

XXVII Symposium of the Scientific Instrument Commission  
16-21 September 2008  
Museum of Science, University of Lisbon  
Portugal

- Programme -

Monday, 15 September

15-18 h



**Exhibition Workshop**

Stephen Johnston, Museum of the History of Science, Oxford University  
Samuel Gessner, Museum of Science/Centre for the History of Science, University of Lisbon  
[Laboratório de Física Cyrillo Soares]  
[Meeting point: left-side entrance of the Museum, near the palm trees: 14.45]

Tuesday, 16 September

8.30

**Registration**

[Museum entrance]

10.00



**Opening Session**

[Anfiteatro de Química]

António Sampaio da Nóvoa, Rector of the University of Lisbon  
Ana Eiró, Director of the Museum of Science, University of Lisbon  
Paolo Brenni, President of the Scientific Instrument Commission  
Marta C. Lourenço, Chair SIC2008/Museum of Science, University of Lisbon

10.15

**Welcome Note**

Mário Soares, Mário Soares Foundation  
Former President of Portugal and former Vice-President of the European Parliament

10.30

**Coffee-Break**



**Instrument Studies I**

**Chair: Stephen Johnston, Museum of the History of Science, Oxford University**  
[Anfiteatro Manuel Valadares]

11.00

*The transmission of science, interfaith dialogue in Al-Andalus*  
Elisabeth J. Gatti, The British Museum

11.20

*Judaeo-Arabic Instruments*  
Silke Ackermann, The British Museum

11.40

*Introducing novel concepts: Using instruments for promoting logarithms and trigonometry in seventeenth-century Portugal*  
Samuel Gessner, Museum of Science/Centre for the History of Science, University of Lisbon

12.00

*History of diagonal scale for measuring instruments*  
Eiju Matsumoto, Society of Historical Metrology, Tokyo

12.20 *Research with air pumps in the eighteenth century*  
Terje Brundtland, Institute for the History and Philosophy of Science and Technology, University of Toronto

12.40 Discussion (20 min)



**Instruments and Society: Partnerships and Collaborative Initiatives Towards Preservation (Parallel Session\*)**

**Chair: Marta C. Lourenço, Museum of Science, University of Lisbon**

[Anfiteatro de Botânica Aurélio Quintanilha]

11.00 *The scientific heritage of physics and chemistry: Didactic instruments in Portuguese secondary schools*

Isabel Malaquias, University of Aveiro

Manuel Queirós, University of Aveiro

Manuel Almeida Valente, University of Aveiro

Maria Emília Gomes, University of Aveiro

Décio R. Martins, University of Coimbra

Carlos Saraiva, EB 2,3 Vila Franca das Naves

Joaquim Almeida, University of Aveiro

João Oliveira, University of Aveiro

Marília Thomaz, University of Aveiro

11.20 *Towards a European national programme for safeguarding scientific and technical heritage*

Catherine Cuenca, Musée des arts et métiers, CNAM, Paris/Université de Nantes

Daniel Thoulouze, Musée des arts et métiers, CNAM, Paris

11.40 *From fragments to an instrument: Restoration of the Gautier's meridian circle*

Marcus Granato, Museu de Astronomia e Ciências Afins, Rio de Janeiro

12.00 *Historical collections at the Observatório do Valongo/UFRJ, Rio de Janeiro*

Rundsthen Vasques de Nader, Observatório do Valongo/Universidade Federal do Rio de Janeiro

Sílvia Lorenz-Martins, Observatório do Valongo/Universidade Federal do Rio de Janeiro

Juliane Rovai, Observatório do Valongo/Universidade Federal do Rio de Janeiro

Marcus Granato, Museu de Astronomia e Ciências Afins, Rio de Janeiro

Katia M.O. Bello, Museu de Astronomia e Ciências Afins, Rio de Janeiro

12.20 *The roots of the future: First public exhibition of Ferrara antique instruments*

Grazia Zini, University of Ferrara

Marco Merli, University of Ferrara

Clelia Caracciolo, University of Ferrara

Michela Biancardi, University of Ferrara

Beatrice Morsiani, Centro di Documentazione Storica, Comune di Ferrara

12.40 Discussion (20 min)

13.00 **Lunch**



**Replicating and interpreting historical experiments**

**Chair: David Pantalony, Canada Science and Technology Museum, Ontario**

[Anfiteatro Manuel Valadares]

