

CURRICULUM VITAE: ALBERT BOSCH



PERSONAL DATA

Born in Barcelona in June 9 1951.

Professional Address: Department of Microbiology, School of Biology, University of Barcelona, Avenida Diagonal 645, 08028 Barcelona.

Present Status: Full Professor (Catedrático de Universidad, NRP A44EC9692)

AWARDS AND RECOGNITIONS.

- Ph. D. Outstanding Award of the School of Biology of Barcelona. University of Barcelona, 1979.
- First Class Cross, Spanish Ministry of Defense, 1990, due to the tasks performed in an outbreak of hepatitis A in a military camp.
- Consolidated Research Group for Enteric Viruses, officially certified by the Autonomous Government of Catalonia since 1995.
- Member of Number of the Royal European Academy of Doctors of Catalonia, 2000 and President of the Sciences Section.
- Recognition of Excellence in Research in the I3 Programme of the Spanish Ministry of Education and Science, 2008.
- President of the Spanish Society for Virology
- Chair of the General Assembly of the International Society for Food and Environmental Virology.
- Member of expert committees of EFSA, AESAN and ACSA (European, National and Autonomous Food Safety Agencies).
- Outstanding Research Award of the Colegio Oficial de Biólogos de Catalonia 2017.

SELECTED PUBLICATIONS (BOOKS) 2007-2019.

COMPLETE

Human Viruses in Water (A. Bosch, Editor). Perspectives in Medical Virology Series. Elsevier, Amsterdam, 2007, ISBN - 978-0-444-52157-6.

Foodborne Viruses: Progress and challenges (M. Koopmans, D. O. Cliver, A. Bosch, Editors). ASM Press, Washington, D.C., USA, 2008, ISBN - 978-1-55581-464-9.

Seguridad Alimentaria. Ciencia, tecnología y legislación. M. Borrás, A. Bosch, J.C. Cheftel, B. Guamis, E. Mata, J.M. Monfort, J. Ordeig, J. Serratos & A. Troncoso. Instituto Tomás Pascual Sanz, Madrid, 2010. ISBN-978-84-7867-056-7.

Virus de transmisión alimentaria. Avances y retos. M. Koopmans, D. O. Cliver & A. Bosch. Editorial Acribia, Zaragoza, 2010. ISBN: 978-84-200-1154-7.

J. Rodrigo de Larrucea, O. Amat, M. Oliveras, A. Bosch, et al. Cómo investigar: Trabajo de final de grado, tesis de máster, tesis doctoral y otros trabajos de investigación. O. Amat & A. Rocafort (Eds.). Editorial Profit, Barcelona, 2017. ISBN: 978-84-16904-69-3.

J. Rodrigo de Larrucea, O. Amat, M. Oliveras, A. Bosch, et al. Com fer recerca: Treball de final de grau, tesi de màster, tesi doctoral i altres projectes de recerca. O. Amat & A. Rocafort (Eds.). Editorial Profit, Barcelona, 2017. ISBN: 978-84-16904-67-9.

CHAPTERS

J. Quer, M. Martell, F. Rodriguez, A. Bosch, R. Jardi, M. Buti & J. I. Esteban. The impact of rapid evolution of hepatitis viruses. En "Origin and evolution of viruses", 2n edition, E. Domingo, R. Webster & J. J. Holland (Eds). Academic Press, New York, 2008, pp 303-349, ISBN-13: 978-0-12-220360-2.

A. Bosch, Steffen Mueller & R.M. Pintó. Coding Biases and Viral Fitness. En "The Picornaviruses", E. Ehrenfeld, E. Domingo & R.P. Roos (Eds). ASM Press, Washington, DC, USA, 2010, pp 271-283, ISBN-13: 978-1-55581-603-2.

A. Bosch & R.M. Pintó. Hepatitis A and E Viruses. En: "Genomes of Food- and Water-Borne Pathogens", P. Fratamico, S. Kathariou & Y. Liu (Eds). ASM Press, Washington, DC, USA, 2010, pp 247-258, ISBN-978-1-55581-457-1.

R.M. Pintó & A. Bosch. Replanteamiento de la detección de virus en alimentos. En: "Virus de transmisión alimentaria. Avances y retos". Koopmans M, Cliver DO, Bosch A (Eds). Acribia, S.A., Zaragoza, 2010. pp 121-150, ISBN: 978-84-200-1154-7.

