



François TADDEI

Centre de Recherches Interdisciplinaires
Inserm U 1001 - Evolutionary Systems
Biology team

François Taddei heads the Evolutionary Systems Biology team at a unit of the French National Institute of Health & Medical Research (INSERM) in Paris-Descartes University's Medical School. After a generalist scientific education, with majors in physics and biology at the *École Polytechnique*, he became a tenured higher civil servant at the French Ministry of Agriculture, before earning a PhD in genetics, studying the molecular causes and evolutionary consequences of changes in the mutation rate with Miroslav Radman. After postdoctoral training with John Maynard-Smith where he modeled the evolution of mutation rate, for the last 12 years, his research team has been studying the evolution and molecular mechanisms of cooperation, genetic changes, errors in gene expression, pathogenicity, antibiotic resistance and aging in *E. coli*. He pioneered the study of aging in this model bacteria and is trying to unravel its mechanisms using microfluidics and systems biology approaches. This work has produced many publications in generalist scientific journals, and has been recognized by several awards, (the European Young Investigator award, the Human Frontier Science Program award, the INSERM Award for Fundamental Research, and the Liliane Bettencourt Life Science Award).

Passionated by education, over the last seven years, he has created the CRI (Center for Research and Interdisciplinary dedicated to foster the new generation of scientists working at the interfaces) in the heart of Paris, which offers 3 programs integrated in the Liliane Bettencourt curriculum:

- a new undergrad program allowing training through research as early as the first year of university (which was not possible so far in France).
- a Master's degree (Interdisciplinary Approaches to Life sciences, AIV), where students have to do 3 rotations in 3 labs of different disciplines.
- a doctoral school (Frontiers of Life, FdV, and supervised by an international scientific council that selects bright international students that want to explore the frontiers between disciplines)

CRI's dedicated facilities host visiting professors, a wide choice of courses and several student discussion clubs, which meet biweekly. It organizes international workshops and conferences such as the first workshop on scientific discovery games, and hands-on research school that will take place in the CRI in July 2011. CRI's main role is to promote new pedagogies to help creative students take initiatives and develop their research projects, with the help of mentors, research institutions, private companies (FT was recipient of research chairs funded by Orange and Axa), and foundations, such as the Bettencourt Foundation, which has supported many student-created activities.

These activities range from the first French synthetic biology team (which won 3 awards in 4 participations in the MIT-sponsored iGEM competition) to the "Paris-Montagne" science festival and the "Science Académie," an outreach program that allows high schools students from disfavored neighborhoods to discover the creativity of science while spending their vacations in research labs.

To foster even more initiatives, the CRI is currently helping the creation of an incubator for innovators in science education. François Taddei has been involved in scientific committees for the NIH, the INSERM and the ministry of research and served as advisor for the french government, the European Union and the OECD that asked him to write a report on the future of education in the 21st century.

François TADDEI

SHORT BIOGRAPHY

Director of Research

tel: +33 (0)1 44 41 25 20 fax: +33 (0)1 44 41 25 29
francois.taddei@inserm.fr

Génétique Moléculaire Evolutive et Médicale
U1001 INSERM, Faculté de Médecine
Université Paris Descartes - PRES Sorbonne Paris Cité
Centre de Recherches Interdisciplinaires (CRI)
24 rue du faubourg Saint-Jacques, 75014 Paris, France

Born August 5, 1967
in Montreuil-sous-Bois (France)
French citizen
Married to Angèle Tang
Two children:
Bosco born in 1998
Sophia born in 2000

