 2012. “No entailing laws, but enablement in the evolution of the biosphere.” In *Genetic and Evolutionary Computation Conference*. Invited Paper. Philadelphia (PA, USA): GECCO’12, ACM, July. doi:10.1145/2330784.2330946

M. Montévil. 2012. “Géométrie du temps biologique : rythmes et protension.” In *Questions de phrasé*, edited by A. bonnet, F. Nicolas & T. Paul. Article invité. Hermann, January. ISBN: 978-2705681555

## Conferences & invited talks

1. M. Montévil. 2014g. “Objets physiques, objets biologiques.” In *Ve Congrès de la Société de Philosophie des Sciences. Métaphysique des sciences*. Lille, June
2. M. Montévil. 2014b. “Changements critiques de symétrie et aléatoire. Mathématiques et objectivation du vivant.” In *École de printemps de la Société Francophone de Biologie Théorique. Le vivant critique et chaotique*. 21 – 25 Mai 2014, St Flour, May
3. M. Montévil. 2014j. “The specificity of biological objects. From physics to biology tier 2.” In *School of Science and Technology*. Università degli Studi di Camerino, Camerino, May
4. M. Montévil. 2014h. “Some aspects of biological time. From physics to biology tier 1.” In *School of Science and Technology*. Università degli Studi di Camerino, Camerino, May
5. M. Montévil. 2014e. “La notion de mesure : de la physique à la biologie.” In *Séminaire du CAMS, Systèmes complexes en sciences sociales*. EHESS, Paris, April
6. M. Montévil. 2014d. “Framing biological objects.” In *Cours: complexité biologique et organisation : démarches théoriques et applications expérimentales*. École Normale Supérieure, Paris, March

7. M. Montévil. 2014i. "Temps et objet biologique." In *Cours: Complexité biologique et organisation : démarches théoriques et applications expérimentales*. Muséum National d'histoire naturelle, Paris, March
8. M. Montévil. 2014f. "La notion de mesure : de la physique à la biologie." Institut d'Étude Avancée, Nantes, March
9. M. Montévil. 2014a. "Biological object and measurement." In *Center for philosophy of science*. University of Pittsburgh, February
10. M. Montévil. 2014c. "Collagen organization in 3D cultures, From physical to biological self-organization." In *Soto and Sonnenschein lab*. Tufts University, Boston, February
11. A. M. Soto et al. 2013. "Towards a theory of organisms." In *Meeting of the International Society for History, Philosophy and Social Studies of Biology*. Montpellier, July
12. G. Longo, M. Montévil & A. Pocheville. 2012b. "Symmetry changes and enablement in the evolution of the biosphere: their impact on biological theoretizing." In *Evolution des Formes : Contraintes - Adaptation*. Muséum National d'Histoire Naturelle, Paris, November
13. M. Montévil. 2011. "Rôle des symétries théoriques dans la mesure en biologie." In *Séminaire de biologie théorique*. CREA-IHPST, Paris, November
14. M. Montévil & M. Mossio. 2011. "The idea of closure in autonomous systems." In *Workshop on Artificial Autonomy ECAL 2011*. Paris, August
15. G. Longo & M. Montévil. 2011b. "From Physics to Biology by symmetry breakings." In *Self-Organization in Biology: scope and limits*. Ceperc, Philosophy of Biology Group, Aix-en-Provence, May
16. A. Pocheville & M. Montévil. 2010. "Intra-organismal ecology: niche construction and gene therapy." In *Organisms as ecosystems, ecosystems as organisms*. Laboratoire Ecologie et Evolution, Université Paris 6, December
17. M. Montévil. 2010. "Géométrie du temps biologique : rythmes et protension." In *Questions de phrasé*. ENS, Paris, September
18. M. Montévil & A. Pocheville. 2010. "Multilevel Causation and criticality: from physics to biology." In *Workshop: multilevel causation*. IHPST, Paris, March
19. M. Montévil. 2009c. "Fin et ouverture...", table ronde." In *Journée d'études L'anneau des disciplines*. ÉNS, Paris, November
20. M. Montévil. 2009a. "Criticité étendue et identité." In *LIGC 2009 "Egalité, identité, isomorphisme"*. Firenze, September
21. M. Montévil & A. Pocheville. 2009. "Niche écologique et temps biologique." In *Les paradigmes de l'écologie : modélisation, économie, et éthique de l'environnement*. CNRS, Cargèse, March
22. M. Montévil. 2009b. "Explorer la singularité physique du vivant: temps biologique, criticité étendue et anti-entropie." In *Séminaire de biologie théorique*. CREA, Paris, March
23. M. Montévil. 2008. "Commentaire de " Réseaux de régulation biologiques et causalité complexe" d'Annick Lesne." In *Fonctions et causalité complexe*. IHPST, Paris, November

POSTER

1. Tessie Paulose et al. 2014. *A Novel 3D Model to Study the Link Between Hormonal Exposure and Mammographic Density in Breast Cancer*. Poster. 16th International Congress of Endocrinology and Endocrine Society's 96th Annual Meeting & Expo ICE/ENDO 2014, Chicago
2. Lucia Speroni et al. 2014. *Development of Software for Automated Morphology Analysis (SAMA) to analyze morphogenic effects of mammatrophic hormones in vitro*. Poster. 16th International Congress of Endocrinology and Endocrine Society's 96th Annual Meeting & Expo ICE/ENDO 2014, Chicago
3. Arnaud Pocheville & Maël Montévil. 2009. *Are there neutral forces in ecology?* Poster. Université Paris 7, December

## Thesis abstract

This work takes place in the context of a theoretical approach in biology which uses the examples of objectivation in physical theories without reducing biological phenomenality to them. We begin by investigating the empirical biological scaling relationships found in the literature (allometric relationships, fractals, ...), including their variability. We will then consider two different aspects of biological time. First, we will develop the notions of protension and retention as an account of local organization of biological time. Then we consider a supplementary temporal dimension to accommodate proper biological rhythms.

Since the notion of symmetry plays a foundational role in physics, we investigate its possible role in biology. In relation with the notion of extended critical transitions, we propose the hypothesis that organisms and evolution can be understood as characterized by ubiquitous symmetry changes. This transforms the status of biological objects, provides an approach of their historicity and leads to propositions on the theoretical nature of biological measurement. We also discuss anti-entropy as a measurement of a potential of variability.

We focus then on the notion of level of organization. We start from the notion of organizational closure, which is considered as a core biological invariant by many theoretical biologists. Then, we will approach levels of organization by the paradigm of criticality, which will allow to define them in a strong theoretical way. Finally, we sketch an operatorial scheme of the coherence of organisms, which combines most of the above mentioned approaches.