A Celebration of DHA

Discovery, Achievement and Challenges for Global Health
40 Years on

Gold Sponsors:

MeadJohnson Nutrition
The Mother and Child Foundation
MARTEK life enriched

Satellite meeting to the ISSFAL Congress

Guest of honour: Professor Michael Crawford

London, England
26-27 May 2010
Biographies for Cedric Hassall, Mark Johnson, and Raymond Keane were unavailable at the time of going to print.
Welcome to a special celebration

Forty years ago, experimental evidence began to appear showing a special role for docosahexaenoic acid (DHA) as a brain selective nutrient. Over the intervening years the discovery that the brain and eye are rich in DHA, that DHA accumulates at a striking rate in utero and through childhood, and the now well-known concept that low DHA status results in suboptimal eye and brain development have emerged to establish DHA as a pivotal nutrient for optimal neural function.

How did modern humans come to rely on a dietary source of DHA? DHA has been a prominent component of the biosphere since the Cambrian explosion of oxidative metabolism and animal evolution 600 million years ago. Session one on DHA and human evolution explores the concept that the food fatty acid quality, not sheer quantity of calories and protein, facilitated the runaway expansion of the human brain. Sessions two and three discuss discovery of the metabolic factors governing polyunsaturated fatty acid nutrition, evidence that development and long term brain and cardiovascular health depend on a dietary supply of DHA, and the emerging role of DHA as a precursor for potent lipid mediators. Sessions four and five outline molecular and translational science underlying the role of DHA in prevention and maintenance of brain health, and conclude with discussion of the challenges for supply of seafood, the richest food source of DHA.

Brain disorders have overtaken all other burdens of ill health combined. The threat posed by poor nutrition represents the greatest extant challenge to human progress. The presentations over a day and half outline a wealth of metabolic, phylogenetic, and evolutionary data pointing to omega-3 DHA as a key diet component for the future of the human species. Consolidating and celebrating our knowledge of DHA is hoped to inspire action to preserve and restore marine resources and the marine-to-human food chain.

Michael Crawford
Stephen Cunnane
Tom Brenna
Nicolas G. Bazan
Rachel V. Gow
Kebreab Ghebremeskel

From the Organizers
Wednesday 26th May 2010
Library of the Royal Society of Medicine
1 Wimpole Street, London W1G 0AE

Exhibition

Why is the brain under siege in the 21st century: Some insights from nutrition during human evolution

Exhibit is open daily from 27 May - 27 June, 2010
Monday - Thursday: 9.00 - 19.00, Friday: 9.00 - 17.30, Saturday: 10.00 - 16.30
Sunday: Closed

Chandos House
2 Queen Anne St., London W1G 9LQ

Opening Session

14:15 – 14:45 Registration
14:45 – 15:00 Professor Cedric Hassall, Honorary Chairman: Opening address

DHA AND HUMAN EVOLUTION: 50 YEARS SINCE HOMO AQUATICUS – Chair: Professor Michael Crawford

15:00 – 15:15 Elaine Morgan: Aquatic origins... 50 years on
15:15 – 15:30 Leigh Broadhurst: The geophysical evidence
15:30 – 15:45 Kathy Stewart: Aquatic foods and fuelling the hominin brain
15:45 – 16:15 Coffee Break
16:15 – 16:30 Stephen Cunnane: Survival of the fattest: nutrition and human brain evolution
16:30 – 16:45 Jorn Dyerberg: The Omega 3 story from Greenland
16:45 – 17:00 Message from Sir David Attenborough
17:00 – 17:30 Discussion
17:30 – 17:45 Book Launch
Human Brain Evolution: The Influence of Freshwater and Marine Food Resources (Eds. Stephen Cunnane and Kathlyn Stewart; published by John Wiley and Sons) Professor Ian Tattersall (American Museum of Natural History, NY), Karen Chambers (Wiley), Kathy Stewart and Stephen Cunnane (Eds.)
17:45 – 18:00 Break

WELCOME: THE CHALLENGE

18.00 – 18.20 Malcolm Gillies Vice Chancellor London Metropolitan University : Introduction
Lord Hameed of Hampstead: The rise of brain disorders
Lord Hameed’s speech opening the debate in the House of Lords on the prevention of neurodevelopmental disorders can be read at: http://www.parliament.the-stationery-office.co.uk/pa/ld200809/ldhansrd/text/91104-0003.htm#91104-0003
18.20 – 22.00 Drinks, Seafood Reception and Canapes
Thursday 27th May 2010
Royal Society of Medicine, 1 Wimpole Street, London W1G 0AE

<table>
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<tr>
<th>Time</th>
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<td>08:00 – 08:45</td>
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| 08:45 – 09:00 | Welcome  
Professor Cedric Hassall and Gold Sponsor                          |
| DISCOVERY: THE ESSENTIAL FATTY ACIDS – Chair: Stephen Cunnane and Gene Anderson |
| 09:00 – 09:15 | Andrew Sinclair: Crawford-omics: a platform for the future            |
| 09:15 – 09:30 | Claudio Galli: Essential fatty acid deficiency                        |
| 09:30 – 09:45 | Laurence Harbige: AA and CNS Autoimmune Disease                       |
| 09:45 – 10:00 | Rudolfo Brenner: The desaturase system                                |
| 10:00 – 10:30 | Discussion                                                             |
| 10:30 – 11:00 | Networking break                                                       |
| DISCOVERY: DHA, THE BRAIN AND THE EYE – Chair: Kebreab Ghebremeskel and Andrew Sinclair |
| 11:00 – 11:15 | Tom Brenna: DHA and brain development: primate models                 |
| 11:15 – 11:30 | Susan Carlson: DHA in infant formulas                                 |
| 11:30 – 11:45 | Ephraim Yavin: DHA molecular species and neurogenesis                 |
| 11:45 – 12:00 | Gene Anderson: Conservation of DHA in vision over 600 million years   |
| 12:00 – 12:15 | Nicolas Bazan: DHA and neuroprotectins                                |
| 12:15 – 12:45 | Discussion                                                             |
| 12:45 – 14:00 | Lunch                                                                  |
| ACHIEVEMENTS: DHA IN CLINICAL MEDICINE – Chair: Mark Johnson and Norman Salem |
| 14:00 – 14:15 | Hee-Yong Kim: DHA and signaling mechanisms                            |
| 14:15 – 14:30 | Michel Lagarde: DHA and redox potential                               |
| 14:30 – 14:45 | Holm Holmsen: DHA and psychotropic drugs                              |
| 14:45 – 15:00 | Ole Mouritsen: Liposome potential in cancer therapy                   |
| 15:00 – 15:15 | Bruce Holub: EPA, DHA and cardiovascular health                       |
| 15:15 – 15:30 | Bill Lands: Past (Passed) opportunities in quantitative nutrition of essential fatty acids |
| 15:30 – 16:00 | Discussion                                                             |
| 16:00 – 16:30 | Networking break                                                       |
| GLOBAL IMPLICATIONS – Chair: Robert McNamara and David James           |
| 16:30 – 16:45 | Norman Salem: DHA – a required nutrient in health and cognition       |
| 16:45 – 17:00 | Joe Hibbeln: Changes in 20th Century fat intakes and mental health    |
| 17:00 – 17:15 | Letten F. Saugstad: The designer of the brain is evolution, but nerve cells themselves are the builders. To secure optimal function we need to provide optimal nutrition, which we do not! |
| 17:15 – 17:30 | Michael Crawford: Brain disorders have overtaken all burdens of ill health |
| 17:30 – 18:00 | Discussion: “Agriculturalizing the oceans to restore photosynthesis to defeat the rise in CO2 levels, oceanic acidification, brain disorders and provide high quality food to enhance mental health.” Michael Crawford, John Stein, Izzeldin S. Hussein, Chris Leftwich, Robert McNamara, David James and Raymond Keane |
| Evening Reception Commences                                           |
| 18:30 – 19:15 | Drinks reception                                                       |
| 19:15 till late | Dinner by our special guest; seafood cookery expert Rick Stein        |
Michael Crawford graduated in chemistry at Edinburgh University. Because of an interest in the gap between medicine and chemistry he studied biochemistry and physiology and then went to the Royal Postgraduate Medical School where he obtained a doctorate in chemical pathology in 1960. His interest took him to Uganda in Africa to establish teaching in pre-clinical and clinical chemistry. He participated in setting up the Muhimbili Medical School in Dar-es-Salaam. His research work, funded by the Medical Research Council and the British Cancer Campaign, focused on the causes of tropical nutrition related disorders of adults such as primary hepatoma and aflatoxin, bladder cancer, and endomyocardial fibrosis, the commonest cause of death from heart failure and volvulus, the commonest surgical emergency.

