

CURRICULUM VITAE:



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1.- ACADEMIC FORMATION:

1. Degree in Biological Sciences (Biochemistry), Universitat de València. 1985-1990.
2. Master Thesis titled "Phylogenetic analysis of viroids and viroidlike RNA satellites. Study of its variability". Universitat de València. 1990.
3. Postgraduate Course in "Use of networks and databases in Molecular Biology". Universitat de València. 1992.
4. Ph.D. in Molecular and Evolutionary Genetics. Dissertation thesis titled "Evolution of biological fitness in experimental populations of vesicular stomatitis virus". Universitat de València. 1991-1995.

2.- PROFESSIONAL EXPERIENCE

1. 1991 System Manager, Bioinformatics Service, Universitat de València
2. October 1st, 1991 to September 30th, 1995. PhD Student Fellow, Department of Genetics, Universitat de València
3. June 1st to August 31st, 1994. Visiting scientist, Department of Biology, University of California San Diego.
4. October 1st, 1995 to September 30th, 1997. Postdoctoral Fellow, Center for Microbial Ecology, Michigan State University.
5. October 1st to December 10th, 1997. Associate Researcher, Center for Microbial Ecology, Michigan State University.
6. October 17th, 1997 to September 3rd, 2001. Assistant Professor of Genetics and Evolution, Department of Genetics, Universitat de València.
7. September 3rd, 2001 to June 31st, 2002. Associate Professor of Population Genetics, Institut *Cavanilles* de Biodiversitat i Biologia Evolutiva, Universitat de València. Leave of absence.
8. July 1st, 2002 to May 1st, 2006. Senior Scientist, Instituto de Biología Molecular y Celular de Plantas, Consejo Superior de Investigaciones Científicas.
9. July 8th, 2002 to October 8th, 2002. Visiting Professor, Department of Microbiology and Molecular Genetics, Michigan State University.
10. Since May 2nd, 2006. Research Professor, Instituto de Biología Molecular y Celular de Plantas, Consejo Superior de Investigaciones Científicas.
11. Since June 1st, 2008. External Professor, Santa Fe Institute, Santa Fe (NM), USA.

3.- PUBLICATIONS:

Hirsch's *h* index: 29 (as in March 26th, 2008)

1. Rodríguez-Cerezo, E., Elena, S.F., Moya, A. and García-Arenal, F. (1991) High genetic stability in natural populations of the plant RNA virus U5-TMV. *J. Mol. Evol.* **32**: 328-332.
2. Elena, S.F., Dopazo, J., Diener, T.O., Flores, R. and Moya, A. (1991) Phylogeny of viroids, viroid-like satellite RNAs and the viroid-like domain of Human Hepatitis Delta virus" *Proc. Natl. Acad. Sci. USA* **88**: 5631-5634.
3. Elena, S.F. and Moya, A. (1991) Some evolutionary parameters of viroids and viroidlike satellite RNAs. *Rev. Ciènc.* **8**: 9-15.
4. Elena, S.F., González-Candelas, F. and Moya, A. (1992) Does the VP1 gene of Foot-and-Mouth Disease Virus behave as a molecular clock?. *J. Mol. Evol.* **35**: 223-229.
5. Hernández, C., Elena, S.F., Moya, A. and Flores, R. (1992) Pear blister canker viroid is a member of the apple scar skin subgroup (apscaviroids) and has also sequence homologies with viroids from other subgroups. *J. Gen. Virol.* **73**: 2503-2507.
6. Quinones, S., Bernal, D., García-Sogo, M., Elena, S.F. and Saus, J. (1992) Exon/intron structure of the human $\alpha 3$ (IV) gene encompassing the Goodpasture antigen ($\alpha 3$ (IV)NC1): Identification of a potentially antigenic region at the triple helix/NC1 domain junction. *J. Biol. Chem.* **267**: 19780-19784. A correction in *J. Biol. Chem.* **269**: 17358 (1994).
7. Hernández, C., Daròs, J.A., Elena, S.F., Moya, A. and Flores, R. (1992) The strands of both polarities of a circular RNA from carnation self-cleave *in vitro* through alternative double- and single- hammerhead structures. *Nucl. Acids Res.* **20**: 6323-6329.
8. Clarke, D.K., Duarte, E.A., Moya, A., Elena, S.F., Domingo, E., and Holland, J.J. (1993) Genetic bottlenecks and population passages cause profound fitness differences in RNA viruses. *J. Virol.* **67**: 222-228.
9. Duarte, E. A., Clarke, D.K., Moya, A., Elena, S.F., Domingo, E. and Holland, J.J. (1993) Many trillionfold amplification of single RNA virus particles fails to overcome the Muller's ratchet effect. *J. Virol.* **67**: 3620-3623.
10. Elena, S.F., Marcos, J.F., Dopazo, J., Flores, R. and Moya, A. (1994) The viroid sequences showed intramolecular correlataion and the hability to form pseudoknots and tetraloops. In *Biología Computacional*, A. Moya (ed.), pp: 163-175. Servei de Publicacions, Universitat de València. ISBN 8437013208.
11. Clarke, D.K., Duarte, E.A., Elena, S.F., Moya, A., Domingo, E. and Holland, J.J. (1994) The Red Queen reigns in the kingdom of RNA viruses. *Proc. Natl. Acad. Sci. USA* **91**: 4821-4824.
12. Duarte, E.A., Novella, I.S., Ledesma, S., Clarke, D.K., Moya, A., Elena, S.F., Domingo, E. and Holland, J.J. (1994) The subclonal components of consensus fitness in an RNA virus clone. *J. Virol.* **68**: 4295-4301.
13. Duarte, E.A., Novella, I.S., Weaver, S.C., Domingo, E., Wain-Hobson, S., Clarke, D.K., Moya, A., Elena, S.F., de la Torre, J.C. and Holland, J.J. (1994) RNA virus quasispecies: significance for viral disease and epidemiology. *Infect. Agents Dis.* **3**: 201-214.
14. Novella, I.S., Elena, S.F., Moya, A., Domingo, E. and Holland, J.J. (1995) Size of genetic bottleneck leading to virus fitness loss is determined by mean initial population fitness. *J. Virol.* **69**: 2869-2872.
15. Novella, I.S., Duarte, E.A., Elena, S.F., Moya, A., Domingo, E. and Holland, J.J. (1995) Exponential increases of RNA virus fitness during repeated transmission. *Proc. Natl. Acad. Sci. USA* **92**: 5841-5844.

16. González-Candelas, F., Elena, S.F. and Moya, A. (1995) Approximate variance of nucleotide divergence between two sequences when restriction fragment data are available. *Genetics* **140**: 1443-1446.
17. Novella, I.S., Clarke, D.K., Quer, J., Duarte, E.A., Lee, C.H., Weaver, S.C., Elena, S.F., Moya, A., Domingo, E. and Holland, J.J. (1995) Extreme fitness differences in mammalian and insect hosts after continuous replication of vesicular stomatitis virus in sandfly cells. *J. Virol.* **69**: 6805-6809.
18. Elena, S.F., González-Candelas, F., Novella, I.S., Duarte, E.A., Clarke, D.K., Domingo, E., Holland, J.J. and Moya, A. (1996) Evolution of fitness in experimental populations of vesicular stomatitis virus. *Genetics* **142**: 673-679.
19. Elena, S. F. (1996) Evolution of biological fitness in experimental populations of vesicular stomatitis virus. Servei de Publicacions, Universitat de València. ISBN 8437022223.
20. Elena, S.F., Cooper, V.S. and Lenski, R.E. (1996) Punctuated evolution caused by selection of rare beneficial mutations. *Science* **272**: 1802-1804.
21. Domingo, E., Escarmís, C., Sevilla, N., Moya, A., Elena, S.F., Quer, J., Novella, I.S. and Holland, J.J. (1996) Basic concepts in RNA virus evolution. *FASEB J.***10**: 859-864.
22. Novella, I.S., Celnis, M. Elena, S.F., Kohn, J., Moya, A., Domingo, E. and Holland, J.J. (1996) Large population passages of vesicular stomatitis virus in interferon-treated cells select variants of only limited resistance. *J. Virol.***70**: 6414-6417.
23. Novella, I.S., Elena, S.F., Moya, A., Domingo, E. and Holland, J.J. (1996) Repeated transfer of small RNA virus populations leading to balanced fitness with infrequent stochastic drift. *Mol. Gen. Genet.* **252**: 733-738.
24. Elena, S.F., Cooper, V.S. and Lenski, R.E. (1996) Mechanisms of punctuated evolution—Reply. *Science* **274**: 1749-1750.
25. Elena, S.F., Moya, A. and González-Candelas, F. (1996) About the simulation of Molecular Evolution processes: considerations about the derivation and checking of a nucleotide divergence variance estimator when restriction fragment data are available. *Qüestió* **20**: 327-344.
26. Elena, S.F., Miralles, R. and Moya, A. (1997) Frequency-dependent selection in a mammalian RNA virus. *Evolution* **51**: 984-987.
27. Miralles, R., Moya, A. and Elena, S.F. (1997) Is group selection a factor modulating the virulence of RNA viruses?. *Genet. Res., Camb.* **68**. 165-172.
28. Elena, S.F. and Lenski, R.E. (1997) Long-term experimental evolution in *Escherichia coli*. VII. mechanisms maintaining the genetic variability within populations. *Evolution* **51**: 1058-1067.
29. Elena, S.F. and Lenski, R.E. (1997) Test of synergistic interactions between deleterious mutations in bacteria. *Nature* **390**: 395-398.
30. Elena, S.F., Dávila, M., Novella, I.S., Holland, J.J., Domingo, E. and Moya, A. (1998) Evolutionary dynamics of fitness recovery from the debilitating effects of Muller's ratchet. *Evolution* **52**: 309-314.
31. Elena, S.F., Ekunwe, L., Hajeela, N., Oden, S.A. and Lenski, R.E. (1998) Distribution of fitness effects caused by random insertion mutations in *Escherichia coli*. *Genetica* **102-103**: 359-367. Reedited in *Contemporary Issues in Genetics and Evolution*. (Eds. R.C. Woodruff and J.N. Thomson, Jr.). Kluwer Academic Publishers.

