

Uniting zinc scientists



The co-Founders of Zinc-Net (from left to right): Lothar Rink, Nicola Lowe, Imre Lengyel and Mike Watkinson.

Why did you decide to establish the European Cooperation in Science and Technology (COST) Action 'Zinc-Net'?

In 2013, our funding application to establish Zinc-Net was supported by COST – Europe's longest-running intergovernmental framework for science and technology cooperation. A 'COST Action' is a COST-funded bottom-up scientific network, started upon the initiative of scientists and researchers. The concept for Zinc-Net originated from the very successful Zinc-UK network that was established in 2009 and led by Dr Imre Lengyel. Our aim was, and still is, to understand and promote the central role that zinc plays in health and disease. As more European laboratories became interested in participating in and contributing to Zinc-UK, we applied for funding from COST to establish a pan-European network enabling breakthrough scientific advancements and the development of new concepts and products, thereby contributing to stronger European research and innovation capacities. The application was backed by researchers from a wide variety of disciplines in 20 countries. The interdisciplinary nature of the network is reflected by the diversity of our own backgrounds, which span nutrition science, chemistry and cell biology.

What are you hoping to achieve by collating the broad existing knowledge base of zinc-related research?

We hope to identify gaps and focus future research activities on addressing the associated unknowns. We will concentrate on interdisciplinary research centred on

the activities of five working groups in the areas of chemical biology; biomarker discovery; clinical co-ordination; industrial liaison and knowledge transfer; and outreach and training. These activities will be linked through our website – the Virtual Institute of Zinc Biology (VIZIBI). We will also organise training opportunities through regular meetings and exchange programmes, which will facilitate the sharing of knowledge across a broad spectrum of perspectives and will help with the standardisation of methodologies.

How will the establishment of Zinc-Net contribute to improved policy decision making throughout the government hierarchy?

The management committee of Zinc-Net is currently made up of scientists from 24 European countries who are involved in zinc-related research, but this may increase in the coming months as the network expands. Many of the committee are well connected with policy makers and government advisory panels throughout Europe and will be able to disseminate the activities and findings of Zinc-Net at the highest level.

It is estimated that zinc deficiency affects up to 20 per cent of the world's population, yet in the absence of reliable, sensitive and specific biomarkers of zinc status, we are uncertain about the exact figure and how best to intervene. One of the objectives of this network is to address this problem through multidisciplinary collaborations that include the end-users.

European scientists are building **Zinc-Net**, a multidisciplinary platform that aims to bring together researchers who are interested in understanding the role of zinc in biological systems

What do you hope the transferable benefits of Zinc-Net will be?

The short-term impacts of Zinc-Net are likely to be knowledge-based, but in the long term, and still within the duration of the COST action, the results will be translated to enable therapies, diagnostics and dietary supplementation for patients suffering from diseases associated with zinc, and for the general public.

Do you hope to build on knowledge gained from previous projects, such as ZENITH, ZINCAGE and EURRECA? What sets Zinc-Net apart from these initiatives, which have similarly tried to bring together interdisciplinary zinc researchers?

Researchers that have been involved in these previous projects will be invited to share their considerable experiences and knowledge with Zinc-Net so that we can move the field forwards.

A key feature will be the active involvement of early stage researchers, as we are convinced that it is essential to start training the next generation of scientists to think and approach problems in interdisciplinary terms as early as possible if we are to make the step change we seek. For better cross-fertilisation, laboratory exchanges of up to three months will be organised for early-stage researchers to learn new methodologies and ideas, or to spend time in an end-user environment. An innovative aspect of the organic process of establishing successful collaborations is the need for discussions, as well as idea-generating workshops, where a major emphasis will be placed on the informality and inclusiveness of Zinc-Net.

Another key feature of this network is gender balance. Many women undertake PhDs and start at the bottom of the scientific research career ladder, but few make it to the top to become professors and research team directors. Specific attention will be paid to overcome gender imbalance and scientific leadership through mentoring. It is our goal to establish mentor-mentee partnerships between early-stage researchers and established researchers – based on pre-defined criteria such as gender, subject discipline and career aspirations – within the network.

