

Stamatios C. Nicolis

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Present position

Since 2015 **Senior researcher under a grant from the Belgian Federal Science Policy Office and under a contract from Wallonia region** Belgium
Unit Biological and Artificial Self-organized Systems / Service de Chimie Physique et Biologie Théorique and Center for NonLinear phenomena and complex systems (GENOLI) , Université Libre de Bruxelles

Positions held

2010 – 2015	Senior researcher Mathematics department, Uppsala University	Sweden
2008 – 2010	Post-doctoral fellowship Mathematics department, Uppsala University	Sweden
2006 – 2008	Post-doctoral fellowship Department of Zoology, University of Oxford	United Kingdom
2005 – 2006	Post-doctoral fellowship Department of Biology, Concordia University, Montreal	Canada
2003 – 2005	Post-doctoral fellowship Centre de Recherche sur la Cognition Animale, Toulouse	France
1998 – 2003	PhD fellowship from the Research department Université Libre de Bruxelles	Belgium

Education

March 2003	PhD in Science Title of the PhD : <i>Dynamique du recrutement alimentaire et de l'agrégation chez les insectes sociaux</i> Supervisor : Pr. J.-L. Deneubourg	Université Libre de Bruxelles
June 2000	DEA (post-graduate diploma in Science) Title of the DEA : <i>Emerging patterns and food recruitment in ants: an analytical study</i>	Université Libre de Bruxelles
June 1997	Degree in Chemistry Title of the Diploma thesis : <i>Étude d'un modèle de recrutement par pistes chimiques chez les fourmis</i>	Université Libre de Bruxelles

Honours

2015 – 2017	"Back to Belgium" Grant awardee from Belgian Federal Science Policy Office Université Libre de Bruxelles
2003 – 2005	Post-doctoral fellowship of the Fyssen Foundation Centre de Recherche sur la Cognition Animale, Toulouse
2002	Petsalis Lepage prize Université Libre de Bruxelles
2001	Van Buuren Foundation prize Université Libre de Bruxelles

Pedagogical activities

Teaching

2012 – 2013	Uppsala University Responsible of the course <i>Mathematical Biology</i> (for a total of 40 hours) addressed to Masters and PhD students in Mathematics, Physics and Biology
2012	Uppsala University Summer school in Collective Behavior Responsible of a tutorial session dedicated to mathematical models analyses addressed to PhD students in Biology
2009 – 2011	Uppsala University Responsible of the course <i>Applied Dynamical Systems</i> (for a total of 40 hours per year) addressed to Masters and PhD students in Mathematics, Physics and Biology
2008 – 2009	Uppsala University Co-responsible with Pr David Sumpter for a total of 15h of the course entitled <i>Applied Dynamical Systems</i> addressed to Masters and PhD students in Mathematics, Physics and Biology

Supervision

2016 – 2017	Université Libre de Bruxelles Gilles DeKeyser Co-responsible of a Master project in Bioinformatics entitled <i>Aggregation dynamics in invertebrates</i> .
2013 – 2016	Uppsala University Oumar Diop Co-responsible of a PhD in <i>Applied Mathematics</i> entitled <i>Predator-prey models with time-dependent parameters</i> in the framework of a cooperation programme between Africa and Sweden.
2013 – 2014	Uppsala University Oumar Diop & Yussuf Yaya Co-responsible of two Master projects in <i>Applied Mathematics</i> in the framework of a cooperation programme between Africa and Sweden.
2011 – 2012	Uppsala University Christoffer Hallgren Responsible of a Bachelor project in <i>Applied Mathematics</i> entitled <i>Temperature effects on ant activity</i> .
2011 – 2014	Uppsala University Natalia Zabzina Co-responsible of a PhD in <i>Applied Mathematics</i> entitled <i>Collective choices associated to the presence of different interacting cooperativity mechanisms</i>
2010 – 2011	Uppsala University Mohammed Jamal Responsible of a Master thesis in <i>Applied Mathematics</i> entitled <i>Non linear phenomena in resource exploitation in group living organisms</i>
2009 – 2010	Uppsala University Na Li Co-responsible of a Master thesis in <i>Applied Mathematics</i> entitled <i>Linear Models of Stock Market</i>

