

Curriculum vitae

Olivier BERNARD

Research Director at INRIA

**Doctor from the University of Pierre et Marie Curie
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BIOCORE Project-Team
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Born on October the 8th 1968, at Tassin-la-demi-lune (69), France

1 Scientific positions

- **Since 1999** : Research scientist at the National Institute of Computer science and automatic control (INRIA) of Sophia-Antipolis, COMORE project (Research Director since 2007).
- **September 96 - December 1998** : Post-doctorate at the CESAME (BELGIUM), with G.Bastin and D.Dochain. "Modelling and control of biological systems".
- **December 95-July 96** : Post-doctorate at INRIA Sophia-Antipolis, COMORE project with J.-L. Gouzé. "Study of the qualitative behaviour of stage structured populations "

2 Diploma

- **January 2004 : HDR. speciality : Information and Communication Sciences** (University Nice-Sophia-Antipolis)
HDR dissertation : " The modelling of biological systems : routes along the long rivers circulating between the ocean of the real and the lac of the models ".
- **1992-1995 : Ph D. specialty : biological oceanography** (Pierre et Marie Curie University, Paris VI)

Thesis title : "Theoretical and experimental study of the growth of *Dunaliella tertiolecta* (chlorophyceae) subject to a variable nitrate limitation : use of the transient dynamics for the modelling design and validation" Directed by : A. Sciandra and C. Lobry.

- **1991-1992 : D.E.A. of automatic control.** (Claude Bernard University, Lyon D). Greatest distinction.
- **1989-1992 : Ecole Centrale de Lyon,** specialization in automatic control. Congratulations of the jury .
- **1986-1989 :** Engineering school preparation, series M' (Lyce du Parc, Lyon).
- **1986 :** Bachelors degree, series C, France).

3 Management of research projects

- **INRIA ARC- Cooperative Research Project - Nautilus [2010-2011].** " Modeling the coupling between hydrodynamics and growth of micro algae". **Project set-up and coordination.** 4 partners. Total budget : 0.37 Millions Euros.
- **French ANR - National Programm on Bioenergy Project - Shamash [2006-2009].** " Biodiesel production using micro algae". **Project set-up and coordination.** 8 partners. Total budget : 2.8 Millions Euros.
- **European project TELEMAT (IST-2000-1.4.1) [2001-2004].** "TELE Monitoring and Advanced Control of high yield wastewater processes". **Project set-up and scientific coordination.** 15 partners. Total budget : 4.6 Millions Euros.
- **French bioinformatic project SEMPO [2001-2004].** " Marine environment simulator driven by computers ". Project set-up and scientific coordination

4 Publications

Papers in biology or biotechnology journals

- [1] T. Lacour, A. Sciandra, A. Talec, P. Mayzaud, and O. Bernard, "Neutral lipids and carbohydrates productivities as a response to the nitrogen status in the haptophyceae *isochrysis sp.* (t-iso) : starvation vs. limitation," *Journal of Phycology*, to appear.
- [2] C. Mocquet, A. Sciandra, A. Talec, and O. Bernard, "Cell cycle implication on nitrogen acquisition and synchronization in *thalassiosira weissflogii* (bacillariophyta)," *Journal of Phycology*, to appear.
- [3] T. Lacour, A. Sciandra, A. Talec, P. Mayzaud, and O. Bernard, "Diel variations of carbohydrates and neutral lipids in n-sufficient and n-starved cyclostat cultures of *isochrysis sp.*," *Journal of Phycology*, to appear.

