MARTIN A. NOWAK
Curriculum Vitae

Personal Information

Name:	Martin Andreas Nowak
Address:	Department of Mathematics, Harvard University
	Cambridge, Massachusetts, United States
Email:	martin_nowak@harvard.edu
Websites:	www.math.harvard.edu/people/nowak-martin/
	www.martinnowak.com/
Degrees:	M.Sc. Vienna
	Ph.D. Vienna (Dr. rer. Nat.)
	M.A. (honoris causa) Oxford
	A.M. (honoris causa) Harvard
	Ph.D. (honoris causa) Cuza University of Iasi
	Ph.D. (honoris causa) Dominican School of Philosophy and Theology

Current Position

Professor of Mathematics and of Biology, Harvard University

Education

1975-1983	Albertus Magnus Gymnasium in Vienna
1983-1989	University of Vienna, studying Biochemistry and Mathematics
1985	First Diploma: Biochemistry (first class honors)
1987	Diploma thesis: Theoretical Chemistry
1987	Second Diploma: Biochemistry (first class honors; finished one year faster)
1987-1989	Doctoral thesis: Mathematics
1989	Final exams for degree *Doctor rerum naturalium* (with highest honors)
	Promotion “sub auspiciis praesidentis”

Scientific Career

Vienna:

1987-1988	Institute for Theoretical Chemistry, Peter Schuster
1987-1989	Institute for Mathematics, Karl Sigmund
1988	Max Planck Institute for Biophysical Chemistry, Göttingen, Manfred Eigen
1993	"Habilitation" at the Institute of Mathematics, University of Vienna

Oxford:

1989-1990 Erwin Schrödinger Scholarship to work with Robert May (Lord May of Oxford)
1990-1992 Guy Newton Junior Research Fellow, Wolfson College
1991 Royal Society Research Grant
1992-1998 Wellcome Trust Senior Research Fellow in Biomedical Sciences
1993-1996 E. P. Abraham Junior Research Fellow, Keble College
1995-1998 Head of Mathematical Biology Group
1996-1998 Senior Research Fellow, Keble College
1997-1998 Professor of Mathematical Biology

Princeton:

1998-2003 Head, Program in Theoretical Biology, Institute for Advanced Study
1999-2003 Associated Faculty, Princeton University, Ecology and Evolutionary Biology
2000-2003 Associated Faculty, Princeton University, Program in Applied and Computational Mathematics

Harvard:

2003 - Professor of Mathematics and of Biology

Prizes, Named Lectures, Memberships

1990 *Promotion sub auspiciis praesidentis rei publicae*
1990 Prize from the Austrian Science Minister
1995 Richardson Lecture, Keble College
1996 Weldon Memorial Prize, Oxford University
1997 Shanks Lecture, Vanderbilt University, Nashville, Tennessee
1998 Albert Wander Prize and Memorial Lecture, University of Bern, Switzerland
1999 Porter Lecture, Rice University, Houston, Texas
1999 Erwin Schroedinger Lecture, University of Vienna, Austria
1999 Akira Okubo Prize, International and Japanese Society for Mathematical Biology
1999 Roger F. Murray Prize, Institute for Quantitative Research in Finance
2000 Gergen Lecture, Duke University
2001 Benjamin Pinkel Lecture, University of Pennsylvania
2001 Corresponding Member, Austrian Academy of Sciences
2001 Rainich Lectures, University of Michigan, Ann Arbor
2001 David Starr Jordan Prize, Stanford University, Cornell University, Indiana University
2003 Henry Dale Prize, The Royal Institution, London
2006 Invited Lecture, Congress for Mathematics, Madrid
2006 R.R. Hawkins Award for *Evolutionary Dynamics*
2007 Radon Lecture, Austrian Academy of Sciences
2008 Coxeter Lectures, Fields Institute, Toronto
2010 Templeton Lectures, Johns Hopkins University

2010 Doctor Honoris Causa, Alexandru Ioan Cuza University of Iasi, Romania
2011 Max Planck Lecture, Stuttgart, Germany
2012 MBI 10th Anniversary Keynote talk, Ohio State University
2012 Plenary speaker, Canadian Mathematical Society
2013 Plenary speaker, International Congress of Ecology, London, England
2013 Simons Lecture, Institute for Mathematics and its Applications, Minneapolis
2013 Andre-Aisenstadt Chair, Centre de Recherches Mathématiques, Montreal
2014 Plenary Opening Talk, Nephrology Conference, Baden, Austria
2014 Keynote Lecture, 11th Austrian Research and Innovation Talk (ARIT)
2015 Plenary speaker, Collins Lecture Series, Massachusetts General Hospital
2015 Plenary speaker, Drug Discovery and World Therapy Congress, Boston
2016 Invited Lecture, Fermilab, Illinois
2016 Sewall Wright Speaker, University of Chicago
2016 Fannie Cox Prize for Excellence in Science Teaching
2017 AACR Team Science Award
2018 The Edmund R. Michalik Distinguished Lecture Series, University of Pittsburgh