A. Bosch, S. Bidawid, F.S. Le Guyader, D. Lees & L-A. Jaykus. Norovirus, hepatitis A virus, and indicator microorganisms in shellfish, soft fruits, and water. En: "Rapid detection, Identification and Quantification of Foodborne Pathogens", J. Hoofar (Ed.). ASM Press, Washington, DC, USA, 2011, pp 333-347, ISBN-978-1-55581-542-4.

- A. Bosch, S. Guix, N.K. Krishna, E. Méndez, S.S. Monroe, M. Pantin-Jackwood & S. Schultz-Cherry. Astroviridae. En: *Virus Taxonomy. Ninth Report of the International Committee on Taxonomy of Viruses*. 2011. A.M.Q King et al. (Eds.). Elsevier, Academic Press, Amsterdam, 2011, pp 953-959, ISBN-978-0-12-384684-6.
- A. Bosch, S. Guix & R.M. Pintó. Epidemiology of Human Astroviruses. En: *Astrovirus Research: Essential Ideas, Everyday Impacts, Future Directions*. 2013. S. Schultz-Cherry (Ed.), Springer Science+Business Media, New York, 2013, pp 1-18, DOI 10.1007/978-1-4614-4735-1_6.
- S. Guix, A. Bosch & R.M. Pintó. Astrovirus Taxonomy. En: *Astrovirus Research: Essential Ideas, Everyday Impacts, Future Directions*. 2013. S. Schultz-Cherry (Ed.), Springer Science+Business Media, New York, 2013, pp 1-18, DOI 10.1007/978-1-4614-4735-1_6.
- S. Guix, A. Bosch & R.M. Pintó. Astrovirus Taxonomy. En *Directions*. 2013. S. Schultz-Cherry (Ed.), Springer Science+Business Media, New York, 2013, pp 97-118, DOI 10.1007/978-1-4614-4735-1_6.
- R.M. Pintó & A. Bosch. Advances in understanding of hepatitis A virus as a food and waterborne pathogen, and progress with vaccine development. En: *Viruses in Food and Water. Risks, Surveillance and Control*. 2013. N. Cook (Ed.), Woodhead Publishing Limited, Cambridge, Inglaterra, 2013, pp 349-361, ISBN-978-0-85709-430-8.
- A. Bosch & R.M. Pintó. Hepatitis A virus. En: *Foodborne viruses and prions and their significance for public health*. 2013. F.M. Smulders, B. Nørrung, H. Budka (Eds.). Food safety assurance and veterinary public health, vol 6, Wageningen Academic Publishers, Wageningen, Holanda, 2013, pp 61-77, ISBN-978-90-8686-226-9.
- R.M. Pintó, A. Bosch & G. Kaplan. Hepatitis A: Immune Response and Virus Evolution. En: *Liver Immunology*. 2014. M. E. Gershwin, J. M. Vierling and M. P. Manns (Eds.), Springer International Publishing, New York, pp 173-189, ISBN-978-3-319-02095-2.
- G. Sánchez & A. Bosch. Survival of enteric viruses in the environment and food. En "Viruses in Foods, Second Edition", S. M. Goyal, J.L. Cannon (Eds.). *Food Microbiology and Food Safety Series*, 2016. Springer International Publishing Switzerland, pp 367-392, ISBN-978-3-319-30721-3.
- M. Koopmans, A. Bosch, A., S. Le Guyader. Chapter 14 – Viruses. In: "Foodborne Diseases, Third edition", C. Dodd, T. Aldsworth, R. A. Stein, D.O. Cliver, and H. Riemann (Eds.) 2017. Academic Press, pp 289-303, ISBN: 978-0-12-385007-2, (doi.org/10.1016/B978-0-12-385007-2.00014-0).

SELECTED PUBLICATIONS (ARTICLES) 2008-2019.