After a Wellcome Fellowship to work with Professor Ernst Baranay, Uppsala, Sweden in 1965 he returned to London to head the Biochemistry Department at the Nuffield Institute of Comparative Medicine whilst maintaining his research laboratory in Uganda until 1972. His comparative studies in Africa and the UK revealed the link between arachidonic and docosahexaenoic acids, the brain and its evolution. From 1982-92 he held a special Chair in Biochemistry at the University of Nottingham. In 1989 he founded the Institute of Brain Chemistry and Human Nutrition as the research arm of the Mother and Child Foundation.

He has been awarded several honours including the prestigious Danone Chair at the University of Ghent, Belgium for the millennium year, an honorary chair at the Albert Schweitzer International University, the International Prize for Modern Nutrition, Gold Medal to recognize the Hofmann la Roche Centenary and from the Government in Oman. He was President of the IVth and Vth International Congresses of the International Society for Fats and Lipids and rapporteur and WHO consultant for the 1978 joint Expert Consultation on the brain. In: “Magnetic Resonance and Brain Function - Approaches from Physics” Proceedings of the 1998 Enrico Fermi International School of Physics, Enrico Fermi Lecture, Course #139, Varenna, Italy, pp 1-27, ed. B. Maraviglia.


Dr. Elaine Morgan
Fellow of Swansea University and Cardiff University, Wales, United Kingdom

Read English at Lady Margaret Hall, Oxford, during the last war. Married, three sons, lives in Wales.

After nearly twenty years as a television dramatist and scriptwriter she wrote a book entitled “The Descent of Woman” in 1972. In the course of writing it she learned about Sir Alister Hardy’s suggestion in an article he had published in 1960 that human ancestors may have been more aquatic at an earlier stage in their evolution.

“The Descent of Woman” was addressed to the general public and was brashly polemic in its approach, which helped it to become a best-seller, but made it much easier for scientists to treat it as outlandish science fiction on a par with flying saucers.

Since then she has published six further (non-best-selling) books on the general theme of human origins in an attempt to persuade them to modify that opinion, including “The Scars of Evolution” (1990), “The Descent of the Child” (1994) and “The Aquatic Ape Hypothesis” (1997). For most of that time the aquatic theme has continued to be officially treated as beyond the pale, but there have been signs within the last few years that a new generation is curious to know why the questions it poses have never been aired or debated in any of the professional journals.

Abstract:
Aquatic origins... 50 years on
Dr. Michael Crawford was one of the first scientists who was willing not merely to consider the possible merits of Sir Alister’s water theory, but to do so publicly in his book “The Driving Force.” At the time when he published it – in 1989 – that was still a courageous decision for anyone with a career at stake. Treating it as a tenable hypothesis, he examined the theory in the light of his own area of expertise, and introduced a whole new range of evidence which no one else had considered. His contribution added considerably to the credibility of the theory, and even more to the morale of the small number of people who had been promoting it up to that point.

Dr. C. Leigh Broadhurst
Research Geochemist, Animal & Natural Resources Institute, U.S. Department of Agriculture, Maryland, USA

Dr. C. Leigh Broadhurst, Ph.D, is an analytical and field research geochemist for the Environmental Management and By-Products Utilization Laboratory, Animal and Natural Resources Institute, USDA Agricultural Research Service, Beltsville, MD. Her research publications span scientific fields from high temperature magmatic simulations to the origin of type 2 diabetes. Dr. Broadhurst currently works on phyto remediation and phytomining of Ni, Zn, Cd and Mn and the health and environmental effects of heavy metals in the environment. In addition, she participates in a cross-disciplinary scientific collaboration which investigates the impact of brain-specific nutrition on the origin of modern human intelligence. Dr. Broadhurst has also been an author, lecturer and consultant in the natural products industry for 18 years, with a special emphasis on long-chain polyunsaturated fats.

Abstract:
Brain-specific lipids from marine and lacustrine food resources: now a recognized factor for the origin and dominance of modern Homo sapiens
Long-chain polyunsaturated fatty acids (LC-PUFA) are dietarily essential, thus normal infant/neonatal intellectual growth and development cannot be accomplished if they are deficient during pregnancy and lactation. Abundant DHA and AA are needed to construct fetal and placental tissues, and sustaining normal adult human brain function also requires LC-PUFA. H. sapiens is unlikely to have evolved a large, complex, metabolically expensive brain in an environment which did not provide abundant dietary LC-PUFA.

The littoral marine and lacustrine food chains provide consistently greater amounts of pre-formed LC-PUFA than the terrestrial food chain. Dietary levels of DHA are 2.5-100 fold higher for equivalent weights of marine fish or shellfish vs. lean or fat terrestrial meats. Mammalian brain tissue and bird egg yolks are the richest terrestrial sources of LC-PUFA. At South African Cape sites, shell middens and fish remains are associated with early modern human remains and the earliest known examples of modern cultural behaviour – the latter clearly indicating that modern thought and communication patterns had developed. In fact, the earliest known human personal decoration consists of drilled seashell beads. Cape sites dating from 164-18 kya cluster within 200 km of the present coast.

Evidence of early H. sapiens is also found around the Rift Valley lakes and up the Nile Corridor into the Middle East. Exploitation of shellfish, stranded/spawning fish; sea birds and eggs by Homo could have provided LC-PUFA for men, women, and children without requiring organized hunting/fishing, or sophisticated social behaviour. The successful migration of H. sapiens to Eurasia depended upon coastal resources and routes.
Kathlyn Stewart has been a Research Scientist in Paleobiology at the Canadian Museum of Nature in Ottawa since 1991. She was Head of Paleobiology Research at the Museum for 8 years. Dr. Stewart graduated with her Ph.D. from the University of Toronto in 1989 in Archaeology and Palaeontology. Her dissertation focused on fish and fishing sites in central and eastern Africa in the past 10,000 years. Since then she has researched the evolution and ecology of fossil fish in Africa, as well as the importance of fish in the diet of early hominins.

Dr. Stewart has been a team member on several expeditions in Kenya, Tanzania and Ethiopia, involved in reconstructing the environment and evolution of early hominins. She has received numerous grants to fund her work in Africa. She has also worked on vertebrate faunas in western Canada, and founded and currently edits a journal on that field.

Dr. Stewart has written or co-edited five books and numerous journal articles. Her co-edited volume “Early Hominid Behavioural Ecology” (1994) contained one of the first articles to link early hominids, fish and nutrition. Dr. Stewart has been an adjunct professor at the Universities of Victoria, Toronto and Trent, and has co-supervised several students. Most recently she and Stephen Cunnane have collaborated on the investigation of the role that aquatic foods, particularly fish and shellfish, have played in the early hominin diet. More specifically, they believe that essential fatty acids, in particular DHA, most available in freshwater and marine foods, especially fish and shellfish, were critical in the growth and maintenance of the hominin brain. Their research is published in “Human Brain Evolution: the Influence of Freshwater and Marine Foods” published in 2010. Dr. Stewart lives in Ottawa with her two children.

