Published in final edited form as:

Ann N Y Acad Sci. 2014 May ; 1314: v–vi. doi:10.1111/nyas.12448.

Introduction to *Human Disorders of Copper Metabolism*

Mary L. Graper,
Wilson Disease Association, Milwaukee, Wisconsin

Dominik Huster,
Deaconess Hospital, Leipzig, Germany

Stephen G. Kaler,
Eunice Kennedy Shriver National Institute of Child Health and Human Development, National Institutes of Health, Bethesda, Maryland

Svetlana Lutsenko,
Johns Hopkins University, Baltimore, Maryland

Michael L. Schilsky, and
Yale University, New Haven, Connecticut

Dennis J. Thiele
Duke University School of Medicine, Durham, North Carolina

On April 8–9, 2013, an international workshop entitled “Human Disorders of Copper Metabolism: Recent Advances and Main Challenges” was held at the Johns Hopkins School of Medicine, Baltimore, Maryland. The workshop focused on the basic and translational aspects of human disorders of copper metabolism. Thirty-seven speakers and 55 other attendees from 15 countries gathered to discuss recent developments and ongoing challenges in Wilson’s disease, Menkes disease, and newly emerging copper metabolic diseases. Twenty-six posters were presented. A unique feature of this meeting, compared to other scientific events in the field of copper research, was a stated emphasis on the translational implications of fundamental research in the field. This goal was achieved through a balanced combination of clinical and basic science presentations, as well as a dedicated session featuring representatives of advocacy groups of affected patients and their family members and individuals whose lives have been affected by these illnesses.

The workshop featured six main scientific sessions: disorders of copper deficiency; mechanistic studies of copper biology; new approaches for diagnosis and treatment; Wilson’s disease, clinical spectrum, and treatment; neurologic Wilson’s disease; and mechanistic understanding of copper overload using model systems. The content of these sessions are summarized in the papers composing these two issues of *Annals*.

Workshop highlights included a discussion of mechanisms for copper balance in humans and model organisms, especially in the liver, brain, and gastrointestinal tract; a description of a new human copper metabolism phenotype (MEDNIK syndrome); the presence of a concentrated depot of copper within the brain’s subventricular zone; and the role of choroid plexus epithelia in brain copper entry. The overall importance of both small and large animal models in dissecting the pathophysiology of copper metabolism disorders and for

experimental therapeutics was reinforced through numerous presentations. Exciting technical advances (e.g., in tissue imaging by X-ray fluorescence microscopy for copper localization) were presented. Many such advances at the forefront are summarized herein, and we remain grateful to the contributing authors for taking the time to provide these manuscripts.

The workshop also offered the opportunity to reflect on the history of research in copper metabolism while serving to invigorate our current efforts and point us toward the most important and exciting future studies. With warm appreciation, we acknowledge the participation of all invited speakers, attendees, patients, and patient advocates, as well as the major sponsors, the National Institute of General Medical Sciences and the Wilson Disease Association (WDA). Sadly, one long-time WDA president and frequent participant in past copper research meetings, H. Ascher Sellner, passed away less than three months before the workshop. His life and legacy are summarized here, *In Memoriam*.

The last decade of intensive biomedical studies has produced a great deal of information on the molecular machinery involved in the handling of copper by the human body. New metabolic connections between copper homeostasis and other physiologic processes have also been identified. Genetic and cell biological studies have expanded our understanding of human copper metabolism and enabled discovery of new disorders linked to improper function of its various components. The main challenges for the next decade will be to translate this accumulated knowledge into clinical practice and to establish a reciprocal information flow among bench scientists, physicians, and patients.

This workshop, as summarized in these issues of *Annals*, successfully organized the copper research community to begin to address these challenges. We hope that this effort will provide an important link to strategies that result in even stronger associations between basic and clinical science and those human subjects affected by disorders of copper metabolism.