

Gurvan MICHEL

Directeur de Recherche CNRS (DR2)



Etat civil

Né le 6 juin 1973 à Nantes

Nationalité française

Marié, 1 enfant

Diplômes universitaires

Habilitation à Diriger les Recherches: Université Pierre et Marie Curie, Paris, 25 Mars 2011

Doctorat de Biologie, Université Joseph Fourier (UJF), Grenoble, 14 Décembre 2000

(Mention : très honorable)

D.E.A. Biologie Structurale et Fonctionnelle, UJF, Grenoble, Juillet 1997 (Mention : Bien)

Ingénieur Agronome, Institut National Agronomique Paris-Grignon, Juillet 1997.

Position permanente de Recherche

Directeur de Recherche CNRS

DR2, depuis le 1^{er} octobre 2011

Chargé de Recherche CNRS

CR2, 2003-2006 ; CR1 2007-2011

Co-responsable de l'Equipe Glycobiologie Marine

UMR 8227 (CNRS – UPMC), Station Biologique de Roscoff

Expérience de Recherche

Stage post-doctoral (Janvier 2001 – Décembre 2002).

Bourse du Conseil National de Recherche du Canada (CNRC).

Biotechnology Research Institute, CNRC, Macromolecular Structure Group, Montreal, Quebec, Canada.

Directeur : Dr Miroslaw Cygler.

Thèse de doctorat (Septembre 1997 – Décembre 2000)

Bourse de Docteur Ingénieur CNRS / Région Bretagne.

Laboratoire de Cristallographie Macromoléculaire, Institut de Biologie Structurale (CNRS/CEA), Grenoble.

Directeur : Dr Otto Dideberg

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D.E.A. (Septembre 1996 – Septembre 97)

LCM (IBS), Grenoble.

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Enseignement

Moniteur du CIES de Grenoble (1997–2000), Université Joseph Fourier, Grenoble.

Mots clés et domaines d'investigation thématiques

- Biochimie, cristallographie des protéines, bioinformatique, génomique
- Métabolisme des glucides, (méta)génomique des bactéries associées aux macroalgues, Développement du modèle de bactérie marine *Zobellia galactanivorans*

Revue à comité de lecture.

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1. **Michel G*** (2015). *Ruminococcal* cellulosomes: molecular Lego to deconstruct microcrystalline cellulose in human gut. *Environmental Microbiology*, in the press.
2. Ficko-Blean E, Hervé C, **Michel G*** (2015). Sweet and sour sugars from the sea: the biosynthesis and remodeling of sulfated cell wall polysaccharides from marine macroalgae. *Perspectives in Phycology*, in the press.
3. Leblanc C, Vilter H, Fournier, J-B, Delage L, Potin P, Rebuffet E, **Michel G**, Solari PL, Feiters MC, Czjzek M (2015) Vanadium haloperoxidases: from the discovery 30 years ago to X-Ray crystallographic and V K-edge absorption spectroscopic studies. *Coordination Chemistry Reviews*, in the press.
4. Groisillier A, Labourel A, **Michel G** and Tonon T (2015) The mannitol utilization system of the marine bacterium *Zobellia galactanivorans*. *Applied and Environmental Microbiology*, 81, 1799-1812.
5. Ficko-Blean E*, Duffieux D, Rebuffet E, Larocque R, Groisillier A, **Michel G*** and Czjzek M* (2015) Biochemical and structural investigation of two paralogous glycoside hydrolases from *Zobellia galactanivorans*: novel insights into the evolution, dimerization plasticity and catalytic mechanism of the GH117 family. *Acta Crystallographica D71*, 209-223.
6. Labourel A, Jam M, Legentil L, Sylla B, Hehemann JH, Ferrières V, Czjzek M and **Michel G*** (2015) Structural and biochemical characterization of the laminarinase ZgLam_{GH16} from *Zobellia galactanivorans* suggests a preferred recognition of branched laminarin. *Acta Crystallographica D71*, 173-184.
7. Fournier JB, Rebuffet E, Delage L, Grijol R, Meslet-Cladière L, Rzonca J, Potin P, **Michel G**, Czjzek M and Leblanc C (2014) The bacterial vanadium iodoperoxidase from the marine Flavobacteriaceae *Zobellia galactanivorans* reveals novel molecular and evolutionary features of halide specificity in this enzyme family. *Applied and Environmental Microbiology*, 80, 7561-7573.
8. Dittami SM, Barbeyron T, Boyen C, Cambefort J, Collet G, Delage L, Gobet A, Groisillier A, Leblanc C, **Michel G**, Scornet D, Siegel A, Tapia JE and Tonon T (2014) Genome and metabolic network of “*Candidatus Phaeomarinobacter ectocarpus*” Ec32, a new candidate genus of *Alphaproteobacteria* frequently associated to brown algae. *Frontiers in Genetics*, 5:241.
9. Martin M, Biver S, Steels S, Barbeyron T, Jam M, Portetelle D, **Michel G**, Vandenberg M (2014) Identification and characterization of a halotolerant, cold-active marine endo- β -1,4-glucanase by using functional metagenomics of seaweed-associated microbiota. *Applied and Environmental Microbiology*, 80, 4958-4967.
10. Deniaud-Bouët E, Kervarec N, **Michel G**, Tonon T, Kloareg B, Hervé C (2014) Chemical and enzymatic fractionation of fucal algal cell-walls: insights into the structure of the extra-cellular matrix of brown algae. *Annals of Botany*, 114, 1203-16.
11. Werner J, Ferrer M, **Michel G**, Mann AJ, Huang S, Juarez S, Ciordia S, Albar JP, Alcaide M, La Cono V, Yakimov MM, Antunes A, Taborda M, da Costa MS, Hai T, Glöckner FO, Golyshina OV, Golyshin PN, Teeling H (2014) *Halorhabdus tiamateae*: Proteogenomics and glycosidase activity measurements identify the first cultivated euryarchaeon from a deep-sea anoxic brine lake as potential polysaccharide degrader. *Environmental Microbiology*, 16, 2525-37.