**Abstract:**

Aquatic foods and fuelling the hominin brain

The human brain has a large requirement for brain-selective nutrients, in particular the omega-3 fatty acid DHA, iodine and iron, for normal growth and ongoing maintenance. These are particularly essential in neonates and infants. These nutrients, especially DHA, are most available in freshwater and marine foods, especially fish and shellfish. Early Homo’s large brain would have required consistent access to the same high quality nutrients. While many traditional theories hypothesized that early Homo evolved in a savanna environment, savannas in fact provide few accessible sources of high quality nutrients. In this paper I present evidence that early hominins were frequenting freshwater wetland environments and consuming, initially, wetlands vegetation. They were also consuming freshwater fish and shellfish, at first in small amounts. Certain taxa of fish, particularly catfish, and shellfish were consistently seasonally available, easy to catch by early hominins with little or no technology, and nutrient-rich. The drastic climatic changes in Plio-Pleistocene eastern Africa, with long periods of drought, are suggested to trigger more extensive exploitation by hominins of freshwater fish and invertebrates. The consistent, long-term consumption of unusually large amounts of these resources, implying an anomalously high intake of brain-selective nutrients and hormones, may have been a catalyst for the encephalization process and other related physiological and anatomical changes in early Homo. The exploitation by later Homo of marine fish and shellfish resources, probably starting about 200,000 years ago, may have triggered encephalization and other processes associated with the emergence of Homo sapiens.
Stephen Cunnane obtained a PhD in Physiology at McGill University in Montreal in 1980. He then did post-doctoral research in the UK (Aberdeen and London) and in Nova Scotia. He joined the Department of Nutritional Sciences at the University of Toronto as an Assistant Professor in 1986. While in Toronto he published extensively on role of omega-3 fatty acids in human health. In 2003, Dr. Cunnane was awarded a Canada Research Chair at the Research Center on Aging and is a full professor in the departments of Medicine and Physiology at the Université de Sherbrooke. The main theme of his research is to learn more brain metabolism during aging and whether certain dietary fats or fuels can help maintain healthy cognitive function during aging.

He is the author of the book - Survival of the Fattest : The Key to Human Brain Evolution (http://www.worldscibooks.com/lifesci/5769.html), which describes the pivotal role of fatness in babies as a prerequisite for evolution of the human brain. He co-edited with Kathy Stewart the book – Human Brain Evolution: Influence of Fresh and Coastal Food Resources (Wiley, 2010). He has also written books on zinc nutrition and flaxseed in human nutrition, and published over 240 research papers.

Abstract:

Nutritional and metabolic constraints on brain development: implications for human brain evolution

Over the past 25-30 years, it has become clear that the development and function of the human brain is especially vulnerable to inadequate intakes of several brain selective nutrients, notably iodine, iron and the omega-3 fatty acid - docosahexaenoic acid. The global scope and permanent adverse impact of this present day nutritional vulnerability indicate that increased availability of these same nutrients must have at least facilitated if not been essential for human brain evolution. Normal human brain development is also exquisitely dependant on sufficient energy supply which, in turn, is directly linked to the evolution of 10% of body weight as fat stores in healthy human neonates. Hence, major changes in hominin metabolism and nutritional requirements were required to evolve both a large brain and, simultaneously, sufficient body fat stores to guarantee the brain’s expanding energy requirements. The brain’s ongoing vulnerability to nutrient and energy inadequacies strongly suggests this evolutionary process occurred in an environment abundant in foods rich in brain selective nutrients. It is now fairly widely accepted that long term access to a higher quality diet was a prerequisite for human brain evolution. The hominin fossil record supports the concept that the shallow water zone along shorelines, lakes, rivers, marshes and estuaries, as well as some intertidal coastal zones in east and southern Africa would have provided ample access to slow-moving fish, aquatic plants, eggs, amphibians, crustaceans and shellfish, the nutrient composition of which would have favoured human brain evolution.
Dr. Jorn Dyerberg

Medical and Scientific Advisor, Napro-Pharma Ltd., Norway, & Unilabs Copenhagen, Denmark

Dr. Jorn Dyerberg is one of the world’s leading authorities on the health benefits of omega-3 fish oils. He received his degree in medicine from the University of Aarhus in Aarhus, Denmark.

In 1971, Dr. Dyerberg published a landmark study in The Lancet regarding heart health. In the early 1970s, he led a research team that studied blood lipid levels among the Inuit population in Greenland. The group set out to find why the Inuit society had a low occurrence of heart disease, despite a diet of mostly seal and fish. Dr. Dyerberg first hypothesized that it was related to the abundance of the omega-3 fatty acids DHA and EPA found in the fish. He would lead 5 separate scientific expeditions to Northwest Greenland to examine the association between fish oil intake and coronary heart disease. Dr. Dyerberg has received several awards and accolades for his groundbreaking omega-3 research.

Dr. Dyerberg has held several physician positions at Denmark hospitals and research institutions and has also served as a professor at the University of Copenhagen in Denmark. He is currently the medical and scientific advisor for Napro-Pharma Ltd. in Norway.

Abstract:

Dyerberg, J. Marine Omega-3 Fatty Acids— the beginnings: The omega-3 story from Greenland.

The omega-3 story as we know it today started with a lead article in the Danish Medical Journal in May 1969, pointing at the peculiarities of the Greenlandic disease spectrum, differing in many ways from that of the Western societies, including Denmark. Among the most striking differences was a far lower incidence of coronary heart diseases in Inuits (Eskimos) compared to e.g. Danes, in spite of the Inuits’ traditionally fatty diet. This inspired Dr. Bang and me to perform a series of expeditions to northwestern Greenland in the 1970ies, finding a high content of EPA and DHA in Eskimo food and in their blood and platelets. We also demonstrated that this could explain their longer cutaneous bleeding time, and thereby lower thrombotic tendency, offering a hypothesis for their low IHD incidence. The publications of these finding in The Lancet in the 1970ies introduced the long chained omega-3 fatty acids into medicine and nutrition.

My presentation is a trip down memory lane sharing our experiences from then.

Dr. Ian Tattersall

Division of Anthropology, American Museum of Natural History, USA

Dr. Ian Tattersall is currently Curator in the Division of Anthropology of the American Museum of Natural History in New York City. Born in England and raised in East Africa, he has carried out both primatological and paleontological fieldwork in countries as diverse as Madagascar, Vietnam, Surinam, Yemen and Mauritius. Trained in archaeology and anthropology at Cambridge, and in geology and vertebrate paleontology at Yale, Tattersall has concentrated his research since the 1960s in three main areas: the analysis of the human fossil record and its integration with evolutionary theory, the origin of human cognition, and the study of the ecology and systematics of the lemurs of Madagascar. Tattersall is also a prominent interpreter of human paleontology to the public, with several trade books to his credit, among them Human Origins: What Bones and Genomes Tell Us About Ourselves (with Rob DeSalle, 2007), The Monkey in the Mirror (2002), Extinct Humans (with Jeffrey Schwartz, 2000), Becoming Human: Evolution and Human Uniqueness (1998), The Last Neanderthal: The Rise, Success and Mysterious Extinction of Our Closest Human Relatives (1995; rev. 1999) and The Fossil Trail: How We Know What We Think We Know About Human Evolution (1995; 2nd. ed. 2009) as well as several articles in Scientific American and the co-editorship of the definitive Encyclopedia of Human Evolution and Prehistory. He lectures widely at venues around the world, and, as curator, has also been responsible for several major exhibits at the American Museum of Natural History, including Ancestors: Four Million Years of Humanity (1984); Dark Caves, Bright Visions: Life In Ice Age Europe (1986); Madagascar: Island of the Ancestors (1989); The First Europeans: Treasures from the Hills of Atapuerca (2003); the highly acclaimed Hall of Human Biology and Evolution (1993), and most recently the successor Hall of Human Origins (2007).
The Lord Hameed (Dr Khalid Hameed) worked for three London teaching hospitals. Following this he developed a successful practice in Central London and was appointed Chief Executive Officer & Executive Director of the Cromwell Hospital, London. He is currently Chairman of the Alpha Hospital Group and also Chairman & Chief Executive Officer of the London International Hospital, which is a new Centre of Excellence being created for treatment of cancer, heart and the brain, in London.

Lord Hameed is Chairman of the Commonwealth Youth Exchange Council, Chairman of the Friends of The British Library, President of the Little Foundation, Chairman of the Wooff Institute, a Trustee of the Ethnic Minority Foundation, a Trustee of the Coexistence Trust, a Governor of the International Students House, a Patron of the Three Faiths Forum, a Trustee of the Maimonides Foundation, and supports other charities. He is involved in interfaith harmony and dialogue for which he regularly undertakes public speaking. In 2005 he was awarded the Sternberg Award for his work on interfaith matters, and in 2007 he was also awarded the Ambassador for Peace Award by the Interreligious & International Federation for World Peace. He was the recipient of the Asian of the Year Award 2007.