Research Interests

Evolution; Evolutionary dynamics; Evolutionary game theory; Adaptive dynamics; Stochastic evolution; Finite populations; Evolutionary graph theory; Evolutionary set theory; Evolution of cooperation; Direct reciprocity; Indirect reciprocity; Spatial selection; Reputation; Fairness; Group selection; Cancer genetics, evolution, treatment; Infection dynamics; Virus dynamics, evolution, treatment; HIV, HBV, COVID-19; Quasispecies theory; Genetic redundancy; Evolution of language; Experimental games; Origin of evolution, pre-life; Evolution of eusociality; Clonal hematopoiesis; Science and philosophy; Science and religion.

Books

Nowak M. A & R. M. May (2000). Virus Dynamics: Mathematical Principles of Immunology and Virology. Oxford: Oxford University Press.

Nowak, M. A. (2006). Evolutionary Dynamics: Exploring the Equations of Life. Cambridge, MA: Harvard University Press.

Nowak, M. A. & R. Highfield (2011). SuperCooperators: Why We Need Each Other to Succeed. Simon & Schuster.

Coakley, S. & & **M. A. Nowak,** eds. (2013). Evolution, Games, and God: The Principle of Cooperation. Harvard University Press.

Selected Publications

Schmid, L., Hilbe, C., Chatterjee, K. & **Nowak**, M.A. (2021). A unified framework of direct and indirect reciprocity. *Nat Hum Behav* DOI: 10.1038/s41562-021-01114-8

Heyde, A., Rohde, D., Cameron, S.M., Zhang, S., Hoyer, F.F., Gerold, J.M., Cheek, D., Iwamoto, Y., Schloss, M.J., Vandoorne, K., Iborra-Egea, O., Munoz-Guijosa, C., Bayes-Genis, A., Reiter, J.G., Craig, M., Swirski, F.K., Nahrendorf, M., **Nowak, M.A.**, Naxerova, K. (2021). Increased stem cell proliferation in atherosclerosis accelerates clonal hematopoiesis. *Cell.* 184(5): 1348-1361. DOI: 10.1016/j.cell.2021.01.049

McAvoy, A., Allen, B. & **Nowak, M.A.** (2020). Social goods dilemmas in heterogeneous societies. *Nat. Hum. Behav*. 4: 819-831. DOI: 10.1038/s41562-020-0881-2

Hauser, O.P., Hilbe, C., Chatterjee, K. & **M.A. Nowak** (2019). Social dilemmas among unequals. *Nature* DOI: 10.1038/s41586-019-1488-5

Hilbe, C., Chatterjee, K. & **M. A. Nowak** (2018). Partners and rivals in direct reciprocity. *Nature Human Behaviour* 1. DOI: 10.1038/s41562-018-0320-9

Noble, C., Olejarz, J., Esvelt, K., Church, G. & **M. A. Nowak** (2017). Evolutionary dynamics of CRISPR gene drives. 3 *Science Advances* 4. e1601964. DOI: 10.1126/sciadv.1601964

Allen B, G Lippner, Chen, Y-T., Fotouhi, B., N Momeni, S-T Yau & **M. A. Nowak** (2017). Evolutionary dynamics on any population structure. *Nature* 544: 227–230. DOI: 10.1038/nature21723

Waclaw, B., Bozic, I., Pittman, M. E., Rhuban, R. H., Vogelstein, B. & **M. A. Nowak** (2015). A spatial model predicts that dispersal and cell turnover limit intratumour heterogeneity. *Nature*. DOI: 10.1038/nature14971

Hauser, O. P., Rand, D. G., Peysakhovich, A. & **M. A. Nowak** (2014). Cooperating with the future. *Nature* DOI: 10.1038/nature13530

Diaz Jr., L. A., Williams, R. T., Wu J., Kinde, I., Hecht, J. R. Berlin, J., Allen, B., Bozic, I., Reiter, J. G., **Nowak**, **M. A.**, Kinzler, K. W., Oliner, K. S. & B. Vogelstein (2012). The molecular evolution of acquired resistance to targeted EGFR blockade in colorectal cancers. *Nature* 486 (7404): 537-540. DOI: 10.1038/nature11219

