*Short Meeting Report: Gordon Research Conference on*

# Thiol-Based Redox Regulation and Signaling

Mechanisms and Organizing Principles in Redox Signaling –
Implications for Age-Related Disease

July 15-20, 2018

Venue: Rey Don Jaime Grand Hotel, Castelldefels, Spain

https://www.grc.org/thiol-based-redox-regulation-and-signaling-conference/2018/

Chair: Tobias P. Dick; Vice Chair: Kate S. Carroll

Number of participants: 198 (from 28 countries)

This interdisciplinary conference provided an important venue for the free exchange of ideas among chemists, biochemists, molecular and cell biologists, physiologists, and clinicians working on various aspects of redox biology. By bringing together investigators with varied expertise in basic and medical research, the meeting stimulated new collaborations and catalyzed scientific progress. The GRC was preceded by a Gordon Research Seminar (GRS) (July 14-15, 2018), which provided opportunities for graduate students and postdoctoral scientists to formally present research and engage in scientific discussions on this important focus area of research.

# Meeting Program

## Sunday

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| 4:00 pm - 8:00 pm | Arrival and Check-in |
| 6:00 pm | Dinner |
| 7:30 pm - 7:40 pm | Welcome / Introductory Comments by GRC Site Staff |
| 7:40 pm - 9:30 pm | **Keynote Session: Concepts and Directions in Redox Signaling Research** |
| | Discussion Leaders: **Tobias Dick** (German Cancer Research Center (DKFZ), Germany) and **Kate Carroll** (The Scripps Research Institute, USA) |
| 7:40 pm - 8:20 pm | **Toren Finkel** (University of Pittsburgh, USA)<br>"Redox Signaling Meets Aging Biology" |
| 8:20 pm - 8:35 pm | Discussion |
| 8:35 pm - 9:15 pm | **Navdeep Chandel** (Northwestern University, USA)<br>"Functional Genomic Screens to Uncover Redox Biology" |
| 9:15 pm - 9:30 pm | Discussion |

## Monday

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| 7:30 am - 8:30 am | Breakfast |
| 9:00 am - 12:30 pm | **New Tools for Redox Signaling Research** |
| | Discussion Leaders: **Vsevolod Belousov** (Shemyakin-Ovchinnikov Institute of Bioorganic Chemistry, Russian Academy of Sciences, Russia) and **Andreas Meyer** (University of Bonn, Germany) |
| 9:00 am - 9:20 am | **Huiwang Ai** (University of Virginia, USA)<br>"Fluorescent Protein Based Biosensors for Compartmentalized Redox Parameters" |
| 9:20 am - 9:30 am | Discussion |
| 9:30 am - 9:50 am | **Yi Yang** (East China University of Science and Technology, China)<br>"Genetically Encoded Sensors for Visualizing Redox Metabolism in Living Cells" |
| 9:50 am - 10:00 am | Discussion |
| 10:00 am - 10:20 am | **Jing Yang** (National Center for Protein Sciences, Beijing, China)<br>"Direct Mapping of oxiPTMs in Proteomes" |
| 10:20 am - 10:30 am | Discussion |
| 10:30 am - 11:00 am | Coffee Break |
| 11:00 am - 11:20 am | **Hadley Sikes** (Massachusetts Institute of Technology, USA)<br>"Understanding and Monitoring the Action of Redox-Directed Cancer Therapeutics" |
| 11:20 am - 11:30 am | Discussion |