EDUCATION

1983 -1984: High school Frédéric Mistral, Avignon (France), Baccalauréat série C (Mathematics/Physics), (Awarded with honours)
1984 -1986: *Lycée Louis Le Grand*, Paris: equivalent to the first two years of university. Preparatory years for the competitive examination to the « Grandes Ecoles », Maths/Physics
1986 -1989: *Ecole Polytechnique*, Palaiseau (France)
Leading French scientific school, Major in Physics & Biology
1989 - 1991: *Ecole Nationale du Génie Rural et des Eaux et Forêts (ENGREF)*
Engineering School for higher civil servant of French Agriculture and Forest Administration
1990 - 1991: Graduate studies in Cellular and Molecular Genetics, University of Paris VI and XI, Professors P Slonimski and JL Rossignol, Awarded with highest honours
1991-1995: PhD in Genetics, University Paris XI (Orsay) : Environment and controls of genetic variability in *E. coli*. Awarded with highest honours
1999: Habilitation à Diriger des Recherches (french diploma entitling to have PhD students), University of Paris XI, France. Maintaining the integrity of the genome and of its expression, medical and evolutionary implications

SCIENTIFIC ACTIVITIES AND TEACHING

2011 : Creation of the "*Licence Frontières du Vivant*", first french bachelor program allowing students to be trained through research
2007 : Founder and director of the interdisciplinary graduate school: *Frontiers in Life Science (FdV)* of Paris Diderot & Paris Descartes Universities dedicated to allow outstanding students explore new frontiers at the interface between disciplines.
2006 : Founder of the "*Paris-Montagne*" science festival in Ecole Normale Supérieure & *Science ac'* outreach program that offered lab training to > 1000 high schoolers from disfavoured background.
2005 : Founder of the *Center for Research & Interdisciplinarity* (Faculty of Medecine, Paris Descartes)
2004-2007 : Head of the interdisciplinary master program *Interdisciplinary Approches to life sciences (AIV)*, Ecole Normale Supérieure, Paris Diderot & Paris Descartes Universities.
Since 2000: Paris 5 Medical school Paris, *INSERM U571* Causes and consequences of genetic and phenotypic variability, head of *Evolutionary systems biology* team
1991-1999: *Institut J.Monod*, Paris, laboratory of mutagenesis Molecular and evolutionary mechanisms controlling genetic variability
1996-1997: Post-doct in J. Maynard Smith (UK) and PH Gouyon's lab (France) on evolution of mutation rate

TENURE POSITIONS HELD

1989-1997: higher civil servant of the French Agriculture and Forest Administration
since 1997: research scientist in *INSERM* (french medical research council)

in international peer-reviewed journals (* corresponding author)

