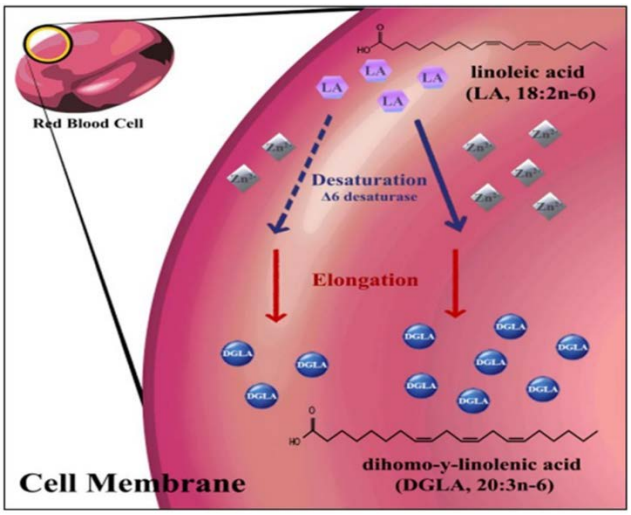
Dr. Elad Tako- Research Focus

Dr. Tako's research accomplishments include the development of the Gallus gallus intra-amniotic administration procedure, and establishing recognized approaches for using animal models within mineral bioavailability and intestinal absorption screening processes. He has also developed a zinc status physiological blood biomarker and molecular tissue biomarkers to assess the effect of dietary mineral deficiencies on intestinal functionality, and how micronutrients dietary deficiencies alter gut microbiota composition and function.

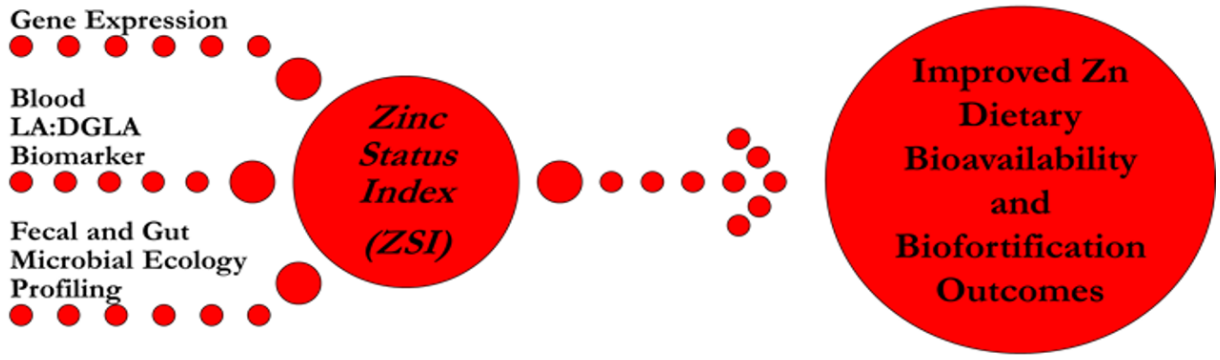
The Tako research group, is focused in the following:

1. The development of the proposed Development of "Zn Status Index". Dr. Tako has devised the "Zn Status Index" by using an animal model (Gallus gallus), this index is a quantifiable score indicating the severity of a dietary Zn deficiency. In generating this score, the Index makes use of three biological parameters:

- Whole blood Linoleic Acid: Dihomo–γ–linolenic Acid (LA:DGLA) ratio, a novel functional indicator of Zn deficiency exploiting erythrocyte fatty acid desaturation.
- Fecal and gastrointestinal microbial ecology phenotyping of defined Zn deficiency stages using next generation sequencing
- mRNA Gene Expression of Zinc dependent proteins