He has national honours from five countries, including the United Kingdom, which awarded him the CBE. He was also appointed as a Deputy Lieutenant of Greater London. Lord Hameed was appointed High Sheriff of Greater London in March 2006 by HM The Queen, an office which is 1,000 years' old. In 2007, he was appointed as a Member of the House of Lords where he sits as a crossbench Peer.

Professor Malcolm Gillies George William Gillies (born 23 December 1954) is Vice-Chancellor of London Metropolitan University. Gillies graduated with a degree in classics from the Australian National University, and subsequently earned a further degree in music from the University of Cambridge. He holds a masters and doctoral degree from King’s College London, and a doctoral degree from the University of Melbourne.

He was previously Deputy Vice-Chancellor (Education) and then Vice-President (Development) of the Australian National University, based in Canberra, Australia and latterly at Yale University in New Haven, United States. During 1983-5 he was a Hungarian Government Scholar at the Academy of Sciences in Budapest. Between 1998-2001 he was the President of the Australian Academy of the Humanities and during 2004-6 the inaugural President of the Council for the Humanities, Arts and Social Sciences.

Since coming to the United Kingdom Malcolm Gillies has become an alternate director of the Office of the Independent Adjudicator, Vice-Chair of London Higher and a Trustee of the City of London Academy Islington. He is also on the Research Policy Committee of Universities UK. In July 2008 he was appointed the Schools-Higher Education “Champion” for London by the quondam Schools Minister, Lord Adonis.

A musician and linguist by training, Malcolm Gillies has published a dozen books and over one hundred articles, chapters and reviews. In 2007 his book Self-Portrait of Percy Grainger (with Pear and Carroll) gained a Deems Taylor Award of the American Society of Composers, Authors and Publishers. He has edited Oxford University Press’s series Studies in Musical Genesis, Structure and Interpretation since 1997. Since 2000 he has been Board Chair of the international contemporary-music ensemble, Elision.

Gillies served as Vice-Chancellor and President of The City University from 2007-2009.

London Metropolitan University announced on 19 November 2009 that The Board of Governors had appointed Malcolm Gillies as the university’s new Vice-Chancellor. Professor Gillies took up the post on 25 January 2010.
Abstract:
Crawford-Omics: A Platform For The Future
Andrew J Sinclair
Metabolic Research Unit, School of Medicine, Deakin University, Geelong, Vic, 3217, Australia

Background – Before there was ‘omics’, Michael Crawford was a protein biochemist and a keen observer of nature. He had returned from Africa to head up the Biochemistry Department at the Nuffield Institute of Comparative Medicine (NICM). Prior to my joining his team in 1970, Michael was interested in differences in the fat and polyunsaturated fatty acid (PUFA) content of wild versus domesticated meats with colleagues such as Gale, Woodford & Casperd from Uganda. He published a landmark paper in The Lancet in 1968 on this topic. I joined NICM after a postdoc in Canada, having previously done my PhD in Melbourne on essential fatty acid deficiency in rats & humans.

The Crawford-omics platform:
(i) Crawford himself – an extraordinary vibrant fellow who was enthusiastic about everything; in this instance grappling with muscle and liver differences in PUFA compared with brain PUFA (the constant fingerprint).

(ii) The environment – The Biochemistry Department at NICM was well equipped with Pye-Unicam GCs, technicians, lab space and a really positive atmosphere of discovery in this multi-disciplinary Institute, lead by the Director, Dr Len Goodwin.

(iii) The nutrition scene – at this time, nutritionists did not consider omega 3 PUFA were essential for mammals (these were fish fats!). The Crawford-omics platform changed this attitude towards the omega 3 PUFA.

(iv) The physical platform – this was a long lab bench on which yards of individual GC traces were spread & pored over by Michael, Coral, Glynn, Pam, Lynn and others. This was the engine room of discovery, where the brain PUFA fingerprint or Crawford-omics platform was born.

(v) The questions being asked – what was the meaning of the brain fingerprint? what was the composition of human milk?; surely omega 3 PUFA were essential for mammals? what was the rate of accretion of DHA in the brain?; what happened to the brain deprived of PUFA?; could obligate carnivores be raised on ‘vegetarian-like’ diets?; did dietary PUFA drive brain size & complexity?

(vi) The colleagues – during this time, Ahmed Hassam, Aaron Munhambo and John Rivers joined us, we collaborated with Dick Fiennes and Alistair Hay from NICM and Claudio Galli and others visited us. This platform was focussed on DHA in the mammalian brain and served to support the many great researchers and their studies that followed this period at NICM.
Speaker

1962 Degree in Medicine at the University of Milano, Italy.
1963-1967 Research Fellow at The City of Hope Medical Centre, Duarte, Calif (Dept Neurochemistry, Lab. Lipid Biochemistry and Neurochemistry), and Int. Fellowship of The National Multiple Sclerosis Society, New York.
1970 PhD in Pharmacology, University of Milan, School of Medicine
1972-1980 Associate Professor of Pharmacology, Institute of Pharmacological Sciences School of Pharmacy, University of Milan. Since 1981, full Professor, same Institution (since January 2001 Department of Pharmacological Sciences)
2004-2009 President of the School of Herbal Sciences and Technologies, University of Milan

Publications:
Author of over 280 publications in refereed journals, and co-editor of several volumes in International Series, in the field of lipid nutrition, metabolism and pharmacology. Over 4800 citations in the international literature.

Major research areas / observations concern:

a. Dietary polyunsaturated fatty acids (PUFA) with special attention to the n-3 FA, and nervous and cardiovascular systems. Biochemical, functional and pathophysiological aspects : from cell cultures to human studies.
b. New analytical strategies for the assessment of the fatty acid status in a drop of blood collected non invasively in population groups, including 4d old neonates, and for the evaluation of the bioavailability of FA (n-3) in different formulations
d. Local Mediterranean food plants and nutraceuticals

Memberships :
- International Society of Neurochemistry
- International Society for the Study of Fatty Acids and Lipids (ISSFAL), President (April 1997- March 2000)
- Member of the International Olive Oil Council
- Field Editor of various International Journals

Abstract:
Essential Fatty Acids : from deficiencies to optimal intakes.

Background:
Research on essential fatty acids (EFA) after their discovery decades ago, was initially focussed on the impact of deficiencies in animal studies. More recently attention has been mainly devoted to human studies, focussed on the relationships between intakes, especially of the Long Chain PolyUnsaturated compounds (LCP) of the n-3 series present in very limited amounts in the diet, and the incorporation in cells and tissues, on one hand, and the impact on the health status, on the other.

Aims:
The assessment of the FA status in the body through methodologies applicable to population studies, provides the basis for the evaluation of the relationships between availability, rates of utilization, and physio-pathological factors and conditions. This type of information is very relevant in order to the define requirements and recommendations aimed to optimize the intakes.

Results:
Research on these issues has revealed several relevant informations :
Levels of the n 3 LCP , EPA (20:5), DHA (22:6) and to some extent DPA (22:5 n-3) are the most variable under several conditions :

a. Physiological states (significant reductions, also of n- 6 LCP, in pregnant vs non pregnant women; maximal levels in neonates and minimal in school aged children, and reduction associated to aging, also gender differences for selected n- 3 LCP).
b. Different dietary habits (regional differences, in the same country, e.g. Italy, and on a global scale, different countries) and lifestyles (e.g. cigarette smoking).
c. Differences in the relative levels of metabolic intermediates (e.g. DPA modulated by elongation and desaturation steps) in pathological conditions (cystic fibrosis, Alzheimer’s), indicating that additional factors in the balance are enzymatic steps involved in LCP metabolism (desaturations and elongations).