12. Martin M, Portetelle D, **Michel G**, Vandenbol M (2014) Microorganisms living on macroalgae: Diversity, interactions, and biotechnological applications. *Applied Microbiology and Biotechnology*, 98, 2917-35.
13. Groisillier A, Shao Z, **Michel G**, Goultquer S, Bonin P, Krahulec S, Nidetzky B, Duan D, Boyen C, Tonon T (2014) Mannitol metabolism in brown algae involves a new phosphatase family. *Journal of Experimental Botany*, 65, 559-570.
14. Labourel A, Jam M, Jeudy A, Hehemann JH, Czjzek M, **Michel G*** (2014) The β -glucanase ZgLamA from *Zobellia galactanivorans* evolved a bent active site adapted for an efficient degradation of algal laminarin. *Journal of Biological Chemistry*, 289, 2027-2042.
15. Thomas F, Lundqvist LC, Jam M, Jeudy A, Barbeyron T, Sandström C, **Michel G**, Czjzek M. (2013) Comparative Characterization of Two Marine Alginate Lyases from *Zobellia galactanivorans* Reveals Distinct Modes of Action and Exquisite Adaptation to Their Natural Substrate. *Journal of Biological Chemistry*, 288, 23021-23037
16. Ma S, Duan G, Chai W, Geng C, Tan Y, Wang L, Le Sourd L, **Michel G**, Yu W, Han F (2013) Purification, cloning, characterization and essential amino acid residues analysis of a new ι -carrageenase from *Cellulophaga* sp. QY3. *PLOS One*, 8, e64666.
17. Collén J, Porcel B, Carré W, Ball B, Chaparro C, Tonon T, Barbeyron T, **Michel G**, Noel B, Valentin K, Elias M, Artiguenave F, Arun A, Aury JM, Barbosa-Neto JF, Bothwell JH, Bouget FY, Brillet L, Cabello-Hurtado F, Capella-Gutiérrez S, Charrier B, Cladière L, Cock JM, Coelho SM, Colleoni C, Czjzek M, Da Silva C, Delage L, Denoëud F, Deschamps P, Dittami SM, Gabaldón T, Gachon CMM, Groisillier A, Hervé C, Jabbari K, Katinka M, Kloareg B, Kowalczyk N, Labadie K, Leblanc C, Lopez PJ, McLachlan D, Meslet-Cladière L, Moustafa A, Nehr Z, Nyvall Collén P, Panaud O, Partensky F, Poulain J, Rensing SA, Rousvoal S, Samson G, Symeonidi A, Weissenbach J, Zambounis A, Wincker P, Boyen C (2013) Genome structure and metabolic features in the red seaweed *Chondrus crispus* shed light on evolution of the Archaeplastida. *Proceedings of the National Academy of Science*, 110, 5247-5252.
18. Hehemann JH, Correc G, Thomas F, Bernard T, Barbeyron T, Jam M, Helbert W, **Michel G***, Czjzek M* (2012) Biochemical and structural characterization of the complex agarolytic enzyme system from the marine bacterium *Zobellia galactanivorans*. *Journal of Biological Chemistry*, 287, 30571-84
19. Thomas F, Barbeyron T, Tonon T, Genicot S, Czjzek M and **Michel G*** (2012) Characterization of the first alginolytic operons in a marine bacterium: From their emergence in marine *Flavobacteriia* to their independent transfers to marine *Proteobacteria* and human gut *Bacteroides*. *Environmental Microbiology*, 14, 2379-94.
20. Thomas F, Hehemann JH, Rebuffet E, Czjzek M and **Michel G*** (2011) Gut and environmental *Bacteroidetes*: the food connection. *Frontiers in Microbiology*, 2, 93.
21. Popper ZA, **Michel G**, Hervé C, Domozych D, Willats WGT, Tuohy MG, Kloareg B, Stengel DB (2011) Evolution and diversity of plant cell walls: from algae to flowering plants. *Annual Review of Plant Biology*, 62, 567-590.
22. Rebuffet E, Groisillier A, Thompson A, Jeudy A, Barbeyron T, Czjzek M* and **Michel G*** (2011) Discovery and structural characterization of a novel glycosidase family of marine origin. *Environmental Microbiology*, 13, 1253-1270.
23. Rousvoal S, Groisillier A, Dittami SM, **Michel G**, Boyen C and Tonon T (2011) Mannitol-1-phosphate dehydrogenase activity in *Ectocarpus siliculosus*, a key role for mannitol synthesis in brown algae. *Planta*, 233, 261-273.