32. Miralles, R., Moya, A. and Elena, S.F. (1999) Effect of population patchiness and migration rates on the adaptation and divergence of vesicular stomatitis virus quasispecies populations. *J. Gen. Virol.* **80**: 2051-2059.
33. Miralles, R., Gerrish, P.J., Moya, A. and Elena, S. F. (1999) Clonal interference and the evolution of RNA virus. *Science* **285**: 1745-1747.
34. Elena, S.F. and Moya, A. (1999) Rate of deleterious mutation and the distribution of its effects on fitness in vesicular stomatitis virus. *J. Evol. Biol.* **12**: 1078-1088.
35. Elena, S.F. (1999) Little evidence for synergism among deleterious mutations in a non-segmented RNA virus. *J. Mol. Evol.* **49**: 703-707.
36. Elena, S.F., Miralles, R., Cuevas, J.M., Turner, P.E. and Moya, A. (2000) The two faces of mutation: extinction and adaptation in RNA viruses. *IUBMB Life*. **49**: 5-9.
37. Miralles, R., Moya, A. and Elena, S.F. (2000) Diminishing returns of population size in the rate of RNA virus adaptation. *J. Virol.* **74**: 3566-3571.
38. de la Peña, M., Elena, S.F. and Moya, A. (2000) Effect of deleterious mutation-accumulation on the fitness of RNA bacteriophage MS2. *Evolution* **54**: 686-691.
39. Moya, A., Elena, S.F., Bracho, M.A., Miralles, R. and Barrio, E. (2000) The evolution of RNA viruses: Population Genetics view. *Proc. Natl. Acad. Sci. USA.* **97**: 6967-6973. Reedited in *Variation and Evolution in Plants and Microorganisms*. (Eds. F.J. Ayala, W.M. Fitch and M.T. Clegg). National Academy of Sciences Press.
40. Turner, P.E. and Elena, S.F. (2000) Cost of host radiation in an RNA virus. *Genetics*. **156**: 1465-1470.
41. Elena, S.F., Dopazo, J., de la Peña, M., Flores, R., Diener, T.O. and Moya, A. (2001) Phylogenetic analysis of viroid and viroid-like satellite RNAs from plants: a reassessment. *J. Mol. Evol.* **53**: 155-159.
42. Elena, S.F., Sanjuán, R., Bordería, A.V. and Turner, P.E. (2001) Transmisión bottlenecks and the evolution of fitness in rapidly evolving RNA viruses. *Infect. Genet. Evol.* **1**: 41-48.
43. Miralles, R., Ferrer, R., Solé, R.V., Moya, A. and Elena, S.F. (2001) Multiple infection dynamics has pronounced effects on the fitness of RNA viruses. *J. Evol. Biol.* **14**: 654-662.
44. Elena, S.F. and Lenski, R.E. (2001) Epistasis between new mutations and genetic background, and a test of genetic canalisation. *Evolution* **55**: 1746-1752.
45. Elena, S.F. (2001) Evolutionary consequences and costs of plasmid-borne resistance to antibiotics. Chap. 11 in *Antibiotic Development and Resistance*, (eds. D. Hughes y D. Andersson). Harwood Academic Publishers. Pp. 163-180.
46. Elena, S.F. (2001) Evolutionary history conditions the timing of transmission in vesicular stomatitis virus. *Infect. Genet. Evol.* **1**: 151-159.
47. Fares, M.A., Ruiz-González, M.X., Moya, A., Elena, S.F. and Barrio, E. (2002) Endosymbiotic bacteria: GroEL buffers against deleterious mutations". *Nature* **417**: 398.
48. Elena, S.F., Sanjuán, R., Bordería, A.V. and Turner, P.E. (2002) Differential effects of vertical and horizontal transmission in the fitness of an RNA virus: A reanalysis. *Infect. Genet. Evol.* **1**: 307-309
49. Elena, S.F. (2002) Environmental restrictions to viral adaptation: an experimental approach. *Antoine van Leeuwenhoek* **81**: 135-142.

50. Elena, S.F. (2002) Evolution and adaptation of RNA viruses. *Investigación y Ciencia* (spanish edition of *Scientific American*) **313**: 46-55. Reedited in *Temas Investigación y Ciencia. Virus y Bacterias* **48**: 39-47 (2007).
51. Cuevas, J.M., Elena, S.F. and Moya, A. (2002) Molecular basis of adaptive convergence in experimental populations of RNA viruses. *Genetics* **162**: 533-542.
52. Elena, S.F. (2002) Evolution in experimental populations of RNA viruses. Chap. 26 in *Evolución: la base de la Biología*, (ed. M. Soler). Proyecto Sur Ediciones. Pp. 439-451.
53. Bordería, A.V. and Elena, S.F. (2002) r and K selection in experimental populations of vesicular stomatitis virus and the adaptation to the multiplicity of infection. *Infect. Genet. Evol.* **2**: 137-143.
54. Fares, M.A., Elena, S.F., Ortiz, J., Moya, A. and Barrio, E. (2002) A sliding window-based method to detect selective constraints in protein-coding genes and its application to RNA viruses. *J. Mol. Evol.* **55**: 509-521.
55. Saldaña, J., Elena, S.F. and Solé, R.V. (2003) Coinfection and superinfection in RNA virus populations: a selection-mutation model. *Math. Biosci.* **183**: 135-160.
56. Cuevas, J.M., Moya, A. and Elena, S.F. (2003) Evolution of RNA virus in spatially-structured heterogeneous environments. *J. Evol. Biol.* **16**: 456-466.
57. Elena, S.F., Codoñer, F.M. and Sanjuán, R. (2003) Intra-clonal variation in RNA viruses: generation, maintenance and consequences. *Biol. J. Linn. Soc.* **79**: 17-26.
58. Elena, S.F. and Lenski, R.E. (2003) Evolution experiments with micro-organisms: dynamics and genetic bases of adaptation. *Nat. Rev. Genet.* **4**: 457-469.
59. Elena, S.F., Codoñer, F.M., Cuevas, J.M. and Sanjuán, R. (2003) Adaptive dynamics during experimental evolution of RNA viruses. *Biology Int.* **44**: 75-77.
60. Elena, S.F. and de Visser, J.A.G.M. (2003) Environmental stress and the effects of mutation. *J. Biol.* **2**: 12.
61. de Visser, J.A.G.M., Hermisson, J., Wagner, G.P., Ancel-Meyers, L., Bagheri-Chaichian, H., Blanchard, J.L., Chao, L., Cheverud, J.M., Elena, S.F., Fontana, W., Gibson, G., Hansen, T.F., Krakauer, D., Lewontin, R.C., Ofria, C., Rice, S.H., von Dassow, G., Wagner, A. y Whitlock, M.C. (2003) Evolution and detection of genetic robustness. *Evolution* **57**: 1959-1972.
62. Elena, S.F. and Sanjuán, R. (2003) Climb every mountain?. *Science* **302**: 2074-2075.
63. Sanjuán, R., Moya, A. and Elena, S.F. (2004) The distribution of fitness effects caused by single-nucleotide substitutions in an RNA virus. *Proc. Natl. Acad. Sci. USA* **101**: 8396-8401.
64. Sanjuán, R., Codoñer, F.M., Moya, A. and Elena, S.F. (2004) Natural selection and the organ-specific differentiation of HIV-1 V3 hypervariable region. *Evolution* **58**: 1185-1194.
65. Sanjuán, R., Moya, A. and Elena, S. F. (2004) The contribution of epistasis to the architecture of fitness in an RNA virus. *Proc. Natl. Acad. Sci. USA.* **101**: 15376-15379.
66. Cuevas, J.M., Sanjuán, R., Moya, A. and Elena, S.F. (2005) Mode of selection and experimental evolution of antiviral drugs resistance in vesicular stomatitis virus. *Infect. Genet. Evol.* **5**: 55-65.
67. Cooper, T. F., Lenski, R. E. and Elena, S. F. (2005) Parasites and mutational load: an experimental test of a pluralistic theory for the evolution of sex. *Proc. R. Soc. B.* **272**: 311-317.
68. Elena, S.F. and Sanjuán, R. (2005) RNA viruses as complex adaptive systems. *Biosystems* **81**: 31-41.