Publications

Articles in peer-reviewed journals

- Bles, O., J.-L. Deneubourg, and S. C. Nicolis (2018). "Food dissemination in ants: Robustness of the trophallactic network against resource quality". *Journal of Experimental Biology*.
DOI: 10.1242/jeb.192492.
- Nicolis, G. and S.C. Nicolis (2018). "Feedbacks, nonlinearities and nonequilibria: A thermodynamic perspective". *Journal of Theoretical Biology* **458**, pp. 1–9.
DOI: 10.1016/j.jtbi.2018.08.039.
- Planas-Sitjà, I., S.C. Nicolis, G. Sempo, and J.-L. Deneubourg (2018). "The interplay between personalities and social interactions affects the cohesion of the group and the speed of aggregation". *PLOS ONE* **13**.8, pp. 1–13.
DOI: 10.1371/journal.pone.0201053.
- Ranganathan, S., S. C. Nicolis, R. Swain, and D. J. T. Sumpter (2017). "Setting development goals using stochastic dynamical system models". *PLOS ONE* **12**.2, e0171560.
DOI: 10.1371/journal.pone.0171560.
- Salazar, M.-O. L., S. C. Nicolis, M. C. Martín, G. Sempo, J.-L. Deneubourg, and I. Planas-Sitjà (2017). "Group choices seemingly at odds with individual preferences". *Proceeding of the Royal Society Open Science* **4**.7, p. 170232.
DOI: 10.1098/rsos.170232.
- Basios, V., S. C. Nicolis, and J.-L. Deneubourg (2016). "Coordinated aggregation in complex systems". *The European Physical Journal Special Topics* **225**.6-7, pp. 1143–1147.
DOI: 10.1140/epjst/e2016-02660-5.
- Broly, P., E. Quentin, D. Geoffrey, S. C. Nicolis, and J.-L. Deneubourg (2016). "Sensitivity of density-dependent threshold to species composition in arthropod aggregates". *Scientific Reports* **6**, p. 32576.
DOI: 10.1038/srep32576.
- Nicolis, S. C., J. Halloy, and J.-L. Deneubourg (2016). "Transition between segregation and aggregation: the role of environmental constraints". *Scientific Reports* **6**, p. 32703.
DOI: 10.1038/srep32703.
- Nicolis, G. and S. C. Nicolis (2015). "Probabilistic network approach to decision-making". *Open Systems* **22**.2, p. 1550012.
DOI: 10.1142/S1230161215500122.
- Ranganathan, S., S. C. Nicolis, V. Spaizer, and D. J. T. Sumpter (2015). "Understanding democracy and development traps using a data-driven approach". *Big Data* **3**.1, pp. 22–33.
DOI: 10.1089/big.2014.0066.
- Vogel, D., S. C. Nicolis, A. Perez-Escudero, V. Nanjundiah, D. J. T. Sumpter, and A. Dussutour (2015). "Phenotypic variability in unicellular organisms: from calcium signalling to social behaviour". *Proceedings of the Royal Society of London B: Biological Sciences* **282**.1819, p. 20152322.
DOI: 10.1098/rspb.2015.2322.
- Arganda, S., S. C. Nicolis, A. Perochain, C. Péchabandens, G. Latil, and A. Dussutour (2014). "Collective choice in ants: the role of protein and carbohydrates ratios". *Journal of Insect Physiology* **69**, pp. 19–26.
DOI: 10.1016/j.jinsphys.2014.04.002.
- Zabzina, N., A. Dussutour, R. P. Mann, D. J. T. Sumpter, and S. C. Nicolis (2014). "Symmetry restoring bifurcation in collective decision-making". *PLoS Computational Biology* **10**.12, e1003960.
DOI: 10.1371/journal.pcbi.1003960.
- Dussutour, A. and S. C. Nicolis (2013). "Flexibility in collective decision-making by ant colonies: Tracking food across space and time". *Chaos, Solitons & Fractals* **50**, pp. 32–38.
DOI: 10.1016/j.chaos.2013.02.004.
- Nicolis, S. C., J. Fernández, C. Pérez-Penichet, C. Noda, F. Tejera, O. Ramos, D. J. T. Sumpter, and E. Altshuler (2013). "Foraging at the edge of chaos: internal clock versus external forcing". *Physical Review Letters* **110**.26, p. 268104.
DOI: 10.1103/PhysRevLett.110.268104.
- Perna, A., B. Granovskiy, S. Garnier, S. C. Nicolis, M. Labédan, G. Theraulaz, V. Fourcassié, and D. J. T. Sumpter (2012). "Individual rules for trail pattern formation in Argentine ants (*Linepithema humile*)". *PLoS Computational Biology* **8**.7, e1002592.
DOI: 10.1371/journal.pcbi.1002592.
- Sumpter, D. J. T., N. Zabzina, and S. C. Nicolis (2012). "Six predictions about the decision making of animal and human groups". *Managerial and Decision Economics* **33**.5-6, pp. 295–309.
DOI: 10.1002/mde.2553.