1. Taddei, F.* , Matic, I., and Radman, M. (1995). Cyclic AMP-dependent SOS induction and mutagenesis in resting bacterial populations. *Proc. Natl. Acad. Sci. USA* 92, 11736-11740
2. Radman, M.* , Matic, I., Halliday, J., and Taddei, F. (1995). Editing DNA replication and recombination by mismatch repair: from bacterial genetics to mechanisms of predisposition to cancer in humans. *Phil. Trans. R. Soc. Lond. B* 347, 97-103.
3. Taddei, F.* , Radman, M., and Halliday, J. A. (1995). Mutation rate of the F episome. *Science* 269, 289-290.
4. Matic, I.* , Taddei, F., and Radman, M. (1996). Genetic barriers among bacteria. *Trends Microbiol.* 4, 69-73.
5. Taddei, F* , Radman, M., Maynard-Smith, J. Toupance, B. Gouyon, P. H., Godelle, B. (1997). Role of mutator alleles in adaptive evolution. *Nature* 387, 700-703
6. Matic, M., Radman, M., Taddei, F.* , Picard, B., Bingen, E., Denamur, E. and Helion, J. (1997). Highly variable mutation rates in commensal and pathogenic *E. coli* *Science* 277, 1833-1834
7. Vulic, M.* , Dionisio, F. Taddei, F. Radman M. (1997). Molecular keys to Speciation: DNA polymorphisms and the control of genetic exchange in bacteria. *Proc. Natl. Acad. Sci. USA* 94 9763-9767
8. Taddei, F.* , Halliday, J. A., Matic, M., and Radman, M. (1997). Genetic analysis of mutations in aging colonies of *E. coli*. *Molec. Gen. Genet.* 256 277-281
9. Taddei, F.* Matic, I., Godelle B., Radman, M. (1997). To be a mutator, or how pathogenic and commensal bacteria can evolve rapidly. *Trends Microbiol.* 5 427-428
10. Taddei, F.* , H. Hayakawa, M.-F. Bouton, A.-M. Cirinesi, I. Matic, M. Sekiguchi and M. Rdman. (1997). Counteraction by MutT protein of transcriptional errors caused by oxidative damage. *Science*, 278, 128-130.
11. Tenaillon, O* . Toupance, B. Le Nagard, H. Taddei, F. Godelle, B. (1999) Mutators, population size, adaptive landscape and the adaptation of asexual populations. *Genetics* 152, 485-493
12. Radman* , M. Matic, I. Taddei, F. (1999) Evolution of evolvability, *Ann. N. Y. Acad. Sci.* 870, 146-55
13. Brégeon, D. Matic, I. Radman, M. Taddei, F* . (1999) Inefficient Mismatch repair : genetic defects and down regulation. *J. Genet.* 78, 21-28
14. Denamur E., Lecointre G., Darlu P., Acquaviva C., Sayada C., Sunjevaric I., Rothstein R., Elion J., Taddei F., Radman M* . and Matic I. 2000. Evolutionary implications of the frequent horizontal transfer of mismatch repair genes. *Cell* 152:149-157
15. Dukan S., Farewell A., Ballesteros M., Taddei F., Radman M. and Nystrom T*. 2000. Protein oxidation in response to increased transcriptional or translational errors. *Proc Natl Acad Sci USA* 97: 5746-9.
16. Matic I.* , Taddei F. and Radman M. 2000. No genetic barriers between salmonella enterica serovar typhimurium and escherichia coli in SOS-induced mismatch repair-deficient cells. *J. Bacteriol* 182: 5922-4.
17. Matic I* ., Taddei F. and Radman M. 2000. Interspecies recombination and mismatch repair. Generation of mosaic genes and genomes. *Methods Mol. Biol.* 152: 149-57.
18. Radman M* ., Taddei F. and Matic I. 2000. Evolution-driving genes. *Res. Microbiol.* 151: 91-95.
19. Tenaillon O.* , Le Nagard H., Godelle B. and Taddei F. 2000. Mutator and Sex in Bacteria: Conflict between Adaptive Strategies. *Proc Natl Acad Sci USA* 97: 10465-10470.
20. Picard B., Duriez P., Gouriou S., Matic I., Denamur E* . and Taddei F. 2001. Mutator natural *Escherichia coli* isolates have an unusual virulence phenotype. *Infect. Immun.* 60:9-14
21. Giraud, A., Matic, I., Tenaillon, O., Clara, A., Radman, M., Fons, M., and Taddei, F*. 2001. Costs and benefits of high mutation rates: adaptive evolution of bacteria in the mouse gut. *Science*, 291:2606-8
22. Tenaillon O, Taddei, F, Radman M, Matic I. Second-order selection in bacterial evolution: selection acting on mutation and recombination rates in the course of adaptation. *Res Microbiol.* 2001 152(1):11-6
23. Bregeon D, Colot V, Radman M, Taddei, F*. Translational misreading: a tRNA modification counteracts a +2 ribosomal frameshift. *Genes Dev.* 2001 15(17):2295-306
24. Giraud A, Radman M, Matic I, Taddei, F. The rise and fall of mutator bacteria. *Curr Opin Microbiol.* 2001 4(5):582-5
25. Denamur E, Bonacorsi S, Giraud A, Duriez P, Hilali F, Amorin C, Bingen E, Andremont A, Picard B, Taddei, F, Matic I. High frequency of mutator strains among human uropathogenic *Escherichia coli* isolates. *J Bacteriol.* 2002 184(2):605-9
26. Giraud A, Matic I, Radman M, Fons M, Taddei, F*. Mutator bacteria as a risk factor in treatment of infectious diseases. *Antimicrob Agents Chemother.* 2002 46(3):863-5
27. Rocha EP, Matic I, Taddei, F. Over-representation of repeats in stress response genes: a strategy to increase versatility under stressful conditions? *Nucleic Acids Res.* 2002 30(9):1886-94
28. Dionisio F, Matic I, Radman M, Rodrigues OR, Taddei, F. Plasmids spread very fast in heterogeneous bacterial communities. *Genetics.* 2002 Dec;162(4):1525-32
29. Bjedov I, Tenaillon O., Gérard B, Souza V, Denamur E., Radman M, Taddei, F, and Matic I. Stress-Induced Mutagenesis in Bacteria *Science* 2003 300: 1404-1409
30. Bambou JC, Giraud A, Menard S, Begue B, Rakotobe S, Heyman M, Taddei F, Cerf-Bensussan N, Gaboriau-Routhiau V. In vitro and ex vivo activation of the TLR5 signaling pathway in intestinal epithelial

