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Guest editorial:

Celebrating public health nutrition in Oporto

On September 23–25, 2010, five professional societies meet at the Old Customs House Convention Center (Alfândega) on the shores of the Duoro river in Oporto, Portugal, to hold the Second World Congress on Public Health Nutrition (II WCPHN). Besides reporting on scientific progress, this event will recognize some of the legends, past and present, who have made a lasting impression in this field.

At the opening ceremony of the congress, we shall pay tribute to one of the Honorary Presidents of WCPHN I and II, José María Bengoa, who passed away in January of this year in his native Bilbao. José María Bengoa, former director of the WHO Nutrition Unit and founder of the Cavendas Foundation in Venezuela, is perhaps best remembered as the pioneering dean of nutrition in public and community health. The Hildegard Grunow Foundation will also present the first Rainer Gross Award: Innovation in Nutrition at the meeting. This commemorates the achievements of Rainer Gross, who passed away in September 2006, at the moment the inaugural I WCPHN was being held in Barcelona. As documented in the article below, this tireless German innovator projected an animus to bring nutritional science to public health problems. Recognizing that

the field of public health nutrition also has its *living legends*, the Oporto meeting will pay homage to the other two Honorary Presidents of the WCPHN, Nevin Scrimshaw and Igor de Garine, as well.

In its endeavour to support innovation, the WCPHN focuses strongly on including, exciting and empowering the younger generations of the international nutrition community. Micronutrients also feature at the Oporto meeting with a Sight and Life workshop on evidence in multiple micronutrient nutrition: from science to effective programs, symposia on breastfeeding, assessment of nutrient status and safety of zinc, and debates on fortified spreads, oral vitamin A supplementation, and malaria and iron. As the director of the Center for Studies of Sensory Impairment, Aging and Metabolism (CeSSIAM), I am proud that, to celebrate our silver jubilee (see report on page 4), students and staff of my institution have contributed 21 free papers to the Oporto program; the CeSSIAM 25th Anniversary Symposium will focus on resolving the dilemmas surrounding the safety and efficacy of iron. When the effort is to link emerging scientific principles to benefit human lives and livelihoods, as in Oporto, we are fortunate that the micronutrient agenda will be represented in full.



Noel W. Solomons

Feature:

Rainer Gross' legacy

We received the sad news of Rainer Gross' untimely death on September 30, 2006, while we were attending the First World Congress on Public Health Nutrition (WCPHN) in Barcelona. In September 2010, exactly four years later, we are again headed for a WCPHN, this time on the opposite coast of the Iberian peninsula, in Oporto, Portugal, where the Hildegard Grunow Foundation of Munich is sponsoring the first Rainer Gross Prize: Recent Innovations in Nutrition in Developing Countries.

Born in 1945 in Garmisch, near Munich, Germany, Rainer Gross was known as a tireless advocate who would not let the world forget about the ongoing silent emergency of undernutrition and its complex causes. Before joining UNICEF in 2002 as Chief of Nutrition, he worked as a researcher, advisor and leader of health and nutrition programs around the world. Widely respected as an authority in his field, Rainer specialized in a number of areas, including undernutrition in emergencies and the delivery of micronutrients. Among his many virtues and virtuositities, we commemorate, in particular, the legacy of his decade-long concern

about the need to make public health iron interventions safe, as well as effective.

Avoiding adverse effects of iron

Rainer's interest in improving the safety, effectiveness and efficiency of oral supplementation with iron began many years before the 2005 study on Pemba Island, Zanzibar, discovered that giving iron to children who are not iron deficient could be harmful. Already in the 1990s he felt that it would be preferable to give the supplement on alternate days, rather than daily, and to avoid exposing individuals who did not need iron. He recognized that not all anemia is due to iron deficiency, and that not all members of an at-risk population are iron deficient or anemic.

Realizing that the potential adverse effects of unnecessary exposure to iron could be avoided by screening out the non-anemic individuals, he teamed up with engineers at Diehl, Germany, to provide specifications for the Erlangen Microlight-guide Photometer (EMPHO). This was the first white-light skin probe that could assess capillary hemoglobin concentra-



Rainer Gross

tions, and thus detect anemia, without the need to extract blood. He and his students, including his son Patrick, published the preliminary findings with animal and human tissues in the Food and Nutrition Bulletin in 1996.