69. Elena, S.F. and Bracho, M.A. (2005) Origin and evolution of viruses. *Mètode* **45**: 95-104.
70. Sanjuán, R., Cuevas, J.M., Moya, A. and Elena, S.F. (2005) Epistasis and the adaptability of an RNA virus. *Genetics* **170**: 1001-1008.
71. Elena, S.F., and Sanjuán, R. (2005) Adaptive value of high mutation rates in RNA viruses: separating causes from consequences. *J. Virol.* **79**: 11555-11558.
72. Codoñer, F.M., Cuevas, J.M., Sánchez-Navarro, J.A., Pallás, V. and Elena, S.F. (2005) Molecular evolution of the plant virus family *Bromoviridae* based on RNA 3 encoded proteins. *J. Mol. Evol.* **61**: 697-705.
73. Elena, S.F., Whittam, T.S., Winkworth, C.L., Riley, M.A. and Lenski, R.E. (2005) "Genomic divergence of *Escherichia coli* strains, with evidence for horizontal transfer and variation in mutation rates". *Int. Microbiol.* **8**: 271-278.
74. Codoñer, F.M., and Elena, S.F. (2006) Evolutionary relationships among members of the *Bromoviridae* deduced from whole proteome analysis. *Arch. Virol.* **151**: 299-307.
75. Elena, S.F., Carrasco, P., Daròs, J.A. and Sanjuán, R. (2006) Mechanisms of genetic robustness in RNA viruses. *EMBO Reports* **7**: 168-173.
76. Codoñer, F.M., Fares, M.A., and Elena, S.F. (2006) Adaptive covariation between the coat and movement proteins of prunus necrotic ringspot virus. *J. Virol.* **80**: 5833-5840.
77. Daròs, J.A., Elena, S.F., and Flores, R. (2006) Viroids: an Ariadne's thread into the RNA labyrinth. *EMBO Reports* **7**: 593-598.
78. Sanjuán, S.F., Forment, J., and Elena, S.F. (2006) *In silico* predicted robustness of viroids RNA secondary structures. I. The effect of single mutations. *Mol. Biol. Evol.* **23**: 1427-1436.
79. Rico, P., Ivars, P., Elena, S.F., and Hernández, C. (2006) Insights into the selective pressures restricting pelargonium flower break virus genome variability: evidences for host adaptation. *J. Virol.* **80**: 8124-8132.
80. Sanjuán, R. and Elena, S.F. (2006) Epistasis correlates to genome complexity. *Proc Natl. Acad. Sci. USA* **103**: 14402-14405.
81. Sanjuán, R., Forment, J. and Elena, S.F. (2006) *In silico* predicted robustness of viroids RNA secondary structures. II. Interaction between mutation pairs. *Mol. Biol. Evol.* **23**: 2123-2130.
82. Codoñer, F.M., Daròs, J.A., Solé, R.V. and Elena, S.F. (2006) The fittest versus the flattest: experimental confirmation of the quasispecies effect with subviral pathogens. *PLoS Pathog.* **2**(12):e136.
83. Carrasco, P., Daròs, J.A., Agudelo-Romero, P. and Elena, S.F. (2007) A real-time RT-PCR assay for quantifying the fitness of tobacco etch virus in competition experiments. *J. Virol. Meth.* **139**: 181-188.
84. de Visser, J.A.G.M. and Elena, S.F. (2007) The evolution of sex: empirical insights into the roles of epistasis and drift. *Nat. Rev. Genet.* **8**: 139-149.
85. Elena, S.F., Wilke, C.O., Ofria, C. and Lenski, R.E. (2007) Effects of population size and mutation rate on the evolution of mutational robustness. *Evolution* **61**: 666-674.
86. Martin, G., Elena, S.F. and Lenormand, T. (2007) Distribution of epistasis in microbes fit predictions from a fitness landscape model. *Nat. Genet.* **39**: 555-560.

87. Beerenwinkel, N., Pachter, L., Sturmfels, B., Elena, S.F. and Lenski, R.E. (2007) Analysis of epistatic interactions and fitness landscapes using a new geometric approach. *BMC Evol. Biol.* **7**: 60.
88. de la Iglesia, F. and Elena, S.F. (2007) Fitness declines in tobacco etch virus upon serial bottleneck transfers. *J. Virol.* **81**: 4941-4947.
89. Carrasco, P., de la Iglesia, F. and Elena, S.F. (2007) The distribution of fitness and virulence effects caused by single-nucleotide substitutions in tobacco etch virus. *J. Virol.* **81**: 12979-12984.
90. Elena, S.F. and Sanjuán, R. (2007) Virus evolution: insights from an experimental approach. *Annu. Rev. Ecol. Syst. Evol.* **38**: 27-52.
91. Elena, S.F., and Codoñer, F.M. (2007) Bioinformatic tools in phytopathology. Chap. 2 in *Herramientas Biotecnológicas en Fitopatología*, (eds. V. Pallás, P. Rodríguez-Valenzuela, J.F. Marcos, and C. Escobar) pp: 109-134. Mundi Prensa.
92. Sardanyés, J., Elena, S.F. and Solé, R.V. (2008) Simple quasispecies models for the survival-of-the-flattest effect: the role of space. *J. Theor. Biol.* **250**: 560-568.
93. Herranz, M.C., Al Rwahnih, M., Sánchez-Navarro, J.A., Elena, S.F., Choueiri, E., Myrta, A. and Pallás, V. (2008) Low genetic variability in the coat and movement proteins of *American plum line pattern virus* from different geographic origins. *Arch. Virol.* **153**: 367-373.
94. Agudelo-Romero, P. and Elena, S.F. (2008) The degree of plant resilience to infection correlates with virus virulence and host-range. *Span. J. Agricult. Res.* **6**: 160-169.
95. Fiore, N., Fajardo, T.V.M., Prodan, S., Herranz, M.C., Aparicio, F., Montealegre, J., Elena, S.F., Pallás, V. y Sánchez-Navarro, J. (2008) Genetic diversity of the movement and coat protein genes of South American isolates of *Prunus necrotic ringspot virus*. *Arch. Virol.* **153**: 909-919.
96. Elena, S.F., Agudelo-Romero, P., Carrasco, P., Codoñer, F.M., Martín, S., Torres-Barceló, C. and Sanjuán, R. (2008) Experimental evolution of plant RNA viruses. *Heredity* **100**: 478-483.
97. Duran-Vila, N., Elena, S.F., Daròs, J.A., and Flores, R. (2008) Structure and evolution of viroids. Chap. 2 in *Origin and Evolution of Viruses* 2nd Edition (eds. E. Domingo, C. Parrish and J.J. Holland) pp: 43-65. Elsevier.
98. Codoñer, F.M., and Elena, S.F. (2008) The promiscuous evolutionary history of the *Bromoviridae* family. *J. Gen. Virol.* **89**: 1739-1747.
99. Agudelo-Romero, P., Carbonell, P., de la Iglesia, F., Carrera, J., Rodrigo, G., Jaramillo, A., Pérez-Amador, M.A. and Elena, S.F. (2008) Changes in the gene expression profile of *Arabidopsis thaliana* after infection with *Tobacco etch virus*. *Virol. J.* **5**: 92.
100. Agudelo-Romero, P., Carbonell, P., Pérez-Amador, M.A., and Elena, S.F. (2008) Virus adaptation by manipulation of host's gene expression. *PLoS ONE*. **3**(6): e2397.
101. Clune, J., Misevic, D., Ofria, C., Lenski, R.E., Elena, S.F., and Sanjuán, R. (2008) Natural selection fails to optimize mutation rates for long-term adaptation on rugged fitness landscapes. *PLoS Comput. Biol.* **4**(9): e1000187.
102. Elena, S.F. and Sanjuán, R. (2008) The effect of genetic robustness on evolvability in digital organisms. *BMC Evol. Biol.* **8**: 284.

103. Torres-Barceló, C., Martín, S., Daròs, J.A. and Elena, S.F. (2008) From hypo- to hyper-suppression: Effect of amino acid substitutions on the RNA silencing suppressor activity of *Tobacco etch virus* HC-Pro. *Genetics* **180**: 1039-1049.
104. Agudelo-Romero, P., de la Iglesia, F. and Elena, S.F. (2008) The pleiotropic cost of host-specialization in *Tobacco etch potyvirus*. *Infect. Genet. Evol.* **8**: 806-814.
105. Lin, S.S., Wu, H.W., Elena, S.F., Chen, K.C., Niu, Q.W., Yeh, S.D., Chen, C.C. and Chua, N.M. (2009). "Molecular evolution of a viral non-coding sequence under the selective pressure of amiRNA-mediated silencing". *PLoS Pathog.* **In press**.
106. Sanjuán, R., Agudelo-Romero, P. and Elena, S.F. (2009). Upper-limit mutation rate estimation for a plant RNA virus. *Biol. Lett.* **In press**.
107. Sardanyés, J., Solé, R.V. and Elena, S.F. (2008). Robustness to mutations depends on whether RNA virus replication occurs geometrically or via a stamping machine. SFI Working Paper 08-12-050.