- [4] F. Mairet, O. Bernard, M. Ras, L. Lardon, and J.-P. Steyer, "Modeling anaerobic digestion of microalgae using adm1.," *Bioresour Technol*, vol. 102, no. 13, pp. 6823–6829, 2011.
- [5] F. Mairet, O. Bernard, P. Masci, T. Lacour, and A. Sciandra, "Modelling neutral lipid production by the microalga *Isochrysis affinis galbana* under nitrogen limitation," *Biores. Technol.*, vol. 102, pp. 142–149, 2011.
- [6] F. Mairet, O. Bernard, P. Masci, T. Lacour, and A. Sciandra, "Modelling neutral lipid production by the microalga *Isochrysis affinis galbana* under nitrogen limitation," *Biores. Technol.*, vol. 102, pp. 142–149, 2010.
- [7] F. Mairet, O. Bernard, E. Cameron, M. Ras, L. Lardon, J.-P. Steyer, and B. Chachuauat, "Three-reaction model for the anaerobic digestion of microalgae," *Biotechnology and Bioengineering*, pp. n/a–n/a, 2011.
- [8] A. Karama, O. Bernard, and J. Gouzé, "Constrained hybrid neural modelling of biotechnological processes," *International Journal of Chemical Reactor Engineering*, vol. 8, pp. A21, 2010.
- [9] G. Bougaran, O. Bernard, and A. Sciandra, "Modelling continuous cultures of microalgae colimited with nitrogen and phosphorus," *Journal of Theoretical Biology*, 2010.
- [10] L. Lardon, A. Hlias, B. Sialve, J.-P. Steyer, and O. Bernard, "Life-cycle assessment of biodiesel production from microalgae," *Environ. Sci. Technol.*, vol. 43, pp. 6475–6481, 2009.
- [11] B. Sialve, N. Bernet, and O. Bernard, "Anaerobic digestion of microalgae as a necessary step to make microalgal biodiesel sustainable," *Biotechnol. Advances*, vol. 27, pp. 409–416, 2009.
- [12] O. Bernard, A. Sciandra, and S. Rabouille, "Carbon fixation prediction during a bloom of *emiliana huxleyi* is highly sensitive to the assumed regulation mechanism," *Biogeosciences Discussions*, vol. 6, no. 3, pp. 5339–5372, 2009.
- [13] G. Goffaux, A. V. Wouwer, and O. Bernard, "Continuous - discrete interval observers for monitoring microalgae cultures," *Biotech. Progress*, vol. 25, pp. 667–675, 2009.
- [14] O. Bernard, A. Sciandra, and S. Madani, "Multimodel analysis of the response of the coccolithophore *Emiliana huxleyi* to an elevation of pCO_2 under nitrate limitation," *Ecol. Model.*, vol. 211, pp. 324–338, 2008.
- [15] J.-P. Cadoret and O. Bernard, "La production de biocarburants lipidique avec des microalgues : promesses et défis," *Journal de la société de biologie*, vol. 202, pp. 201–211, 2008.
- [16] J. Rodriguez, E. Roca, J. Lema, and O. Bernard, "Determination of the adequate minimum model complexity required in anaerobic bioprocesses using experimental data," *J. Chem. Tech. Biotech.*, vol. 83, pp. 1694–1702, 2008.
- [17] O. Barrou, A. Karama, E. Lakhal, O. Bernard, M.-N. Pons, and J.-P. Corriou, "Estimation of a reduced model of the bsm1 activated sludge wastewater treatment plant," *International Journal of Chemical Reactor Engineering*, vol. 6, p. A63.

- [18] J. Hess and O. Bernard, "Advanced dynamical risk analysis for monitoring anaerobic digestion process," *Biotechnology Progress*, vol. In Press, 2008.
- [19] J.-P. Steyer, O. Bernard, and D. Batstone, "Lessons learnt from 15 years of ICA in anaerobic digestion processes," *Wat. Sci. Tech.*, vol. 53, pp. 25-33, 2006.
- [20] F. Grognard and O. Bernard, "Stability analysis of a wastewater treatment plant with saturated control," *Wat. Sci. Tech.*, Vol 53 No 1 pp 149-157, 2006.
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- [22] L. Mailleret, J.-L. Gouzé, and O. Bernard, "Nonlinear control for algae growth models in the chemostat," *Bioprocess and Biosystem Engineering*, vol. 27, pp. 319–328, 2005.
- [23] O. Bernard, B. L. Dantec, B. Chachuat, J.-P. Steyer, L. Lardon, S. Lambert, P. Ratini, J. Lema, G. Ruiz, J. Rodriguez, P. Vanrolleghem, U. Zaher, D. D. Pauw, K. D. Neve, K. Lievens, D. Dochain, O. Schoefs, R. Farina, V. Alcaraz-Gonzalez, V. Gonzalez-Alvarez, P. Lemaire, J. Martinez, O. Duclaud, and J. Lavigne, "An integrated system to remote monitor and control anaerobic wastewater treatment plants through the internet," *Wat. Sci. Tech.*, vol. 52, pp. 457–464, 2005.
- [24] O. Bernard and G. Bastin, "Identification of reaction schemes for bioprocesses : determination of an incompletely known yield matrix," *Bioprocess and Biosystem Engineering*, vol. 27, pp. 293–302, 2005.
- [25] B. Faugeras, O. Bernard, A. Sciandra, and M. Levy, "A mechanistic modeling and data assimilation approach to estimate the carbon/chlorophyll and carbon/nitrogen ratios in a coupled hydrodynamical-biological model," *Nonlinear Processes in Geophysics*, vol. 11, pp. 515–533, 2004.
- [26] J.-P. Steyer, L. Lardon, and O. Bernard, "Sensors network diagnosis in anaerobic digestion processes using evidence theory," *Wat. Sci. Tech.*, vol. 50, pp. 21–29, 2004.
- [27] L. Mailleret, O. Bernard, and J.-P. Steyer, "Robust regulation of anaerobic digestion processes," *Wat. Sci. Technol.*, vol. 48, pp. 87–94, 2003.
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- [30] A. Karama, O. Bernard, A. Genovesi, D. Dochain, A. Benhammou, and J.-P. Steyer, "Hybrid modelling of anaerobic wastewater treatment processes," *Wat. Sci. Technol.*, vol. 43, no. 1, pp. 43–50, 2001.
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Papers in automatic control or applied mathematics journals