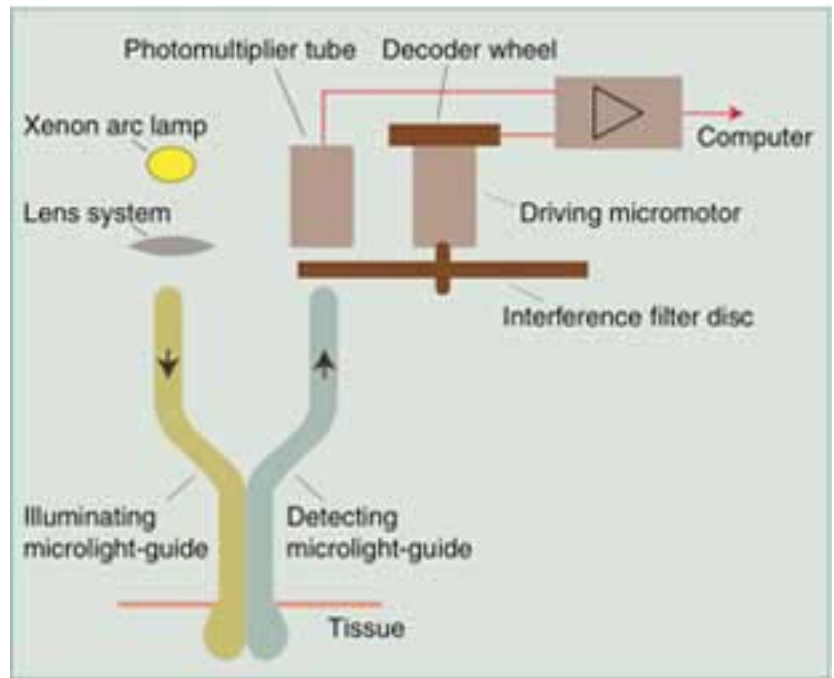
About the same time, while working on the Regional Community Nutrition Program of the SEAMEO-TROPMED in Jakarta, Indonesia, he and his colleague Werner Schultink were impressed by the possible benefits of using an iron dosage regimen that skipped days. According to theoretical and animal model considerations, this could reduce total iron delivery, increase efficiency of uptake of each dose and reduce cumulative intestinal iron exposure. There was also a good chance that more people would take the supplement appropriately, if there were a longer, regular interval between doses. So they decided to test the efficacy of a weekly oral iron dose. Initial studies across various age groups and physiological conditions suggested that this had almost the same effects on anemia and iron deficiency as daily administration.

A multi-micronutrient agenda

The researchers next reasoned that it would make sense to give other micronutrients as well as iron and folic acid, which were the usual supplements used to treat anemia at that time. They reasoned that, if equally assimilated at spaced dosing as well as with daily dosing, other vitamins and minerals of public health interest should improve the impact of supplementation. The theoretical consideration was that the intestinal uptake and biological utilization of iron could be optimized by addressing other potential micronutrient deficiencies. In turn, this would benefit general well-being and disease resistance, as well as addressing those components of nutritional anemia not related to limitation of iron. The ensuing trials of weekly multiple micronutrient supplementation showed promise as compared to the daily format.

Encouraged by the results emerging in Indonesia, Rainer leaped with both feet into the policy and program arena. He invited colleagues from industry, academia and public health to a series of international meetings in Singapore, New York, Capetown and Rio de Janeiro to create an alternate-day multi-micronutrient agenda. In the Rio conclave, the concept of the ‘foodlet’ emerged. Envisaged as an ideal delivery form for infants and young children, the foodlet, which is a cross between a food and a tablet, was developed as a large, soft, tasty tablet containing multiple micronutrients and a high concentration of milk powder that could be chewed or crumbled and mixed with any meal or drink.

