



## European Network for oxysterol research (ENOR): 10th ENOR symposium – Web meeting

## 1. Introduction

The European Network for Oxysterol Research (ENOR; <https://www.oxysterols.net/>) was founded by Dr Gérard Lizard (Inserm / University of Burgundy, Dijon, France) and Prof Luigi Iuliano (Sapienza University of Rome, Rome, Italy) in 2010 [1]. The aim of the ENOR, which is a self-promoting and self-sustaining organization, is to favour interactions between research groups, and to stimulate novel researches on oxysterols [2] and phytosterols [3].

In 2021, due to the persistent uncertain situation due to COVID-19 pandemic, the annual ENOR meeting was carried out in the form of video-conferences thanks to the help of Prof. Steven R. Wilson (University of Oslo, Sweden), Dr. Hanne Røberg-Larsen (University of Oslo, Sweden) and Dr. James Thorne (University of Leeds, United Kingdom). This symposium, which took place on 16–17 September 2021, brought 80 participants from all over the world, including Australia, Belgium, Brazil, Czech Republic, China, Finland, France, Germany, India, Ireland, Israel, Italy, Japan, Lebanon, Lithuania, Morocco, Netherlands, Poland, Portugal, Russia, Serbia, Slovenia, Spain, Switzerland, Sweden, Tunisia, Turkey and United Kingdom.

The program is available online on the ENOR website (<https://www.oxysterols.net/symposia>), and we had the pleasure of welcoming two invited speakers for two plenary lectures: Prof. P. Tontonoz (University of California, Los Angeles, United States of America) for a conference entitled 'New pathways in cellular and systemic lipid transport', and Dr. J. Xuntian (Washington University School of Medicine, St Louis, United States of America) for a conference entitled 'Newborn screening for Niemann-Pick C disease'. During this meeting comprising three sessions (Metabolism of oxysterols and phytosterols; Sterol chemistry and methodology advancements in oxysterol research; Oxysterols in health and disease), 29 oral communications were given. The participants of the web meeting had the possibility to publish their work in a Special Issue of the Journal 'Steroids'. We thank the Editor in Chief, Prof. T.M. Penning (Philadelphia, Pennsylvania, USA), for this excellent opportunity for the ENOR's members.

In this special issue of Steroids, 6 publications (4 research papers, 2 reviews) have been published. Dr. I. Ghzaïel (Dijon, France) demonstrates on murine myoblasts C2C12 that milk thistle (*Sylibum marianum*) seed oil and  $\alpha$ -tocopherol strongly attenuate cell death induced by  $7\beta$ -hydroxycholesterol, whose plasma concentration is significantly increased in patients with sarcopenia. Milk thistle seed oil and  $\alpha$ -tocopherol also strongly counteract mitochondrial and peroxisomal dysfunction [4]. The ability to reduce peroxisomal dysfunction and normalize peroxisomal activity has led to the notion of pexotherapy: attenuation of peroxisomal dysfunctions by natural or synthetic

molecules or mixtures of molecules. In the context of oxysterol-associated toxicity, Dr. R. Chiba (Kyoto, Japan) showed on human neuroblastoma SH-SY5Y cells that  $\alpha$ -tocopherol, but not  $\alpha$ -tocotrienol, suppresses 24(S)-hydroxycholesterol-induced cell death by inhibiting endoplasmic reticulum membrane disruption [5]. In the context of oxysterols and cancer, Dr. H. Zhang (Leeds, United Kingdom), shows an association between liver X receptor polymorphism and blood lipids [6]. Dr. S. Otto (Jena, Germany) reports that increased cholesterol absorption is associated with In-stent-restenosis after stent implantation for stable coronary artery disease [7]. A review by Dr. J. H. Taskinen (Helsinki, Finland) reports the effects of pharmacological inhibition of oxysterol-binding protein (OSBP) on umbilical cord endothelial cells [8], and the other review by Dr. L. Rezig (Tunis, Tunisia) provides an update on the cytoprotective activities of nutrients present in the Mediterranean diet, vis-à-vis 7-ketocholesterol and  $7\beta$ -hydroxycholesterol [9], in the context of the prevention of age-related diseases [10].

In 2022, ENOR's activity has restarted, and in September 2022, a web meeting was also very successful. In September 21–22, 2023, we will have a face-to-face conference in Toulouse, France (<https://www.oxysterols.net/>), then in Leeds (United Kingdom, 2024) and Helsinki (Finland, 2025) in order to pursue active researches on all aspects of oxysterols and phytosterols for the benefit of all.