24. Thomas F, Barbeyron T and **Michel G*** (2011) Evaluation of reference genes for real time quantitative PCR in the marine flavobacterium *Zobellia galactanivorans*. *Journal of Microbiological Methods*, 84, 61-66.
25. Dittami SM, **Michel G**, Collén J, Boyen C and Tonon T (2010) Chlorophyll binding proteins revisited – a multigenic family of light harvesting and stress proteins from a brown algal perspective. *BMC Evolutionary Biology*, 10, 365.
26. Bhattacharyya S, Liu H, Zhang Z, Jam M, Dudeja PK, **Michel G**, Linhardt RJ, and Tobacman J (2010) Carrageenan-induced innate immune response is modified by enzymes that hydrolyze distinct galactosidic bonds. *Journal of Nutritional Biochemistry*, 21, 906-913.
27. **Michel G***, Tonon T, Scornet D, Cock JM and Kloareg B (2010) The cell wall polysaccharide metabolism of the brown alga *Ectocarpus siliculosus*. Insights into the evolution of extracellular matrix polysaccharides in Eukaryotes. *New phytologist*, 188, 82-97.
28. **Michel G***, Tonon T, Scornet D, Cock JM and Kloareg B (2010) Central and storage carbon metabolism of the brown alga *Ectocarpus siliculosus*. Insights into the origin and evolution of storage carbohydrates in Eukaryotes. *New phytologist*, 188, 67-81.
29. Rebuffet E, Barbeyron T, Jeudy A, Jam M, Czjzek M and **Michel G** (2010) Identification of catalytic residues and mechanistic analysis of family GH82 α -carrageenases. *Biochemistry*, 49, 7590–7599.
30. Wecker P, Klockow C, Schüler M, Dabin J, **Michel G** and Glöckner FO (2010) Life cycle analysis of the model organism *Rhodospirellula baltica* SH1T by transcriptome studies. *Microbial Biotechnology*, 3, 583-594.
31. Groisillier A, Hervé C, Jeudy A, Rebuffet E, Chevolut Y, Pluchon PF, Flament D, Geslin C, Morgado I, Power D, Branno M, Moreau H, **Michel G**, Boyen C and Czjzek M (2010) MARINE-EXPRESS: taking advantage of high throughput cloning and expression strategies for the post-genomic analysis of marine organisms. *Microbial Cell Factories*, 9, 45.
32. Cock JM, Sterck L, Rouzé P, Scornet D, Allen AE, Amoutzias G, Anthouard V, Artiguenave F, Aury JM, Badger JH, Beszteri B, Billiau K, Bonnet E, Bothwell JH, Bowler C, Boyen C, Brownlee C, Carrano CJ, Charrier B, Cho GY, Coelho SM, Collén J, Corre E, Da Silva C, Delage L, Delaroque N, Dittami SM, Doulebeau S, Elias M, Farnham G, Gachon CM, Gschloessl B, Heesch S, Jabbari K, Jubin C, Kawai H, Kimura K, Kloareg B, Küpper FC, Lang D, Le Bail A, Leblanc C, Lerouge P, Lohr M, Lopez PJ, Martens C, Maumus F, **Michel G**, Miranda-Saavedra D, Morales J, Moreau H, Motomura T, Nagasato C, Napoli CA, Nelson DR, Nyvall-Collén P, Peters AF, Pommier C, Potin P, Poulain J, Quesneville H, Read B, Rensing SA, Ritter A, Rousvoal S, Samanta M, Samson G, Schroeder DC, Ségurens B, Strittmatter M, Tonon T, Tregear JW, Valentin K, von Dassow P, Yamagishi T, Van de Peer Y, Wincker P. (2010) The *Ectocarpus* genome and the independent evolution of multicellularity in the brown algae. *Nature*, 465, 617-621.
33. Hehemann J-H, Correc G, Barbeyron T, Helbert W, Czjzek M* and **Michel G*** (2010) Transfer of carbohydrate-active enzymes from marine bacteria to Japanese gut microbiota. *Nature*, 464, 908-912.
34. Hehemann J-H, **Michel G**, Barbeyron T and Czjzek M. (2010) Expression, purification and preliminary X-ray diffraction analysis of the catalytic module of a β -agarase from the flavobacterium *Zobellia galactanivorans*. *Acta Crystallographica F*, 66, 413-417.