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| 11:30 am - 11:40 am | **Yimon Aye** (Cornell University / Weill Cornell Medicine, USA)<br>"Swiss Army Man: A Single Molecule that Simultaneously Profiles and Decodes Precision Protein-Cysteine Signaling Axes in Living Systems" |
| 11:40 am - 11:45 am | Discussion |
| 11:45 am - 11:55 am | **Valentin Cracan** (Harvard Medical School / Massachusetts General Hospital, USA)<br>"Genetically Encoded Tools for Compartment-Specific Manipulation of NAD+/NADH and NADP+/NADPH in Living Cells" |
| 11:55 am - 12:00 pm | Discussion |
| 12:00 pm - 12:10 pm | **Jiska van der Reest** (Cancer Research UK Beatson Institute, United Kingdom)<br>"Proteome-Wide Analysis of Cysteine Oxidation Using SICyLIA" |
| 12:10 pm - 12:15 pm | Discussion |
| 12:15 pm - 12:25 pm | **Xiaojing Yang** (University of Illinois at Chicago, USA)<br>"Dynamic Crystallography Studies of Protein Thiol Switches" |
| 12:25 pm - 12:30 pm | Discussion |
| 12:30 pm | Lunch |
| 1:30 pm - 4:30 pm | Free Time |
| 3:00 pm - 4:00 pm | Power Hour<br>*The GRC Power Hour is an optional informal gathering open to all meeting participants. It is designed to help address the challenges women face in science and support the professional growth of women in our communities by providing an open forum for discussion and mentoring.*<br>Organizer: **Yvonne Janssen-Heininger** (University of Vermont, USA) |
| 4:30 pm - 6:00 pm | Poster Session |
| 6:00 pm - 8:00 pm | **Mechanisms of Redox Signaling in Aging**<br>Discussion Leaders: **Michael Ristow** (Energy Metabolism Laboratory, ETH Zurich, Switzerland) and **Rodney Levine** (National Institutes of Health, USA) |
| 6:00 pm - 6:20 pm | **Vadim Gladyshev** (Brigham and Women's Hospital / Harvard Medical School, USA)<br>"Selenium, Redox and Aging" |
| 6:20 pm - 6:30 pm | Discussion |
| 6:30 pm - 6:50 pm | **Ursula Jakob** (University of Michigan, USA)<br>"Effects of Developmental ROS on Stress Resistance and Lifespan" |
| 6:50 pm - 7:00 pm | Discussion |
| 7:00 pm - 7:20 pm | **Kitai Kim** (Memorial Sloan-Kettering Cancer Center, USA)<br>"Homeostatic Redox Balance and Epigenetic Changes During the Cellular Transition to Stem Cells" |
| 7:20 pm - 7:30 pm | Discussion |
| 7:30 pm - 7:40 pm | **Helena Cocheme** (MRC London Institute of Medical Sciences, United Kingdom)<br>"Redox Regulation of Autophagy Extends Lifespan in *Drosophila*" |
| 7:40 pm - 7:45 pm | Discussion |

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| 7:45 pm - 7:55 pm | **Giuseppe Filomeni** (Danish Cancer Society Research Center, Denmark)<br>"GSNOR Links S-Nitrosylation to the Mitochondrial Theory of Aging" |
| 7:55 pm - 8:00 pm | Discussion |
| 8:00 pm | Dinner |

## Tuesday

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| 7:30 am - 8:30 am | Breakfast |
| 8:30 am | Group Photo |
| 9:00 am - 12:30 pm | **Dysregulation of Redox Signaling in Age-Related Disease**<br>Discussion Leaders: **Carola Neumann** (Magee-Womens Research Institute, USA) and **Arne Holmgren** (Karolinska Institutet, Sweden) |
| 9:00 am - 9:20 am | **Marcus Conrad** (Helmholtz Zentrum Muenchen, Germany)<br>"Ferroptosis Mechanisms and Pharmacological Tractability in Degenerative Disease" |
| 9:20 am - 9:30 am | Discussion |
| 9:30 am - 9:50 am | **Albert Van Der Vliet** (University of Vermont, USA)<br>"Dynamic Redox-Based Control of Tyrosine Kinase Signaling in Health and Disease" |
| 9:50 am - 10:00 am | Discussion |
| 10:00 am - 10:20 am | **Thomas Michel** (Cardiovascular Division, Brigham and Women's Hospital / Harvard Medical School, USA)<br>"Probing *In Vivo* Oxidant Pathways in the Cardiovascular System Using Chemogenetic Approaches" |
| 10:20 am - 10:30 am | Discussion |
| 10:30 am - 11:00 am | Coffee Break |
| 11:00 am - 11:20 am | **Cristina Furdui** (Wake Forest School of Medicine, USA)<br>"Integrated Redox Analysis of Head and Neck Cancer Reveals New Opportunities for Diagnosis and Treatment" |
| 11:20 am - 11:30 am | Discussion |
| 11:30 am - 11:40 am | **Kumar Somyajit** (University of Copenhagen, Denmark)<br>"Redox-Controlled Boundaries of Physiological and Pathological Responses at a Replication Fork" |
| 11:40 am - 11:45 am | Discussion |
| 11:45 am - 11:55 am | **Igor Asanovic** (Medical University of Vienna, Austria)<br>"Characterization of PYROXD1, a Novel Redox-Redulator of tRNA Splicing" |
| 11:55 am - 12:00 pm | Discussion |
| 12:00 pm - 12:10 pm | **Evanna Mills** (Dana-Farber Cancer Institute / Harvard Medical School, USA)<br>"Accumulated Succinate Controls Mitochondrial ROS Production to Activate Adipose Tissue Thermogenesis" |
| 12:10 pm - 12:15 pm | Discussion |