Comments and Conclusions:
The ample differences in the LCP n-3 fatty acid status in relation to the above conditions provide information on the underlying factors, criteria for optimization of intakes and for strategies aimed to the prevention and treatment of pathologial states (cardiovascular, neurological and inflammatory) which are clearly affected by inadequate intakes. The assessment of the FA status on a global scale is a very relevant step for the progress in our understanding of the roles of LCP.
Dr. Laurence S. Harbige is currently a Reader in the School of Science at the Universities at Medway Campus in Kent and a visiting lecturer at the University of London. Between 1982 and 1992 he worked in the Department of Biochemistry and Nutrition headed by Professor Michael A Crawford at the Nuffield Laboratories of Comparative Medicine, Zoological Society of London, following which he moved to the Department of Immunology, United Medical and Dental Schools of Guy’s and St. Thomas’s Hospitals, University of London (now King’s College) in 1992. His main research interests are in the mechanisms by which fatty acids and other lipids affect immune cell functions and autoimmune disease and their role in the pathogenesis and treatment of multiple sclerosis and related disorders. He was the first chairman of the British Society for Immunology’s (BSI) Nutrition and Immunity Affinity Group and is on the executive committee and council member of the International Forum on Immunonutrition, Education and Research (iFINER). He has acted as an expert reviewer and/or panel member for the Medical Research Council (MRC), BBSRC, Wellcome Trust, Food Standards Agency (FSA), MRC (South Africa) and the Multiple Sclerosis Society of Great Britain and Northern Ireland. Recently with Dr Mike Leach they received a prestigious USA National Multiple Sclerosis Society FastForward (speeding delivery of new treatments for MS) award.

Abstract:
Arachidonic Acid and CNS Autoimmune Disease
Polyunsaturated fatty acids of the n-6 family particularly arachidonic acid (AA) are essential for the structural and functional integrity of cells and tissues of the nervous system in addition they are also essential for cells and tissues of the immune system. In the human disease Multiple Sclerosis (MS) where T-lymphocytes mediate inflammation and demyelination in the CNS we have shown a disturbance in lymphocyte n-6 fatty acid metabolism and dysregulation of regulatory and inflammatory cytokines. In addition we find a protective effect of the longer chain n-6 fatty acids in the T-lymphocyte mediated autoimmune disease experimental autoimmune encephalomyelitis (EAE), an animal model of MS. We tested the working hypothesis that dysregulated n-6 fatty acid and cytokine metabolism was important in the pathogenesis of MS in a randomised double-blind, placebo controlled trial of high and low dose selected \( \gamma \)-linolenic acid (18:3 n-6)-rich oil (where 18:3 n-6 is rapidly converted to the longer chain 20:3 n-6, DGLA and 20:4 n-6, AA). The high dose had a marked clinical effect in relapsing-remitting MS, significantly decreasing the relapse rate and the progression of disease. Laboratory findings paralleled worsening clinical changes in the placebo group in that production of pro-inflammatory cytokines (TNF-\( \alpha \), IL-1\( \beta \), IL-6) was increased and anti-inflammatory TGF-\( \beta \) markedly decreased with concomitant loss of membrane n-6 linoleic (18:2 n-6, LA) and arachidonic acids. In contrast in the high dose group there was decreased pro-inflammatory cytokines and preservation of TGF-\( \beta \) and membrane n-6 fatty acids. Improvement in disability (Expanded Disability Status Scale) with high dose also suggests a beneficial effect on neuronal lipids and neural function. Thus disturbed n-6 fatty acid metabolism in MS appears to give rise to loss of long chain n-6 fatty acids and the regulatory/anti-inflammatory cytokine TGF-\( \beta \) and increased pro-inflammatory cytokines and loss of these important neural fatty acids for CNS structure and function.
Born on July 17th 1922 in Banfield, Argentina, became Dr. in Chemistry of the School of Exact Physical and Natural Sciences, University of Buenos Aires in 1946. After a Scholarship in Aberdeen working with Dr. John Lovern was appointed fulltime Professor of Biochemistry at the School of Medicine, University of La Plata in 1956. Continuing with his research in lipids biochemistry he initiated the biochemical research at the University of La Plata.

He founded, together with Dr. L. F. Leloir, the Argentine Society of Biochemical Research in 1965, and was member of the Director Council of the CONICET from 1968 to 1970. He founded the INIBIOLP in 1982.

One of his main lines of research was the biosynthesis and function of unsaturated fatty acids. He discovered the existence of n-3 polyunsaturated fatty acids together with n-6 fatty acids in fresh water fish of the Río de La Plata in 1953.

He specially devoted to the desaturases, its regulation mechanisms, and proved for the first time that $\Delta_6$ and $\Delta_5$ desaturases were depressed in type I Diabetes due to insulin deficiency, since insulin evoked the desaturase expression through a genomic mechanism.

Dr. Brenner demonstrated that the desaturases were modulated by hormones and by nuclear receptors PPARs, LXR$s$, and SREBP-1 interaction through genomic mechanisms.

The function of unsaturated fatty acids and cholesterol on membranes phospholipids structure, biophysical properties and enzyme bound activities was investigated.

Many studies were devoted to the biochemistry of the insect Triatoma infestans vector of Chagas disease.

He published 300 articles in international journals, 14 chapters in scientific books, presented 290 works in international congresses, gave 130 conferences and directed 40 thesis.

He received many national and international awards and is member of 4 Scientific Academies.

Abstract:

*The mechanism of biosynthesis of unsaturated fatty acids, its regulation and effects.*

The discovery of essentiality of linoleic and $\alpha$-linolenic acids, for animals in 1928 opened the necessity to study their function and transformations and led to the description of n-9, n-6 and n-3 families of fatty acids. In this way the sequential effect of elongases adding malonyl CoA and $\Delta_9$, $\Delta_5$ and $\Delta_6$ desaturases producing the double bonds at different distances of COOH group were discovered between 1958 and 1961 by Bernard et al, Stoppel and Nugteren, respectively. The $\Delta_9$ desaturases, today called stearoyl CoA desaturases, producing the monoenoic fatty acids, oleic and palmitoleic, and $\Delta_6$ and $\Delta_5$ desaturases producing the polyenoic fatty acids, were shown to regulate specially their biosynthesis. It was found that fatty acids of n-6 and n-3 series compete between them and insulin activated; while the other hormones, glucagon, adrenaline, corticoids, adrenergocorticotropic, and so on, deactivated the desaturases. Soon we proved that the main mechanism of control was at the level of mRNA expression and now we know that nuclear factors PPAR$\alpha$, LXR$\alpha$, RXR$\alpha$; and regulatory binding protein 1-c (SRIBP-1c) interact in this modulation that is modified by diet composition.

The different desaturases have been isolated by the groups of Stritmather, Clarke, and other, and the sequence of amino acids determined, showing the existence of catalytic and Cyt b5 regions. In animals the desaturases are bound to the endoplasmic reticulum membrane crossing it three times and require electrons provided by the NADH-Cyt b5 reductase. They are able to synthetize n-6 and n-3 acyl-CoA up to 24 carbons. Then they are $\beta$-oxidized in the peroxisomes to 22 carbon acyl-CoA, then stopped by the thioesterases by conversion to the free acids. Therefore the activity of desaturases is dependent not only on an appropriate composition and structure but on the correct incorporation in the membrane bilayer and the provision of electrons by the NADH-Cyt b5 reductase.
Tom J. Brenna, PhD, is Professor of Human Nutrition in the Division of Nutritional Sciences at Cornell University, Ithaca, New York, USA. He is also a member of Cornell’s graduate faculties of Chemistry and Chemical Biology, of Food Science and Technology, and of Geological Sciences, and is Adjunct Professor in the Dept. of Community and Preventative Medicine at the University of Rochester (NY) Medical College.

He earned his B.S. (1980) in Nutritional Biochemistry from the University of Connecticut, working in the lipids laboratory of the late Robert G. Jensen. His PhD (1985) work was in Chemistry from Cornell University, under thesis advisor George H. Morrison developing biological ion microscopy. From 1985 to 1989 he was staff scientist at IBM’s Technology Laboratory in Endicott, NY, where his research interests were in the area of Fourier Transform Mass Spectrometry. In 1989 he joined Cornell’s faculty as Assistant Professor of Human Nutrition.

His research group focuses on study of polyunsaturated fatty acid (PUFA) nutrition in the perinatal period, and their role in neural and retinal development. Studies of the efficacy of DHA and related PUFA as structural components of the central nervous system have helped to define the mechanism by which these fats improve visual and neural function. His group is also active in the development and application of biomedical mass spectrometry, and in the use of high precision isotope ratio mass spectrometry for detection of endogenous steroid doping. The National Institutes of Health (NIH) has supported his research continuously since 1991 for these and related studies, as have several other government and private entities. He has served two terms on the Board of Directors of the International Society for the Study of Fatty Acids and Lipids (ISSFAL).