35. **Michel G***, Barbeyron T, Kloareg B and Czjzek M (2009) The family 6 carbohydrate binding modules have co-evolved with their appended catalytic modules towards similar substrate specificity. *Glycobiology*, 19, 615-623.
36. Mark P, Baumann M, Eklöf J, Gullfot F, **Michel G**, Kallas A, Teeri T, Brumer H and Czjzek M (2009) Analysis of nasturtium TmNXG1 complexes by crystallography and molecular dynamics provides detailed insight into substrate recognition by family GH16 xyloglucan endo-transglycosylases and endo-hydrolases. *Proteins: Structure, Function, and Bioinformatics*, 75, 820-836.
37. Barbeyron T, L'Haridon S, **Michel G** and Czjzek M. (2008) Description of a novel bacteria belonging to the genus *Mariniflexile*: *Mariniflexile fucanivorans* sp. nov., a marine *Flavobacteriaceae* degrading sulphated fucans from brown algae. *International Journal of Systematic and Evolutionary Microbiology*, 58, 2107 - 2113.
38. Barbeyron T, Carpentier F, L'Haridon S, Schüler M, **Michel G** and Amann R (2008) Description of *Maribacter forsetii* sp. nov., marine bacteria of the family *Flavobacteriaceae*, isolated from North Sea water, and emended description of the genus *Maribacter*. *International Journal of Systematic and Evolutionary Microbiology*, 58, 790-797.
39. Dabin J, Jam M, Czjzek M and **Michel G** (2008) Expression, purification, crystallization and preliminary X-ray analysis of the polysaccharide lyase RB5312 from the marine planctomycete *Rhodopirellula baltica*. *Acta Crystallographica F*, 64, 224-227.
40. Charrier B, Coelho S, Le Bail A, Tonon T, **Michel G**, Potin P, Kloareg B, Boyen C, Peters AF and Cock JM (2008) Development and physiology of the brown alga *Ectocarpus siliculosus*: two centuries of research. *New Phytologist*, 177, 319-332.
41. Baumann MJ, Eklöf JM, **Michel G**, Kallas AM, Teeri TT, Czjzek M and Brumer H (2007) Structural evidence for the evolution of xyloglucanase activity from XETs: biological implications for cell wall metabolism. *The Plant Cell*, 19, 1947-1963.
42. Flament D, Barbeyron T, Jam M, Potin P, Czjzek M, Kloareg B and **Michel G***. (2007) Alpha-agarases define a new family of glycoside hydrolases, distinct from beta-agarase families. *Applied and Environmental Microbiology*, 73, 4691-4694.
43. Guibet M, Colin S, Barbeyron T, Genicot S, Kloareg B, **Michel G** and Helbert W. (2007) Degradation of λ -carrageenan by *Pseudoalteromonas carrageenovora* λ -carrageenase: a new family of glycoside hydrolases unrelated to κ - and ι -carrageenases. *Biochemical journal*, 404, 105-114.
44. Colin S, Deniaud E, Jam M, Descamps V, Chevolut Y, Kervarec N, Yvin JC, Barbeyron T, **Michel G*** and Kloareg B. (2006) Cloning and biochemical characterization of the fucanase FcnA: definition of a novel glycoside hydrolase family specific for sulfated fucans. *Glycobiology*, 16, 1021-1032.
45. **Michel G**, Nyval-Collen P, Barbeyron T, Czjzek M and Helbert W (2006) Bioconversion of red seaweed galactans: a focus on bacterial agarases and carrageenases. *Applied Microbiology and Biotechnology*, 71, 23-33.
46. Feiters MC, Leblanc C, Küpper FC, Meyer-Klaucke W, **Michel G** and Potin P. (2005) Bromine is an endogenous component of a vanadium bromoperoxidase. *Journal of the American Chemical Society* 127, 15340-15341. [7]
47. Colin C, Leblanc C, **Michel G**, Wagner E, Leize-Wagner E, Van Dorsselaer A and Potin P. (2005) Vanadium-dependent iodoperoxidases in *Laminaria digitata*, a novel biochemical function diverging from brown algal bromoperoxidases. *Journal of Biological Inorganic Chemistry* 10, 156-166.