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| 12:15 pm - 12:25 pm | **Bernd Moosmann** (Johannes Gutenberg University Mainz, Germany)<br>"The Dark Side of the Moon: Membrane Thiols Cause Premature Aging *In Vivo*" |
| 12:25 pm - 12:30 pm | Discussion |
| 12:30 pm | Lunch |
| 1:30 pm - 4:30 pm | Free Time |
| 4:30 pm - 6:00 pm | Poster Session |
| 6:00 pm - 8:00 pm | **Pharmacological Manipulation of Redox Signaling** |
| | Discussion Leaders: **Yvonne Janssen-Heininger** (University of Vermont, USA) and **Ana Denicola** (University of the Republic, Uruguay) |
| 6:00 pm - 6:20 pm | **Elias Arner** (Karolinska Institutet, Sweden)<br>"Anticancer Potential of Cell-Specific Redox Effects by Drugs Targeting Thioredoxin Reductase 1" |
| 6:20 pm - 6:30 pm | Discussion |
| 6:30 pm - 6:50 pm | **Michael Murphy** (MRC Mitochondrial Biology Unit, University of Cambridge, United Kingdom)<br>"Manipulating Mitochondrial Thiol Redox Status *In Vivo*" |
| 6:50 pm - 7:00 pm | Discussion |
| 7:00 pm - 7:20 pm | **Amit Singh** (Indian Institute of Science, India)<br>"Redox Diversity Breeds Drug Tolerance in *Mycobacterium tuberculosis*" |
| 7:20 pm - 7:30 pm | Discussion |
| 7:30 pm - 7:40 pm | **Sharon Campbell** (University of North Carolina at Chapel Hill, USA)<br>"Redox Regulation of the Oncogenic KRas G12C Mutant" |
| 7:40 pm - 7:45 pm | Discussion |
| 7:45 pm - 7:55 pm | **Jonathan Ghergurovich** (Princeton University, USA)<br>"Targeting the oxPPP: Discovery and Characterization of Cell-Active G6PD Inhibitors" |
| 7:55 pm - 8:00 pm | Discussion |
| 8:00 pm | Dinner |

## Wednesday

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| 7:30 am - 8:30 am | Breakfast |
| 9:00 am - 12:30 pm | **Thiol Peroxidases in Redox Signaling** |
| | Discussion Leaders: **Elizabeth Veal** (Newcastle University, United Kingdom) and **Luis Netto** (Universidade de Sao Paulo, Brazil) |
| 9:00 am - 9:20 am | **Leslie Poole** (Wake Forest School of Medicine, USA)<br>"Disulfide Formation Kinetics of Two-Cysteine Peroxiredoxins and a Model for Peroxide Sensing" |
| 9:20 am - 9:30 am | Discussion |
| 9:30 am - 9:50 am | **Christine Winterbourn** (University of Otago, Christchurch, New Zealand)<br>"Multiple Possibilities for Peroxiredoxin Involvement in Redox Signaling" |