**Abstract:**

**DHA and Brain Development. Primate Models**

Foods vary widely in their DHA content. Non-ruminant terrestrial vegetarian animals must biosynthesize all DHA from precursor ω3 PUFA, whereas fish eating animals can obtain all DHA from diet. These differences are reflected in the metabolic potential for DHA biosynthesis. On this basis, omnivorous primates such as the baboon, with big brains compared to subprimates, are the best available parallels for human DHA and PUFA nutrition. Studies show that preformed dietary DHA is about an order of magnitude more efficacious for supplying the developing brain with DHA compared to the plant-based precursor α-linolenic acid. Recent studies show that the PUFA fatty acid desaturase (FADS) genes coding for the rate limiting DHA synthetic enzymes express multiple alternative transcripts (AT) in neonatal and fetal baboons. These AT are expressed in several species including chickens. Expression levels of the new FADS AT are differentially regulated by dietary PUFA in neonatal baboons. While their function is yet to be established, FADS AT represent widely expressed molecular entities that could provide fatty acid or metabolic specificity for DHA synthesis.
Susan E. Carlson, Ph.D. is the AJ Rice Professor of Nutrition at the University of Kansas Medical Center (Kansas City) in the School of Allied Health (Dietetics and Nutrition). For over 30 years, she has been conducting clinical trials to study docosahexaenoic acid (DHA). Her major research interest is nutritional intake of DHA during intrauterine life, infancy and toddlerhood and the effects on infant and toddler development. In 2002, she was made an honorary member of the American Dietetic Association for her pioneering work in proposing and testing the theory that dietary DHA is important for the developing human central nervous system. In 2008, she received the March of Dimes Agnes Higgins Award for excellence in maternal and infant nutrition. Dr. Carlson is an author on numerous peer-reviewed articles and textbook chapters. She has been an organizer of two international conferences and two workshops on the role of long chain polyunsaturated fatty acids for maternal and infant health. She is a charter member of the International Society for the Study of Fatty Acids and Lipids (ISSFAL) and currently president-elect of that society. She was the local organizer for the ISSFAL 2008 meeting held in Kansas City, Missouri. She is also a member of the American Pediatric Society and the American Society for Nutrition, and editor of the European Journal of Lipid Science and Technology and a consulting editor for the American Journal of Clinical Nutrition. Dr. Carlson reviews widely for journals devoted to publishing research in pediatrics, lipids and nutrition and speaks frequently on the topic of DHA in infant and child development.

Abstract:

DHA in infant formulas

Thirty years ago, a serendipitous observation made by my graduate student, Jayne Carver Putnam, that infants fed human milk had much higher RBC membrane DHA (and AA) than infants fed infant formulas led to the beginning of my interest in the role of DHA in brain development, and, more particularly, to studies that asked: “Is dietary DHA a conditionally essential nutrient for the developing human brain?” Time and Timing have both played a role in our bit of the story of DHA and infant development. First Time: clinical studies take a LONG time and some of the first studies were pretty unsophisticated. Thirty years on, we are not nearly as far along as we would like to be with this story. Timing has been a better friend. Pioneering work of Michael Crawford, Andrew Sinclair, Tom Sanders, Martha Neuringer and Tom Clandinin in the 1970s provided plausibility for the idea that formula-fed infants would benefit from DHA. We began working with preterm infants in 1983, knowing that they were born with very little brain DHA and would be the most likely group to show any benefits of DHA feeding. Even the Timing of the science of Newborn Medicine was critical, as neonatologists had just figured out how to prevent most respiratory deaths in preterm infants and their brain development became the next focus in Neonatology. Many studies in the intervening 30 years, including our own, support the idea that DHA is a conditionally essential nutrient for the developing human. In our institution, we (John Colombo, Kathleen Gustafson and I) are still pursuing this question with ever more sophisticated methods by manipulating DHA exposure during intrauterine, postnatal life (preterm, late preterm, term birth) and, most recently, in young children; and our interest and that of others has expanded from brain development to development of the autonomic nervous system and immunity.
Abstract:
Remodeling of DHA-containing phospholipid molecular species during impaired neurogenesis following n-3-alpha linolenic acid deprivation

Diminished levels of docosahexaenoic acid (DHA, 22:6n-3), the major polyunsaturated fatty acid synthesized from α-linolenic acid (ALA, 18:3n-3), have been implicated in changes in neurotransmitter production, ion channel disruption and impairments of a variety of cognitive, behavioral and motor functions in the perinatal and adult mammal. Perinatal deficiency of ALA imposed on pregnant rats from conception to 4 weeks after birth resulted in transient aberrations of cell migration around birth in several regions including the cortical layers IV-VI, the corpus callosum and the sub-ventricular zone in ALA-deficient newborn. A delayed migration of cells to CA1 and dentate gyrus areas noticed was associated with retention of cells in the subicular area adjacent to the hippocampus. By 4 weeks while myelin basic protein organization in the cortical plate was not impaired, apparent losses of neurofilament-positive fibers were encountered.

Major changes in the composition of the frontal cortex molecular species of ethanolamine phosphoglycerides (PG) were determined by quadrupole/time-of-flight (Q-TOF) mass spectrometry combined with electrospray ionization (ESI). Substantial depletions in both di-acyl and alkyl-acyl (plasmalogen) 18:0/22:6 ethanolamine PG species were not counterbalanced by docosapentaenoic (22:5n-6, DPA) containing identical derivatives in sn-1 position. Instead 16:0/22:5 and 18:1/22:5 became major diacyl and plasmalogen ethanolamine PG species replenishing the losses of 18:0/22:6. The substitution of 18:0/22:6 by other molecular species may provide clues on the importance of individual PG species during brain organogenesis.

Dr. Ephraim Yavin

The area of developmental neurobiology which uses genomics and lipidomics to unravel the mechanisms of brain organization during its course of normal ontogeny or under pathophysiological conditions has been the major topic pursued over the years in my laboratory. My scientific career was prompted at the Hebrew University-Hadassah Medical School, in Jerusalem where I earned a PhD in lipid biochemistry with Shimon Gat.

Subsequently I joined the laboratory of John Menkes (Pediatrics) and James Mead (VA) at UCLA where I studied brain lipid disorders and developed a technique to grow dissociated nerve cells on polymer-coated dishes. I then moved to the Shriver Center in Waltham Mass, and was appointed as fellow at the Dept of Neurobiology, HMS. At this stage I developed my scientific program focusing on fatty acid (FA) biosynthesis in primary and transformed neuronal and glia cell cultures. Subsequently I joined the staff of the Weizmann Institute of Science in Rehovot. As Senior Scientist and later as Associate and Full Professor at the Dept of Neurobiology, I extended my interests in studying the role of lipid-derived second messengers in the developing brain during intrauterine life under normal and under oxidative stress conditions. It was during this period that I developed a rat model of intrauterine growth retardation to study events associated with lipid peroxidation following ischemic episodes. Using supplements of DHA in cell culture models we discovered a link between the double bond content of ethanolamine phospholipids and perturbation of lipid asymmetry as prerequisites for stress-induced apoptotic cell death. Over the years my research interest has focused on molecular processes triggering ischemic damage in utero and the neuroprotective role of certain polyunsaturated FAs. These studies lead to the hypothesis that DHA is a natural antioxidant which accumulates during critical in utero stages of the developing brain and is essential for neurogenesis. Most recently using a combination of PCR-Select cDNA subtraction and gene array hybridization, we identified a set of differentially expressed gene markers and documented impaired neuronal cell migration during neurogenesis in brains of pups fed during the perinatal period with omega-3 deficient diets. On various occasions I held visiting Professorial positions at NIH in Bethesda, Rockville and Baltimore MD, collaborating with colleagues such as Leonard Kohn, Gordon Guroff, Norman Salem and Mark Mattson. Additionally I have held visiting Professorial positions at Hopital de la Salpetriere, Paris with Nicole Baumann and Bernard Zalc as well as Susumo Ando at the Tokyo Metropolitan Institute of Aging.