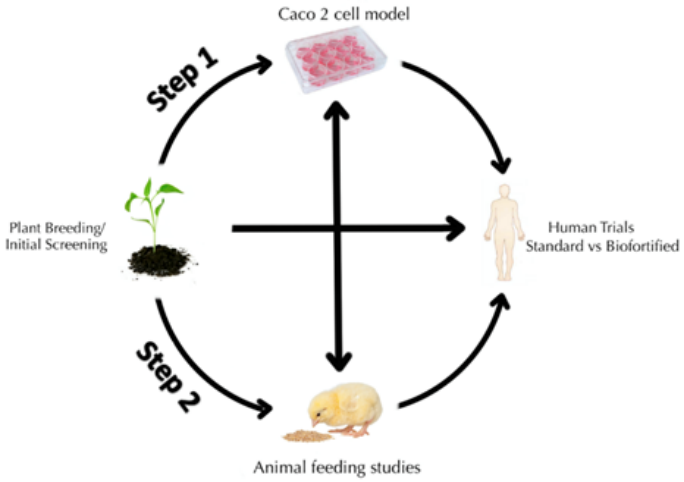


A truncated schematic of the LA to DGLA fatty acid pathway within the erythrocyte membrane. Lack of dietary zinc (broken line), needed for Δ^6 desaturase enzyme function, will impede conversion of reactant (LA) to product (DGLA) and will result in an increased ratio of LA to DGLA. This ratio may be a sensitive biomarker to identify endogenous zinc deficiency.



A combination of gene expression, blood LA:DGLA biomarker, fecal microbial ecology profiling may link to a "zinc status index" for better identification of Zn status

2. The combined application of the Caco-2 cell bioassay coupled with in vivo (Gallus gallus) feeding trial represents an effective approach to predicting Fe bioavailability in humans.



Schematic diagram depicting Fe bioavailability screening of biofortified staple food crops. Step 1, assessing Fe bioavailability in vitro (the Caco-2 cell bioassay), this model allows rapid and cost effective screening of hundreds of samples. Step 2, selection of most promising lines and tailoring the appropriate and specific diet that is relevant to the target population to be assessed in a long term in vivo feeding trial (Gallus gallus). This two-step screening process is employed in advance of human efficacy studies to refine experimental design, evaluate the biofortified food in the context of the targeted food system. This approach not only predicts but can cost-effectively monitor the Fe-biofortified crop once released to farmers.

3. Characterize the intestinal microbiome and its influence on intestinal brush border membrane and functionality (tissue related functional proteins and morphometric characterization) in response to dietary phytochemicals and prebiotics.

The study of the totality of the microbes living on or in us (termed the microbiome or microbiota) is a relatively new and rapidly expanding field of scientific inquiry and research. The scientific community is just beginning to understand how and why these microbes affect our health, and, in turn, how our health shapes their composition within us. We are primarily interested in the observed differences of the resident gut microflora between Zn deficient and Zn replete subjects. Using next generation sequencing techniques, we can glean information about potential relationships between certain families of microbes and Zn utilization within the host; information which may ultimately constitute a new and reactive biomarker of Zn deficiency.Prebiotics are usually non-digestible carbohydrates/ fibers of varying length and complexity that serve as raw material for gut bacteria and other microbes to utilize for energy. The fermentation of these substances, in turn, yield beneficial effects such as increasing production of short chain fatty acids, decreasing pro-inflammatory immune factors, and increasing the uptake of mincronutrients. We are interested in learning more about these effects in regards to how they may modulate mineral absorption and bioavailability in vivo.

4. The intra-amniotic administration (*Gallus gallus*)- an emerging in vivo approach to assess bioactive compounds with potential nutritional benefits.

In recent years, the intra amniotic administration ("in ovo feeding") approach was further developed and currently is widely applied in the evaluation process of nutrients on the intestinal brush border membrane functionality, and the effects of functional foods (primarily plant origin compounds) with potential prebiotic effects on the intestinal microbial populations. This review collates the information of nutrients with potential nutritional benefits and their effects on the mineral absorption, gut development, brush border membrane (BBM) functionality, bacterial populations, and immune system.