14.00 *Dangerous experiments for boys*

Tacye Phillipson, National Museums Scotland

14.20 *Electrical instruments and experiments in eighteenth century: forgotten know-how?*

Christine Blondel, Centre de recherche en histoire des sciences et des techniques, CNRS/Cité des sciences et de l'industrie, Paris

14.40 *Reconstructing the camera obscura effect; becoming optical experimenters*

Elizabeth Cavicchi, Massachusetts Institute of Technology

15.00 *Revisiting Hertz's experiments: The propagation of electric force*

Roland Wittje, University of Regensburg

15.20 Discussion (40 min)



**Instrument Studies: Telescopes (Parallel Session\*)**

**Chair: Sara Schechner, Harvard University**

[Anfiteatro de Botânica Aurélio Quintanilha]

14.00 *Galileo's Telescope: History, scientific analysis and replicated observations*

Giorgio Strano, Istituto e Museo di Storia della Scienza, Firenze

14.20 *On the making of early telescopes: Giovanni Paolo Lembo's lecture notes in Lisbon in 1615-17*

Henrique Leitão, Centre for the History of Science, University of Lisbon

14.40 *Material study of a 6-foot Nairne & Blunt reflecting telescope*

Lúis Tirapicos, Museum of Science, University of Lisbon

15.00 *Telescope clock drives*

James Caplan, Observatoire Astronomique de Marseille-Provence

15.20 *The 28-inch refractor at Greenwich: The relationship between a telescope, its building and access for a general audience*

Gloria C. Clifton, Royal Observatory Greenwich, National Maritime Museum

15.40 Discussion (20 min)

16.00 **Coffee-Break**



**Instruments and Spaces: Astronomical Observatories**

**Chair: Gloria C. Clifton, Royal Observatory Greenwich**

[Anfiteatro Manuel Valadares]

16.30 *"Centres of genial influence": Spaces, dreams and instruments in early American astronomical observatories*

Richard L. Kremer, Dartmouth College

16.50 Historical scientific instruments at the Vatican Observatory

Ileana Chinnici, INAF-Osservatorio Astronomico di Palermo

Sabino Maffeo, Specola Vaticana, Città del Vaticano

17.10 *Building a new observatory: The new physical laboratory at the Royal Observatory Greenwich (1891-1900)*

Rebekah Higgitt, Royal Observatory Greenwich, National Maritime Museum

17.30 *The 'new' Leiden Observatory and its instruments*

Hans Hooijmaijers, Boerhaave Museum, Leiden

17.50 Discussion (25 min)



**Instruments and Society: Historical Instruments in Science Teaching (Parallel Session\*)**

**Chair: Pedro Casaleiro, Science Museum, University of Coimbra**

[Anfiteatro de Botânica Aurélio Quintanilha]

16.30 *'How would the Earth be without air?' Teaching proposal for the exploration of a science museum using the history of science*

Flora Paparou, University of Athens/First High School of Chios

Alexandra Karaliota, University of Athens

Stathis Psillos, University of Athens

Paraschos Kallitsis, First High School of Chios

16.50 *Teaching Astronomy with the Clementine gnomon: Measuring Sun radius, obliquity, nutation, and eccentricity of ecliptic*

Costantino Sigismondi, International Centre for Relativistic Astrophysics, University of Rome La Sapienza

- 17.10 *An example of the scientific heritage of Joseph Plateau: the Anorthoscope*  
 Danny Segers, Museum for the History of Sciences/Ghent University  
 Bartel Van Waeyenberge, Ghent University/Max-Planck-Institut für Metallforschung, Stuttgart  
 Martijn Withouck, Ghent University  
 Kristel Wautier, Museum for the History of Sciences/Ghent University
- 17.30 *A new didactical project in Padua: 'Physics Laboratories and historical scientific instruments'*  
 Sofia Talas, Museum of the History of Physics, University of Padua
- 17.50 Discussion (25 min)
- 18.15 Meeting Point at the Museum Entrance (general information & practicalities)
- 18.30 **Visit to the Laboratorio Chimico of the Polytechnic School**  
 Marta C. Lourenço, Museum of Science, University of Lisbon
- 18.30 **Visit to the temporary exhibition 'Mathematical Board Games' (Parallel Visit\*)**  
 Jorge Nuno Silva, Centre for the History of Science, University of Lisbon
- 19.30 **Welcome Cocktail**  
 [Museum Entrance]

