Conclusions

This brings our workshop to a close but we have hardly brought the challenges facing us to a close: to understand the depths and breadth of micronutrient nutrition as it effects infant health in the first 6 months of life. At the outset of the conference we were asked to think of the perinate, neonate and infant through 5 months of age as a unique nutritional 'target group' that could become increasingly more visible to the public health community, beyond the clinician, a more accessible group of very high-risk individuals whose special nutritional needs could be better understood, assessed and addressed with micronutrients, as required, to improve quality of life. We have been reminded that young infants are a group whose nutritional well-being is intimately and uniquely influenced by the health and nutrition of someone else, the mother, and that the importance of this dependency is only magnified in the developing world where maternal nutrition, primary health care and social support systems reaching this highly vulnerable dyad remain inadequate. The very young infant is indeed a uniquely complex and immature individual, in whom micronutrient-health interactions appear to depend, in part, on gestational age, developmental and functional maturity, and size at birth. These interactions also appear to be influenced by the periconceptual and antenatal status of the mother and the status of the fetus and infant with respect to individual or combinations of micronutrients; on the type and severity of a health disorder, the type, timing and frequency of feeding mode after birth – whether breast- or formula-fed or subsisting on complementary foods – and on household hygienic and socioeconomic factors.

So the neonate and young infant are very different from older infants and children, with different health problems, functional and developmental capacities, growth trajectories, nutritional stores and probabilities of health and survival. These realities have repeatedly challenged us over the past 3 days as we have attempted to bring the state-of-the-art in this field together. In order to optimize micronutrient nutriture and interactions with health and development in the young infant we need to think about pre- and periconceptual maternal intakes and status for a range of micronutrients. Achieving a balance in nutriture across multiple micronutrients appears to be key, even though we remain largely ignorant of what it means under different

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materno-infant health conditions. Imbalances and deficits need to be addressed. Some single nutrient maternal interventions, such as those delivering iodine, folic acid and iron, are proving themselves worthy across populations of vastly different health status. Others, such as prenatal vitamin A may be most appropriate when carefully delivered to undernourished populations. We know little about the roles of other water-soluble vitamin deficiencies in the first 6 months of life. However, we do know that at birth infants are not well endowed with respect to vitamins A, K, D and possibly E, so all the fat solubles are running lean early in life in all populations. We do not know why these low levels exist but adverse infant health or survival have been associated with apparent deficiencies in these nutrients in some high-risk groups, necessitating our attention to these effects in early infancy. Other single nutrients, such as zinc and possibly vitamin A, may offer more clear improvement to infant health and survival when delivered directly to the infant postnatally. There is little doubt that mothers and their young infants in undernourished populations are exposed to multiple, simultaneous micronutrient deficiencies, yet the health benefits of delivering many micronutrients at the same time to mothers or infants, at least as supplements, remain unproven. It is likely that different populations of mothers and their infants have unique individual and therefore mixed micronutrient needs due to their diverse dietary, health and genetic backgrounds, which may need to be taken into account when formulating multiple micronutrient supplements or fortifying foods across populations. We are left with lots of research questions to address in our careers and for those who follow, trying to make the neonate and young infant a healthier individual through better micronutrient nutrition. I would like to just say before I pass the microphone to Dr. Delange that I have learned a great deal in the past 3 days and I hope we all take home new ideas on how our new insights will influence our future thinking about micronutrients in early life.

K.P. West Jr.

Of course, as expected, what you have said is so complete and so exhaustive that I have not much to add. This workshop has certainly been an extremely spectacular success. Our colleague from Hungary is proud of being a Hungarian, not only by principle but also because of the things that have been achieved in his country. Transposing this into micronutrients, I am pleased and proud to be an iodine man because many of the points which have been discussed so carefully during this meeting have been more or less put in place regarding the iodine business, including supplementation to more than one billion individuals around the world, which is of course a big enterprise and success. A lot of scientific questions remain on the metabolism, the bioavailability, the pathogenesis of deficiency or excess, the recommendations

for the dietary allowances, the upper limits for the indicators and so on, for each of the micronutrients we have been discussing. But there is in my opinion a key point which has not been discussed. This is implementation. Once we have reached the conclusion that action should be taken, the question will be how is this going to be done, who will do it, and who will pay for doing it. This is the experience we have been facing with iodine very acutely.

At this stage I would like to underline the efficiency of the collaboration illustrated by this workshop between the scientific and academic world and the industry. There is no doubt that the academic world has the theoretical advantage of knowledge, I am not sure that is always the case but it is supposed to be so, but there is no doubt that it is the industry which has the potential to implement what is recommended, coming from the scientific world. This connection has to be very cautiously established, respecting ethical rules, and this is not that easy.

Once the program has been implemented a key point is to ensure quality control and monitoring. Again taking iodine as an example, quality control has been neglected, I am afraid to say, due to the enthusiasm of implementing salt plants, and the world has been facing epidemics of iodine-induced hyperthyroidism with some lethal outcomes.

The final point I want to underline is that once programs to correct micronutrient deficiencies have been implemented, the sustainability of these programs has to be guaranteed. For example a program of salt iodination in the former USSR was mandatory and was remarkably successful up to 1990. Then, for pure financial reasons, this program has been interrupted and the consequence has been the recurrence of a dramatic rise in iodine deficiency with hundreds of new cases of cretinism.

Finally I would like to extend our deepest gratitude to the Nestlé network starting with the headquarters in Vevey up to the remarkable contribution and support provided by the regional Nestlé network. This has been an unforgettable event which will be followed up by the production of a book, so we are all absolutely committed to submitting our manuscripts if not yet done.

F.M. Delange