48. Lindner HA, Nadeau G, Matte A, **Michel G**, Menard R and Cygler M. (2005) Site-directed mutagenesis of the active site region in the quinate/shikimate 5-dehydrogenase YdiB of *Escherichia coli*. *Journal of Biological Chemistry* 280, 7162-7169.
49. Jam M, Flament D, Allouch J, Potin P, Thion L, Kloareg B, Czjzek M, Helbert W, **Michel G** and Barbeyron T. (2005) The endo- β -agarases AgaA and AgaB from the marine bacterium *Zobellia galactanivorans*: two paralog enzymes with different molecular organizations and catalytic behavior. *Biochemical Journal* 385, 703-713.
50. **Michel G**, Li Y, Sulea T, Linhardt RJ, Raman R, Prabhakar V, Pojasek K, Sasisekharan R and Cygler M. (2004) The Structure of Chondroitin B Lyase Complexed with Glycosaminoglycan Oligosaccharides Unravels a Calcium-Dependent Catalytic Machinery. *Journal of Biological Chemistry* 279, 32882-32896.
51. **Michel G**, Helbert W, Kahn R, Dideberg O. and Kloareg B. (2003) The Structural Bases of the Processive Degradation of iota-Carrageenan, a Main Cell Wall Polysaccharide of Red Algae. *Journal of Molecular Biology* 334, 421-433.
52. **Michel G**, Roszak AW, Sauv e V, Maclean J, Matte A, Coggins JR, Cygler M and Laphorn AJ. (2003) Structures of shikimate dehydrogenase AroE and its Paralog YdiB. A common structural framework for different activities. *Journal of Biological Chemistry* 278, 19463-19472.
53. **Michel G**, Sauv e V, Li Y, Larocque R, Matte A and Cygler M. (2002) The structure of the RlmB 23S rRNA methyltransferase reveals a new methyltransferase fold with a unique knot. *Structure* 10, 1303-1315.
54. **Michel G**, Chantalat L, Fanchon E, Henrissat B, Kloareg B and Dideberg O. (2001) The iota-carrageenase of *Alteromonas fortis*. A beta-helix fold-containing enzyme for the degradation of a highly polyanionic polysaccharide. *Journal of Biological Chemistry* 276, 40202-40209.
55. **Michel G**, Chantalat L, Duee E, Barbeyron T, Henrissat B, Kloareg B and Dideberg O. (2001) The kappa-carrageenase of *P. carrageenovora* features a tunnel-shaped active site: a novel insight in the evolution of Clan-B glycoside hydrolases. *Structure* 9, 513-525.
56. Barbeyron T, **Michel G**, Potin P, Henrissat B and Kloareg B. (2000) iota-Carrageenases constitute a novel family of glycoside hydrolases, unrelated to that of kappa-carrageenases. *Journal of Biological Chemistry* 275, 35499-35505.
57. **Michel G**, Flament D, Barbeyron T, Vernet T, Kloareg B and Dideberg O. (2000) Expression, purification, crystallization and preliminary X-ray analysis of the iota-carrageenase from *Alteromonas fortis*. *Acta Crystallographica D* 56, 766-768.
58. **Michel G**, Barbeyron T, Flament D, Vernet T, Kloareg B and Dideberg O. (1999) Expression, purification, crystallization and preliminary X-ray analysis of the kappa-carrageenase from *Pseudoalteromonas carrageenovora*. *Acta Crystallographica D* 55, 918-920.