4.- CONFERENCES:

1. Rodríguez-Cerezo, E., Elena, S.F., Moya, A. and García-Arenal, F. (1989) Variability and evolution of field isolates of plant RNA viruses. 2nd International Symposium on Positive Strand RNA Viruses. Viena (Austria).
2. Elena, S.F., Dopazo, J., Flores, R. and Moya, A. (1990) A first phylogeny of viroids. II Congreso Nacional de Virología. Valladolid (Spain).
3. Dopazo, J., Elena, S.F., Flores, R. and Moya, A. (1990). A first phylogeny of viroids and viroid-like satellite RNAs. International Meeting on Biology: Genome expression and pathogenesis of plant RNA viruses. Fundación Juan March. Madrid (Spain).
4. Elena, S.F., Dopazo, J., Flores, R., Diener, T.O. and Moya, A. (1990) A phylogenetic reconstruction for viroids and viroid-like satellite RNAs. VIIIth International Congress of Virology (ICV-90). Berlin (Germany).
5. Elena, S.F., Flores, R. and Dopazo, J. (1990) Study of the intraspecific variability of viroids. XXV Jornadas de Genética Luso-Españolas. Alcalá de Henares (Spain).
6. González-Quintanilla, M., Elena, S.F., Buades, C., Dopazo, J. and Moya, A. (1990) Analysis of the variability of viroids and viroidlike RNA satellites. XXV Jornadas de Genética Luso-Españolas. Alcalá de Henares (Spain).
7. Elena, S.F., Rubio, L., González-Candelas, F., Domingo, E. and Moya, A. (1991) Does the phylogeny of Foot-and-Mouth Disease Virus behave as a molecular clock?. International Meeting on Biology: Workshop on Coevolution of viruses, their hosts and vectors. Fundación Juan March. Madrid (Spain).
8. Elena, S.F., Marcos, J.F., Dopazo, J., Flores, R. and Moya, A. (1992) The sequences of viroids shwon intramolecular correlation and the potential to form pseudokonts and tetraloops. III Congreso Nacional de Virología. Barcelona (Spain).
9. Elena, S.F., Muñoz, A., Domingo, E. and Moya, A. (1992) A stochastic model to predict the genetic variability during a viral infection. III Congreso Nacional de Virología. Barcelona (Spain).
10. Hernández, C., Elena, S.F., Moya, A. and Flores, R. (1992) The peach blister cranker viroid has the central conserved region of *apscaviroids* and homologous sequences with other viroidal subgroups. III Congreso Nacional de Virología. Barcelona (Spain).

11. Nieto, A., Elena, S.F., Sentandreu, R. and del Castillo, L. (1992) Isolation and sequentiation of *SEC18* gen of *Candida albicans*. Biotec-92. Santiago de Compostela (Spain).
12. Member of the organization comitee of the I Reunión Nacional about "Computational analysis of the structure and evolution of biological macromolecules". Valencia (Spain), (1992).
13. Moya, A., Buades, C., Elena, S.F., González-Candelas, F., Barrio, E. and Latorre, A. (1992) The resolution of three evolutionary problems by means of the maximum-likelihood phylogenetic reconstruction method. I Reunión Nacional about "Computational analysis of the structure and evolution of biological macromolecules". Valencia (Spain).
14. Moya, A., Latorre, A., González, A., Carrió, R., Elena, S.F., Fernández-Pedrosa, V. and Martínez-Torres, D. (1993) The Population Genetics as the theoretical framework of Molecular Evolution: some examples. IX Seminarios de Genética de Poblaciones y Evolución. Granada (Spain).
15. Elena, S.F., Flores, R. and Moya, S. (1993) Phylogenetic evidence supports the concept that viroid and viroidlike satellite RNAs are relics of the RNA world. 7th ISSOL Meeting, 10th International Conference on the Origin of Life. Barcelona (Spain).
16. Elena, S.F., Flores, R. and Moya, A. (1993) Statistical evaluation of recombination events in viroids evolution. IXth International Congress of Virology (ICV-93). Glasgow (Scotland).
17. Elena, S.F., Clarke, D.K., Duarte, E.A., Domingo, E., Holland, J.J. and Moya, A. (1993) Rate of fitness evolution of VSV under different population dynamics. IXth International Congress of Virology (ICV-93). Glasgow (Scotland).
18. Moya, A., Bracho, A. and Elena, S.F. (1994) How much experimental confirmation of Population Genetical theories could be obtained with RNA viruses as model?. XXIX Jornadas de Genética Luso-Españolas. Lleida (Spain).
19. Assistance to the X Seminarios de Genética de Poblaciones y Evolución. Miraflores de la Sierra (Spain), (1995).
20. González-Candelas, F., Elena, S.F. and Moya, A. (1995) About the simulation of molecular evolutionary processes. V Conferencia española de Biometría. Valencia (Spain).
21. Elena, S.F., Cooper, V.S. and Lenski, R.E. (1996) Punctuated equilibria of quantitative characters caused by periodic selection in experimental populations of *Escherichia coli*. 19th Midwest Ecology and Evolution Conference. East Lansing, MI (USA).
22. Elena, S.F., Cooper, V.S. and Lenski, R.E. (1996) Punctuated equilibria of quantitative characters caused by periodic selection in experimental populations of *Escherichia coli*. 50th Annual Meeting of the American Sociaties for the Study of Evolution and Systematic Biologists. Saint Louis, MO (USA).
23. Elena, S.F. and Lenski, R.E. (1996) Mechanisms maintaining the genetic variability within populations in *Escherichia coli*. Forum on Environmental Remediation & Environmental Toxicology and Microbial Ecology Forum. Lansing, MI (USA).
24. Oden, S.A., Elena, S.F. and Lenski, R.E. (1996) Synergistic interactions and distribution of mutational effects on the fitness of *Escherichia coli*. Forum on Environmental Remediation & Environmental Toxicology and Microbial Ecology Forum. Lansing, MI (USA).
25. Elena, S.F., Cooper, V.S. and Lenski, R.E. (1996) Punctuated evolution caused by selection of rare beneficial mutations. Forum on Environmental Remediation & Environmental Toxicology and Microbial Ecology Forum. Lansing, MI (USA).

26. Moya, A., Bracho, A., Miralles, R., Barrio, E. and Elena, S.F. (1996) The population genetics of RNA viruses. Workshop on RNA viral quasispecies. International Meeting on Biology. Fundación Juan March. Madrid (Spain).
27. Miralles, R., Elena, S.F. and Moya, A. (1996) Is group selection a factor modulating the virulence of RNA viruses?. International Meeting on Biology. Workshop on RNA viral quasispecies. Fundación Juan March. Madrid (Spain).
28. Elena, S.F. and Lenski, R. E. (1997) Test of synergistic interactions among deleterious mutations in bacteria. 51th Annual Meeting of the American Societies of Naturalists, Systematic Biologists and for the Study of Evolution. Boulder, CO (USA).
29. Elena, S.F. and Lenski, R. E. (1997) Distribution of fitness effects caused by the random insertion of transposons into the genome of *Escherichia coli*. Gordon Research Conferences on Microbial Population Biology. Plymouth, NH (USA).
30. Gerrish, P.J. and Elena, S.F. (1998) Life history evolution of HIV. Alcalá 1st International Conference on Mathematical Ecology. Alcalá de Henares (Spain).
31. Elena, S.F., Lenski, R.E. and Moya, A. (1998) Deleterious mutations and their effect on the fitness of microbes. XII Seminarios de Genética de Poblaciones y Evolución. Begur (Spain).
32. Elena, S.F., Miralles, R., Gerrish, P.J. and Moya, A. (1999) Clonal interference and the evolution of RNA virus. VII European Society for Evolutionary Biology Congress. Barcelona (Spain).
33. Miralles, R., Moya, A. and Elena, S.F. (1999) Differences in the evolutionary outcome induced by dynamics of coinfection and superinfection in Vesicular Stomatitis Virus. VII European Society for Evolutionary Biology Congress. Barcelona (Spain).
34. Cuevas, J.M., Miralles, R., Moya, A. and Elena, S.F. (1999) Efecto de la tasa de migración y la estructura poblacional en la adaptación y divergencia del virus de la estomatitis vesicular. II Congreso de la Sociedad Española de Genética. A Coruña (Spain).
35. Member of the organization comitee of the meeting "Evolution: from molecules to ecosystems". Valencia (Spain), (2000).
36. Elena, S.F., Turner, P.E., Cuevas, J.M. and Moya, A. (2000) Adaptive radiation of RNA viruses: host-range expansion. XIII Seminarios de Genética de Poblaciones y Evolución. Baiona (Spain).
37. Cuevas, J.M., Elena, S.F. and Moya, A. (2001) Evolutionary convergence in experimental populations of RNA viruses. VIIIth Congress of the European Society for Evolutionary Biology. Aarhus (Denemark). Poster.
38. Elena, S.F. (2001) Environmental restrictions to viral adaptation. An experimental approach. 9th International Symposium on Microbial Ecology. Amsterdam (The Netherlands). Invited talk.
39. Elena, S.F. (2001) Exploring the role of symbionine (GroEL) in buffering deleterious mutational effects during vertical transmission of bacteria. ESF/LESC Exploratory Workshop: "Long Term Evolution with Microbes". Aussois (France). Invited speach.
40. Member of the organization comitee of the "VII Congreso de la Sociedad Española de Virología". Valencia (Spain) (September 2001).
41. Cuevas, J.M., Moya, A. and Elena, S.F. (2001) Effect of migration rate and host-heterogeneity in the divergence and adaptation of the vesicular stomatitis virus. VII Congreso Nacional de Virología. Valencia (Spain). Poster.