- S. Guix, S. Caballero, C. Fuentes, A. Bosch & R.M. Pintó. Genetic analysis of the hypervariable region of the human astrovirus nsP1a coding region: design of a new RFLP typing method. *Journal of Medical Virology*, 2008, 80: 306-315.
- Ll. Aragonès, A. Bosch & R.M. Pintó. Hepatitis A virus mutant spectra under the selective pressure of monoclonal antibodies: codon usage constraints limit capsid variability. *Journal of Virology*, 2008, 82: 1688–1700.
- A. Kroneman, et al.. Data quality of 5 years of central norovirus outbreak reporting in the European Network for food-borne viruses. *Journal of Public Health*, 2008, 30: 82-90.
- A. Bosch, S. Guix, D. Sano & R.M. Pintó. New tools for the study and direct surveillance of viral pathogens in water. *Current Opinion in Biotechnology*, 2008, 19: 295-301.
- R.M. Pintó, M.I. Costafreda & A. Bosch. Risk assessment in shellfish-borne outbreaks of hepatitis A. *Applied and Environmental Microbiology*, 2009, 75: 7350–7355.
- D. Sano, R.M. Pintó, T. Omura & A. Bosch. Detection of oxidative damages on viral capsid protein for evaluating structural integrity and infectivity of human norovirus. *Environmental Science and Technology*, 2010, 44: 808–812.
- Ll. Aragonès, S. Guix, E. Ribes, A. Bosch & R.M. Pintó. Fine-Tuning Translation Kinetics Selection as the Driving Force of Codon Usage Bias in the Hepatitis A Virus Capsid. *PLoS Pathogens*, 2010, 6(3): e1000797. doi:10.1371/journal.ppat.1000797.
- D. Sano, U. Pérez-Sautu, S. Guix, R.M. Pintó, T. Miura, S. Okabe & A. Bosch. Quantification and genotyping of human sapoviruses in the Llobregat River catchment, Spain. *Applied and Environmental Microbiology*, 2011, 77: 1111-1114.
- A. Bosch, G. Sánchez, M. Abbaszadegan, A. Carducci, S. Guix, F.S. Le Guyader, R. Netshikweta, R.M. Pintó, W.H.M. van der Poel, S. Rutjes, D. Sano, M.B. Taylor, W.B. van Zyl, D. Rodríguez-Lázaro, K. Kovač & J. Sellwood. Analytical methods for virus detection in water and food. *Food Analytical Methods*, 2011, 4: 4-12.
- U. Pérez-Sautu, M.I. Costafreda, J. Caylà, C. Tortajada, J. Lite, A. Bosch & R.M. Pintó. Hepatitis A virus vaccine escape variants and potential new serotype emergence. *Emerging Infectious Diseases*, 2011, 17: 734-737.
- L. D'Andrea, R.M. Pintó, A. Bosch, H. Musto & J. Cristina. A detailed comparative analysis on the overall codon usage patterns in hepatitis A virus. *Virus Research*, 2011, 157: 19-24.
- C. Fuentes, S. Guix, A. Bosch & R.M. Pintó. C-terminal nsP1a protein of human astrovirus is a phosphoprotein which interacts with the viral polymerase through the formation of a heterodimer. *Journal of Virology*, 2011, 85: 4470–4479.
- K. Mattison, N. Corneau, I. Bergc, A. Bosch, E. Duizer, I. Gutiérrez-Aguirre, Y. L'Homme, Y. Lucero, Z. Luo, A. Martyres, M. Myrmel, M. O'Ryan, F. Pagotto, D. Sano, S. Svraka, U. Urzua & S. Bidawid. Microarray for the confirmation and typing of norovirus RT-PCR products. *Journal of Virological Methods*, 2011, 173: 233-250.
- U. Pérez-Sautu, M.I. Costafreda, J. Lite, R. Sala, I. Barrabeig, A. Bosch & R.M. Pintó. Molecular epidemiology of hepatitis A virus infections in Catalonia, Spain, 2005–2009: Circulation of newly emerging strains. *Journal of Clinical Virology*, 2011, 52: 98– 102.
- U. Pérez-Sautu, D. Sano, S. Guix, G. Kasimir, R.M. Pintó & A. Bosch. Human norovirus occurrence and diversity in the Llobregat river catchment, Spain. *Environmental Microbiology*, 2012, 14: 494-502. (Ahead of print, doi:10.1111/j.1462-2920.2011.02642.x).

