

Joe Yuichiro Wakano

Research Accomplishments

(May 22nd, 2013)

Current Position

Associate Professor

School of Interdisciplinary Mathematical Sciences

Meiji University

Research Interests

Mathematical Biology

Mathematical modeling, analysis and simulation in Ecology and Evolution

(evolutionary game theory, behavioral ecology, evolution of social/individual learning, evolution of cooperation, pattern formation, reaction diffusion equations, etc.)

Selected Papers

Wakano JY, Maenosono S, Komoto A, Eiha N & Yamaguchi Y (2003) Self-organized pattern formation of bacteria colony modelled by reaction diffusion system and nucleation theory. *Physical Review Letters* **90**:258102

Wakano JY, Aoki K & Feldman MW (2004) Evolution of social learning: a mathematical analysis. *Theoretical Population Biology* **66**:249-258

Wakano JY, Nowak MA & Hauert C (2009) Spatial dynamics of ecological public goods. *Proceedings of the National Academy of Sciences of the USA* **106**:7910-7914

Wakano JY, Iwasa Y (2013) Evolutionary branching in a finite population: Deterministic branching versus stochastic branching. *Genetics* **193**:229-241

Wakano JY, Ohstuki H & Kobayasi Y (2013) A mathematical description of the inclusive fitness theory. *Theoretical Population Biology* **84**:46-55

Research Grants (competitive funding)

MEXT Grant-in-Aid for Scientific Research (KAKENHI) No.25870800 (2013-2015)

MEXT Grant-in-Aid for Scientific Research (KAKENHI) on Innovative Areas (2010-2014) No.22101004 "Replacement of Neanderthals by Modern Humans: Testing Evolutionary Models of Learning" (Leader: T.Akazawa)

JST PRESTO "Innovative model of biological processes and its development"
(2009-2012)

Global COE Program "Formation and Development of Mathematical Sciences Based
on Modeling and Analysis" (Leader:M.Mimura) (2008-2012)

MEXT Grant-in-Aid for Scientific Research (KAKENHI) No.20770019 (2008-2010)

MEXT Grant-in-Aid for Scientific Research (KAKENHI) No.18-09976 (2006-2007)

MEXT Grant-in-Aid for Scientific Research (KAKENHI) No.17770011 (2005)

Current/Former members in my lab

2013-	Kenichi Aoki (visiting professor; human evolution)
2013-	Yutaka Kobayashi (PD; evolutionary models)
2012-	Tomasso Scotti (Ph.D; population ecology)
2012-	Chiaki Miura (PD; population genetics)
2011-	Rokyo Okajima (PD; evolution)
2010-2011	Takuya Machida (PD; stochastic analysis)
2009-2012	Wataru Nakahashi (PD; human evolution)
2009-2010	Zu Jian (PD; adaptive dynamics)

Membership

Japanese Society for Mathematical Biology (JSMB)

Japan Physical Society (JPS)

Japan Society for Industrial and Applied Mathematics (JSIAM)

Ecological Society of Japan (ESJ)

The Anthropological Society of Nippon (ASN)

Affiliated Scientist of Center for Ecological Research (Kyoto University)

Contribution as a reviewer

Physical Review Letters, The American Naturalist, Journal of Theoretical Biology,
Theoretical Population Biology, Evolutionary Ecology, Mathematical Biosciences,
Journal of Ethology, Population Ecology, BMC Evolutionary Biology, Current
Anthropology, Physica A, International Journal of Dynamical Systems and
Differential Equations, Evolution and Human Behavior, Behavioral Ecology,
Proceedings B, PNAS, Journal of Royal Society Interface

All publications (peer reviewed journal papers)

visit <http://joefs.mind.meiji.ac.jp/~joe/research/> for the most recent information

