

# Contents

## Introduction

- HERITAGE MICROBIOLOGY, SCIENCE AND THE *MARY ROSE*: WHAT ARE WE TRYING TO ACHIEVE? 3  
Christopher Dobbs, *The Mary Rose Trust, Portsmouth, UK*

## Part 1: Heritage Monuments And Materials

- HERITAGE RESEARCH AND PRACTICE: TOWARDS A BETTER UNDERSTANDING? 11  
Thomas Warscheid, *LBW - Bioconsult, Wiefelstede, Germany*
- MAPPING DECAY: GIS, MICROBES AND STONE DEGRADATION ACROSS SCALES 27  
Robert Inkpen, *University of Portsmouth, Portsmouth, UK*
- MICROBIAL COLONISATION OF HISTORIC BUILDINGS IN LATIN AMERICA 39  
Christine C. Gaylarde and B. Otto Ortega-Morales, *Universidad Autónoma de Campeche, Campeche, México*
- ANALYSIS OF BACTERIAL COMMUNITIES ON AN ANTIQUE STAINED GLASS WINDOW 45  
Massamiliano Marvasi, E. Vedovato, C. Balsamo, G. Mastromei, B. Perito, *University of Florence, Florence, Italy*
- ASSESSING THE SUITABILITY OF NOVEL BIOCIDES FOR USE ON HISTORIC SURFACES 51  
Irene Fortune<sup>1</sup>, H-L. Alakomi<sup>2</sup>, M.E. Young<sup>3</sup>, A.A. Gorbushina<sup>4</sup>, W.E. Krumbein<sup>5</sup>, I. Maxwell<sup>6</sup>, C. McCullagh<sup>3</sup>, P. Robertson<sup>3</sup>, M. Saarela<sup>2</sup>, J. Valero<sup>7</sup>, M. Vendrell<sup>8</sup>,  
<sup>1</sup>*Historic Scotland Conservation Centre, Edinburgh, UK*, <sup>2</sup>*VTT Technical Research Centre of Finland, Espoo, Finland*, <sup>3</sup>*Robert Gordon University, Aberdeen UK*, <sup>4</sup>*Carl von Ossietzky Universität, Oldenburg, Germany*, <sup>5</sup>*Biogema-Consulting, Edewecht, Germany*, <sup>6</sup>*Historic Scotland, Edinburgh, UK*, <sup>7</sup>*Fundación Inasmet, San Sebastian, Spain*, <sup>8</sup>*Universidad de Barcelona, Barcelona, Spain*
- BIOCALCIFICATION: THE CONTEXT FOR BIOREMEDIATION 62  
Piero Tiano, *Institute for the Conservation and Valorisation of the Cultural Heritage, Florence, Italy*

THE BIOBRUSH PROJECT FOR BIOREMEDIATION OF HERITAGE STONE	76
Eric May, A.M. Webster, R. Inkpen, D. Zamarreño, J. Kuever <sup>1</sup> , C. Rudolph <sup>1</sup> , T. Warscheid <sup>2</sup> , C. Sorlini <sup>3</sup> , F. Cappitelli <sup>3</sup> , E. Zanardini <sup>3</sup> , G. Ranalli <sup>4</sup> , L. Krage <sup>5</sup> , A. Vgenopoulos <sup>6</sup> , D. Katsinis <sup>6</sup> , E. Mello <sup>7</sup> and M. Malagodi <sup>7</sup> , <i>University of Portsmouth, Portsmouth, UK</i> , <sup>1</sup> <i>Stiftung Institut für Werkstofftechnik, Bremen, Germany</i> , <sup>2</sup> <i>LBW-Bioconsult, Oldenburg, Germany</i> , <sup>3</sup> <i>Universita Degli Studi di Milano, Milan, Italy</i> , <sup>4</sup> <i>Universita del Molise, Italy</i> , <sup>5</sup> <i>Riga Technical University, Riga, Latvia</i> , <sup>6</sup> <i>NTUA, Athens, Greece</i> , <sup>7</sup> <i>Syremont S.p.A., Pavia, Italy</i>	