## Wednesday, 17 September



### Instrument Studies II

**Chair: Deborah Douglas, MIT Museum**

[Anfiteatro Manuel Valadares]

- 9.00 *From laboratory to power plant: The birth of industrial electrical measurement instruments (1870-1910)*  
 Paolo Brenni, CNR/Fondazione Scienza e Tecnica, Firenze
- 9.20 *Explaining the science of James Smithson: 'Smithson's Pile'*  
 Steven C. Turner, Smithsonian Institution
- 9.40 *Thermometers of the Yale College Observatory*  
 Shae S. Trewin, Peabody Museum, Yale University
- 10.00 *Mars globes and the canal controversy*  
 Joshua F.K. Nall, The Whipple Museum of the History of Science, Cambridge
- 10.20 Discussion (30 min)



### Instruments and Society: Exhibiting Instruments to Broader Audiences I (Parallel Session\*)

**Chair: Samuel Gessner, Museum of Science/Centre for the History of Science, University of Lisbon**

[Anfiteatro de Botânica Aurélio Quintanilha]

- 9.00 *Historical instruments as tools to develop the curiosity of young people: The example of Heron's fountain*  
 Alain Faisant, Stéphane Bourlès & Dominique Bernard, Institut de Physique de Rennes, Université de Rennes 1
- 9.20 *The preservation of scientific heritage at MAST, Rio de Janeiro*  
 Ronaldo Mourão, Instituto Histórico e Geográfico Brasileiro, Rio de Janeiro
- 9.40 *The origins of scientific tradition in Urbino: The instruments of Federico of Montefeltro in virtual reality*  
 Roberto Mantovani, Physics Laboratory & Museum of Scientific Instruments, Univ. of Urbino 'Carlo Bo'
- 10.00 *Different objects, different conceptions of education: The case of the instruments of the Museum of Astronomy and related sciences (Brazil)*  
 Andréa F. Costa, Museu de Astronomia e Ciências Afins e Universidade Federal do Estado do Rio de Janeiro  
 Guaracira Gouvêa, Universidade Federal do Estado do Rio de Janeiro

10.20 Discussion (30 min)

10.50 **Coffee-Break**



**Instruments and Spaces**

**Chair: Liba Taub, Whipple Museum, University of Cambridge (to be confirmed)**

[Anfiteatro Manuel Valadares]

11.20 *Christ Church Library: Mathematical instruments and architectural space in eighteenth-century Oxford*  
Stephen Johnston, Museum of the History of Science, Oxford University

11.40 *Accommodating scientific instruments in architectural theory*  
Alistair Kwan, Yale University

12.00 *Places and cases: geoscientific instruments at the National Museum of Australia*  
Denis Shephard, Australia

12.20 *French astronomical observatories and their instruments at the end of the nineteenth century*  
Françoise Le Guet Tully, Observatoire de la Côte d'Azur, Nice  
Jean Davoigneau, Ministère de la Culture, Paris

12.40 Discussion (20 min)



**Trade, Makers & Suppliers I (Parallel Session\*)**

**Chair: Steven C. Turner, Smithsonian Institution**

[Anfiteatro de Botânica Aurélio Quintanilha]

11.20 *Nicolas Bion, Ingénieur du Roi*  
Anthony Turner, France

11.40 *Do it yourself at the University of Porto: Locally built scientific instruments from the collection of the Museum of Science*  
Marisa Monteiro, José Moreira Araújo & Luís Bernardo, Museum of Science, University of Porto

12.00 *Teaching physics with instruments: German suppliers 1860-1945*  
Paul Zoller & Sheila M. Zoller, University of Colorado/Gnomix Inc

12.20 *The 'Technology Museum' at the Industrial Institute of Lisbon: Acquisition of equipment and didactical purposes*  
Ana Cardoso de Matos, University of Évora

12.40 Discussion (20 min)

13.00 **Lunch**

**Workshop Navigation Instruments**

José Manuel Malhão Pereira, Centre for the History of Science, University of Lisbon

[Museum terrace]

[Meeting point for ALL workshop participants: Anfiteatro Manuel Valadares, 13.00]



