Concluding Remarks

I would like first to thank you all for sharing your experiences and exchanging knowledge; we all have benefited from it. We all shared the objectives and the goal that we wish to further the lot of children in the world. To that goal these exciting 3 days have enhanced our ability to carry out our objectives. It is appropriate that we thank the sponsors who have brought us together here, and that is the Nestlé Nutrition Institute, its director, Dr. Ferdinand Haschke and Dr. Denis Barclay who have organized this meeting, and we must also not forget Dr. Philippe Steenhout who conceived this conference and organized it initially before he turned things over to Dr. Barclay and we are grateful for all their efforts. We also express our gratitude to the local organizers, Pierre Schaufelberger; we thank Vipapan Panitantum and Montip Nagsevi and all the other staff of Nestlé Viet Nam for organizing this so splendidly and for feeding us so excellently.

Now it is Dr. Rigo’s and my job to summarize what has happened in the last 3 days and that is essentially impossible. We decided to steal a few of your slides and show them again, mainly to remind you of what you heard during the meeting. That is what we are going to do over the next 30 min and Dr. Rigo will start and I will finish up.

Ekhard Ziegler

First of all I want to thank you, Dr. Ziegler, for his collaboration in this meeting; it was so easy for me to work with him. If any of you are asked to organize a meeting, you need to do it with Dr. Ziegler.

We started the workshop with a beautiful overview by Berthold Koletzko on the early feeding and the programming effect up to adult age. His topic focused on the protein hypothesis, and all of us are now waiting for the results of this wonderful controlled randomized study.

After that we had a very elegant presentation by Allison Yates on the dietary reference intakes and the new concept for protein and energy requirements. She showed us that all the components of the dietary reference
intake were used in the new reference for the different nutrients and macroand micronutrients in the diet of pediatric patients and also adults. She showed us the different components of this dietary reference intake.

After that we had the opportunity to meet a few of the main workers in the new recommendation data, and it was very interesting to discuss the new protein and energy requirements for infants and children. First of all, Nancy Butte presented the energy requirements. These data were based on the increase in total energy expenditure which was evaluated with doubly labeled water and also heart rates. She presented the new energy requirements in infants. The new energy requirement is far from the previous one, and at the end of the first year of life the new energy requirement is quite decreased to about 15%. Then it was shown that in large infants there is also a significant difference between the new energy requirements when the children are 5–12 years old.

In the following presentation Peter Garlick showed us the protein requirements for infants and children which are mainly based on multiple nitrogen balance studies in order to evaluate the need for maintenance and the question of utilization for growth. We can base the requirements on maintenance and protein deposition according to the slope observed during multiple metabolic balance studies in infancy. The protein deposition was calculated using recent measurements of total body potassium content in infants and children between 4 and 18 years of life. If we now look at the new approach to protein requirements we see that there is a relative reduction in the protein requirement during the first 6 months of life which was also based on the human milk intake in those infants. There is very good agreement between the milk protein intake and the requirement calculated by the factorial approach. So the protein requirement seems also to be slightly lower for large infants. Amino acid requirements were also presented according to the same technology. It was a factorial approach because presently there are some insufficient results on the indicator of amino acid oxidation. Dr. Garlick presented data for infants between 1 and 4 years of age and the new recommendation represents between 60 and 95% of the previous one according to the different essential amino acids.

Following this presentation the question was to know what the potential toxic effect or deleterious effect of high protein supply could be, and this was presented by Irene Axelsson. From these data we can see that there are different indices of protein overload when we increase the protein supply in the newborn infant. Eventually we can speculate on some long-term effects, and she presented data on the increase in kidney growth in formula-fed versus breastfed infants, and we know that nephrogenic activity is completely closed at the time of birth.

After that the second discussion was on the growth of breastfed and formula-fed infants, and in his presentation Ekhard Ziegler tried to answer the question, can the energy and protein intake of breastfed infants be emulated in formula-fed infants. He showed that for energy intake, even with this perturbation in the energy density of formulas, it is only possible to affect the
energy intake and growth during the first 2 months of life but no later. In terms of protein intake he concluded that emulating the protein intake of breastfed infants in the first 4 months of life is possible, but with complex interventions. It can probably also be achieved with starter formula with 1.8 g protein/100 kcal and follow-up formula with 1.5 g/100 kcal. But at a borderline protein concentration it appears possible that infants compensate with a greater intake of formula thereby consuming an excess amount of energy.