- [37] F. Mazenc, N. S., and O. Bernard, “Exponentially stable interval observers for linear systems with delay,” *Siam Journal Contr. Optim.*, to appear.
- [38] O. Bernard, “Hurdles and challenges for modelling and control of microalgae for CO₂ mitigation and biofuel production,” *Journal of Process Control*, vol. 21, no. 10, pp. 1378–1389, 2011.
- [39] M. Moisan and O. Bernard, “Robust interval observers for global lipschitz uncertain chaotic systems,” *Systems Control Letters*, vol. 59, no. 11, pp. 687 – 694, 2010.
- [40] F. Mazenc and O. Bernard, “Interval observers for linear time-invariant systems with disturbances,” *Automatica*, 2010.
- [41] F. Mazenc and O. Bernard, “Interval observers for planar systems with complex poles,” *IEEE TAC*, no. 55, pp. 523–527, 2010.
- [42] F. Mairet, M. Moisan, and O. Bernard, “Interval observer-based estimator of specific growth rate in bioreactors,” *JESA*, vol. 44, pp. 493–507, 2010.
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- [44] M. Moisan, O. Bernard, and J.-L. Gouzé, “Near optimal interval observers bundle for uncertain bioreactors,” *Automatica*, vol. 45, pp. 291–295, 2009.
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- [46] G. Goffaux, A. Vande Wouwer, and O. Bernard, “Continuous - discrete interval observers applied to the monitoring of cultures of microalgae,” *J. Proc. Contr.*, vol. 19, pp. 1182–1190, 2009.

- [47] L. Mailleret, J.-L. Gouzé, and O. Bernard, “Global stabilization of a class of partially known positive systems,” *Automatica*, vol. 44, pp. 2128–2134.
- [48] O. Bernard and A. Sciandra, “Generic analysis of the response of calcifying microalgae to an elevation of pCO_2 : qualitative vs quantitative analysis.,” *ARIMA*, vol. 9, pp. 57–84, 2008.
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- [51] O. Bernard and G. Bastin, “On the estimation of the pseudo-stoichiometric matrix for mass balance modeling of biotechnological processes,” *Math. Biosciences*, vol. 193, pp. 51–77, 2005.
- [52] L. Mailleret, O. Bernard, and J.-P. Steyer, “Robust nonlinear adaptive control for bioreactors with unknown kinetics,” *Automatica*, vol. 40 :8, pp. 365–383, 2004.
- [53] O. Bernard and J.-L. Gouzé, “Closed loop observers bundle for uncertain biotechnological models,” *J. Process. Contr.*, vol. 14 :7, pp. 765–774, 2004.
- [54] L. Mailleret, O. Bernard, and J.-P. Steyer, “Contrôle asymptotique non-linéaire des fermenteurs anaérobie,” *Journal Européen des systèmes automatisés*, vol. 37, pp. 275–286, 2003.
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- [56] O. Bernard, Z. Hadj-Sadok, M. Pengov, and D. Dochain, “Modelling, monitoring and control of anaerobic digestion processes,” *Journal A.*, vol. 41, pp. 82–88, 2000.
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- [58] O. Bernard and J.-L. Gouzé, “Nonlinear qualitative signal processing for biological systems : application to the algal growth in bioreactors,” *Math. Biosciences*, vol. 157, pp. 357–372, 1999.
- [59] O. Bernard and S. Souissi, “Qualitative behavior of stage-structured populations : application to structural validation,” *J. Math. Biol.*, vol. 37, pp. 291–308, 1998.
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Book chapters