Past and present services for professional societies include among others ISN Council member (91-95) Chairman and program coordinator for ISN School of Neurochemistry (Montpellier 93; Okazaki 95; Boston 97); ESN Secretary (97-91, 93), ISSFAL council member (97-01), Chair man, 7th ISDN General Meeting, (88), organizer of various scientific international meetings and speaker in numerous international scientific meetings. Throughout my scientific career I have served and I continue to serve as field editor in the area of lipids and brain development for neurochemical journals including J Neurochem; J Neurosci Res; J Mol Neurosci (sec. editor, 1988-92); Develop Neurosci; Neurochem. Path and Int J Develop Neuroscience. During my tenure at the Weizmann Institute I served as departmental Chairman and Director of the Nella and Leon Benozio Center for Neurosciences (96-01) and currently I am holding a senior professorial position at London Metropolitan University, IBCHN.

Professor Ephraim Yavin
IBCHN, London Metropolitan University, United Kingdom

A Celebration of DHA
Discovery, Achievement and Challenges for Global Health
40 Years on
Robert Eugene Anderson, MD, PhD holds faculty appointments in the Departments of Ophthalmology, Cell Biology, Geriatrics, and Biochemistry & Molecular Biology at the University of Oklahoma Health Sciences Center. He is the Dean McGee Professor of Ophthalmology, George Lynn Cross Research Professor, and Director of Research in the Department of Ophthalmology and the Dean McGee Eye Institute. Dr. Anderson received his PhD in Biochemistry (1968) from Texas A&M University and his MD from Baylor College of Medicine (1975). In 1968, he was a postdoctoral fellow at Oak Ridge Associated Universities. At Baylor, he was appointed Assistant Professor in 1969, Associate Professor in 1976, and Professor in 1981. He joined the faculty of the University of Oklahoma Health Sciences Center in 1995. He served as director of the Oklahoma Center for Neuroscience from 1995-1999 and chairman of the Department of Cell Biology from 1998-2007.

Dr. Anderson has published extensively in the areas of lipid metabolism in the retina and biochemistry of retinal degenerations. He has edited 14 books, 13 on retinal degenerations and one on the biochemistry of the eye. Dr. Anderson has received numerous awards, including the Dolly Green Award (1982) and two Senior Scientific Investigator Awards (1990 and 1997) from Research to Prevent Blindness, Inc and an Award for Outstanding Contributions to Vision Research from the Alcon Research Institute (1985). He has served on the editorial boards of Investigative Ophthalmology and Visual Science, Journal of Neuroscience Research, Neurochemistry International, Current Eye Research, and Experimental Eye Research. Dr. Anderson has received grants from the National Institutes of Health, The Retina Research Foundation, the Foundation Fighting Blindness, and Research to Prevent Blindness, Inc. He is currently PI on 2 R01 grants from the National Eye Institute now in their 28th and 38th years of continuous funding. In addition, he is PI on 3 center grants (P20 COBRE from NCRR, P30 Vision Center from NEI, and FFB Southwest Center-Without-Walls).

Notable discoveries from Dr. Anderson’s laboratory include: 1) First demonstration of the essentiality of omega-3 fatty acids in retinal function, 2) The role of the phosphoinositide cascade in phototransduction in the invertebrate retina, 3) The neuroprotective role of the insulin receptor/PI 3-kinase/Akt pathway in stress-induced retinal degenerations, 4) The role of oxidant stress in light-induced apoptosis of photoreceptor cells, and 5) The identification of the biosynthetic step catalyzed by the ELOVL4 protein, which is mutated in Stargardt-3 juvenile macular degeneration.

Abstract:

Mutation in ELOVL4 (Elongation of Very Long chain Fatty Acids) Gene Causes Autosomal Dominant Stargardt Disease (STGD-3), a Juvenile Form of Macular Degeneration

Very long chain polyunsaturated fatty acids (VLC-PUFA) containing 28 to 40 carbons were discovered in the retina over 20 years ago by Marta Aveldano and Howard Sprecher. However, VLC-PUFA have been largely ignored because of the difficulty in working with them and the absence of a cellular function. Mutations in the ELOVL4 gene were identified in 2001 in patients with STGD-3 and it was suggested that the ELOVL4 protein was involved in DHA metabolism. Studies have shown that the mutation causes the expression of a truncated ELOVL4 protein that mis-localizes in cells, due to loss of a C-terminal ER-retention signal. Our laboratory showed that ELOVL4 was not involved in DHA metabolism, but rather was essential for the biosynthesis of C-28 to C-40 VLC-PUFA. ELOVL4 is a member of the ELOVL family of elongases, which catalyzes the rate-limiting condensation step in fatty acid elongation. We established the substrate specificity of ELOVL4 by expressing the protein in HEK293 and HEPG2 cells via adenoviral transduction. Non-transduced and GFP expressing cells were used as controls. HEPG2 cells were treated with 20:5n3 and HEK293 with 26:0, 28:0 and 30:0, harvested, total lipids extracted, converted to fatty acid methyl esters (FAMES) and analyzed by tandem gas chromatography-mass spectrometry (GC-MS). HEK293 cells elongated the precursors VLC-FA (28:0 to 32:0). Control cells internalized the precursor with the same efficiency as ELOVL4-transduced cells, but did not elongate the precursors. HEPG2 cells elongated 20:5n3 up to 34:5n3.

These and other studies have clearly established the role for ELOVL4 in VLC-PUFA biosynthesis. What is not clear is why photoreceptor cells die when the ELOVL4 gene is mutated. There are three possibilities: 1) VLC-PUFA are essential for maintenance of cell viability, 2) The mis-localization of the mutant protein causes a cellular stress that leads to cell death, and 3) The mis-localized protein is catalytically active and produces a 2-keto fatty acid, which cannot be further metabolized, and which is toxic to the cell. We are currently trying to distinguish between these three possibilities.
Nicolas Bazan's contributions in neuroscience began with the discovery that brain ischemia or seizures releases unesterified docosahexaenoic acid (DHA), known as the “Bazan effect” (citation classic – “Neural Stimulation or Onset of Cerebral Ischemia Activates Phospholipase A2” Current Contents, 30:10, 1991). He found that platelet activating factor (PAF) is released by injury or stimulation in the brain and eyes; uncovered PAF binding in synaptic and intracellular membranes (1990); defined PAF-mediated regulation of early gene expression (1989); and found a role for PAF in long-term potentiation and memory (1994-95). He then uncovered that DHA supply to the nervous system is liver regulated (1989). He discovered that in photoreceptor renewal, retinal pigment epithelium recycling retains DHA within photoreceptors by a "short loop" (RPE-to-photoreceptors) and a "long loop" (liver-to-retina) (1985). He found that Usher’s Syndrome patients have DHA shortage in the blood, implicating the long loop in retinal degenerations (1986).

He discovered enzyme-mediated formation of DHA derivatives in the retina (1984) and coined the term docosanoids. He and his colleagues discovered the synthesis and bioactivity of the first docosanoid, neuroprotectin D1 (2002-4), which arrests apoptosis in retinal pigment epithelial cells at the pre-mitochondrial level, and is neuroprotective in brain ischemia-reperfusion and in cellular models of Alzheimer’s disease. Then he found a decrease in DHA-derived NPD1 in the CA1 area of Alzheimer’s diseases patients, and that NPD1 promotes down-regulation of pro-inflammatory genes and of pro-apoptotic Bcl-2 proteins, and neuronal and glial cell survival from AP toxicity.

Dr. Bazan holds more than 20 patents that includes a family of new analgesics similar to Tylenol® and devoid of adverse effects on the liver and kidneys; novel PAF antagonists that protect the brain from inflammation and damage; and applications for neuroprotectin D1 in brain and retina injury, aging, and neurodegenerative diseases, such as Alzheimer’s and macular degeneration.

He is the founder of several academic centers and programs that include the Institute of Biochemical Research (INIBIBB), of the School of Biological Sciences and of the Graduate Program in Biochemistry at the University of the South, Argentina (1970) and of the LSU Neuroscience Center of Excellence (1988), LSUHSC, New Orleans where a mentoring model was created for faculty developed to foster research excellence.