So following the first 2 days the question arose, is it possible to translate the new recommendations into clinical practice. When I teach nutrition to students in Belgium I have the habit of discussing the evolution of energy and protein supply during the first year of life, and I use this example: body weight according to time. During the first month of life we provide close to 200 ml/kg, or 600 ml of milk. The babies receive only milk until about 5 months of age and at this time the milk intake decreases progressively to 150 ml/kg body weight/day. At 5 months we start with complementary feeding and provide some food mixtures. At 6 months we start with a little meal at lunch, and an evening meal at 9 months of age. Therefore from the feeding we can calculate what could be the energy and protein supply during the first year of life. Presently the recommendation for the mother is to use the lowest protein content formula during all the first year of life. If we then recommend decreasing the protein supply, not giving too much meat or protein during the evening meal, and then calculate the protein supply, we find that energy is relatively high during the first month of life, 130 kcal/kg/day. It decreases at 3 months but stays close to 100 kcal, which is about 20% more than the new recommendations. When we look at protein supply it is about 2.4 during the first months of life and after 6 months it is still about 2 g protein/kg body weight/day. So much more than the new recommendation. We need to think about what could be the consequences of the new recommendations. Recommendations should be translated into regulations. We have the Codex Alimentarius and the European Union directives needed to provide the new recommendations. I also think that there is an implication for industry; products need to be adapted to the recommendations. We also need prospective studies to evaluate the safety of the new recommendations in newborn infants.

Jacques Rigo

The first talk I will review is Jacques Rigo’s talk about body composition and he obviously has spent a great deal of effort and has immense data on the body composition of growing premature and full-term infants. He produced graphs showing, for instance, that the various methods we have, including TOBEC, DEXA and the indirect methods that Nancy Butte used, all produce about the same pattern of change in fat-free body mass; the change in fat mass is expressed as percentage per kilogram. But Jacques Rigo showed that
premature infants who are fed formula do better in terms of gain in fat-free mass, but they also gain a little bit more in fat mass.

We come now to the very exciting talk by Hans van Goudoever. I gained several insights that furthered my knowledge. One was that the gut of young animals, and by extension probably also of young infants, undergoes tremendous growth disproportional to body weight and body growth. One of the implications is that most infants who are growing rapidly probably have abdominal discomfort most of the time because their gut is also growing so fast. But the real scientific insight for me was that premature infants who receive not unreasonable protein intakes in the first few days don't oxidize any amino acids. This can only mean that they are not getting enough protein because oxidation is turned on only when there is a surfeit of amino acids. Lysine oxidation is close to 0.3 and in oxidation it is close to 0 in premature infants. I really admire him for these studies because they are not easy to do; they are easy to do in piglets but in human infants they are quite involved. Therefore we are grateful to him for having done these excellent studies. He concluded overall that both in humans and pigs high amounts of dietary amino acids are utilized first pass by the intestine, and one implication is that, when we estimate required dietary intakes of protein for premature infants, we make a correction for the inefficiency of intestinal absorption and we use factors like 10 or 15%. I think we probably have to apply a much higher correction factor because some of the limiting amino acids are retained by the gut and not made available systemically.

Now we come to the talk by Harvey Anderson that we heard over the phone this morning. It was quite a feat for Denis Barclay to arrange this and for the audiovisual people to pull it off; I have never been at a conference where we had a speaker more than 9,000 km away. You remember that as he spoke he mostly raised questions which is for the most part where the field is; the regulation of food intake consists of a large number of questions with very few answers. He showed us some very interesting findings, but we are far from any good understanding. One of the real problems is that when we say regulation we have to think of very short-term, short-term and long-term, and ultimately what counts in human nutrition or any nutrition is long-term regulation, week to week. After all what makes us obese is long-term excess of energy intake or energy retention.

Now next we come to Carlo Agostoni who told us that most studies that have looked at the protein intake of older infants and toddlers find that the protein intake is high in terms of requirements. We don’t know why toddlers and older infants are receiving such high protein intakes, perhaps tradition or custom, but we cannot conclude that the infant has a need for such high protein intake. So the infant must somehow select because at that age it has very limited selection, but it is not an impossibility. Of course the current hypothesis is that such high protein intakes have adverse effects on the later development of obesity, and this I have to remind you is a useful hypothesis,
nothing more. I think that being big is not necessarily going to be a disadvantage because we all know that height confers very significant advantages in life. So there may be a higher risk of diabetes, but everything being equal a big child could succeed in life much more than their little sibling.