- [63] O. Bernard and I. Queinnec, *Dynamic models of biochemical processes : properties of models*, ch. 2. Hoboken : Wiley, 2008.
- [64] O. Bernard and J.-L. Gouzé, *State estimation for bioprocesses*, ch. 4. Hoboken : Wiley, 2008.
- [65] O. Bernard, B. Chachuat, and J.-P. Steyer, STATE ESTIMATION FOR WASTE-WATER TREATMENT PROCESSES. Water Quality Measurements Series - Wastewater Monitoring, Wiley, pp 247-263, 2006.
- [66] S. Souissi and O. Bernard, *Identification of interactions in copepod populations using a qualitative study of stage-structured population models*, pp. 365–383. Handbook of Scaling Methods in Aquatic Ecology : Measurement, Analysis, Simulation, CRC Press, 2003.
- [67] O. Bernard and J.-L. Gouzé, *State estimation for bioprocesses*, pp. 813–855. ICTP lecture notes : Mathematical Control Theory, Trieste : ICTP, 2002.
- [68] O. Bernard, *Mass balance modelling of bioprocesses*, pp. 769–812. ICTP lecture notes : Mathematical Control Theory, Trieste : ICTP, 2002.
- [69] O. Bernard and J.-L. Gouzé, *Estimation d'état*, ch. 4, pp. 87–120. Automatique des bioprocés, Paris : Hermes Science, 2001.
- [70] O. Bernard and I. Queinnec, *Modèles dynamiques de procédés biochimiques. Propriétés des modèles*, pp. 23–52. Automatique des bioprocés, Paris : Hermes Science, 2001.

Conference proceedings in automatic control / applied mathematics

- [71] F. Mazenc and O. Bernard, “Interval observers for linear systems with additive disturbances,” in *Proceedings of the NOLCOS conference*, Bologna, Italy, 2010.
- [72] A. Akhmetzhanov, F. Grogard, P. Masci, and O. Bernard, “Optimization of a photobioreactor biomass production using natural light,” in *Proceedings of the 49th CDC conference*, Atlanta, USA, 2010.
- [73] O. Bernard, A. Sciandra, and S. Rabouille, “Predictions of carbon fixation during a bloom of *emiliana huxleyi* as a function of the regulating inorganic carbon species,” in *Proceedings of the Mathmod 09 conference*, Vienna, Ostrich, 2009.
- [74] C. G. Diguez, E. Roca, and O. Bernard, “Reduction of the anaerobic digestion model n° 1 for an industrial wastewater treatment plant by principal component analysis,” in *Proceedings of the ECC conference*, Budapest, Hungary, 2009.
- [75] O. Bernard, P. Masci, and A. Sciandra, “A photobioreactor model in nitrogen limited conditions,” in *Proceedings of the Mathmod 09 conference*, Vienna, Ostrich, 2009.
- [76] G. Bougaran, O. Bernard, and A. Sciandra, “Modelling continuous cultures of microalgae colimited with nitrogen and phosphorus,” in *Proceedings of the Mathmod 09 conference*, Vienna, Ostrich, 2009.