- cells by a commensal *Escherichia coli* strain. *J Biol Chem.* 279:42984-92, 2004
31. Saint-Ruf C., Taddei F., Matic I., stress and survival of aging *Escherichia coli* rpoS colonies. *Genetics*, 2004. 168(4): p. 541-546.
 32. Stewart E.J., Madden R., Paul G., Taddei F. (2005) Aging and Death in an Organism that Reproduces by Morphologically Symmetric Division. *PLoS Biol*, 3(2): e45.
 33. Le Chat L., Fons M, Taddei F., *Escherichia coli* mutators : selection criteria and migration effect. *Microbiology*, 2006 Jan; 152 (Pt1):67-73
 34. De Paepe M., Taddei F. (2006) Viruses'life history: towards a mechanistic basis of a trade-off between survival and reproduction among phages. *PLoS Biol*, 4(7): e193.
 35. Brown SP., Le Chat L., De Paepe M., Taddei F. (2006) Ecology of microbial invasions: amplification allows virus carriers to invade more rapidly when rare. *Current Biology*, 16(20): 2048-2052.2
 36. L. Xu, L. Robert, Q. Ouyang, F. Taddei, Y. Chen, A. B. Lindner, D. Baigl Micro-Contact Printing of Living Bacteria Arrays with Cellular Resolution, *Nano Lett.* 2007, 7, 2068-2072
 37. Brown SP, Taddei F. (2007) The durability of public goods changes the dynamics and nature of social dilemmas. *PLoS One.* 2007 Jul 4;2(7):e593.
 38. Veening JW, Stewart EJ, Berngruber TW, Taddei F, Kuipers OP and Hamoen LW. Bet-hedging and epigenetic inheritance in bacterial cell development. *PNAS.* 2008 Mar; 105 (11): 4393-4398.
 39. Lindner AB, Madden R, Demarez A, Stewart EJ, and Taddei F. Asymmetric segregation of protein aggregates is associated with cellular aging and rejuvenation. *PNAS.* 2008 Feb; 105 (8): 3076-3081.
 41. Giraud A, Arous S, De Paepe M, Gaboriau-Routhiau V, Bambou JC, Rakotobe S, Lindner AB, Taddei F, Cerf-Bensussan N. Dissecting the genetic components of adaptation of *Escherichia coli* to the mouse gut. *PLoS Genetics.* 2008 Jan; 4(1):e2.
 42. Fontaine F, Stewart EJ, Lindner AB, Taddei F. Mutations in two global regulators lower individual mortality in *Escherichia coli*. *Mol Microbiol.* 2008 Jan;67(1):2-14.
 43. Brown SP, Le Chat L, Taddei F. Evolution of virulence: triggering host inflammation allows invading pathogens to exclude competitors. *Ecol Lett.* 2008 Jan;11(1):44-51.
 44. Nogueira T, Rankin DJ, Touchon M, Taddei F, Brown SP, Rocha EP. Horizontal Gene Transfer of the Secretome Drives the Evolution of Bacterial Cooperation and Virulence. *Curr Biol.* 2009 Sep 30.
 45. Ferroni A, Guillemot D, Moumille K, Bernede C, Le Bourgeois M, Waernessyckle S, Descamps P, Sermet-Gaudelus I, Lenoir G, Berche P, Taddei F. Effect of mutator *P. aeruginosa* on antibiotic resistance acquisition and respiratory function in cystic fibrosis. *Pediatr Pulmonol.* 2009 Aug;44(8):820-5.
 46. Baeriswyl S, Diard M, Mosser T, Leroy M, Manière X, Taddei F, Matic I. Modulation of aging profiles in isogenic populations of *Caenorhabditis elegans* by bacteria causing different extrinsic mortality rates. *Biogerontology.* 2009 May 15.
 47. Sam P. Brown, R. Fredrik Inglis, François Taddei Evolutionary ecology of microbial wars: within-host competition and (incidental) virulence, *Evolutionary Applications*, Special Issue: Evolutionary Medicine [Volume 2, Issue 1](#), pages 32-39, February 2009
 48. De Paepe M., De Monte S., Robert L., Lindner A., Taddei F, Emergence of variability in isogenic *Escherichia coli* populations infected by a filamentous virus *PLoS ONE* (2010) Jul 27;5(7):e11823
 49. Robert L, Paul G, Chen Y, Taddei F, Baigl D, Lindner AB. Pre-dispositions and epigenetic inheritance in the *Escherichia coli* lactose operon bistable switch. *Mol Syst Biol.* (2010) 6:357.
 50. Wang P., Robert L., Pelletier J., Dang W.L., Taddei F., Wright A., Jun S. Robust Growth of *Escherichia coli*. *Current Biology* (2010) Jun 22;20(12):1099-103. Epub 2010 May 27
 51. De Paepe M, Gaboriau-Routhiau V, Rainteau D, Rakotobe S, Taddei F, Cerf-Bensussan N. Trade-Off between Bile Resistance and Nutritional Competence Drives *Escherichia coli* Diversification in the Mouse Gut. *PLoS Genet.* 2011 Jun;7(6):e1002107. Epub 2011 Jun 16
 52. Tesfazgi Mebrhatu M, Wywiał E, Ghosh A, Michiels CW, Lindner AB, Taddei F, Bujnicki JM, Van Melderen L, Aertsen A. Evidence for an evolutionary antagonism between Mrr and Type III modification systems. *Nucleic Acids Res.* 2011 Apr 19