- Nicolis, S. C. (2011). "Information flow and information production in a population system". *Physical Review. E, Statistical, Nonlinear, and Soft Matter Physics* **84.1**, p. 011110.
DOI: 10.1103/PhysRevE.84.011110.
- Nicolis, S. C. and A. Dussutour (2011). "Resource exploitation strategies in the presence of traffic between food sources". *Biosystems* **103.1**, pp. 73–78.
DOI: 10.1016/j.biosystems.2010.10.002.
- Nicolis, S. C. and D. J. T. Sumpter (2011). "A dynamical approach to stock market fluctuations". *International Journal of Bifurcation and Chaos* **21.12**, pp. 3557–3564.
DOI: 10.1142/S0218127411030726.
- Nicolis, S. C., N. Zabzina, T. Latty, and D. J. T. Sumpter (2011). "Collective irrationality and positive feedback". *PLOS ONE* **6.4**, e18901.
DOI: 10.1371/journal.pone.0018901.
- Nicolis, H. and S. C. Nicolis (2010). "The selfish to egalitarian transition in young children: developmental processes versus cooperative interactions". *Nonlinear Dynamics, Psychology, and Life Sciences* **14.3**, pp. 257–264.
- Dussutour, A., M. Beekman, S. C. Nicolis, and B. Meyer (2009). "Noise improves collective decision-making by ants in dynamic environments". *Proceedings of the Royal Society of London B: Biological Sciences* **276.1677**, pp. 4353–4361.
DOI: 10.1098/rspb.2009.1235.
- Dussutour, A., S. C. Nicolis, G. Shephard, M. Beekman, and D. J. T. Sumpter (2009). "The role of multiple pheromones in food recruitment by ants". *Journal of Experimental Biology* **212.15**, pp. 2337–2348.
DOI: 10.1242/jeb.029827.
- Nicolis, C. and S. C. Nicolis (2009). "Propagation of extremes in space". *Physical Review. E, Statistical, Nonlinear, and Soft Matter Physics* **80.2**, p. 026201.
DOI: 10.1103/PhysRevE.80.026201.
- Dussutour, A., S. C. Nicolis, E. Despland, and S. J. Simpson (2008). "Individual differences influence collective behaviour in social caterpillars". *Animal Behaviour* **76.1**, pp. 5–16.
DOI: 10.1016/j.anbehav.2007.12.009.
- Nicolis, S. C. (2008). "Communication networks in insect societies". *Bio-Inspired Computing and Communication*, pp. 155–164.
- Nicolis, S. C., E. Despland, and A. Dussutour (2008). "Collective decision-making and behavioral polymorphism in group living organisms". *Journal of Theoretical Biology* **254.3**, pp. 580–586.
DOI: 10.1016/j.jtbi.2008.06.028.
- Nicolis, S. C. and A. Dussutour (2008). "Self-organization, collective decision making and resource exploitation strategies in social insects". *European Physical Journal B: Condensed Matter Physics* **65.3**, pp. 379–385.
DOI: 10.1140/epjb/e2008-00334-3.
- Nicolis, S. C. and C. Nicolis (2008). "Extreme events in bimodal systems". *Physical Review. E, Statistical, Nonlinear, and Soft Matter Physics* **78.3**, p. 036222.
DOI: 10.1103/PhysRevE.78.036222.
- Nicolis, C. and S. C. Nicolis (2007). "Return time statistics of extreme events in deterministic dynamical systems". *Europhysics Letters* **80.4**, p. 40003.
DOI: 10.1209/0295-5075/80/40003.
- Nicolis, S. C. (2007). "Kinetics of aggregate formation in social insects". *Bulletin of Mathematical Biology* **69.7**, pp. 2387–2403.
DOI: 10.1007/s11538-007-9224-y.
- Dussutour, A., S. C. Nicolis, J.-L. Deneubourg, and V. Fourcassié (2006). "Collective decisions in ants when foraging under crowded conditions". *Behavioral Ecology and Sociobiology* **61.1**, pp. 17–30.
DOI: 10.1007/s00265-006-0233-x.
- Nicolis, S. C., G. Theraulaz, and J. L. Deneubourg (2005). "The effect of aggregates on interaction rate in ant colonies". *Animal Behaviour* **69.3**, pp. 535–540.
DOI: 10.1016/j.anbehav.2004.06.007.
- Nicolis, S. C. (2004). "Fluctuation-induced symmetry breaking in a bistable system: a generic mechanism of selection between competing options". *International Journal of Bifurcation and Chaos* **14.7**, pp. 2399–2405.
DOI: 10.1142/S0218127404010667.
- Nicolis, S. C., C. Detrain, D. Demolin, and J.-L. Deneubourg (2003). "Optimality of Collective Choices: A Stochastic Approach". *Bulletin of Mathematical Biology* **65.5**, pp. 795–808.
DOI: 10.1016/S0092-8240(03)00040-5.