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## References

- [1] G. Lizard, M. Poirot, L. Iuliano, European network for oxysterol research (ENOR): 10 th anniversary, *J. Steroid Biochem. Mol. Biol.* 214 (2021) 105996.
- [2] V. Mutemberezi, O. Guillemot-Legrès, G.G. Muccioli, Oxysterols: from cholesterol metabolites to key mediators, *Prog. Lipid Res.* 64 (2016) 152–169.
- [3] P.J.H. Jones, M. Shamloo, D.S. MacKay, T.C. Rideout, S.B. Myrie, J. Plat, J. B. Roulet, D.J. Baer, K.L. Calkins, H.R. Davis, P. Barton Duell, H. Ginsberg, H. Gylling, D. Jenkins, D. Lütjohann, M. Moghadasian, R.A. Moreau, D. Mymin, R. E. Ostlund Jr., R.T. Ras, J. Ochoa Reparaz, E.A. Trautwein, S. Turley, T. Vanmierlo, O. Weingärtner, Progress and perspectives in plant sterol and plant stanol research, *Nutr. Rev.* 76 (10) (2018) 725–746.
- [4] I. Ghzaïel, A. Zarrouk, S. Essadek, L. Martine, S. Hammouda, A. Yammine, M. Ksila, T. Nury, W. Meddeb, M. Tahri Joutey, W. Mihoubi, C. Caccia, V. Leoni, M. Samadi, N. Acar, P. Andreoletti, S. Hammami, T. Ghraïri, A. Vejux, M. Hammami, G. Lizard, Protective effects of milk thistle (*Sylibum marianum*) seed oil and  $\alpha$ -tocopherol against  $7\beta$ -hydroxycholesterol-induced peroxisomal alterations in murine C2C12

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- myoblasts: nutritional insights associated with the concept of pexotherapy, *Steroids* 183 (2022), 109032.
- [5] R. Chiba, Y. Urano, N. Noguchi,  $\alpha$ -Tocopherol suppresses 24(S)-hydroxycholesterol-induced cell death via inhibition of endoplasmic reticulum membrane disruption, *Steroids* 189 (2023), 109136.
- [6] H. Zhang, P. Lianto, W. Li, M. Xu, J.B. Moore, J.L. Thorne, Associations between liver X receptor polymorphisms and blood lipids: a systematic review and meta-analysis, *Steroids* 185 (2022), 109057.
- [7] S. Otto, D. Lütjohann, A. Kerksiek, S. Friedrichs, P. Christian Schulze, S. Möbius-Winkler, T.C. Pörner, O. Weingärtner, Increased cholesterol absorption is associated with In-stent-restenosis after stent implantation for stable coronary artery disease, *Steroids* 187 (2022), 109079.
- [8] J.H. Taskinen, H. Ruhanen, S. Matsysik, R. Käkälä, V.M. Olkkonen, Global effects of pharmacologic inhibition of OSBP in human umbilical vein endothelial cells, *Steroids* 185 (2022), 109053.
- [9] L. Rezig, I. Ghzaïel, M. Ksila, A. Yammine, T. Nury, A. Zarrouk, M. Samadi, M. Chouaïbi, A. Vejux, G. Lizard, Cytoprotective activities of representative nutrients from the Mediterranean diet and of Mediterranean oils against 7-ketocholesterol- and 7 $\beta$ -hydroxycholesterol-induced cytotoxicity: application to age-related diseases and civilization diseases, *Steroids* 187 (2022), 109093.
- [10] T. Nury, A. Yammine, I. Ghzaïel, K. Sassi, A. Zarrouk, F. Brahmi, M. Samadi, S. Rup-Jacques, D. Vervandier-Fasseur, J.P. Pais de Barros, V. Bergas, S. Ghosh, M. Majeed, A. Pande, A. Atanasov, S. Hammami, M. Hammami, J. Mackrill, B. Nasser, P. Andreoletti, M. Cherkaoui-Malki, A. Vejux, G. Lizard, Attenuation of 7-ketocholesterol- and 7 $\beta$ -hydroxycholesterol-induced oxiaoptophagy by nutrients, synthetic molecules and oils: potential for the prevention of age-related diseases, *Ageing Res Rev* 68 (2021), 101324.
- Gérard Lizard<sup>a,\*</sup>, Marc Poirot<sup>b</sup>, Luigi Iuliano<sup>c,d</sup>
- <sup>a</sup> *Team Bio-PeroxiLL, “Biochemistry of the Peroxisome, Inflammation and Lipid Metabolism” (EA7270), University Bourgogne, Inserm 21000, Dijon, France*
- <sup>b</sup> *Cancer Research Center of Toulouse (CRCT), Team “Cholesterol Metabolism and Therapeutic Innovations”; Equipe labellisée par la Ligue Nationale Contre le Cancer, The French Network for Nutrition and Cancer Research (NACRe Network), INSERM UMR 1037-CNRS U 5071-Université de Toulouse, 31037 Toulouse, France*
- <sup>c</sup> *INSERM UMR 1037-CNRS U 5071-Université de Toulouse, 31037 Toulouse, France*
- <sup>d</sup> *UOC of Internal Medicine, Sapienza University of Rome, ICOT University Hospital, Latina; & Vascular Biology & Mass Spectrometry Laboratory, Department of Medico-Surgical Sciences and Biotechnologies, Sapienza University of Rome, Latina, Italy*
- \* Corresponding author at: Faculté des Sciences Gabriel, 6 boulevard Gabriel, Laboratoire Bio-PeroxiLL, 21000 Dijon, France.  
E-mail address: [gerard.lizard@u-bourgogne.fr](mailto:gerard.lizard@u-bourgogne.fr) (G. Lizard).