Other publications

1. Radman, M.*, Taddei, F., and Halliday, J. (1994). Correction des erreurs dans l'ADN : de la génétique bactérienne aux mécanismes de la prédisposition héréditaire aux cancers chez l'homme. *Médecine/Sciences* 10, 1024-1030
2. Matic, I.*, Taddei, F., and Radman, M. (1996). Vers une génétique moléculaire de l'évolution des espèces. *Médecine/Sciences* 12, 891-898.
3. Taddei, F.*, Matic, I., and Radman, M. (1997). Mutagenèse et adaptation. *bulletin de la Société Française de Génétique (in Médecine/Sciences)* 13, I-VI 2) TaMaRa (Taddei, F., Matic, I., and Radman, M.) (1996). Du nouveau sur l'origine des espèces. *La Recherche* 291, 52-59
4. Taddei, F.*, and Radman, M. (1996). Evolution de l'ADN. In *Dictionnaire de l'Evolution et du Darwinisme*. P. Tort, eds. (Paris: Presses Universitaires de France), pp. 1487-1500.
5. Taddei, F.*, Vulic, M., Radman, M., and Matic, I. (1997). Stress and mutagenesis in bacteria. In *Stress, adaptation and evolution*, K. Bijlsma and V. Loeschcke, eds. (Basel: Birkhäuser). 271-290.
6. Bangham, C.*, Anderson, R.M., Baquero, F., Bax, R., Hastings, I., Koella, J., Lipsitch, M., McLean, A., Taddei, F. and Levin, B., (1997). Group report: Evolution of infectious diseases: the impact of vaccines, drugs and social factors. In *Evolution in health and disease* S. Stearns eds. (Oxford: Oxford University Press). p 152-160.