42. Sanjuán, R., Bordería, A.V., Turner, P.E. and Elena, S.F. (2001) Bottlenecks during ribovirus transmission: evolution of biological fitness. VII Congreso Nacional de Virología. Valencia (Spain). Poster.
43. Fares, M.A., Elena, S.F., Moya, A. and Barrio, E. (2001) A new method for analyzing selective constraints in protein-coding genes based on sliding windows. III Congreso de la Sociedad Española de Genética. Seville (Spain). Poster.
44. Elena, S.F., Codoñer, F.M., and Sanjuán, R. (2002). Evolutionary genetics: lessons from bacteria and RNA viruses. Workshop on “Intraclonal Genetic Variation: Ecological and Evolutionary Aspects”, organized by The Linnean Society of London & Royal Entomological Society. London (UK). Invited talk.
45. Workshop on “Detection and Evolution of Genetic Robustness”. Santa Fe Institute. Santa Fe, NM (USA). April 2002.
46. Elena, S.F. (2002). Adaptive dynamics during experimental evolution of RNA viruses. International Symposium on “Integrative Biology and Complexity in Natural Systems”, organized by IUBS/UNESCO/CNRS. París (France). Invited talk.
47. Elena, S.F. (2002). Is viral adaptation a self-organized phenomenon?. 2nd Workshop on Viral Evolution, organized by the S. R. Nobel Foundation. Ardmore, OK (USA). Invited talk.
48. Member of the organization committee of the “XIV Seminarios de Genética de Poblaciones y Evolución”. Gandía (Valencia, Spain) (November 2002).
49. 1st Workshop of the “Red Nacional de Virología de Plantas”. Xàvea (Valencia, Spain) (March 2003).
50. Co-organizer (with G. Bell and J.A.G.M. de Visser) of the symposium “Experimental microbial evolution: the roles of sex, recombination and mutation” within the IXth of the European Society for Evolutionary Biology. Leeds (UK) (August 2003).
51. Elena, S.F. and Lenski, R.E. (2003). Experimental evolution of gene regulation and expression: the *tetAR* operon in *E. coli*. IXth European Society for Evolutionary Biology Congress. Leeds (UK). Talk.
52. Codoñer, F.M., Cuevas, J.M., Sánchez-Navarro, J.A., Pallás, V. and Elena, S.F. (2003). Molecular evolution of the plant virus family *Bromoviridae* based on RNA 3 encoded proteins. IXth European Society for Evolutionary Biology Congress. Leeds (UK). Poster.
53. Sanjuán, R., Moya, A. and Elena, S.F. (2003). Characterization of the distribution of mutational effects for an RNA virus. IXth European Society for Evolutionary Biology Congress. Leeds (UK). Poster.
54. Elena, S.F. (2003). Experimental evolution of plant viruses: disentangling the roles of mutation, selection and chance. AAB Advances in Plant Virology. Montpellier (France). Invited talk.
55. Cuevas, J.M., Moya, A. and Elena, S.F. (2003). Adaptive dynamics of RNA viruses in presence of antiviral drugs. VIII Congreso Nacional de Virología. Barcelona (Spain) Talk.
56. Codoñer, F.M., Cuevas, J.M., Sánchez-Navarro, J.A., Pallás, V. and Elena, S.F. (2003). Molecular evolution of the plant virus family *Bromoviridae* based on RNA 3 encoded proteins. VIII Congreso Nacional de Virología. Barcelona (Spain) Talk.
57. Elena, S.F., Cooper, T.F. and Lenski, R.E. (2004). Parasites and mutational load: an experimental test of a pluralistic theory for the maintenance of sex. 2nd PARTNER Workshop: Origin and spread of asexuals. European Science Foundation. Valencia (Spain). Invited talk.

58. Elena, S.F. (2004). How can microbial experimental evolution help to understand pathogens natural evolution?. VII International Meeting on Molecular Epidemiology and Evolutionary Genetics of Infectious Diseases. Valencia. Organizer.
59. Elena, S.F. (2004). Distribution of mutational effects and contribution of epistasis to fitness architecture in RNA viruses. Experimental Evolution Workshop. University of Fribourg. Fribourg (Switzerland). Invited talk.
60. Workshop on “Robustness of specialist/generalist strategies”. Santa Fe Institute. Santa Fe, NM (USA). October 2004.
61. Sanjuán, R., Moya, A. and Elena, S.F. (2004). The distribution of fitness effects caused by single-nucleotide substitutions in an RNA virus. 3rd Workshop on Viral Evolution. S. R. Nobel Foundation. Ardmore, OK (USA). Talk.
62. Sanjuán, R., Moya, A. and Elena, S.F. (2004). The contribution of epistasis to the architecture of fitness in an RNA virus. 3rd Workshop on Viral Evolution. S. R. Nobel Foundation. Ardmore, OK (USA). Talk.
63. Carrasco, P., Agudelo-Romero, P., Daròs, J.A. and Elena, S.F. (2004). Quantifying the fitness of tobacco etch Potyvirus by means of competition assays based on RT-qPCR with TaqMan. 3rd Workshop on Viral Evolution. S. R. Nobel Foundation. Ardmore, OK (USA). Poster.
64. Elena, S.F., Agudelo-Romero, S.P., Carrasco, M.P., Codoñer, F.M. and Daròs, J.A. (2004). Experimental evolution of plant viruses: ongoing projects and perspectives. XV Seminarios de Genética de Poblaciones y Evolución. Sigüenza (Spain). Talk.
65. Elena, S.F. (2005). Deleterious mutations, epistasis and the evolution of genome robustness in RNA viruses. 10^{ème} Rencontres de Virologie Végétale. Aussois (France). Invited talk.
66. Elena, S.F. (2005). Experimental evolution of RNA phytoviruses. 5th EMBO Young Investigator Program Meeting. Heidelberg (Germany). Talk.
67. EMBO Young Investigator Program 3rd Symposium on Quantitative Biology. Heidelberg (Germany) (June 2005).
68. Codoñer, F.M., Daròs, J.A., Solé, R.V. and Elena, S.F. (2005). Selection for fitness versus selection for robustness in subviral RNA phytopathogens. Congreso de la Sociedad Española de Genética. Almería. Invited talk.
69. Elena, S.F. (2005). Deleterious mutations, epistasis and the evolution of genome robustness in riboviruses. V EMBO-Spain meeting. Alicante. Invited talk.
70. Elena, S.F. (2005) What can we learn about the mechanisms of genome evolution using viroids as model system? Mathematical Biosciences Institute Workshop on Aspects of Self-Organization in Evolution. Ohio State University, Columbus, OH (USA). Invited talk.
71. Elena, S.F. (2005) Individual hypersensitivity versus population robustness in RNA viruses. Workshop on Frontiers in Evolutionary Ecology. MPI für Limnologie, Plön (Germany). Invited talk.
72. Elena, S.F. (2005) Some thoughts about virus origin and the mechanisms of viral evolution. II Symposium *Omnis Cellula* Origin of Life and Evolution. Societat Catalana de Biologia, Barcelona. Invited talk.
73. Elena S.F. March 2005 Mechanisms of genetic robustness in RNA viruses. Workshop on New Directions in Infection Biology and Immunity. MPI für Infektionsbiologie, Berlin (Germany). Invited talk.