Rand, D. G., Greene, J. D. & **M. A. Nowak** (2012). Spontaneous giving and calculated greed. *Nature* 489 (7416): 427-430. DOI: 10.1038/nature11467

Rosenbloom, D. I. S., Hill, A. L., Rabi, S. A., Siliciano, R. F. & **M. A. Nowak** (2012). Antiretroviral dynamics determines HIV evolution and predicts therapy outcome. 18 *Nat. Med.* 9: 1378-1385. DOI: 10.1038/nm.2892

Michel, J. B., Shen, Y. K., Presser Aiden, A., Veres, A. & M. K. Gray, The Google Books Team, Pickett, J. P., Hoiberg, D., Clancy, D., Norvig, P., Orwant, J., Pinker, **Nowak**, **M. A.** & E. Lieberman Aiden (2011). Quantitative analysis of culture using millions of digitized books. 331 *Science* 6014: 176-182. DOI: 10.1126/science.1199644

Nowak, **M. A.**, Tarnita, C. E. & E. O. Wilson (2010). The evolution of eusociality. *Nature* 466: 1057-1062. DOI: 10.1038/nature09205

Yachida, S., Jones, S., Bozic, I., Antal, T., Leary, R., Fu, B., Kamiyama, M., Hruban, R. H., Eshleman, J. R., **Nowak**, **M. A.**, Velculescu, V. E., Kinzler, K, W., Vogelstein, B. & Iacobuzio-Donahue, C. A. (2010). Distant metastasis occurs late during the genetic evolution of pancreatic cancer. *Nature* 467: 1114–1117. DOI: 10.1038/nature09515

Ohtsuki, H., Iwasa, Y. & **M. A. Nowak** (2009). Indirect reciprocity provides only a narrow margin of efficiency for costly punishment. *Nature* 457: 79-82. DOI: 10.1038/nature07601

Rand, D. G., Dreber, A., Ellingsen, T., Fudenberg, D. & **M. A. Nowak** (2009). Positive interactions promote public cooperation. *Science* 325: 1272-1275. DOI: 10.1126/science.1177418

Tarnita, C. E., Antal, T., Ohtsuki, H. & **M. A. Nowak** (2009). Evolutionary dynamics in set structured populations. *Proc. Natl. Acad. Sci. USA* 106: 8601-8604. DOI: 10.1073/pnas.0903019106

Dreber, A., Rand, D. G., Fudenberg, D. & **M. A. Nowak** (2008). Winners don't punish. *Nature* 452: 348-351. DOI: 10.1038/nature06723

Nowak, **M. A.** & H. Ohtsuki (2008). Prevolutionary dynamics and the origin of evolution. *Proc. Natl. Acad. Sci. USA* 105: 14924-14927. DOI: 10.1073/pnas.0806714105

Hauert, C., Traulsen, A., Brandt, H., **Nowak**, **M. A.** & K. Sigmund (2007). Via freedom to coercion: The emergence of costly punishment. *Science* 316: 1905-1907. DOI: 10.1126/science.1141588

Lieberman, E., Michel, J. B., Jackson, J., Tang, T. & **M. A. Nowak** (2007). Quantifying the evolutionary dynamics of language. *Nature* 449: 713-716. DOI: 10.1038/nature06137

Nowak, **M. A.** (2006). Five rules for the evolution of cooperation. *Science* 314: 1560-1563. DOI: 10.1126/science.1133755

Ohtsuki, H., Hauert, C., Lieberman, E. & **M. A. Nowak** (2006). A simple rule for the evolution of cooperation on graphs and social networks. *Nature* 441: 502-505. DOI: 10.1016/j.jtbi.2005.11.012

Lieberman, E., Hauert, C. & **M. A. Nowak** (2005). Evolutionary dynamics on graphs. *Nature* 433: 312-316. DOI: 10.1038/nature03204

Michor, F., Hughes, T. P., Iwasa, Y., Branford, S., Shah, N. P., Sawyers, C. L. & **M. A. Nowak** (2005). Dynamics of chronic myeloid leukemia. *Nature* 435: 1267-1270. DOI: 10.1038/nature03669

Nowak, **M. A.** & K. Sigmund (2005). Evolution of indirect reciprocity. *Nature* 437: 1291-1298. DOI: 10.1038/nature04131

Nowak, **M. A.**, Michor, F., & Y. Iwasa (2004). Evolutionary dynamics of tumor suppressor gene inactivation. *Proc. Natl. Acad. Sci. USA* 101: 10635-10638. DOI: 10.1073/pnas.0400747101