7. Read*, A., Aaby, P., Antia, R., Ebert, D., Ewald, P., Gupta, S., Holmes, E., Moxon, R., Sasaki, A., Shields, D. and Taddei, F. (1997). Group report: What can evolutionary biology contribute to understanding virulence? In *Evolution in health and disease* S. Stearns eds. (Oxford: Oxford University Press). p 205-215.
8. TaMaRa (Taddei, F., Matic, I., and Radman, M.) (2000) . SOS génome : réparation et évolution. *Pour la Science* 269, 66-73.
9. Radman M., Taddei F. and Matic I. (2000) DNA repair systems and bacterial evolution. *Cold Spring Harbour symposia on Quantitative Biology*. Vol. LXV. 1-9
10. Livio Riboli-Sasco, Alice Richard, François Taddei, "Science Academie": Raising Scientific Passions and Fostering a New Social Link 163 - 171 2007 in *Science Education: Models and Networking of Student Research Training under 21, NATO Security through Science Series - E: Human and Societal Dynamics*.
11. Ariel B. Lindner, Francois Taddei : Forming the Next Generation of European Interdisciplinary Scientists 172 - 182 2007 in *Science Education: Models and Networking of Student Research Training under 21, NATO Security through Science Series - E: Human and Societal Dynamics*
- 12 Riboli-Sasco, L., Brown, S. P, Taddei, F, Why teach? 2008, The evolutionary origins and ecological consequences of costly information transfer, in [*Sociobiology of Communication an interdisciplinary perspective*](#), d'Ettorre P and HughesD. P, Oxford University Press, Oxford
- 13 Taddei, F: Training creative and collaborative knowledge-builders : a major challenge for 21st century education, 2009 report written for OECD on the future of education. <http://www.cri-paris.org/docs/ocde-francois-taddei-fev2009.pdf>
- 14 Taddei F., Riboli-Sasco L. [Proposing measures to promote the education of creative and collaborative knowledge-builders](#) In: *Measuring Creativity: the book*. ed. / E. Villalba. European Commission, 2010. p. 369-389

CONFERENCES

Every year FT gives more than a dozen conferences or seminars in congresses or in research institutions belonging to different european countries or to USA, Canada, China, Korea, India, Japan, Qatar or Brasil (e.g. in november 2011 he gave lectures in *World Innovation Summit for Education* and *World Science Forum on the future of learning through research*)

OTHER

Member of the different french (medical research council = *INSERM*) or american (*NIH*) study sections or committees (including the ethic committee from *INSERM*)

Organizer of conference on the cost of antibiotic resistance (*Pasteur Institute* Paris 1999)

Coordinator 1998-2001 of a multidisciplinary program of the french ministry of research including MDs, ecologist population geneticist, molecular geneticist on the role of enhanced genetic variability on evolution of infectious disease and on the emergence of antibiotic resistance

Organizer in September 2005 of an interdisciplinary conference on « innovations » for the *Institut des Hautes Etudes Scientifiques* in Bures/Yvette, France, which hosts 7 Fields medals.

Organizer of an *EMBO* meeting on prokaryot complexity in 2006 in Heidelberg.

Organizer of summer schools & workshops in France, Croatia and China since 2007 on topics including: interdisciplinary approaches to longevity, education 2.0, science 2.0, scientific discovery games and open science.

Multiple Interviews with journalists from newspapers, TV and radio, see for instance :
<http://www.cri-paris.org/en/accueil-cri/education-2.0/>
<http://www.cri-paris.org/en/accueil-cri/cri-dans-la-presse/>

Speaker at TEDx Paris 2010: <http://www.tedxparis.com/2010/francois-taddei>

Referee for different journals including *PloS Biol*, *Nature*, *PNAS* and *Science*.