The zinc problem

A pan-European, collaborative COST Action platform, **The Network for the Biology of Zinc**, has been proposed as a way to address the causes and consequences of zinc deficiency and imbalance that can have severe and diverse consequences for human health

ZINC WAS ONLY identified as an essential nutrient for human health in the 1960s when Professor Ananda Prasad demonstrated that stunted growth and delayed sexual development of young men in Iran could be reversed by zinc supplementation. Today, knowledge of the role of zinc in human health has considerably improved and scientists are able to detect zinc in biological tissues with a high level of sensitivity; image the movement of zinc at the cellular level; and look at the impact of zinc on gene expression, protein levels and metabolism.

THE STATE OF KNOWLEDGE

Since the 1960s, technological advances have hugely aided the understanding of zinc biology and facilitated important discoveries, such as the array of roles it plays in health and disease. Regardless of these steps forward, there are still many fundamental issues concerning zinc biology that remain unresolved, despite considerable research.

Sub-optimal dietary zinc intake and/or sub-optimal zinc status due to other conditioning factors are recognised as predisposing issues for several public health problems, including Alzheimer's disease, certain cancers, Type 2 diabetes and age-related macular degeneration. According to the World Health Organization (WHO), zinc imbalance or deficiency is the 11th leading cause of morbidity and mortality worldwide. Over 450,000 deaths per year among children between the ages of six months and five years are attributable to this affliction.

In addition, marginal zinc deficiency leads to immune system dysfunction, behavioural issues, memory deficits and a host of other diseases.

Clearly, research is needed to find the most effective methods for optimising zinc levels in order to prevent disease; research that will involve gaining a fundamental understanding of the molecular mechanisms underlying zinc metabolism and homeostasis. However, current progress in these areas has been confounded by the fact that research in the field of zinc biology is pursued by a limited number of research groups in Europe, who all work in different disciplines including chemistry, biology, nutritional science, agriculture, public health and medicine. "The major obstacle to gaining a full understanding of zinc biology and the development of more food-appropriate products and medical devices is the lack of appreciation for, and appropriate knowledge of, the problems disparate disciplines face," explains Professor Nicola Lowe, a zinc researcher from the University of Central Lancashire, UK. To address these issues, she has co-founded an interdisciplinary and collaborative Europe-wide network of zinc researchers that aims to unite collaborations from all over the world.

One of the problems with having segregated research groups across Europe is that there is no standardisation of protocols related to experimental methods used in zinc research. This makes it very difficult and inefficient for researchers to compare the data they generate. An earlier project that focused on

MANAGEMENT COMMITTEE REPRESENTATIVES ARE FROM THE FOLLOWING COUNTRIES:

- Bulgaria
- Croatia
- Czech Republic
- Denmark
- Estonia
- Finland
- France
- Germany
- Greece
- Hungary
- Iceland
- Israel
- Italy
- The Netherlands
- Norway
- Poland
- Portugal
- Romania
- Serbia
- Slovenia
- Spain
- Switzerland
- Turkey
- United Kingdom



INTELLIGENCE

ZINC-NET

COST ACTION TD1304

OBJECTIVES

To establish a comprehensive understanding of the role of zinc biology in medicine by creating a multidisciplinary research platform to stimulate and accelerate new, innovative and high impact scientific research.

WORKING GROUPS (WG) AND LEADERS

WG1: Chemical Biology (leader: **Professor Mike Watkinson**, Queen Mary University London, UK)

WG2: Biomarker Discovery (leader: **Professor Elena Planells**, University of Granada, Spain)

WG3: Clinical Co-ordination (leader: **Professor Arie Moran**, Ben-Gurion University of the Negev, Israel)

WG4: Industrial Liaison (leader: **Dr Gündoğ Yucesan**, Yildiz Technical University, Turkey)

WG5: VIZIBI Knowledge Transfer, Outreach & Training (leader: **Dr Imre Lengyel**, University College London, UK)

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CONTACT

Professor Nicola Lowe
COST Action Chair

Professor of Nutritional Sciences
University of Central Lancashire

T +44 1772 893599
E nmlowe@uclan.ac.uk

www.cost.eu/domains_actions/fa/Actions/TD1304

NICOLA LOWE is COST Action Chair and Professor of Nutritional Sciences at the University of Central Lancashire. Her primary area of research is micronutrient metabolism with a particular focus on zinc. She has worked on numerous international research projects and is author of over 50 peer-reviewed publications.