- Theraulaz, G., E. Bonabeau, S. C. Nicolis, R. V. Solé, V. Fourcassié, S. Blanco, R. Fournier, J. L. Joly, P. Fernández, A. Grimal, P. Dalle, and J.-L. Deneubourg (2002). "Spatial patterns in ant colonies". *Proceedings of the National academy of Sciences of the United States of America* **99**.15, pp. 9645–9649.
DOI: 10.1073/pnas.152302199.
- Nicolis, S. C. and J.-L. Deneubourg (1999). "Emerging patterns and food recruitment in ants: an analytical study". *Journal of Theoretical Biology* **198**.4, pp. 575–592.
DOI: 10.1006/jtbi.1999.0934.

Book chapters

- Nicolis, S. C. (2016). "Decision-making at the cellular level: the physarum paradigm". *Advances in Physarum Machines: Sensing and Computing with Slime Mould*. Ed. by Andrew Adamatzky. Springer International Publishing, pp. 705–721.
- (2015). "Animal construction as a free boundary problem: evidence of fractal scaling laws". *Chaos, Information Processing and Paradoxical Games*. Vol. 20. World Scientific, pp. 399–409.
DOI: 10.1142/9789814602136_0020.
- Dussutour, A., N. Colasurdo, S. C. Nicolis, and E. Despland (2007). "How do ants and social caterpillars collectively make decisions?" *Cognitive Decision-Making: Empirical and Foundational issues*. Cambridge Scholars Publishing, pp. 48–65.
- Deneubourg, J.-L., S. C. Nicolis, and C. Detrain (2005). "Optimality of communication in self-organised social behaviour". *Self-Organisation and Evolution of Social Systems*. Cambridge: Cambridge University Press, pp. 25–35.

Proceedings

- Ranganathan, S., V. Spaiser, S. C. Nicolis, Ranjula Bali Swain, and D. J. T. Sumpter (2014). "Data-driven Modeling in the Social Sciences-A pragmatic approach for policy-makers". *Workshop Paper Series, 20th ACM SIGKDD Conference on Knowledge Discovery and Data Mining: Data Science for Social Good*.
- Nicolis, S. C., J.-L. Deneubourg, and A. Soquet (2000). "Auto-organisation induite par des fluctuations dans les systèmes phonologiques". *XIIIèmes Journées sur la Parole*.