To test if a foodlet-based multiple micronutrient supplement could effectively reduce anemia and improve infant growth, the International Research on Infant Supplementation (IRIS) Study Group conducted a UNICEF financed, multi-center, randomized trial in Indonesia, Peru, South Africa and Vietnam. Selected infants, aged 6 to 11 months at entry, were randomly



assigned to receive one of four treatment groups (multiple micronutrients daily; multiple micronutrients at twice the dose once a week; iron alone daily; placebo) for six months. The results were published in the Journal of Nutrition in 2005. None of the supplements was able to control anemia fully. A daily dose of multiple micronutrients was marginally more effective than iron alone and multiple micronutrients

Schematic drawing of the EMPHO detection device (redrawn from the original and reproduced with permission from the Food and Nutrition Bulletin). The Erlangen Microlight-guide Photometer (EMPHO) is an apparatus designed to measure backscattered light from living tissues. It consists of four functional modules: the light source, the microlight-guide cable, the detection device and the computing system



An infant chewing a foodlet during the IRIS multicenter study

Weekly supply of foodlets as distributed in the IRIS study

given weekly. Following the positive results of that study, the government of Peru successfully adapted the weekly foodlet program of IRIS into a multi-year public health program that had a substantial effect at the community level.

A generator of ideas

This spirit of innovation and projection of practical new solutions was wrapped up with Rainer Gross' thrust for capacity building and for alleviating poverty with its negative effects on human health and function. Rainer Gross proved to be a dynamo, a generator of fresh ideas, and a magnet for like-minded professionals to put the ideas to the test. Needless to say, he

brought his micronutrient animus from his experience in program-building efforts in Brazil, Southeast Asia and Peru to his final post at the UNICEF headquarters in New York.

As our personal tribute to the micronutrient legacy of our departed friend, the Hildegard Grunow Foundation is supporting a research project in Guatemala that aims to validate a new generation of devices for non-invasive assessment of hemoglobin. Such portable units, once validated for accurate sensitivity and deployed in mass oral iron interventions, could identify those children who are fully intact hematologically, and spare them the hazards of supplemental iron.

Noel W. Solomons, MD, CeSSIAM, Guatemala City, and Klaus Schümann, MD, Hildegard-Grunow-Foundation for Nutrition Research, Munich

Feature:

CeSSIAM celebrates 25 years of nutrition research (part 2)

The Center for Studies of Sensory Impairment, Aging and Metabolism (CeSSIAM) in Guatemala was founded on July 1, 1985, to assert the need for academic freedom in the pursuit of public health research. It allowed the researchers to move forward, rather than looking backward, in the development of a research agenda. Throughout the 25-year history of CeSSIAM, the study of micronutrients has been central to its scientific fabric, enabling progress in understanding the health implications of vitamin A, vitamin D, riboflavin, zinc, iron and iodine. This second part of our article highlights some of the ways in which CeSSIAM has contributed to knowledge on zinc, iron and iodine.

Zinc

CeSSIAM has participated in two international collaborations investigating zinc nutrition. The first of these involved the laboratory of Rosalind Gibson at the University of Guelph, Canada. It set the stage for the zinc experience at the center with a master thesis project by Sian Fitzgerald, in which she documented a high zinc-to-phytate ratio in the habitual diet of periurban pregnant women [15]. Kelly Cavan from the same department led zinc studies in urban schoolchildren. Using a large battery of potential outcome variables, she found some cross-sectional associations between circulating and hair levels of zinc and function [16]. A randomized controlled field trial of zinc supplementation, however, failed to produce major improvements in any of the chemical or functional variables [17]. Manuel Ruz of Chile undertook some of his doctoral study time around this project to refine his comparative investigation of laboratory indicators of zinc status.

Michael Hambidge (University of Colorado Health Science Center) was the senior collaborator in our second adventure in zinc research. With funding from the



CeSSIAM staff, July 2010

Thrasher Foundation, we established metabolic studies in free-living rural children, and measured zinc absorption in meals containing a hybrid maize variety with reduced phytic acid, using stable isotopes of zinc [18]. This turned out to be a prelude to a multi-institutional collaboration as part of the Global Network for Women's and Children's Health of the National Institute for Child Health and Human Development of the US National Institutes of Health. In this study, the effect of both lowering the content of the phytic acid in maize and providing a daily supplement of 5 mg zinc was examined in relation to the growth and illness experience of infants from 6 to 12 months of life [19].