- Rodríguez-Lázaro, D., Cook, N., Ruggeri, F. M., Sellwood, J., Nasser, A., Nascimento, M. S. J., D'Agostino, M., Santos, R., Saiz, J. C., Rzeżutka, A., Bosch, A., Gironés, R., Carducci, A., Muscillo, M., Kovač, K., Diez-Valcarce, M., Vantarakis, A., von Bonsdorff, C.-H., de Roda Husman, A. M., Hernández, M. and van der Poel, W. H. M. Virus hazards from food, water and other contaminated environments. *FEMS Microbiology Reviews*. 2012, 36: 786–814.
- C. Tortajada, P. de Olalla, E. Diez, R. Pinto, A. Bosch, U. Perez, M. Sanz, J. Cayla & S. W. Group. Hepatitis A among men who have sex with men in Barcelona, 1989-2010: insufficient control and need for new approaches. *BMC Infectious Diseases* 12:11. (doi:10.1186/1471-2334-12-11)
- R.M. Pinto, L. D'Andrea, F. J. Perez-Rodríguez, M. I. Costafreda, E. Ribes, S. Guix, & A. Bosch. Hepatitis A virus evolution and the potential emergence of new variants escaping the presently available vaccines. *Future Microbiology*, 2012, 7: 331-346.
- M. Isabel Costafreda, E. Ribes, A. Franch, A. Bosch & R.M. Pintó. A single mutation in the glycoprotein A binding site of hepatitis A virus enhances virus clearance from the blood and results in a lower fitness variant. *Journal of Virology*, 2012, 86: 7887-7895.
- C. Fuentes, A. Bosch, R.M. Pinto & S. Guix. Identification of human astrovirus genome-linked protein (VPg) essential for virus infectivity. *Journal of Virology*, 2012, 86: 10070-10078.
- W.M. El-Senousy, M.I. Costafreda, R.M. Pintó & A. Bosch. Method validation for norovirus detection in naturally contaminated irrigation water and fresh produce. *International Journal of Food Microbiology*, 2013, 167: 74-79.
- C. Fuentes, S. Guix, F.J. Pérez-Rodríguez, N. Fuster, M. Carol, R.M. Pintó & A. Bosch. Standardized multiplex one-step qRT-PCR for hepatitis A virus, norovirus GI and GII quantification in bivalve mollusks and water. *Food Microbiology*, 2014, 40: 55-63.
- M.I. Costafreda, F. Pérez-Rodríguez, L. D'Andrea, S. Guix, E. Ribes, A. Franch, A. Bosch & R.M. Pintó. Hepatitis A virus adaptation to cellular shutoff is driven by dynamic adjustments of codon usage and results in the selection of populations with altered capsids. *Journal of Virology*, 2014, 88:5029-5041.
- A. Sabrià, R.M. Pintó, A. Bosch, R. Bartolomé, T. Cornejo, N. Torne, A. Martínez, M. de Simón, A. Domínguez & S. Guix. Molecular and clinical epidemiology of norovirus outbreaks in Spain during the emergence of GII.4 2012 variant. *Journal of Clinical Virology*, 2014, 60: 96–104.
- A. Bosch, R.M. Pintó & S. Guix. Human astroviruses. *Clinical Microbiological Reviews*, 2014, 27: 1048-1074.
- L. D'Andrea, F.J. Pérez-Rodríguez, M.I. Costafreda, N. Beguiristain, C. Fuentes, T. Aymerich, S. Guix, A. Bosch & R.M. Pintó. Molecular basis of the behavior of hepatitis A virus exposed to high hydrostatic pressure. *Applied and Environmental Microbiology*, 2014, 80: 6499–6505.
- L. D'Andrea, F.J. Pérez-Rodríguez, M. de Castellarnau, S. Manzanares, J. Lite, S. Guix, A. Bosch & R.M. Pintó. Hepatitis A Virus genotype distribution during a decade of universal vaccination of preadolescents. *International Journal of Molecular Sciences*, 2015, 16: 6842-6854.