1. **Wakano JY, Nakata K & Yamamura N (1998)**
Dynamic model of optimal age polyethism in social insects under stable and fluctuating environments.
Journal of Theoretical Biology 193:153–165
2. **Wakano JY & Yamamura N (2001)**
A simple learning strategy which realizes robust cooperation better than Pavlov.
Journal of Ethology 19:1–8
3. **Wakano JY, Kohmatsu Y & Yamamura N (2002)**
Evolutionary dynamics of frequency-dependent growth strategy in cannibalistic amphibians.
Evolutionary Ecology Research 4:719–736
4. **Eiha N, Komoto A, Maenosono S, Wakano JY, Yamamoto K & Yamaguchi Y (2002)**
The mode transition of the bacterial colony.
Physica A 313:609–624
5. **Komoto A, Hanaki K, Maenosono S, Wakano JY, Yamaguchi Y & Yamamoto K (2003)**
Growth dynamics of *Bacillus circulans* colony.
Journal of Theoretical Biology 225:91–97.... DOI [10.1016/S0022-5193\(03\)00224-8](https://doi.org/10.1016/S0022-5193(03)00224-8)
6. **Wakano JY, Maenosono S, Komoto A, Eiha N & Yamaguchi Y (2003)**
Self-organized pattern formation of bacteria colony modelled by reaction diffusion system and nucleation theory
Physical Review Letters 90:258102.... DOI [10.1103/PhysRevLett.90.258102](https://doi.org/10.1103/PhysRevLett.90.258102)
7. **Yamamura N, Higashi M, Behera N & Wakano JY (2004)**
Evolution of mutualism through spatial effects
Journal of Theoretical Biology 226:421–428.... DOI [10.1016/j.jtbi.2003.9.016](https://doi.org/10.1016/j.jtbi.2003.9.016)
8. **Wakano JY (2004)**
Drastic growth effect may explain sympatric cannibalistic polymorphism
Journal of Theoretical Biology 226:69–77.... DOI [10.1016/j.jtbi.2003.8.005](https://doi.org/10.1016/j.jtbi.2003.8.005)

9. **Wakano JY, Komoto A & Yamaguchi Y (2004)**
Phase transition of traveling waves in bacterial colony pattern
Physical Review E 69:051904 DOI [10.1103/PhysRevE.69.051904](https://doi.org/10.1103/PhysRevE.69.051904)

10. **Wakano JY, Aoki K & Feldman MW (2004)**
Evolution of social learning: a mathematical analysis
Theoretical Population Biology 66:249–258 DOI [10.1016/j.tpb.2004.06.005](https://doi.org/10.1016/j.tpb.2004.06.005)

11. **Aoki K, Wakano JY & Feldman MW (2005)**
The emergence of social learning in a temporally changing environment: A theoretical model
Current Anthropology 46:334–340.... DOI [10.1086/428791](https://doi.org/10.1086/428791)

12. **Wakano JY & Ihara Y (2005)**
Evolution of male parental care and female multiple mating: game-theoretical and two-locus diploid models
The American Naturalist 166:E32–44

13. **Wakano JY (2005)**
Evolution of extraordinary female-biased sex ratios: The optimal schedule of sex ratio in local mate competition
Journal of Theoretical Biology 237:193–202.... DOI [10.1016/j.jtbi.2005.04.006](https://doi.org/10.1016/j.jtbi.2005.04.006)

14. **Wakano JY (2006)**
A mathematical analysis on public goods games in the continuous space
Mathematical Biosciences 201:72–89.... DOI [10.1016/j.mbs.2005.12.015](https://doi.org/10.1016/j.mbs.2005.12.015)

15. **Wakano JY & Aoki K (2006)**
A mixed strategy model for the emergence and intensification of social learning in a periodically changing natural environment
Theoretical Population Biology 70:486–497.... DOI [10.1016/j.tpb.2006.04.003](https://doi.org/10.1016/j.tpb.2006.04.003)

16. **Seki M, Wakano JY & Ihara Y (2007)**
A theoretical study on the evolution of male parental care and female multiple mating: Effects of female mate choice and male care bias
Journal of Theoretical Biology 247:281–296.... DOI [10.1016/j.jtbi.2007.03.010](https://doi.org/10.1016/j.jtbi.2007.03.010)

17. **Wakano JY (2007)**
Evolution of cooperation in spatial public goods games with common resource

dynamics

Journal of Theoretical Biology 247:616–622.... DOI [10.1016/j.jtbi.2007.04.008](https://doi.org/10.1016/j.jtbi.2007.04.008)