More recently, we have examined the intestinal uptake of zinc from tablets used widely in programs for oral rehydration, as well as growth or disease resistances as outcome variables. Because circulating zinc concentrations failed to rise appropriately in the subjects given zinc rather than placebo in field studies

(including our own), we used a simple plasma zinc response test to determine the relative bioavailability of the zinc tablet compared to powdered zinc sulfate. In this study with healthy adult males, the tablet delivered only half as much zinc as the powder. This lesser uptake is probably unimportant for the treatment of acute diarrhea, as the site of action is likely within the intestinal lumen; for systemic use, however, a more absorbable zinc formulation might be indicated.

Iron

Iron is not only an essential nutrient; it is also a powerful oxidant, and therefore a two-edged sword in human nutrition. Two of our early field trials on iron showed that preschool children had a prevalence of anemia greater than 20% [20], whereas schoolchildren across the country had less than a 12% rate [21]. Later, our research agenda added the notion of how to improve iron status. In a randomized controlled trial, we showed that adding hemin, the iron-containing entity in bovine blood, to refried black beans improved the hematological status of anemic preschool children [22].

In a series of iron intervention trials, we also examined how iron status, as indicated by ferritin, affected biomarkers of inflammation. Alpha-1 antichymotrypsin, but not other acute-phase response proteins or C-reactive protein (CRP) increased their circulating concentrations during daily supplementation of 20 mg iron to schoolchildren [23]. In a similar population we established, in collaboration with Laura Murray-Kolb and the late John Beard, that immunostimulation, which might confound interpretation of ferritin as an index of iron status, was low [24]. More importantly, we identified different individuals expressing primarily CRP or alpha-1 globulin as the marker of an active inflammatory state.

After the discovery of hepcidin, we collaborated with research groups in Nijmegen, the Netherlands, and Innsbruck, Austria, equipped with assays for active hepcidin and prohepcidin, to assess the relationship of iron status and iron administration to the two hepcidin forms in blood and urine. High iron stores suppressed hepcidin. The adverse consequences of oral supplementation with 12.5 mg iron to infants and toddlers, implicated “free iron” (non-transferrin-bound iron or NTBI) after oral dosing as a contributing factor. CeSSIAM studies have simulated the dosing of oral iron to children with proportionally increased iron doses in adult men. We found that ferrous sulfate results in a burst of NTBI, whereas two other bioavailable iron compounds, NaFeEDTA and iron polymaltose, had a markedly subdued post-supplementation rise in levels of NTBI.

Monica Orozco of the CeSSIAM staff examined the effects of iron supplements on the colon and its antioxidant buffer capacity in her doctoral dissertation research at the University of Manitoba, Canada. She developed a modified assay for free-radical production in human feces, and showed that oral supplementation with iron eroded the capacity of the fecal material to



Caitlin Crowley measuring hemoglobin non-invasively

buffer free-radical formation. She went on to show that concomitant supplementation with extracts of palm oil containing high doses of carotenes mitigated this reduction [25].

Iodine

The idea of using the more stable and robust iodate salts instead of iodide for fortification of salt in humid, tropical countries originated in Guatemala, which has a large number of small-scale salt producers. CeSSIAM has analyzed commercial salt packages from rural areas and documented a wide heterogeneity of fortification. Nicole Umemoto showed that education of schoolchildren could lead to the purchase of the superior brands in their homes [26].

CeSSIAM collaborated with the Centers for Disease Control and Prevention of the USA to standardize an ultrasound-based instrument for measuring the volume of the thyroid gland as a means of assessing goiter prevalence [27]. Finally, in research for a doctoral dissertation, Jesus Bulux showed that oral doses of iodine in oil given to lactating mothers were capable of enriching human milk.

During its 25 years of existence, CeSSIAM has been blessed with talented staff and students, dedicated collaborators and challenging research questions in the area of vitamins and minerals. Many opportunities remain to apply reliable scientific methods to new and important research questions in the future.