- A. Bosch, R. Santos & A. Vantarakis. ISFEV 2014: Environmental, Food and Health Impacts of Enteric Viruses. *Environmental, Food and Health Impacts of Enteric Viruses. Food and Environmental Virology*, 2015, 7: 87.
- S. Guix, A. Pérez-Bosque, L. Miró, M. Moretó, A. Bosch & R.M. Pintó. Type I interferon response is delayed in human astrovirus infections. *PLoS ONE*, 2015, 10, e0123087.
- O. Ferrer, S. Casas, C. Galvañ, F. Lucena, A. Bosch, B. Galofré, J. Mesa, J. Jofre & X. Bernat. Direct ultrafiltration performance and membrane integrity monitoring by microbiological analysis. *Water Research*, 2015, 83: 121-131.
- A. Bosch, R.M. Pintó & S. Guix. Foodborne viruses. *Current Opinion in Food Science*, 2015, 8: 110-119.
- N. Fuster, R.M. Pintó, C. Fuentes, N. Beguiristain, A. Bosch & S. Guix. Propidium monoazide RTqPCR assays for the assessment of hepatitis A inactivation and for a better estimation of the health risk of contaminated waters. *Water Research*, 2016, 101: 226–232.
- A. Sabrià, R.M. Pintó, A. Bosch, R. Bartolomé, T. Cornejo, N. Torner, A. Martínez, M. de Simón, A. Domínguez & S. Guix. Norovirus shedding among food and healthcare workers exposed to the virus in outbreak settings. *Journal of Clinical Virology*, 2016, 82: 119-125.
- F.J. Pérez-Rodríguez, L. D'Andrea, M. de Castellarnau, M.I. Costafreda, S. Guix, E. Ribes, J. Quer, J. Gregori, A. Bosch & R.M. Pintó. Improving virus production through quasispecies genomic selection and molecular breedings. *Scientific Reports*, 2016, 6: 35962. (doi: 10.1038/srep35962).
- D.-L. Vu, A. Bosch, R.M. Pintó & S. Guix. Epidemiology of Classic and Novel Human Astrovirus: Gastroenteritis and Beyond. *Viruses*, 2017, 9: 33. (doi:10.3390/v9020033).
- A. Blanco, S. Guix, N. Fuster, C. Fuentes, R. Bartolomé, T. Cornejo, R.M. Pintó & A. Bosch. Norovirus detection in bottled mineral water associated with a gastroenteritis outbreak. *Emerging Infectious Diseases*, 2017, 23: 1531-1534.
- J. Quer, F. Rodríguez-Frias, J. Gregori, D. Taberner, M. E. Soria, D. García-Cehic, M. Homs, A. Bosch, R. M. Pintó, J. I. Esteban, E. Domingo, C. Perales. Deep sequencing in the management of hepatitis virus infections. *Virus Research*, 239: 115-125. (doi: 10.1016/j.virusres.2016.12.020).
- A. Bosch (Editor). *Applied Virology. Journal of Applied Microbiology (Special Issue)*, 2018, 124: 932-1022. (doi: 10.1111/jam.13750).
- J.A. Lowther, A. Bosch, S. Butot, J. Ollivier, D. Mäde, S.A. Rutjes, G. Hardouing, B. Lombard, P. in't Veld, & A. Leclerc. Validation of ISO method 15216 part 1 – Quantification of hepatitis A virus and norovirus in food matrices. *International Journal of Food Microbiology*, (in Press 2018). (doi.org/10.1016/j.ijfoodmicro.2017.11.014).
- A. Sabrià, J. Gregori, D. Garcia-Cehic, S. Guix, T. Pumarola, S. Manzanares-Laya, J. Caylà, A. Bosch, J. Quer, R.M. Pintó. Evidence for positive selection of hepatitis A virus antigenic variants in vaccinated men-having-sex-with men patients: implications for immunization policies. *EBioMedicine*, 2019, 39: 348-357. (doi.org/10.1016/j.ebiom.2018.11.023).
- S. Guix, R.M. Pintó & A. Bosch. Final consumer options to control and prevent foodborne Norovirus infections. *Viruses*, 2019, 11: 333. (doi.org/10.3390/v11040333).