LOTHAR RINK is COST Action Vice-Chair, Professor of Immunology and Head of the Institute of Immunology, RWTH Aachen University. His research interests include the immunobiology of zinc and immunogerontology.

zinc research involved undertaking a systematic review and meta-analysis of published data, but the diversity of methods used for zinc analysis and dietary intake information made this seemingly straightforward task a massive challenge. With this in mind, through nurturing a platform where experimental studies could be collaboratively designed and data analysed collectively, progress in this area could be significantly improved.

ZINC-NET FOSTERS INTERDISCIPLINARITY

The UK has a special reputation for zinc research, with a notable achievement being the Nobel Laureate Sir Aaron Klug's discovery of zinc finger proteins. Following this tradition, in 2009 Zinc-UK was established and over 120 scientists involved in zinc research became part of a collaborative platform that aimed to understand and promote the central role that zinc plays in health and disease. As increasing numbers of European laboratories became interested in attending Zinc-UK meetings, it became apparent that a pan-European network needed to be established to bring together the breadth of knowledge and expertise from scientists across the continent. Therefore, Lowe, along with colleagues Dr Imre Lengyel from University College London (UCL), UK; Professor Mike Watkinson from Queen Mary University of London, UK; and Professor Lothar Rink from Aachen University, Germany, put together the proposal for Zinc-Net, a pan-European network with the same overall aim.

Zinc-Net was launched in October 2013 as a Cooperation in Science and Technology (COST) Action network. It is funded by the EC until 2017, and will foster interdisciplinary research by providing a forum for scientists and end-users from different disciplines to discuss and address the fundamental scientific problems relating to the role of zinc in health and disease.

Such an interdisciplinary approach is essential for overcoming problematic issues related to zinc biology. For example, the role that zinc plays in associated diseases is poorly understood, yet this knowledge is essential to be able to advise on dietary zinc supplementation for health benefit. In addition to allowing scientists from different disciplines to work together, Zinc-Net also facilitates interaction with end-users. While researchers need to understand the needs of this stakeholder group, end-users must also engage with the difficulties that researchers face developing ideas into economically relevant and ecologically viable concepts.

INTERACTING THROUGH VIZIBI

The main platform for these interactions will be the Virtual Institute of Zinc Biology (VIZIBI), an open source platform that will have both an internal and external face. The internal area will include a forum for researchers to exchange technical knowledge, methodologies

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and best practice on both an international and interdisciplinary level. There will also be a place to share ideas for publications, workshop reports, keynote speaker presentations, webinars and network-related news. Some of this information will also be shared with the external face of the platform, in a format and language that is accessible to the general public. By sharing research knowledge between experts in the field and the public, Zinc-Net hopes to dispel some of the myths surrounding the role of zinc in human health. "The VIZIBI forum will be open to all zinc researchers, even if they are not members of Zinc-Net, in a bid to defragment the knowledge base," elaborates Lengyel. "This will be a 'one stop shop' for anyone interested in conducting research on zinc."

INFLUENCING POLICY

The five working groups of Zinc-Net each have different aims but will all work collaboratively in a pipeline that will range from helping to develop new imaging methodologies to clinical work on model organisms and humans, as well as encouraging discussions with industry that will facilitate the entry of zinc-related products into the healthcare market.

All of these efforts will be showcased via VIZIBI, and social media will allow for fast and efficient distribution of information. In addition to fostering new ideas through interdisciplinary work, an important part of Zinc-Net is to ensure policy changes in the healthcare sector that parallel advances in zinc research. Zinc-Net plans to invite world leaders to discuss hot topics on their online platform. Disseminating these findings at the highest level of policy is paramount to address the fact that around 20 per cent of the world's population suffers from zinc deficiency.

Even though the network has only recently been established, the team is already positive about the future: "We hope that Zinc-Net will provide a strong platform to widely disseminate the importance of zinc and assist bids to undertake this vital research through Horizon 2020," they conclude.