74. Elena, S.F. May 2006. The fittest versus the flattest: experimental confirmation of the quasispecies effect with subviral pathogens. 6th EMBO YIP Meeting. Vienna (Austria). Talk.
75. Co-organizer (with A. Buckling) of the symposium "Evolutionary Ecology" within the XIth International Symposium on Microbial Ecology-ISME 11. Vienna (Austria) (August 2006).
76. Elena, S.F., Carrasco, P., Daròs, J.A., and Sanjuán, R. August 2006. Evolution of mutational robustness in RNA viruses. XIth International Symposium on Microbial Ecology-ISME 11. Vienna (Austria). Invited talk.
77. Elena, S.F. and de la Iglesia, F. 2006. Fitness declines in tobacco etch virus upon serial bottleneck transfers. 4th Workshop on Viral Evolution. S. R. Nobel Foundation. Ardmore, OK (USA). Talk.
78. III Meeting EMBO Young Investigator Program Spain. Valencia, Octubre 2006. Organizer.
79. Elena, S.F. 2006. RNA virus replicate in an always fluctuating world: organ-specific adaptation, gene flow and metapopulation structure. ESF/CONGEN Workshop: "Experimental metapopulations in evolutionary biology". Montpellier (France). Invited Talk.
80. Elena, S.F. 2007. Experimental RNA virus evolution. IXth Congreso Nacional de Virología. Zaragoza (Spain). Invited closing conference.
81. Agudelo-Romero, P., Sanjuán, R. and Elena, S.F. 2007. TEV experimental evolution: evolutionary dynamics and the molecular basis of adaptation. IXth Congreso Nacional de Virología. Zaragoza (Spain). Poster.
82. Torres-Barceló, C., Martín, S., Daròs, J.A. and Elena, S.F. 2007. RNA silencing suppression as an adaptive strategy of plant RNA viruses. IXth Congreso Nacional de Virología. Zaragoza (Spain). Poster.
83. Elena, S.F., Torres-Barceló, C., Martín, S. and Daròs, J.A. 2007. "The evolution of silencing suppression and other ways viruses have to escape from silencing". First BiosafeNET Seminar *Balancing resistance and risk: plant endogenous viral sequences and virus-resistant transgenic plants as possible sources of resistance and virus emergence*. Ca'Tron di Roncade, Italia. Invited Talk.
84. Elena, S.F. 2007. "The evolution of silencing suppression activity in multifunctional proteins encoded by plant RNA viruses". 7th EMBO YIP Meeting. Heidelberg (Germany). Talk.
85. Elena, S.F. 2007. "The evolution of silencing suppression and other ways viruses have to escape from silencing". Conferences Jacques Monod on *Evolutionary Genetics of Host-Parasite Relationships*. Roscoff, Francia. Invited Talk.
86. 3rd Meeting of the Spanish Systems Biology Network (REBS). Murcia, November 2007. Organizer.
87. Rodrigo, G., Carrera, J., Jaramillo, A. and Elena, S.F. 2007. Modeling and optimization of the interaction between RNA silencing pathway and viral suppressors of silencing. CAMDA 07 Conference. Valencia (Spain). Poster.
88. Agudelo-Romero, P., Carbonell, P., Pérez-Amador, M.A. and Elena, S.F. 2007. Virus adaptation by manipulation of host's gene expression. CAMDA 07 Conference. Valencia (Spain). Poster.
89. Elena, S.F. 2008. Viral adaptation and manipulation of the transcriptome of the host. IIM-CSIC Workshop on Systems Biology. Vigo (Spain). Invited Talk.
90. Elena, S.F. 2008. Virus evolution. 1st meeting of the PVYwide Organization. Paris (France). Invited Talk.

91. Elena, S.F. 2008. Virus fitness and host switching. Technical CIDD Workshop on virus adaptation on multi-host fitness landscapes. Center for Infectious Diseases Dynamics, Pennsylvania State University, State College, PA (USA). Invited Talk.
92. Sanjuán, R., Gago, S. and Elena, S.F. 2008. Direct estimation of mutation rate for *Chrysanthemum chlorotic mottle viroid* (CChMVd). Viroid-2008 International conference on viroids and viroid-like RNAs. Berlin (Germany). Talk.
93. Elena, S.F. 2008. Virus adaptation by manipulation of host's gene expression. 5th Workshop on Viral Evolution, organized by the S. R. Nobel Foundation. Ardmore, OK (USA). Talk.
94. Torres-Barceló, C., Martín, S., DARòs, J.A. and Elena, S.F. 2008. From hypo- to hyper-suppression: effect of amino acid substitutions on the RNA silencing suppressor activity of Tobacco etch virus HC-Pro. 5th Workshop on Viral Evolution, organized by the S. R. Nobel Foundation. Ardmore, OK (USA). Poster.
95. Agudelo-Romero, P., de la Iglesia, F. and Elena, S.F. 2008. The pleiotropic cost of host-range expansion in Tobacco etch potyvirus. 5th Workshop on Viral Evolution, organized by the S. R. Nobel Foundation. Ardmore, OK (USA). Poster.
96. Sardanyés, J., Elena, S.F. and Solé, R. 2008 "Simple quasispecies models for the survival-of-the-flattest effect: the role of space". Workshop on Spatial Evolutionary Dynamics, organizado por Institut des Systèmes Complexes. Paris (France). Talk.
97. Santa Fe Institute 2008 Annual Bussiness Network and Board of Trustees' Symposium. Santa Fe, NM (USA). Noviembre 2008. Assistance.
98. Elena, S.F. 2008 "The evolutionary genetics of plant virus emergence". *International Conference Genetic Control of Plant Pathogenic Viruses and their Vectors: Towards New Resistance Strategies*. El Puerto de Santa María (Spain). Invited Talk.
99. 4th Meeting of the Spanish Systems Biology Network (REBS). Valencia, December 2008. Organizer.
100. Elena, S.F. 2008 "Virus adaptation by manipulation of host's gene expression". 4th Meeting of the Spanish Systems Biology Network (REBS). Valencia (Spain). Talk.
101. Agudelo-Romero, P., Carbonell, P., de la Iglesia, F., Carrera, J., Rodrigo, G., Jaramillo, A., Pérez-Amador, MA. and Elena, S.F. 2008 "Changes in the gene expression profile of *Arabidopsis thaliana* after infection with *Tobacco etch virus*". 4th Meeting of the Spanish Systems Biology Network (REBS). Valencia (Spain). Poster.
102. Rodrigo, G., Carrera, J., Jaramillo, A. and Elena, S.F. 2008 "Modeling and optimization of the interaction between RNA silencing pathway and viral suppressors of silencing". 4th Meeting of the Spanish Systems Biology Network (REBS). Valencia (Spain). Poster.
103. 2009 Congress of the Spanish Genetical Society. Málaga, September 2009. Scientific board.

5.- PARTICIPATION IN FUNDED RESEARCH PROJECTS:

1. Project PB91-0051-C02-02 "Genetic variability of RNA viruses: Biological fitness of variants and the effect of deleterious mutations accumulation" funded by the Comisión Interministerial de Ciencia y Tecnología, Spain. (1992-1995). IP. Prof. Andrés Moya.

2. Project PB94-0034-C02-02 "Genetic variability of RNA viruses: Population dynamics between viral variants" funded by the Comisión Interministerial de Ciencia y Tecnología, Spain (1995-1998). IP. Prof. Andrés Moya.
3. Project PM97-0060-C02-02 "Genetic variability of RNA viruses: Molecular basis and quantification of biological fitness gains" funded by the Dirección General de Investigación Sanitaria, Spain (1998-2001). IP. Prof. Andrés Moya.
4. Project 1FD97-2328 "Molecular epidemiology of high-prevalence viral diseases: large-scale study of the hepatitis C virus in the Valencian Community" funded by the FEDER program of the European Union (2000-2002). IP. Prof. Andrés Moya.
5. Project GV01-65 "Effect of epistasis and genome complexity in the dynamics of viral evolution" funded by the Generalitat Valenciana, Spain (2002-2003). IP. Dr. Santiago F. Elena.
6. Project BMC2001-3096 "Adaptive evolution and genetic variability in viral coinfections" funded by the Ministerio de Ciencia y Tecnología, Spain (2002). IP. Prof. Andrés Moya.
7. Project BMC2003-00066 "Experimental evolution of plat viruses: characterization of mutational effects and the evolutionary implications of genome segmentation" funded by the Ministerio de Ciencia y Tecnología, Spain (2003 - 2006). IP. Dr. Santiago F. Elena.
8. Project GRUPOS03/064 for R+D consolidated groups funded by the Generalitat Valenciana (2003 - 2004). IP. Prof. Ricardo Flores.
9. Project GV04B280 "PTGS suppression as an adaptive response in plant viruses" funded by the Generalitat Valenciana, Spain (2004-2005). IP. Dr. Santiago F. Elena.
10. EMBO Young Investigator Program - MEC Special actions BFU2004-22607-E and BFU2005-23720-E/BMC (2005 - 2007). IP. Dr. Santiago F. Elena.
11. Joint Action with France HF2005-0284 "Coevolutionary synergistic interactions among phytoviruses" financed by the Spanish Ministerio de Educación y Ciencia (2006 - 2007). Spanish IP. Dr. Santiago F. Elena. French co-IP. Dr. Rémy Froissart (CNRS-INRA-CIRAD, Montpellier)
12. Project BFU2005-24995-E/BMC "Spanish Network for Systems Molecular Biology" funded by the Ministerio de Educación y Ciencia, Spain (2006 - 2007). IP. Santiago F. Elena
13. Project ACOMP06/015 Complementary funds to R+D Projects funded by the Generalitat Valenciana, Spain (2006). IP. Prof. Santiago F. Elena.
14. Project BMC2006-14819-CO2-01/BMC "Experimental evolution of plant viruses: deleterious mutations, mechanisms of genomic robustness and the evolution of the interaction with plant defence mechanisms" funded by the Ministerios de Educación y Ciencia, Spain (2007-2009). IP. Prof. Santiago F. Elena.
15. Project ACOMP07/263 Complementary funds to R+D Projects funded by the Generalitat Valenciana, Spain (2007). IP. Prof. Santiago F. Elena.
16. Joint Action with France HF2007-0098 "The interplay between mutation and adaptation across fixed or variable environments in RNA viruses" financed by the Spanish Ministerio de Educación y Ciencia (2008 - 2009). Spanish IP. Prof. Santiago F. Elena. French co-IP. Dr. Guillaume Martin (CNRS-IRD, Montpellier).
17. Project RGP12/2008 "Evolutionary implications of virus-encoded gene-silencing suppression" financed by the Human Frontier Science Program Organization. 2008-2011. IP: Santiago F. Elena.