Nowak, **M. A.**, Sasaki, A., Taylor, C. & D. Fudenberg (2004). Emergence of cooperation and evolutionary stability in finite populations. *Nature* 428: 646-650. DOI: 10.1038/nature02414

Nowak, **M. A.** & K. Sigmund (2004). Evolutionary dynamics of biological games. *Science* 303: 793-799. DOI: 10.1126/science.1093411

Wei, X., Decker, J. M., Wang, S., Hui, H., Kappes, J. C., Xiaoyun, W., Salazar, J. F., Salazar, M. G., Kilby, J. M., Saag, M. S., Komarova, N. L., **Nowak**, **M. A.**, Hahn, B. H., Kwong, P. D. & G. M. Shaw (2003). Antibody neutralization and escape by HIV-1. *Nature* 422: 307-312. DOI: 10.1038/nature01470

Nowak, **M. A.**, Komarova, N. L. & P. Niyogi (2002). Computational and evolutionary aspects of language. *Nature* 417: 611-617. DOI: 10.1038/nature00771

Nowak, **M. A.**, Komarova, N. L. & P. Niyogi (2001). Evolution of universal grammar. *Science* 291: 114-118. DOI: 10.1126/science.291.5501.114

Nowak, **M. A.**, Page, K. M. & K. Sigmund (2000). Fairness versus reason in the ultimatum game. *Science* 289: 1773-1775. DOI: 10.1126/science.289.5485.1773

Nowak, **M. A.**, Plotkin, J. B. & V. A. A. Jansen (2000). The evolution of syntactic communication. *Nature* 404: 495-498. DOI: 10.1038/35006635

Nowak, **M. A.** & K. Sigmund (1998). Evolution of indirect reciprocity by image scoring. *Nature* 393: 573-577. DOI: 10.1038/31225

Nowak, **M. A.**, Boerlijst, M. C., Cooke, J. & J. Maynard Smith (1997). Evolution of genetic redundancy. *Nature* 388: 167-171. DOI: 10.1038/40618

Nowak, **M. A.** & C. R. M. Bangham (1996). Population dynamics of immune responses to persistent viruses. *Science* 272: 74-79. DOI: 10.1126/science.272.5258.74

Nowak, **M. A.**, Bonhoeffer, S., Hill, A. M., Boehme, R., Thomas, H. C. & H. McDade (1996). Viral dynamics in hepatitis B virus infection. *Proc. Natl. Acad. Sci. USA* 93: 4398-4402. DOI: 10.1073/pnas.93.9.4398

Nowak, **M. A.**, May, R. M., Phillips, R. E., Rowland-Jones, S., Lalloo, D. G., McAdam, S., Klenerman, P., Köppe, B., K., Sigmund, K., Bangham, C. R. M. & A. J. McMichael (1995). Antigenic oscillations and shifting immunodominance in HIV-1 infections. *Nature* 375: 606-611. DOI: 10.1038/375606a0

Wei, X., Ghosh, S. K., Taylor, M. E., Johnson, V. A., Emini, E. A., Deutsch, P., Arnaout, R. A., Bonhoeffer, S., **Nowak**, **M. A.**, Hahn, B. H., Saag, M. S. & G. M. Shaw (1995). Viral dynamics in human immunodeficiency virus type 1 infection. *Nature* 373: 117-122. DOI: 10.1038/373117a0

Nowak, **M. A.** & R. M. May (1994). Superinfection and the evolution of parasite virulence. *Proc. R. Soc. B.* 255: 81-89. DOI: 10.1098/rspb.1994.0012

Tilman, D., May, R. M., Lehman, C. L. & **M. A. Nowak** (1994). Habitat destruction and the extinction debt. *Nature* 371: 65-66. DOI: 10.1038/371065a0

Nowak, **M. A.** & K. Sigmund (1993). A strategy of win-stay, lose-shift that outperforms tit for tat in the Prisoner's Dilemma game. *Nature* 364: 56-58. DOI: 10.1038/364056a0

Nowak, **M. A.** & R. M. May (1992). Evolutionary games and spatial chaos. *Nature* 359: 826-829. DOI: 10.1038/359826a0

Nowak, **M. A.** & K. Sigmund (1992). Tit for tat in heterogeneous populations. *Nature* 355: 250-253. DOI: 10.1038/355250a0

Nowak, **M. A.**, Anderson, R. M., McLean, A. R., Wolfs, T. F.W., Goudsmit, J., & R. M. May (1991). Antigenic diversity thresholds and the development of AIDS. *Science* 254: 963-969. DOI: 10.1126/science.1683006.

Total publications: > 500; Citations > 140000, h-index > 165 (Google Scholar)