## Part 2: Molecular Methods For Heritage Artefacts And Monuments

MOLECULAR STUDIES FOR CULTURAL HERITAGE: STATE OF THE ART	97
Juan M Gonzalez, M.C. Portillo, and C. Saiz-Jimenez, <i>CSIC, Sevilla, Spain</i>	
BACTERIA IN ARCHAEOLOGICAL AND WATERLOGGED WOOD: MOLECULAR PROTOCOLS FOR DIVERSITY AND COMMUNITY STUDIES	108
Sarah Hotchkiss <sup>1</sup> , E. Landy <sup>2</sup> , Lai Ka Pang <sup>3</sup> and Julian I. Mitchell <sup>1</sup> , <sup>1</sup> <i>University of Portsmouth, Portsmouth, UK</i> , <sup>2</sup> <i>University of Surrey, Guildford, UK</i> , <sup>3</sup> <i>National Taiwan Ocean University, Taiwan (Republic of China)</i>	
SYNCHROTRON RADIATION FOR THE INVESTIGATION OF OBJECTS OF CULTURAL HERITAGE VALUE	128
Andrew D. Smith, <i>CCLRC Daresbury Laboratory, Warrington, UK</i>	
FLUORESCENT <i>IN SITU</i> HYBRIDIZATION (FISH) AS MOLECULAR TOOL TO STUDY BACTERIA CAUSING BIODETERIORATION	143
Clara Urzi, <i>University of Messina, Messina, Italy</i>	
IDENTIFICATION OF BACTERIA FROM WATERLOGGED ARCHAEOLOGICAL WOOD	151
Anna-Christine Helms, <i>The National Museum of Denmark, Brede, Denmark</i>	
NOVEL COMBINED APPROACH BASED ON PHOSPHOLIPID FATTY ACIDS AND 16S-rDNA PCR-SSCP ANALYSES TO CHARACTERISE FOULING BIOFILMS ON HISTORIC MONUMENTS	156
B.Otto Ortega-Morales <sup>1</sup> , C.C. Gaylarde <sup>1</sup> and C.C. Christoph Tebbe <sup>2</sup> , <sup>1</sup> <i>Universidad Autónoma de Campeche, Campeche, México</i> , <sup>2</sup> <i>Institut für Agrarökologie, Bundesforschungsanstalt für Landwirtschaft, Braunschweig, Germany</i>	
ON THE USE OF 23S rRNA GENE SEQUENCES TO ASSESS A HIGH DIVERSITY OF ACIDOBACTERIA IN ALTAMIRA CAVE	166
J. Zimmermann, Juan Gonzalez, and C. Saiz-Jimenez, <i>CSIC, Sevilla, Spain</i>	

**Part 3: Historic Ships And Their Preservation**

- THE *IN-SITU* PRESERVATION OF ARCHAEOLOGICAL SITES UNDERWATER: AN EVALUATION OF SOME TECHNIQUES 179  
 Martijn Manders<sup>1</sup>, David Gregory<sup>2</sup>, Vicki Richards<sup>3</sup>, <sup>1</sup>*Rijksdienst voor Archeologie, Cultuurlandschap en Monumenten (RACM), Amersfoort, The Netherlands*, <sup>2</sup>*National Museum of Denmark, Brede, Denmark*, <sup>3</sup>*Western Australian Museum, Shipwreck Galleries, Fremantle, Australia*
- MOLECULAR BACTERIAL DIVERSITY IN THE TIMBERS OF THE TUDOR WARSHIP THE *MARY ROSE* 204  
 Julian Mitchell<sup>1</sup>, Ka-Lai Pang<sup>2</sup>, Mark Jones<sup>3</sup> and Andy Smith<sup>4</sup>, <sup>1</sup>*University of Portsmouth, Portsmouth, UK*, <sup>2</sup>*National Taiwan Ocean University, Keelung, Taiwan (Republic of China)*, <sup>3</sup>*The Mary Rose Trust, Portsmouth, UK*, <sup>4</sup>*STFC Daresbury Laboratory, Warrington, UK*
- TIMBER CONSERVATION ON NELSON'S FLAGSHIP *HMS VICTORY* 219  
 Tony Bravery, *BRE Centre for Timber Technology and Construction, Watford, UK*
- INFORMING THE CONSERVATION, DISPLAY AND LONG-TERM PRESERVATION OF THE *HMS VICTORY* TRAFALGAR SAIL 236  
 Paul Wyeth, *University of Southampton, Winchester, UK*
- EXTRACTION OF IRON COMPOUNDS FROM WATERLOGGED PINE WOOD FROM THE *VASA* 245  
 G. Almkvist and I. Persson, *Swedish University of Agricultural Sciences, Uppsala, Sweden*
- ELECTROLYSIS IN THE CONSERVATION OF LARGE ARTEFACTS: THE M33 AND THE S.V.CUTTY SARK 257  
 Sheelagh A. Campbell, I.B. Beech, S.P. Gillard, B.D. Barker and P. Lawton<sup>1</sup>, *University of Portsmouth, Portsmouth, UK*, <sup>1</sup>*Hampshire County Council Museums Service, Portsmouth, UK*
- DESICCATED STORAGE OF CHLORIDE-CONTAMINATED IRON: A STUDY OF THE EFFECTS OF LOSS OF ENVIRONMENTAL CONTROL 279  
 David Watkinson<sup>1</sup> and Mark R. T. Lewis<sup>2</sup>, <sup>1</sup>*Cardiff University, Cardiff, UK*, <sup>2</sup>*National Museum of Wales, Cardiff, UK*

**Endnote**

- MICROBIOLOGY AND ART: AN EDUCATION OPPORTUNITY 293  
 Joanna Verran, *Manchester Metropolitan University, Manchester, UK*
- Subject Index 300

**International Scientific Committee:**

Dr Robert Blanchette (USA)  
Professor Cesareo Saiz-Jimenez (Spain)  
Professor Claudia Sorlini (Italy)  
Dr Christine Gaylarde (Brazil)  
Dr David Gregory (Denmark)  
Professor Robert J. Koestler (USA)  
Dr Eric May (UK, Convener)  
Professor Ralph Mitchell (USA)  
Dr Piero Tiano (Italy)  
Dr Thomas Warscheid (Germany)

**Local Organising Committee:**

E. May University of Portsmouth (Chair)  
I. Beech, University of Portsmouth  
S. Campbell, University of Portsmouth  
D. Childs, Mary Rose Trust, Portsmouth  
C. Dobbs, Mary Rose Trust, Portsmouth  
R. Eaton, University of Portsmouth  
R. Inkpen, University of Portsmouth  
M. Jones, Mary Rose Trust, Portsmouth  
D. Pert, University of Portsmouth  
A. Webster, University of Portsmouth