6.- DIRECTION OF THESIS AND SUPERVISSION OF POSTDOCTORAL AND VISITING RESEARCHERS:

PhD Theses

1. M. Rosario Miralles Borrego. "Efecto del tamaño y estructuración poblacional en poblaciones experimentales del virus de la estomatitis vesicular (VSV)". May 9th, 2000. Qualification: Excellent *Cum Laude*.
2. José M. Cuevas Torrijos "Restricciones adaptativas durante la evolución experimental del virus de la estomatitis vesicular (VSV)". September 24th, 2003. Qualification: Excellent *Cum Laude*.
3. Rafael Sanjuán Verdeguer. "Robustez genética, epistasia y evolución de los virus de RNA". February 15th, 2005. Qualification: Excellent *Cum Laude*.
4. Francisco M. Codoñer Cortés. "Evolución molecular y relaciones taxonómicas de la familia *Bromoviridae* de virus de plantas". September 15th, 2006. Qualification: Excellent *Cum Laude*.
5. S. Patricia Agudelo Romero. Fellow from the Spanish Ministerio de Educación y Ciencia, 2004-.
6. Clara Torres Barceló. Fellow from the Generalitat Valenciana, 2004-.
7. Guillermo Rodrigo Tárrega. Fellow from the Generalitat Valenciana, 2007-.
8. Javier Carrera Montesinos. 2007-.
9. Nicolas Tromas. Fellow from the Spanish Ministerio de Educación y Ciencia, 2007-.
10. Jasna Lalic. Fellow from the JAE-CSIC, 2008-.
11. Guillaume Lafforgue. 2008-.

Master Theses

1. M. Rosario Miralles Borrego. "Caracterización de los niveles de selección en poblaciones experimentales del virus de la estomatitis vesicular". December 18th, 1995. Universitat de València. Qualification: Excellent.
2. Rafael Sanjuán Verdeguer. "Pruebas estadísticas para filogenias obtenidas mediante matrices de distancias: cómo evaluar las ramas cuando otros métodos no son aplicables". September 15th, 2002. Universitat de València. Qualification: Excellent.
3. Francisco Manuel Codoñer Cortés. "Estructura poblacional intra-paciente del HIV-1". September 15th, 2002. Universitat de València. Qualification: Excellent.
4. Clara Torres Barceló. "La supresión del silenciamiento génico post-transcripcional como estrategia evolutiva de los virus de plantas". December 14th, 2005. Universitat de València. Qualification: Excellent.
5. Josep Sardanyes Cayuela. "Error threshold and sensitivity to mutations depend on whether RNA virus replication occurs geometrically or via a stamping machine". June 30th, 2008. Universitat Pompeu Fabra. Qualification: Excellent.

Postdoctoral students

1. Dr. Paul E. Turner. Postdoctoral student. Postdoctoral fellow from the National Academy of Sciences-NATO, 1999.
2. Dr. M. Purificación Carrasco Valero. Postdoctoral associated. September 2003 – Decembre 2007 + November 2008 - .
3. Dr. Rafael Sanjuán Verdeguer. Postdoctoral I3P CSIC research associate. April 2005-December 2007.
4. Dr. Susana Martín García. Postdoctoral fellow from the Juan de la Cierva program (MEC). January 2006 – December 2008.

Visiting scientists

1. Dr. Howard Ochman. Sabbatic from the University of Arizona. August 2000 – January 2001.
2. Antonio V. Bordería Giner. PhD student. Fellow from the Spanish National Institutes of Health (ISCIII), January-July 2001.
3. Sherri Goings. PhD student Michigan State University. January-June 2007.
4. Jeffrey Clune. PhD student. Michigan State University. January-July 2007.
5. Guillaume Lafforgue. FEMS Fellow. September-December 2007.
6. Jasna Lalic. FEMS Fellow. September-December 2007.

7.- INVITED TALKS:

1. "Viroids, viroidlike domain of the hepatitis δ factor and RNA satellites: study of primitive living forms". July 30th, 1991. Centro de Biología Molecular Severo Ochoa (Madrid, Spain).
2. "Evolutionary Biology of RNA viruses". November 20th, 1991. Ecology and Evolutionary Biology Program, Michigan State University (East Lansing MI, USA).
3. "Beneficial and deleterious mutations in microbes". March 3rd, 1999. Instituto Gulbenkian do Ciência (Oeiras, Portugal).
4. "Deleterious mutations, epistasis and sex in bacteria and RNA virus". March 9th, 1999. Centro Nacional de Biología Fundamental, Instituto de Salud Carlos III (Majadahonda, Spain).
5. "Deleterious mutations, epistasis and sex in bacteria and RNA virus". April 9th, 1999. Instituto de Biología Molecular y Celular de Plantas (València, Spain).
6. "The two faces of mutation: extinction and adaptation in viruses". November 22nd, 1999. Caja de Ahorros del Mediterráneo (València, Spain).
7. "The two faces of mutation: extinction and adaptation in viruses". March 23rd, 2000. Caja de Ahorros del Mediterráneo (Torrent, Spain).
8. "Experimental evolution in viruses: Is there a limit to viral adaptation? We hope so!". October 20th, 2000. Institut für Tierzucht und Genetik, Veterinärmedizinische Universität Wien.
9. "Extinction and adaptation in the viral world". February 1st, 2001. Department of Ecology and Evolutionary Biology, University of Arizona (Tucson AZ, USA).

10. "Why endosymbiotic bacteria had not got extincted a thousand and one times by genomic mutational load?". February 1st 2002. Instituto de Biología Molecular y Celular de Plantas (València, Spain).
11. "Adaptive dynamics during experimental evolution of RNA viruses". May 30th, 2002. Centre d'Etudes sur le Polymorphisme des Micro-Organismes (CNRS-IRD, Montpellier, France).
12. "Experimental evolution of RNA viruses: exploring the roles of mutation, selection and chance". March 10th, 2004. Instituto de Biomedicina de Valencia (València, Spain).
13. "Experimental RNA virus evolution". May 25th, 2004. Friedrich Miescher Institute (Novartis) (Basel, Switzerland).
14. "Distribution of mutational effects and contribution of epistasis to the genetic architecture of RNA virus fitness". April 15th, 2005. IRSI-Caixa Foundation (Badalona, Spain).
15. "Individual hypersensitivity versus population robustness in RNA virus". November 9th, 2005. Centre d'Ecologie Fonctionnelle et Evolutive (CNRS, Montpellier, France).
16. "Individual hypersensitivity versus population robustness in RNA viruses". February 6th, 2006. Sainsbury Laboratory-John Innes Center (Norwich, UK).
17. "Mecanismos de robustez mutacional en virus de RNA". February 10th, 2006. Department of Biotechnology, Universidad Complutense de Madrid (Madrid, Spain).
18. "Individual hypersensitivity versus population robustness in RNA viruses". February 17th, 2006. Department of Biology, National University of Ireland (Maynooth, Ireland).
19. "Mecanismos de robustez mutacional en virus de RNA". May 11st, 2006. Centro Nacional de Biotecnología, CSIC (Madrid, Spain).
20. "Mechanisms of mutational robustness in RNA viruses". July 5th, 2006. Amsterdam Medical Center (Amsterdam, The Netherlands).
21. "Mechanisms of genetic robustness in RNA viruses". September 19th, 2006. MPI for Developmental Biology (Tübingen, Germany).
22. "Neutrality and robustness in RNA subviral pathogens: *in silico* and *in vivo* studies". September 21st, 2006. Institute for Evolution and Biodiversity, University of Münster (Münster, Germany).
23. "Genomic complexity and mutational robustness". November 24th, 2006. Centro Andaluz de Biología del Desarrollo, CSIC-UPO (Seville, Spain).
24. "Una aproximación experimental a la evolución viral: desentrañando los papeles de la mutación, la selección y el azar". December 4th, 2006. IVth Cycle of Conferences "Encuentros con la Ciencia" organized by Ámbito Cultural de El Corte Inglés and the Universidad de Málaga (Málaga, Spain).
25. "Mechanisms of genetic robustness in RNA viruses". October 22nd, 2007. Department of Pathobiology, University of Illinois (Urbana, USA).
26. "Mechanisms of genetic robustness in RNA viruses". January 11st, 2008. Instituto Gulbenkian de Ciência (Oeiras, Portugal).
27. "Mechanisms of genetic robustness in RNA viruses". February 12nd, 2008. Evolutionary Biology Program, Ludwig Maximilian University (Munich, Germany).
28. "Experimental RNA virus evolution". May 5th, 2008. Rockefeller University (New York, USA).