**Trade, Makers & Suppliers II**

**Chair: Paolo Brenni, CNR/Fondazione Scienza e Tecnica, Firenze**

[Anfiteatro Manuel Valadares]

15.00 *Direct and reverse engraving: Can we link the working communities in the past and connect the scholarly communities today?*  
Jim Bennett, Museum of the History of Science, University of Oxford

15.20 *Reading between the lines: The instrument trade in the newspapers of eighteenth-century London*  
Alexi S. Baker, Oxford University

15.40 Discussion (20 min)



### **Instruments and Society: Science and Politics (Parallel Session\*)**

**Chair: Ana Simões, Centre for the History of Science, University of Lisbon**

[Anfiteatro de Botânica Aurélio Quintanilha]

- 15.00 *'The luggage of the demarcator': Science and politics in the borders, from Portuguese America to Brazil*  
Heloisa M. Gesteira, Museu de Astronomia e Ciências Afins, Rio de Janeiro
- 15.20 *The giant solar furnace of Odeillo: Between technology, politics and culture in France (1948-2008)*  
Pierre Teissier, University of Oxford
- 15.40 Discussion (20 min)
- 16.00 **Coffee-Break**
- 16.30 **Poster Session**  
[Laboratório de Física Cyrillo Soares]  
Complete list of posters at the end of the Programme.
- 17.30 **Opening of the Exhibition 'Collection of Scientific Instruments from the Instituto Superior de Engenharia de Lisboa'**  
[Temporary Exhibition Gallery]
- 18.30 **Visit to the Pharmacy Museum**  
João Neto, Pharmacy Museum  
[Meeting Point: Museum stairs, 18.00]

## **Thursday, 18 September**

- 10.00 **Visit to the Museum of the Academy of Sciences**  
Miguel Telles Antunes, Academy of Sciences  
[Meeting Point: Museum stairs, 9.30]
- 11.30 **Visit to the Collection of the Instituto Superior Técnico**  
Carlos Matos Ferreira, Instituto Superior Técnico  
[Meeting Point: Museum stairs, 11.00]
- 12.30 **Lunch**  
[Centro de Congressos IST]
- 14.30 **Visit to the Metrology Museum**  
António Cruz, Instituto Português de Qualidade
- 17.00 **Visit to the Maritime Museum**  
Comandante Rodrigues Pereira & Tenente Gonçalves Neves, Maritime Museum
- 18.30 **Visit to the Astronomical Observatory of Lisbon, University of Lisbon**  
Rui J. Agostinho, OAL/University of Lisbon

## **Friday, 19 September**

- 7.00 **Travel to Coimbra (bus)**  
[Meeting Point: Museum stairs, 7.00]
- 10.00 **Visit to the Astronomy Collection, University of Coimbra**  
Artur Soares Alves, University of Coimbra
- 11.30 **Visit to the Science Museum, University of Coimbra**  
Paulo Gama Mota, Science Museum, University of Coimbra
- 12.30 **SIC Business Meeting**  
[Amphiteatro Chimico, Science Museum]

- 13.00 **Lunch**  
[Grill D. Dinis, University of Coimbra]
- 15.00 **Visit to the Museum of Physics, University of Coimbra**  
Ermelinda Ramos Antunes & Catarina Pires, University of Coimbra
- 17.00 **Note by Fernando Seabra Santos, Rector of the University of Coimbra, followed by visit to the *Biblioteca Joanina***
- 18.30 **Return to Lisbon**

## Saturday, 20 September



### Back to the Source: Instrument Materials

**Chair: Neil Brown, UK**

[Anfiteatro Manuel Valadares]

- 9.00 *Natural magnets and their use in early instruments*  
Alison D. Morrison-Low, National Museums Scotland
- 9.20 *The superconducting supply chain*  
David Pantalony, Canada Science and Technology Museum, Ontario
- 9.40 *In search of Iceland spar*  
Toril Johannessen, Bergen National Academy of the Arts, Norway
- 10.00 Discussion (30 min)



### Trade, Makers & Suppliers III (Parallel Session\*)

**Chair: Robert S. Hicks, Mütter Museum, Philadelphia**

[Anfiteatro de Botânica Aurélio Quintanilha]