* Equal contribution to the work

Participation in scientific meetings

2017	SIAM Conference on Applications of Dynamical Systems - Mini symposium Excitability, Regulation and Collective Decision Making 21 – 25 May 2017, Snowbird, United States of America Invited talk entitled <i>Collective behaviour and individual variability : from personalities to heterospecific interactions</i> COSA colloquia, National Research Center "Demokritos" March 2017, Athens, Greece Invited talk entitled <i>Inter-individual variability and collective decision-making</i>
2016	Dynamics Days 6 – 10 June 2016, Corfu, Greece Presentation of an oral communication entitled <i>Transition between segregation and aggregation : the role of environmental constraints</i>
2015	Physarum workshop 3 – 5 December 2015, New York, United States of America Invited talk entitled <i>Plasticity of decision-making patterns in Physarum polycephalum</i> Applied Mathematics seminar series 23 January 2015, Orebro, Sweden Invited talk entitled <i>Self-organization in group-living systems</i>
2013	Chaos, Solitons & Fractals Conference 29 November 2013, Amsterdam, Netherlands Invited talk entitled <i>Flexibility in collective decision- making by ant colonies: Tracking food across space and time</i> Biomathematics and Ecology: Education and Research-2013 11 – 13 October 2013, Arlington, United States of America Invited talk entitled <i>Foraging at the Edge of Chaos: Internal Clock versus External Forcing</i>
2012	International workshop on Ethology and Rheology of Physarum and Its Related Topics 2 – 3 July 2012, Hakodate, Japan Invited talk entitled <i>Circadian rhythms-modulated patterns of collective decision-making</i> Complejidad 2012 9 – 12 January 2012, Havana, Cuba Invited talk entitled <i>Collective decision-making, positive feedbacks and irrationality</i>
2011	3rd Swedish Meeting of Mathematics in Biology 4 – 16 December 2011, Umeå, Sweden Presentation of an oral communication entitled <i>Information flow and information production in a population system</i>
2010	International workshop on the Complexity Paradigm 11 – 12 February 2010, Bruxelles, Belgium Invited talk entitled <i>An empirically-grounded dynamical approach to modelling daily fluctuations in stock markets</i>
2009	First Swedish Meeting of Mathematics in Biology 17 – 18 December 2009, Uppsala, Sweden Poster presentation entitled <i>Biological Problem Solving</i>

- 2008 **International workshop on Collective behaviors in bio- and bio-related systems**³
September 2008 Sapporo, Japan
Presentation of an oral communication entitled *Self-organising communication in social insects*
- 2007 **Summer school "Ecological Complex Systems: Stochastic Dynamics and Patterns"**
22 – 26 July 2007 Palermo, Italy
Invited talk entitled *Self-organised communication networks in social insects*
- Biowire 2007**
2 – 5 April 2007 Cambridge, United Kingdom
Invited talk entitled *Self-organised communication networks in social insects in connection with collective decision making and spatial pattern formation*
- 2005 **Société Québécoise pour l'étude Biologique du Comportement** 4 – 6 November 2005
Montreal, Canada
Poster presentation entitled *Stratégies collectives du recrutement alimentaire chez les fourmis : une approche de modélisation*
- 2000 **XIIIèmes journées sur la Parole**
19 – 23 June 2000 Aussoy, France
Poster presentation entitled *Auto-organisation induite par des fluctuations dans les systèmes phonologiques*
- International Conference in Complex Systems** 21 – 28 May 2000 Nashua, United States of America
Presentation of an oral communication entitled *Fluctuation-induced self-organization in a phonological system*
- Séminaire intensif de l'école doctorale Phénomènes nonlinéaires et mécanique statistique**
26 – 27 April 2000 Bruxelles, Belgium
Poster presentation entitled *Dynamique d'agrégation chez les fourmis: Construction de "cimetières"*
- 1999 **Séminaire intensif de l'école doctorale Phénomènes nonlinéaires et mécanique statistique**
12 – 13 March 1999 De Haan, Belgium
Presentation of an oral communication entitled *Dynamique du recrutement alimentaire chez les fourmis*
- 1998 **Colloque annuel de la section française de l'Union internationale pour l'étude des insectes sociaux**
2 – 4 September 1998 Albi, France
Presentation of an oral communication entitled *Étude d'un modèle de recrutement alimentaire chez les fourmis en présence d'un grand nombre de sources*