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Noel W. Solomons

Conference report:

Sharing innovative approaches to fight malnutrition

On March 30–31, 2010, the Global Alliance for Improved Nutrition (GAIN) hosted its first Africa Regional Forum in Johannesburg, South Africa. Focusing on the theme “Sharing Innovative Approaches to Fight Malnutrition”, the forum served as a platform to advocate for more concerted attention to food and nutrition security, and to share experience and lessons learned in combating malnutrition at scale in Africa. More than 160 participants representing government, industry, international organizations, non-governmental organizations, academia and the media from eighteen African countries attended. The event was successful in getting participants to share their nutrition programming successes and failures openly, learn from each other, and network so they can continue dialoguing and sharing long after the forum.

On day one, keynote addresses and panels highlighted ways to improve links between evidence-based nutrition policies and action. Participants discussed examples of proven public-private partnerships to fight malnutrition with the necessary steps to strengthen national capacity to design and implement successful nutrition programs. In his opening address, Jay Naidoo, Chair of the GAIN Board and the Development Bank of Southern Africa, emphasized the need to look at food and nutrition as a human right, while stressing the need for accountability

from all stakeholders battling malnutrition in Africa. Senior ministers and leaders from Kenya, Côte d’Ivoire, South Africa and ECOWAS (Economic Community of West African States) presented successes and failures



Graça Machel, Jay Naidoo and Ida Odinga (L–R) during the Johannesburg Forum

in the fight against malnutrition. An active and well-attended marketplace session promoted project-to-project knowledge sharing and networking.

On day two, participants had the opportunity to further develop nutrition programming experiences and share lessons learned and leading practices through facilitated, interactive working group sessions. In a personal, candid and inspiring closing address, Graça Machel of South Africa and Mozambique announced her commitment to getting malnutrition higher on the political agenda of African countries and to improving the lives of African children.

The forum served as catalyst to help governments meet their commitments around ensuring that the right to food and adequate nutrition is respected through the creation of what Jay Naidoo called an “unstoppable movement”. Strong support for the movement from high level senior change agents from Africa, notably Lady Ida Odinga of Kenya and Graça Machel of South Africa and Mozambique, will help give it momentum. These prominent women committed themselves to be dedicated activists and nutrition champions for the cause and take up the issue with key political decision makers in the region.

Extracted from the report on the First Africa Regional Forum written by Karie Atkinson of GAIN. The original report can be accessed in English and French at: <http://www.gain-health.org/documents>

Review:

How to improve nutritional impact of social programs

The report published by the World Food Programme in April 2010 [1] briefly reviews the context of poverty, food and nutrition insecurity, child undernutrition, nutritional and epidemiological transition, the situation of the HIV epidemic, as well as the role of social safety net programmes in the eight countries that belong to the Central American Integration System (Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Panama and the Dominican Republic). Social safety nets are common-purpose, articulated mechanisms consisting of free or subsidized programs that seek to develop human capital, reduce inequality and social exclusion, ensure adequate nutrition, health and welfare, enhance living conditions, minimize food and nutrition vulnerability, assist on risks management at any negative event, promote self-reliance and empowerment, and redistribute income among the poorest in order to obtain an immediate impact on reducing poverty and inequity

The report aims to provide a technical and advocacy instrument to mobilize and expand public, civil-society and private-sector commitments towards the nutritional protection of priority groups (children under two years, pregnant and lactating women, people with HIV, indigenous people and those of African descent). More than 200 people were involved in the development of this comprehensive study, which was conducted from June to December 2009 with a broad-based partnership including representatives from the eight participating countries, regional academic institutes and UN agencies, as well as other international organizations and WFP technical staff.

After presenting details of the study, the report suggests concrete actions to strengthen social programs with a nutritional dimension in the framework of a human rights approach. Nutritional dimension is understood as the adequate identification of main nutritional problems, the groups of populations and

zones affected as well as the incorporation of objectives, interventions/actions and nutritional indicators among the different phases of a program cycle.