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| 9:50 am - 10:00 am | Discussion |
| 10:00 am - 10:20 am | **Tobias Dansen** (University Medical Center Utrecht, The Netherlands)<br>"Peroxiredoxins Facilitate the Oxidation of Thiols in Target Proteins Through Distinct Mechanisms" |
| 10:20 am - 10:30 am | Discussion |
| 10:30 am - 11:00 am | Coffee Break |
| 11:00 am - 11:20 am | **Elena Hidalgo** (Pompeu Fabra University, Spain)<br>"Using Fission Yeast to Study Oxidative Stress in Toxicity and Signalling" |
| 11:20 am - 11:30 am | Discussion |
| 11:30 am - 11:40 am | **W. Todd Lowther** (Wake Forest School of Medicine, USA)<br>"Novel Structural Insights into the Rearrangements Required for the Disulfide-Bond Formation Step of Peroxiredoxins" |
| 11:40 am - 11:45 am | Discussion |
| 11:45 am - 11:55 am | **Bruce Morgan** (University of Kaiserslautern, Germany)<br>"A Potential Role for $H_2O_2$ and Peroxiredoxins in Regulating Cellular Time-Keeping" |
| 11:55 am - 12:00 pm | Discussion |
| 12:00 pm - 12:10 pm | **Paul Pace** (Centre for Free Radical Research, University of Otago, Christchurch, New Zealand)<br>"Exploring a Putative Redox Relay Between Peroxiredoxins and the Cytoskeletal-Regulatory Protein CRMP2" |
| 12:10 pm - 12:15 pm | Discussion |
| 12:15 pm - 12:25 pm | **Mehmet Berkmen** (New England BioLabs, USA)<br>"Using Peroxidases to Enhance Oxidative Folding in *E. coli*" |
| 12:25 pm - 12:30 pm | Discussion |
| 12:30 pm | Lunch |
| 1:30 pm - 4:30 pm | Free Time |
| 4:30 pm - 6:00 pm | Poster Session |
| 6:00 pm - 8:00 pm | **Oxidative Stress Resistance and Damage Control**<br>Discussion Leaders: **Luise Krauth-Siegel** (Heidelberg University, Germany) and **Joris Messens** (Redox Signaling Lab, Center for Structural Biology, VIB, Vrije Universiteit Brussel, Belgium) |
| 6:00 pm - 6:20 pm | **Gilles Charvin** (Institut de Génétique et Biologie Moléculaire et Cellulaire (IGBMC), GIE-CERBM, CNRS, France)<br>"Integration of Hydrogen Peroxide Stress in Single Dividing Cells" |
| 6:20 pm - 6:30 pm | Discussion |
| 6:30 pm - 6:50 pm | **Michael Davies** (University of Copenhagen, Denmark)<br>"Disulfide Bonds: A Crucial and Neglected Target for Biological Oxidants" |
| 6:50 pm - 7:00 pm | Discussion |

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| 7:00 pm - 7:20 pm | **Marcel Deponte** (TU Kaiserslautern, Germany)<br>"Mother Nature Invented Glutathione: But Why So Much? Principles and Open Questions in Glutathione Metabolism" |
| 7:20 pm - 7:30 pm | Discussion |
| 7:30 pm - 7:40 pm | **Dana Reichmann** (The Hebrew University of Jerusalem, Israel)<br>"Profiling of Redox-Dependent Heterogeneity in Single Cells" |
| 7:40 pm - 7:45 pm | Discussion |
| 7:45 pm - 7:55 pm | **Emily Flashman** (University of Oxford, United Kingdom)<br>"Enzyme-Catalysed Cysteine Oxidation and Its Role in Plant Flood Tolerance" |
| 7:55 pm - 8:00 pm | Discussion |
| 8:00 pm | Dinner |