Kathryn Dewey gave us a wonderful talk about breastfeeding and why and when we should introduce complementary foods. I found her arguments very compelling, even though I feel that in industrialized countries it is not a big issue and I think she agrees with that. But in developing countries it is a big and important issue, and we are grateful to her. We all heard her conclusions and I think they are well supported by the data. I especially like her findings about iron deficiency because I find the same thing that breastfed babies are at a considerable risk of becoming iron-deficient.

Then we heard from Jehan-François Desjeux about a new development in the rehabilitation of malnourished infants and children. The food that he told us about is the RUFT, ready-to-use therapeutic food, and I was quite impressed by the benefits of this food. I know very little about malnutrition but I think this is a very promising approach. The conclusion was that, in severely malnourished children presenting with dehydration and secondary cholera, rigorous intravenous and oral rehydration is effective with full and rapid recovery.

Katherine Macé gave us a wonderful overview of the new developments in dairy technology. A summary of plasma tryptophan levels in babies receiving the various formulas shows that the tryptophan levels in α-lactalbumin-enriched formula are similar to those in breastfed babies, and when casein glycomacropeptide is removed the threonine levels become more like those in breastfed babies. Later we heard that the glycomacropeptide isn’t perhaps all that bad after all if we were able to get rid of the threonine it contains, which is the problem. She gave us her overview of what she thinks technology is going to go. She thinks that a further decrease in the protein quantity in infant formulas is certainly feasible, but their added benefit of health in term infants is questionable, and that implies also for follow-on formulas, not for starter formulas.

Finally Bo Lönnerdal’s wonderful presentation, which you must still have in mind. He and his colleagues have expressed human recombinant human milk proteins in rice and this is a very exciting development. The nice thing is that this is an edible plant, no extensive purification is needed, essentially the recombinant rice can be fed. The conclusions were that bioactive proteins could be added to infant foods, hopefully that will happen in our lifetime, the regulatory agencies and the public willing.

I wish you all a good and safe trip home. It was great to have you all here.

Ekhard Ziegler

A few words from the perspective of the Nestlé Nutrition Institute. This workshop is coming to an end and I must say it was very attractive, compelling
and motivating because we learned a great deal, with a lot of new findings which we could discuss and to which we could observe your reactions. So for us at the Nestlé Nutrition Institute, it was a great opportunity being together with you here in Viet Nam.

I must say there were a number of key issues that became completely clear to me, among these being protein energy requirements, amino acid requirements and utilization. There are also a few issues which remain unclear, such as breast feeding and obesity, and the timing and way to introduce complementary feeding. The speakers addressed all aspects in a very fair and balanced way and I would like to thank them sincerely for their efforts; many were not easy to present. Then there also issues where considerable research is needed for clarification. For example, Dr. Axelsson mentioned that we are hunters and that we should feed meat to infants. This is something completely new, and I think you would all agree that we need research to clarify this.

Another question which surprised me is that cereals are not considered amongst the best choices for complementary feeding. I am surprised for two reasons. The first is that in 1867 the founder of our company developed a cereal-based milk to promote child survival. Scientific publications on cereals were already in German publications, dominating pediatric literature, 40 years before appearance of the first US infant nutrition publications. I know this because I had to review all the literature for Dr. Sam Fomon for his book on the history of pediatric nutrition. I am also surprised because cereals are an integral part of culture and feeding habits in many countries. Emigration of European populations to North America and elsewhere have propagated European complementary feeding practices in which cereals are not the primary source of nutrition. However in Latin America, Africa and especially Asia where 80% of the world’s babies are born, infants and children would not receive adequate nutrition nor even survive without cereal-based complementary foods. Finally, cereals are very convenient since they are well suited to fortification and can thus contribute to enhancing the nutrition of infants and children in many emerging as well as industrialized countries. So research is needed; we are listening to you and perhaps we will meet 5 years from now to discuss the next generation of findings.

I would like to close by thanking the two Chairpersons of this workshop, Ekhard Ziegler and Jacques Rigo, for putting together this fascinating scientific program. Thanks also to all the speakers and participants for their contributions, as well as the local Nestlé team headed by Ms. Montip Nagsevi and Ms. Vipapan Panitantum, for their most professional workshop organization and wonderful social events. Hopefully we will all meet somewhere else in the world at another Nestlé Nutrition Workshop.

Ferdinand Haschke