- 9.00 *For a dictionary of French scientific instrument-makers*  
Denis Beaudouin, France  
Paolo Brenni, CNR/Fondazione Scienza e Tecnica, Firenze  
Anthony Turner, France
- 9.20 *X-rays for medicine in twentieth-century Spain: The firm Crisa*  
Pedro Ruiz-Castell, Centre d'Història de la Ciència, Universitat Autònoma de Barcelona  
Alfons Zarzoso, Museu d'Història de la Medicina de Catalunya, Barcelona
- 9.40 *Bopp's physical apparatus*  
Steven D. Beare, USA
- 10.00 Discussion (30 min)

### 10.30 **Coffee-Break**



### Instruments and Spaces: Laboratories

**Chair: Alison Morrison-Low, National Museum of Scotland**

[Anfiteatro Manuel Valadares]

- 11.00 *A room of one's own polariscope, or: Is pure sugar in Barbados still pure in Berlin?*  
David R. Singerman, Massachusetts Institute of Technology
- 11.20 *The architecture of instrumentation: Early work at the Mond Laboratory, Cambridge*  
Boris Jardine, Department of History and Philosophy of Science, University of Cambridge
- 11.40 *Laboratories at the Medicine Faculty of the University of Coimbra in the second half of the nineteenth century*  
Maria Burguete, Carlos Fiolhais & Décio R. Martins, University of Coimbra

12.00 *Scientific photography in the nineteenth century: Artificial lights and related instruments*  
Marília Peres, Centre for Molecular Sciences and Materials, University of Lisbon  
Estela Jardim, Faculty of Sciences, University of Lisbon  
Fernanda Madalena Costa, Centre for Molecular Sciences and Materials, University of Lisbon

12.20 Discussion (40 min)



**Instrument Studies III – Twentieth Century (Parallel Session\*)**

**Chair: Roland Wittje, University of Regensburg**

[Anfiteatro de Botânica Aurélio Quintanilha]

11.00 *The development of the scanning tunneling microscope in Japan*  
Mari Yamaguchi, University of Tokyo

11.20 *The construction of the Milan relativistic cyclotron*  
Leonardo Gariboldi, Sezione di Storia della Fisica & Museo Astronomico di Brera, University of Milan

11.40 *The transmission X-ray microscope: An unusual history of successful instrumental development?*  
Andreas Junk, University of Oldenburg

12.00 *The role of instruments in the development of black-body research*  
Daisuke Konagaya, Ryukoku University, Kyoto

12.20 Discussion (40 min)

13.00 **Lunch**

**Workshop Navigation Instruments**

José Manuel Malhão Pereira, Centre for the History of Science, University of Lisbon



**Instruments and Society: Exhibiting Instruments to Broader Audiences II**

**Chair: Richard L. Kremer, Dartmouth College**

[Anfiteatro Manuel Valadares]

14.30 *Keeping the black box closed: Shifting the emphasis to the social in displays of scientific instruments*  
Erin McLeary & Jennifer Landry, Chemical Heritage Foundation, Philadelphia  
(delivered by Robert D. Hicks)

14.50 *The most important instrument*  
Deborah G. Douglas, MIT Museum

15.10 *Instruments, black boxes and interactives*  
Pedro Casaleiro, Science Museum, University of Coimbra

15.30 Discussion (45 min)



**Picturing Instruments: Case-Studies in Iconography (Parallel Session\*)**

**Chair: Carlos Matos Ferreira, Instituto Superior Técnico, Lisbon**

[Anfiteatro de Botânica Aurélio Quintanilha]

14.30 *A matter of time: Sundial iconography in art, literature and music*  
Sara Schechner, Harvard University

14.50 *The image of heaven and earth*  
Diederick Wildeman, Netherlands Maritime Museum

15.10 *Domesticating the enchanter's glass: A telescopic tale*  
Richard Dunn, Royal Observatory Greenwich, National Maritime Museum

15.30 *"Can dead men vote twice?" Iconography of U.S. naval navigation during World War II*  
Robert D. Hicks, Mütter Museum, College of Physicians of Philadelphia