8.- STAYS IN OTHER RESEARCH CENTERS:

1. Centro de Biología Molecular *Severo Ochoa* (CSIC-UAM). Two months (1993). PhD Student. Supervisor: Dr. Esteban Domingo.
2. Department of Biology and Center for Molecular Genetics, University of California at San Diego. Three months (1994). PhD Student. Supervisor: Dr. John J. Holland.
3. Center for Microbial Ecology, Michigan State University. Twenty seven months (from October 3rd, 1995 to December 10th, 1997). Postdoc. Supervisor: Dr. Richard E. Lenski.
4. Department of Microbiology and Molecular Genetics, Michigan State University. Three months (from July 8th, 2002 to- October 8th, 2002). Adjunt Visiting Associate Professor. Supervisor: Dr. Richard E. Lenski.
5. Department of Microbiology and Molecular Genetics, Michigan State University. Fifteen days (November 2006). Visiting Associate Professor. Supervisor: Dr. Richard E. Lenski.

9.- FELLOWSHIPS AND AWARDS:

1. Scholarship for undergraduate studies from the Ministerio de Educación y Ciencia. Years 1985-86, 1986-87 and 1987-88.
2. Fellowship for undergraduate research assistants from the Ministerio de Educación y Ciencia in the Department of Genetics, Universitat de València. Years 1988-89 and 1989-90.
3. Fellowship from the Universitat de València for graduate students. Year 1991-1992.
4. Fellowship from the Consellería d'Educació i Ciència de la Generalitat Valenciana. Years 1991-92, 1992-93, 1993-94 and 1994-95.
5. Fellowship from the Consellería d'Educació i Ciència de la Generalitat Valenciana for a visit to the University of California at San Diego (three months) with Prof. John J. Holland (1994).
6. Extraordinary doctorate award. Universitat de València. 1994-95.
7. Postdoctoral fellowship from the Spanish Ministerio de Educación y Ciencia to stay in the Center for Microbial Ecology (Michigan State University) with Prof. Richard E. Lenski (1995-1997).
8. Award from the National Academy of Sciences of the U.S.A. for attending to the *Colloquium on Genetics and the Origin of Species*. Irvine, CA.
9. Award from the Conselleria de Cultura, Educació i Ciència de la Generalitat València for attending the *XIII Seminarios de Genética de Poblaciones y Evolución*. Baiona, Spain.
10. Sabbatical (three months) fellowship from the Spanish Ministerio de Educación, Cultura y Deporte to stay in the Center for Microbial Ecology (Michigan State University) with Prof. Richard E. Lenski (2002).
11. EMBO Young Investigator Programme. Year 2005.
12. Award from the Universidad Politécnica de Valencia for attending the IIIrd Noble Foundation Workshop on Virus Evolution.

13. Award from the Universidad Politécnica de Valencia for attending the IVth Noble Foundation Workshop on Virus Evolution.

10.- TEACHING EXPERIENCE:

1. 1991-1992, Universitat de València: A Practical Course of Genetics (60 hours). Teaching assistant.
2. 1992-1993, Universitat de València: Introduction to networks and data bases in Molecular Biology (25 hours). Teaching assistant.
3. 1993-1994, Universitat de València: Problems and Questions in Genetics (60 hours). Teaching assistant.
4. 1994-1995, Universitat de València: A Practical Course of Genetics (60 hours). Teaching assistant.
5. 1997-1998, Universitat de València: Genetic Analysis Techniques (60 hours). A Practical Course of Molecular Evolution (30 hours). Computational Molecular Biology for graduated students (10 hours). Assistant professor.
6. 1998-1999, Universitat de València: Genetics (25 hours). Evolutionary Biology (30 hours). A Practical Course of Molecular Evolution (30 hours). Computational Molecular Biology for graduated students (10 hours). Advanced Molecular Evolution for graduated students (10 hours). Microbial Experimental Evolution (Centro de Astrobiología, INTA-NASA; 10 hours). Assistant professor.
7. 1999-2000, Universitat de València: Genetics (37.5 hours). Evolutionary Biology (30 hours). A Practical Course of Genetics (50 hours). A Practical Course of Molecular Evolution (30 hours). Computational Molecular Biology for graduated students (30 hours). Assistant professor.
8. 2000-2001, Universitat de València: Genetics (37.5 hours). Evolutionary Biology (67.5 hours). A Practical Course of Genetics (60 hours). Assistant professor.
9. 2001-2002. Universitat de València: Evolutionary Biology (115 hours). A Practical Course of Genetics (30 hours). Computational Molecular Biology for graduated students (30 hours). Associate professor.
10. 2005-2006. EMBO YIP PhD Course: Experimental Viral Evolution (8 hours).
11. Member of 9 PhD thesis committees, including 4 in foreign countries.
12. Member of the Advanced Studies Diplôme committee for the program Biodiversity and Evolutionary Biology of the Universitat de València. 2004-05, 2005-06, 2006-07.
13. Representative of the IBMCP in the Biotechnology PhD Program Coordinating Committee, Universitat de València (2007-08 to the present).

11.- OTHER PROFESSIONAL EXPERIENCES:

1. Assistant of Cytology and Histology. Department of Microscopical Morphology. Universitat de València. 1986-87.
2. Assistant of Microbiology. Department of Microbiology. Universitat de València. 1987-88.
4. System Manager of the Bioinformatics Unit. Universitat de València. 1991-1995.

5. Coordinator of the Section of Cell and Tissue Cultures of the S.C.S.I.E. Universitat de València. From April 1998 to February 1999.
6. Referee for *Advances in Ecological Research*; *ALife*; *American Journal of Botany*; *American Naturalist*; *Bioessays*; *Biology Letters*; *BMC Evolutionary Biology*; *BMC Infectious Diseases*; *BMC Microbiology*; *Evolution*; *Genetics*; *Infection, Genetics and Evolution*; *Journal of Biology*; *Journal of Evolutionary Biology*; *Journal of General Virology*; *Journal of Virology*; *Molecular Biology and Evolution*; *Nature Review Genetics*; *Phycological Research*; *PLoS ONE*; *PLoS Pathogens*; *Proceedings of the National Academy of Sciences of the USA*; *Proceedings of the Royal Society of London series B*; *Science*; *Spanish Journal of Agronomical Research*; *The American Naturalist*; *Trends in Ecology & Evolution* and *Trends in Microbiology*; *Virus Research*.
7. Referee for the following founding agencies: Spanish MEC (BMC-BFU Program, 2007), Spanish ANEP, CNRS program "Maladies Infectieuses Emergentes" (France), FWF of Austria, Wageningen University (The Netherlands), French Ministry of Research and New Technologies (Microbiology program), EEUU National Science Foundation (Genes and Genome Systems program), The Neatherlands NWO (From Molecule to Organisms ALW), The South African NRF, EMBO Short Term Fellowships.
8. Associated editor of *Infection, Genetics and Evolution* (2001 -); *Evolution* (2002 - 2005); *Journal of Evolutionary Biology* (2002 - 2005); *BMC Evolutionary Biology* (2005 -); *The Open Genomics Journal* (2007 -); *The Open Virology Journal* (2007 -); *The American Naturalist* (2008 -).
9. Translation to Spanish of the book "*Evolutionary Analysis 2nd edition*" by S. Freeman y J.C. Herron, for Prentice Hall, 2002. In cooperation with Prof. José L. Ménsua Fernández.
10. Head of the Stress Biology Department of the IBMCP (June 1st, 2005 -).
11. Co-ordinator Scientific Comission of the IBMCP (June 1st, 2005 -).
12. Member of the Genetic Variation and Evolution Study Section (Center for Scientific Review), National Institutes of Health, USA. (October 2006 -).
13. Member of the committee "Habilitation à Diriger des Recherches" of Dr. Emmanuel Jacquot, University of Rennes (France). December 19th, 2007.

11.- MEMBER OF THE FOLLOWING SCIENTIFIC ORGANIZATIONS:

1. Member of the Spanish Association of Biologists.
2. Member of the Spanish Society of Virology.
3. Member of the American Society for the Study of the Evolution.
4. Former member of the American Asociation for the Advance of Science (1996 - 2005).
5. Member of the Spanish Society of Genetics.
6. Member of the Society of Molecular Epidemiology and Evolutionary Genetics of Infections Diseases.
7. Founder member of the Spanish Society of Evolutionary Biology.
8. Councillor of the European Society of Evolutionary Biology (ESEB); 2003-2007.