18. **Wakano JY & Aoki K (2007)**
Do Social Learning and Conformist Bias Coevolve? Henrich and Boyd Revisited
Theoretical Population Biology 72:504–512.... DOI [10.1016/j.tpb.2007.04.003](https://doi.org/10.1016/j.tpb.2007.04.003)
19. **Hauert C, Wakano JY & Doebeli M (2008)**
Ecological Public Goods Games: cooperation and bifurcation
Theoretical Population Biology 73:257–263.... DOI [10.1016/j.tpb.2007.11.007](https://doi.org/10.1016/j.tpb.2007.11.007)
20. **Wakano JY & Whiteman HH (2008)**
Evolution of polyphenism: the role of density and relative body size on morph determination
Evolutionary Ecology Research 10:1157–1172....
21. **Wakano JY, Nowak MA & Hauert C (2009)**
Spatial dynamics of ecological public goods
Proceedings of the National Academy of Sciences of the United States of America 106:7910–7914.... DOI [10.1073/pnas.0812644106](https://doi.org/10.1073/pnas.0812644106)
22. **Zu J, Mimura M & Wakano JY (2010)**
The evolution of phenotypic traits in a predator–preysystem subject to Allee effect
Journal of Theoretical Biology 262:528–543.... DOI [10.1016/j.jtbi.2009.10.022](https://doi.org/10.1016/j.jtbi.2009.10.022)
23. **Kurokawa S, Wakano JY & Ihara Y (2010)**
Generous cooperators can outperform non–generous cooperators when replacing a population of defectors
Theoretical Population Biology 77:257–262.... DOI [10.1016/j.tpb.2010.03.002](https://doi.org/10.1016/j.tpb.2010.03.002)
24. **Wakano JY & Hauert C (2011)**
Pattern formation and chaos in spatial ecological public goods games
Journal of Theoretical Biology 268:30–38.... DOI [10.1016/j.jtbi.2010.09.036](https://doi.org/10.1016/j.jtbi.2010.09.036)
25. **Wakano JY, Ikeda K, Miki T & Mimura M (2011)**
Effective dispersal rate is a function of habitat size and corridor shape: mechanistic formulation of a two–patch compartment model for spatially continuous systems
Oikos 120: 1712–1720.... DOI [10.1111/j.1600-0706.2011.19074.x](https://doi.org/10.1111/j.1600-0706.2011.19074.x)

26. **Wakano JY, Kawasaki K, Shigesada N & Aoki K (2011)**
Coexistence of individual and social learners during range-expansion
Theoretical Population Biology 80:132–140.... DOI [10.1016/j.tpb.2011.06.001](https://doi.org/10.1016/j.tpb.2011.06.001)

27. **Wakano JY (2012)**
Spatiotemporal dynamics of cooperation and spite behavior by conformist transmission
Communications on Pure and Applied Analysis 11:375–386.... DOI [10.3934/cpaa.2012.11.375](https://doi.org/10.3934/cpaa.2012.11.375)

28. **Mirrahimi S, Perthame B & Wakano JY (2012)**
Evolution of species trait through resource competition
Journal of Mathematical Biology 64:1189–1223.... DOI [10.1007/s00285-011-0447-z](https://doi.org/10.1007/s00285-011-0447-z)

29. **Kobayashi Y & Wakano JY (2012)**
Evolution of social versus individual learning in an infinite island model
Evolution 66:1624–1635.... DOI [10.1111/j.1558-5646.2011.01541.x](https://doi.org/10.1111/j.1558-5646.2011.01541.x)

30. **Aoki K, Wakano JY & Lehmann L (2012)**
Evolutionarily stable learning schedules and cumulative culture in discrete generation models
Theoretical Population Biology 81:300–309.... DOI [10.1016/j.tpb.2012.01.006](https://doi.org/10.1016/j.tpb.2012.01.006)

31. **Wakano JY & Lehmann L (2012)**
Evolutionary and convergence stability for continuous phenotypes in finite populations derived from two-allele models
Journal of Theoretical Biology 310:206–215.... DOI [10.1016/j.jtbi.2012.06.036](https://doi.org/10.1016/j.jtbi.2012.06.036)

32. **Nakahashi W, Wakano JY & Henrich J (2012)**
Adaptive social learning strategies in temporally and spatially varying environments
Human Nature 23:386–418.... DOI [10.1007/s12110-012-9151-y](https://doi.org/10.1007/s12110-012-9151-y)

33. **Wakano JY & Iwasa Y (2013)**
Evolutionary branching in a finite population: Deterministic branching versus stochastic branching
Genetics 193:229–241.... DOI [10.1534/genetics.112.144980](https://doi.org/10.1534/genetics.112.144980)

34. **Wakano JY, Ohstuki H & Kobayasi Y (2013)**
A mathematical description of the inclusive fitness theory
Theoretical Population Biology 84:46–55.... DOI [10.1016/j.tpb.2012.11.007](https://doi.org/10.1016/j.tpb.2012.11.007)

35. Lehmann L, **Wakano JY** & Aoki K (2013)
On optimal learning schedules and the marginal value of cumulative cultural evolution
Evolution DOI [10.1111/evo.12040](https://doi.org/10.1111/evo.12040)
36. Lehmann L, & **Wakano JY** (2013)
The handaxe and the microscope: individual and social learning in a multidimensional model of adaptation
Evolution and Human Behavior 34:109–117.... DOI [10.1016/j.evolhumbehav.2012.11.001](https://doi.org/10.1016/j.evolhumbehav.2012.11.001)
37. Perthame B, Mirraimi S, **Wakano JY** (in press)
Direct competition results from strong competition for limited resource
Journal of Mathematical Biology....