15.50 Discussion (25 min)

- 16.15 **Coffee Break**
- 16.45 **Summary of SIC2008**  
 **Paolo Brenni, CNR/Fondazione Scienza e Tecnica Firenze**  
 [Anfiteatro de Química]
- 17.00 **Reverse salients in the histories of science and technology: A conversation between dinosaurs (Open Session)**  
 **Chair: Jim Bennett, Museum of the History of Science, University of Oxford**  
 [Anfiteatro de Química]  
 Thomas P. Hughes, University of Pennsylvania/MIT  
 John L. Heilbron, University of California at Berkeley/University of Oxford
- 18.30 **Group Photo, followed by free time**  
 [Museum stairs]
- 20.00 **Conference Dinner**  
 Restaurant La Paparrucha  
 Rua D. Pedro V, 18  
 [Meeting Point: Museum stairs, 19.30]

## Sunday, 21 September

- 7.00 **Travel to Porto**  
 [Meeting Point: Museum stairs, 7.00]
- 11.00 **Visit to the Parada Leitão Museum**  
 Patrícia Costa, Parada Leitão Museum (ISEP)
- 12.30 **Lunch**  
 [Faculty of Engineering, University of Porto]
- 14.00 **Visit to the Museum of the Faculty of Engineering, University of Porto**  
 Susana Medina, Museum of the Faculty of Engineering, University of Porto
- 16.00 **Visit to the Museum of Science, University of Porto**  
 Luís Bernardo & Marisa Monteiro, University of Porto
- 18.00 **Porto Calém Cellars**
- 19.00 **Return to Lisbon**

## POSTERS

*The drawings collection of the Museum of Science of the University of Lisbon*  
 Ana Sousa Prates, University of Lisbon

*Five aspects of a sextant: modeling for education and communication*  
 Andréa F. Costa, Douglas Falcão & Ronaldo de Almeida, Museu de Astronomia e Ciências Afins, Rio de Janeiro

*Science through objects: A proposal for a display of historical instruments at the National Museum of Natural History, Lisbon*  
 Catarina Madruga & Jorge Prudêncio, National Museum of Natural History, Lisbon

*Astrometric recognition of the Clementine gnomon and its deviation from celestial north*  
 Costantino Sigismondi, International Centre for Relativistic Astrophysics, University of Rome La Sapienza

*The virtual museum of the Laboratório Nacional de Engenharia Civil, Lisbon*  
 José Moura Esteves & Rita Morgado, Laboratório Nacional de Engenharia Civil, Lisboa

*Recovering a collection of scientific instruments: The case of the scientific museum in Sanremo, Italy*  
 Matteo Leone, Alessandro Paoletti & Nadia Robotti, University of Genoa

*Dry-ice blasting methodology in the restoration of scientific instruments: The case of the Laboratorio Chimico, Lisbon*  
Manuel Lemos, Isabel Tissot & Pedro Pedroso, Archeofactu, Lisboa

*Thesaurus of scientific instruments in Portuguese: A collaborative project between Brazil and Portugal*  
Marcus Granato, Museu de Astronomia e Ciências Afins, Rio de Janeiro  
Marta C. Lourenço, Museum of Science, University of Lisbon

*The collection of scientific instruments of the physics laboratory of the Bento de Abreu State School in Araraquara (SP), Brazil*  
Maria Cristina Zancul & Elton de Oliveira Barreto, State University of São Paulo (UNESP)

*Nineteenth century self-recording photographic meteorological instruments at the Infante D. Luiz Observatory, Lisbon*  
Marília Peres, Centre for Molecular Sciences and Materials, University of Lisbon  
Estela Jardim, Faculty of Sciences, University of Lisbon  
Fernanda Madalena Costa, Centre for Molecular Sciences and Materials, University of Lisbon

*The importance of private collecting in rescuing science artefacts from oblivion (and destruction): An example from Porto*  
Marisa Monteiro, Museum of Science, University of Porto  
Alexis Passechnikoff, Portugal

*Astronomical and geodetical instruments at the Instituto de Investigação Científica Tropical, Lisbon*  
Paula Santos, Instituto de Investigação Científica Tropical, Lisbon

*The personal equation machine at the Astronomical Observatory of Lisbon*  
Rui J. Agostinho, Astronomical Observatory of Lisbon  
Vasco R. Teixeira, Museum of Science, University of Lisbon

*A map of private observatories*  
Thomas A. Hockey, University of Northern Iowa

*Was Coimbra's Observatory Troughton and Simms transit circle displayed at the 1851 Great London Exhibition?*  
Vítor Bonifácio, University of Aveiro  
Isabel Malaquias, University of Aveiro  
João Fernandes, University of Coimbra