Among its recommendations, the report proposes:

- To strengthen the political commitment of governments in favor of the nutrition of the population, mainly of children under two years and pregnant/lactating women.
- To gradually move forward in the formation of genuine social safety systems that encourage intersectoral concurrence and coordination in social programs to ensure that actions cover different levels of causality of undernutrition within a comprehensive approach.
- To incorporate objectives, actions and nutritional indicators in the different stages of social protection programs.
- To review or change the design and operation of conditional transfer programs (cash, in kind, vouchers and others) to increase their nutritional impact.
- To check the guidelines or targeting criteria with the intent to focus interventions on priority groups.
- To review the geographic location of programs to identify potential duplication of interventions and to ensure that the populations covered correspond to the targeting criteria.
- To strengthen human resources capacity in up-to-date and relevant nutrition and health topics and also in social program management.
- To organize and maintain an adequate system of procurement, storage and distribution of inputs and food to ensure continuous and timely delivery to the target population, and the proper functioning of the programs.
- To resolve technical and financial constraints in monitoring and evaluation, and incorporate these aspects into the design of programs.

Summary of the subregional report “Nutritional Dimension of the Social Safety Nets in Central America and the Dominican Republic”. World Food Programme, April 2010. PDF files of this document in English and Spanish can be accessed at:

<http://es.wfp.org/content/dimension-nutricional-de-las-redes-de-proteccion-social-en-centroamerica-y-la-republica-dominicana-a>



- To incorporate the human rights approach as the major framework for all social protection activities from the design to the evaluation stage. It includes a gender and multicultural perspective as well as community participation.
- To increase the allocation of public budget in nutrition for social programs in a framework of state policies as a means of ensuring sustainability of interventions, and gradually decreasing external economic dependence.

To implement these recommendations, the authors state that there will be support and channeling of direct technical assistance to countries according to their needs, capabilities, limitations, challenges and priorities in order to strengthen the nutritional dimension of the social protection programs studied, as well as other similar programs implemented in the same countries or in different contexts.

A. Bowley

News in brief:

Vitamin A assay in foods; a serious challenge to laboratories

SUSTAIN, in collaboration with industry partners, commercial contract laboratories, US government laboratories, vitamin/mineral premix suppliers and food aid manufacturers, assessed variability in the measurement of vitamin A within and between laboratories, as part of the Food Aid Quality Enhancement Project (supported through a grant from The Bill & Melinda Gates Foundation)[1]. Sixteen laboratories analyzed the vitamin A content in a sample set covering the range of vitamin A permitted in corn-soy blend (CSB; one of the cereal-based foods enriched with vitamins and minerals that are integral elements of US humanitarian aid programs).

Analysis of the data revealed a coefficient of variation (CV) of more than 35%, a finding indicating that laboratories were unable to replicate each other's results consistently. In addition, most laboratories were not able to reproduce their own results on the same sample with acceptable precision. They tended to overestimate lower levels and underestimate higher levels of vitamin A within the allowable range. Only two laboratories demonstrated acceptable internal precision, and reported values within the 95% confidence interval for all four

unknown test levels of vitamin A in CSB. On the other hand, most laboratories were able to measure vitamin A in a reference standard with reasonable accuracy and precision as indicated by a CV of 7.1%.

The authors conclude that the largest differences between results probably stem from the procedures used to extract vitamin A from the food matrix for subsequent detection and quantification. Other possible sources of error include: failure to closely follow approved assay methods, failure to verify the quantity of vitamin A in commercial reference standards, failure to provide sufficient analyst training, and failure to carry out method quality control.

Results of this study have implications both for quality control in food aid products (in which vitamin A is used as a marker) and for regulatory oversight of vitamin A content in commercial food products. To obtain a valid assay of vitamin A, laboratories must strictly adhere to a reliable method (e.g. AOAC 2001.13 or AACC 86-06) and use adequate quality control procedures.

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Funding needed to resolve food crisis in Niger

A severe food crisis has again struck the West African country of Niger, which already has one of the highest childhood mortality rates in the world. Due to the poor food harvests and water shortages that followed insufficient and irregular rains in 2009, almost half a million children currently suffer from acute malnutrition. In order to save these children's lives, Helen Keller International is working with partners to provide community-based rehabilitation services, and is seeking \$175,000 in additional funds to expand services to children in need. For more information, see: <http://www.hki.org/press-room/archive/2010/06/28/> and: <http://kristof.blogs.nytimes.com/2010/08/09/a-famine-looms-in-niger/>

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