- [77] F. Mazenc, S. Niculescu, and O. Bernard, "Interval observers for linear systems with delay," in *Proceedings of the CDC conference*, Shanghai, China, 2009.
- [78] F. Mairet and O. Bernard, "Coupling framers to get enhanced interval observers. application to growth rate estimation in a photobioreactor," in *Proceedings of the CDC conference*, Shanghai, China, 2009.
- [79] F. Mairet, M. Moisan, and O. Bernard, "Interval observer ?based estimator of specific growth rate in bioreactors," in *Proceedings of the 2009 Stic & Environnement conference*, Calais, France, 2009.
- [80] P. Masci, O. Bernard, F. Grogard, E. Latrille, J.-B. Sorba, and J. Steyer, "Driving competition in a complex ecosystem : application to anaerobic digestion," in *Proceedings of the ECC conference*, Budapest, Hungary, 2009.
- [81] F. Mazenc and O. Bernard, "Interval observers for planar systems with complex poles," in *Proceedings of the ECC conference*, Budapest, Hungary, 2009.
- [82] F. Mazenc, M. Malisoff, and O. Bernard, "Lyapunov functions and robustness analysis under matrosov conditions with an application to biological systems," in *Proceedings of the ACC conference*, 2008.
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- [84] P. Masci, O. Bernard, and F. Grogard., "Continuous selection of the fastest growing species in the chemostat," in *Proceedings of the IFAC conference*, 2008.
- [85] M. Moisan, O. Bernard, and J.-L. Gouzé, "Robust estimation using direct-reverse time interval observers : Application to an industrial bioreactor," in *Proceedings of the conference STIC & Environnement*, 2007.
- [86] M. Moisan and O. Bernard, "A direct-reverse time interval observer. application to biotechnological models," in *Proceedings of the 7th NOLCOS conference*, Pretoria, South Africa, 2007.
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- [89] M. Moisan and O. Bernard, "Robust interval observers for uncertain chaotic systems," in *Proceedings of the 45th IEEE Conference on Decision and Control*, (San Diego, USA), 2006.
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- [92] J.-L. Gouzé, M. Moisan, and O. Bernard, “Simple interval observers for biotechnological processes,” in *Proceedings of the ISCCSP 2006 conference*, Marrakech, Morocco.
- [93] M. Moisan and O. Bernard, “Robust interval estimation : Comparison between cooperative and ellipsoidal techniques - application to a biotechnological process,” in *Proceedings of the ROCOND 2006 conference*, Toulouse, France.
- [94] J.-L. Gouzé, M. Moisan, and O. Bernard, “A simple improvement of interval asymptotic observers for biotechnological processes,” in *Proceedings of the ROCOND 2006 conference*, Toulouse, France.
- [95] M. Moisan and O. Bernard, “Interval observers for non monotone systems. application to bioprocess models,” in *Proceedings of the 16th IFAC World conference*, Prague, Czech Republic, 2005.
- [96] L. Lardon, O. Bernard, and J.-P. Steyer, “Application du modèle des croyances transférables pour le diagnostic d un réseau de capteurs et d observateurs : application à un procédé de traitement des eaux,” in *Proceedings of the CIFA conference*, Douz, Tunisia, 2004.
- [97] O. Bernard and J.-L. Gouzé, “Multi-observateurs en boucle ferme pour des modèles biotechnologiques mal connus,” in *Proceedings of the CIFA conference*, Douz, Tunisia, 2004.
- [98] B. Chachuat and O. Bernard, “Dveloppement d’observateurs probabilistes pour les bioprocés modélisés par bilan de masse,” in *Proceedings of the CIFA conference*, Douz, Tunisia, 2004.
- [99] O. Bernard and J.-L. Gouzé, “Interval observers bundle for a class of bioprocess models,” in *Proceedings of the SSSC’04 conference*, Oaxaca, Mexico, 2004.
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- [101] L. Mailleret, J.-L. Gouzé, and O. Bernard, “Nonlinear control for algae growth models in the chemostat,” in *Proceedings of ECC03*, Cambridge, UK, 2003.
- [102] L. Lardon, A. Punal, J.-P. Steyer, E. Roca, J. Lema, S. Lambert, P. Ratini, S. Fratetsi, and O. Bernard, “Specifications of modular internet-based remote supervision systems for wastewater treatment plants,” in *Proceedings of the 15th biennial European Conference on Artificial Intelligence (ECAI’2002)*, pp. 5.1–5.5, Lyon, France, 2002.
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- [106] I. Vatcheva, O. Bernard, H. deJong, J.-L. Gouzé, and N. Mars, “Discrimination of semi-quantitative models by experiment selection : method and application in population biology,” in *Proceedings of the Qualitative Reasoning conference*, San Antonio, U.S. 17-19 May, 2001, 2001.
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- [110] O. Bernard, Z. Hadj-Sadok, and J.-L. Gouzé, “Observers for the biotechnological processes with unknown kinetics. application to wastewater treatment,” in *Proceedings of CDC 2000*, Sydney, Australia, 2000.
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- [113] O. Bernard, G. Bastin, and P. Angelov, “Hybrid modelling of biotechnological processes using neural networks,” in *Proceedings of the IFAC World Congress*, vol. O, pp. 469–474, Beijing, China, 1999.
- [114] O. Bernard and G. Bastin, “Structural identification of nonlinear mathematical models for bioprocesses,” in *Proceedings of the Nonlinear Control Systems Symposium 1998*, pp. 449–454, Enschede, Netherlands, 1998.
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