- A. Blanco, I. Abid, N. Al-Otaibi, F.J. Pérez-Rodríguez, C. Fuentes, S. Guix, R.M. Pintó & A. Bosch. Glass wool concentration optimization for the detection of enveloped and non-enveloped waterborne viruses. Food and Environmental Virology. In Press 2019. doi.org/10.1007/s12560-019-09378-0
- B. Sun, A. Bosch, M. Myrmet. Extended direct lysis method for virus detection on berries including droplet digital RT-PCR or real time RT-PCR with reduced influence from inhibitors. Journal of Virological Methods. (In Press 2019).

PATENTS

Inventors/as: Bosch, A.; Pintó, R.M.

Title: Standardized method and kit for the quantification of Hepatitis A virus

Application: PCT/EP2007/055402: WO 200 Country: USA, 2007; Extended to Japan/Canada/Australia. Property: University of Barcelona Barcelona. Type: PCT/EUR/USA Patent code: 000863. Exploitation: 2009-present date (Biomerieux, France).

Inventors: Bosch, A.; Pintó, R.M.

Title: Control for assays based on reverse-transcription polymerase chain reaction

Application: PCT/EP2007/055407: WO 200 Country: USA, 2007; Extended to Japan/Canada/Australia. Property: University of Barcelona Barcelona. Type: PCT/EUR/USA Patent code: 000864. Exploitation: 2009-present date (Biomerieux, France).

SUPERVISOR OF PH.D. RESEARCH PROJECTS

- Survival of enteric viruses in surface water. Student: Rosina Gironés. Department of Microbiology, University of Barcelona. 1986.
- Viral erythrocytic infection in Mediterranean sea bass *Dicentrarchus labrax*. Student: Rosa M. Pintó. Department of Microbiology, University of Barcelona. 1990, Outstanding Ph. D Award School of Biology 1989-1990.
- Virus detection in the environment by molecular hybridization with non radiolabeled probes. Student: José María Díez. Department of Microbiology, University of Barcelona. 1993.
- Hepatitis A virus: Propagation, production of hyperimmune sera and recovery from environmental samples. Student: Rodrigo Gajardo. Department of Microbiology, University of Barcelona. 1993.
- Disinfection of enteric viruses in water food and fomites. Student: Xavier Abad. Department of Microbiology, University of Barcelona. 1994.
- Production of hepatitis A virus immunogens. Student: Joan Francesc González-Dankaart. Department of Microbiology, University of Barcelona. 1999.
- Hepatitis A virus: genetic variability and interactions with the host. Student: Glòria Sánchez Moragas, Department of Microbiology. University of Barcelona, 2003. Outstanding Ph. D Award School of Biology 2002-2003.
- Molecular epidemiology of human enteric viruses in the Cairo water environment. Student: Waled Morsy El-Senousy, Department of Microbiology. University of Barcelona, 2003.
- nsP1a/4 protein and the biological cycle of astrovirus. Student: Susana Guix Arnau, Department of Microbiology. University of Barcelona, 2003. Outstanding Ph. D Award School of Biology 2003-2004.
- Molecular survey of rotavirus in the environment. Student: Cristina Villena Portella Department of Microbiology. University of Barcelona, 2003.
- Astrovirus morphogenesis and replication. Student: Santiago Caballero Díez, Department of Microbiology. University of Barcelona, 2005.
- Mise au point d'une approche moléculaire de détection des rotavirus humains du groupe C et application à l'étude épidémiologique. Student : Islem Abid Ayadi, Faculté des Sciences de Tunis, Université de Tunis El Manar, 2007.
- Hepatitis A virus and its genetic code. Student: Lluís Aragonès Marimon, Department of Microbiology, University of Barcelona, 2009.
- Molecular epidemiology of gastroenteritis and hepatitis viruses in Catalonia. Student: Unai Pérez Sautu, Department of Microbiology, University of Barcelona, 2011
- Hepatitis A virus capsid adaptation to its cellular cycle bottlenecks. María Isabel Costafreda Salvany, Department of Microbiology, University of Barcelona, 2012.
- Effect of the use of codons in translation speed of the capsid codón región in hepatitis A virus populations. Lucía d'Andrea Hirschy, Department of Microbiology, University of Barcelona, 2015.
- Improvement of hepatitis A virus production through genomic selection and molecular breeding of quasispecies. Francisco José Pérez Rodríguez, Department of Microbiology, University of Barcelona, 2016.
- Egress of hepatitis A virus from hepatocytes: implications on antiviral selection. Salida del virus de la hepatitis A de los hepatocitos: implicaciones en la selección de antivirales. Montserrat de Castellarnau Serra, Department of Genetics, Microbiology and Statistics, 2018.