## Thursday

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| 7:30 am - 8:30 am | Breakfast |
| 8:30 am - 9:00 am | Business Meeting<br>*Nominations for the Next Vice Chair; Fill in Conference Evaluation Forms; Discuss Future Site and Scheduling Preferences; Election of the Next Vice Chair* |
| 9:00 am - 12:30 pm | **Redox Control Across Membranes and Compartments**<br>Discussion Leaders: **Johannes Herrmann** (University of Kaiserslautern, Germany) and **Michel Toledano** (French Alternative Energies and Atomic Energy Commission (CEA), France) |
| 9:00 am - 9:20 am | **Carolyn Sevier** (Cornell University, USA)<br>"Molecular Mechanisms to Maintain Cellular Redox Homeostasis" |
| 9:20 am - 9:30 am | Discussion |
| 9:30 am - 9:50 am | **Neil Bulleid** (University of Glasgow, United Kingdom)<br>"Reversing Redox Modifications in the Mammalian Endoplasmic Reticulum" |
| 9:50 am - 10:00 am | Discussion |
| 10:00 am - 10:20 am | **Keith Blackwell** (Harvard Medical School, USA)<br>"Regulation of Oxidative and Proteasomal Stress Responses at the ER" |
| 10:20 am - 10:30 am | Discussion |
| 10:30 am - 11:00 am | Coffee Break |
| 11:00 am - 11:20 am | **Gyorgy Hajnoczky** (Thomas Jefferson University, USA)<br>"Redox Nanodomain Mediated Signaling at ER-Mitochondrial Contact Sites" |
| 11:20 am - 11:30 am | Discussion |
| 11:30 am - 11:50 am | **Deborah Fass** (Weizmann Institute of Science, Israel)<br>"Physiological Functions of Golgi and Extracellular Disulfide Bond Formation" |
| 11:50 am - 12:00 pm | Discussion |
| 12:00 pm - 12:10 pm | **Roberto Sitia** (Vita-Salute San Raffaele University, Italy)<br>"Regulation of Thiol-Mediated Protein Quality Control in the Early Secretory Pathway" |

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| 12:10 pm - 12:15 pm | Discussion |
| 12:15 pm - 12:25 pm | **Jan Riemer** (University of Cologne, Germany)<br>"A Switch-off Mechanism to Protect the Mitochondrial Glutathione Pool from Oxidative Stress" |
| 12:25 pm - 12:30 pm | Discussion |
| 12:30 pm | Lunch |
| 1:30 pm - 4:30 pm | Free Time |
| 4:30 pm - 6:00 pm | Poster Session |
| 6:00 pm - 8:00 pm | **Reactive Sulfur Species and Their Biomedical Relevance** |
| | Discussion Leaders: **Beatriz Alvarez** (University of the Republic, Uruguay) and **Milos Filipovic** (IBGC - Institut de Biochimie et Genetique Cellulaires / CNRS, France) |
| 6:00 pm - 6:20 pm | **James Mitchell** (Harvard University, USA)<br>"The Role of Hydrogen Sulfide in Endothelial Cell Energy Metabolism and Angiogenesis" |
| 6:20 pm - 6:30 pm | Discussion |
| 6:30 pm - 6:50 pm | **Peter Nagy** (National Institute of Oncology, Budapest, Hungary)<br>"Speciation of Reactive Sulfur Species and Their Reactions with Alkylating Agents: Do We Have Any Clue About What Is Present Inside the Cell?" |
| 6:50 pm - 7:00 pm | Discussion |
| 7:00 pm - 7:20 pm | **Jon Fukuto** (Sonoma State University, USA)<br>"The Chemical Biology of Hydropersulfides and Related Polysulfides: Possible Cellular Protectants" |
| 7:20 pm - 7:30 pm | Discussion |
| 7:30 pm - 7:40 pm | **Emilia Kouroussis** (Institut de Biochimie et Génétique Cellulaires (IBGC), University of Bordeaux, France)<br>"Waves of Protein Persulfidation: From Signalling to Aging" |
| 7:40 pm - 7:45 pm | Discussion |
| 7:45 pm - 7:55 pm | **Iria Medraño Fernandez** (Vita-Salute San Raffaele University, Italy)<br>"Aquaporin-8 Gating by Persulfidation: A Spillway to Route $H_2O_2$ Signalling" |
| 7:55 pm - 8:00 pm | Discussion |
| 8:00 pm | Dinner |

## Friday

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| 7:30 am - 8:30 am | Breakfast |
| 9:00 am | Departure |

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