Dr. Bazan has received many awards including the Javits Neuroscience Investigator Award from the National Institute of Neurological Diseases and Stroke, NIH (1989), elected member of the Royal Academy of Medicine, Spain (1996), elected member of the National Academy of Medicine, Spain, (1998), elected member of the Royal College of Physicians of Ireland, Dublin (1999), President, American Society for Neurochemistry(1999-2001), Doctor Honoris Causa: Universidad de Tucuman, Argentina (1999) Endre A. Balazs Prize, International Society of Eye Research (2000)and the Proctor Medal, the highest honor bestowed by The Association for Research in Vision and Ophthalmology (2007). Dr. Bazan also chairs the LSUHSC-wide Executive Research Council and the Translational Research Initiative.

Most recently he has written the novel “Una Vida: A Fable of Music and the Mind”, a compassionate, heartfelt story that takes readers on a tantalizing journey into the secret recesses of the brain of a hauntingly gifted jazz musician whose memory is slipping into the abyss of Alzheimer’s.

Abstract:

DHA-Neuroprotectin D1 are a sentinel for the preservation of vision, brain function and countering neuroinflammation and Alzheimer’s Disease.

The significance of the selective enrichment in omega-3 fatty acids (docosahexaenoyl-DHA chains of membrane phospholipids) in the nervous system (e.g. photoreceptors, synaptic membranes) has remained, until recently, incompletely understood. While studying mechanisms of cell survival in neurodegenerations, we discovered a stereoselective docosanoid synthesized from DHA by 15- lipoxigenase-1, which we dubbed neuroprotectin D1 (NPD1,10R,17S-dihydroxy-docos-4Z,7Z,11E,13E,15E,19Z hexaenoic acid). We found that NPD1 is promptly made in response to oxidative stress and brain ischemia-reperfusion, and in the presence of neurotoxins. NPD1 is protective in experimental brain damage, oxidative-stressed retinal pigment epithelial (RPE) cells, and in human brain cells exposed to amyloid-ß peptide. Thus DHA-NPD1 is a sentinel system for the preservation of brain integrity and function, including vision, since it represents one of the very first defense lines when the homeostasis is threatened by inflammation, injury or neurodegenerations. We will provide examples of the specificity and potency of NPD1 countering initiation and early progression of neurodegenerations as follows: 1) Photoreceptors renew membrane disks containing the phototransduction apparatus and DHA intermittently via shedding of its tips and phagocytosis by retinal pigment epithelial cells. At the same time, new membrane disks are made at the base of the outer segments; their length remains constant and cell integrity is maintained remarkably unchanged throughout many decades. This outcome occurs in spite of the fact that the photoreceptors are in an oxidative stress-prone environment (light, high O2 consumption, high polyunsaturated fatty acid fluxes, etc). We show that phagocytosis of photoreceptor disks promotes via NPD1 synthesis specific refractoriness to oxidative stress-induced apoptosis that lead to homeostatic photoreceptor cell integrity. Disruptions of the sentinel role of NPD1 in photoreceptor renewal may participate in macular degeneration and other retinal degenerations leading to blindness. 2) In brain ischemia-reperfusion, DHA is released and used for NPD1 synthesis, thus eliciting neuroprotection. Anti-apoptotic BCL-2 family of proteins availability is positively modulated by NPD1, whereas pro-apoptotic BCL-2 proteins are negatively regulated, as is the arrival of leukocytes due to neurovascular unit breakdown. 3) NPD1 is drastically reduced in CA1 memory areas from Alzheimer’s patients. Thus we have explored the significance of NPD1 in cellular models that recapitulate part of the Alzheimer’s pathology. Human neurons and astrocytes challenged by amyloid-ß or by overexpressing APPsw (double Swedish mutation) show that NPD1 downregulates amyloidogenic processing of amyloid-ß precursor protein, switches off pro-inflammatory gene expression (TNF-α, COX-2 and B-94-TNF-α inducible pro-inflammatory element), and promotes neural cell survival. The apoptotic cascade involves multiple checkpoints. NPD1 regulation targets upstream events of cell survival as well as neuroinflammatory signaling, in turn promoting homeostatic cell integrity. (Supported by NIH: NINDS R01 NS046741, NEI R01 EY005121 and NCRR P20 RR016816, and by the National Foundation Fighting Blindness)
Obtained a PhD from the University of Wales, UK. His research work, which started at the Nuffield Laboratories of Comparative Medicine, Zoological Society of London in 1985, covers maternal and neonatal nutrition, lipids and cell function, and membrane fatty acids in genetic and non-genetic disorders. He has conducted collaborative studies on fatty acid insufficiency and imbalance in British, Korean, Thai, Vietnamese & Sudanese pregnant women and neonates. At present, Ghebremeskel is coordinating EU FP6 Marie Curie Transfer of Knowledge programme involving Israel and Norway on the role of lipids and fatty acids in development and health. In addition, he is conducting a collaborative research on the beneficial effects of omega 3 fatty acids for pregnant diabetic women (Newham Teaching Hospital), patients with sickle cell disease (Faculty of Medicine, University of Khartoum) and Multiple sclerosis patients (Cyprus Institute of Neurology and Genetics). Ghebremeskel and colleagues have recently reported that maternal diabetes (Type 1 and gestational) induces membrane fatty acid abnormality in the mothers and their babies at birth. He has published over 150 publications on fatty acids, comparative biochemistry, maternal and neonatal nutrition, nutritional ecology and antioxidants.

Hee-Yong Kim, Ph.D., is Chief of the Laboratory of Molecular Signaling, National Institute on Alcohol Abuse and Alcoholism (NIAAA) of the National Institutes of Health (NIH). Dr. Kim is internationally recognized for her research contributions concerning the mechanistic role of n-3 essential fatty acids, especially docosahexaenoic acid (DHA), in brain development and function. Her laboratory investigates the effects of DHA on neuronal membrane remodeling and related signaling processes leading to cell survival and differentiation by applying the powerful methodologic approaches, including lipidomics, proteomics and cellular and molecular biology. Her findings have provided fundamental new insight into the effects of lipid nutrition on the central nervous system. Although many of her studies are done with animal models and cultured cells, the results are directly applicable to some of the pressing questions concerning the effects of dietary lipids on human health. She publishes in competitive peer-reviewed biomedical journals and has written many invited chapters and scholarly reviews. She is also Adjunct Professor of the School of Pharmacy, Medical College of Virginia Commonwealth University.

DHA and Signaling Mechanisms

Enrichment of polyunsaturated fatty acids, especially docosahexaenoic acid (DHA, 22:6n-3), in the brain is known to be critical for optimal brain development and function. Mechanisms for DHA's beneficial effects in the nervous system are not clearly understood at present. As DHA is readily incorporated into the phospholipids in neuronal membranes, DHA can influence not only chemical and physical properties of cell membranes but also membrane related signaling events involved in neuronal survival, proliferation and differentiation. Our studies have indicated that DHA supplementation promotes phosphatidylserine (PS) accumulation and inhibits neuronal cell death under challenged conditions, supporting a notion that DHA is an important neuro-protective agent. We have also identified that activation of three major signaling pathways including Akt, Raf-1 and PKC is facilitated by the DHA-induced PS increase in neuronal membranes. The DHA-mediated membrane-related signaling mechanisms might explain beneficial effects of DHA, particularly on neuronal survival.
Professor Michel Lagarde
Professor of Biochemistry & Molecular Biology, Lyon National Institute of Applied Science, Villeurbanne, France

Present position:
- University Professor (Biochemistry and Molecular Biology) at the Lyon National Institute of Applied Science (INSA-Lyon), Villeurbanne, France.
- Head of the team “Lipid mechanisms in vascular risk” at UMR 870 INSERM / INSA-Lyon.
- Head of the Board of Institute for Multidisciplinary Biochemistry of Lipids (IMBL).
- Director of the Carnot Institute “Lipids for Industry and Safety & health” (LISA)

University training:
- Ph D in Biochemistry (Lyon, 1974).
- D Sc (Lyon 1979).
- Doctorate in Human Biology (Lyon 1983).

Post-doctoral and Sabbatical stays:
- Department of Biochemistry, Royal College of Surgeons, London (1980).

Scientific career:
- Research Assistant, Pasteur Institute (1972-76).
- Research Scientist, INSERM (1976-87).
- University Professor (Dijon 1987-89; Lyon 1989-).

Research activities:
- Lipids in cell function and dysfunction. Lipid signalling, membrane lipids, lipid peroxidation and lipid nutrients.

Teaching activities:
- General biochemistry, metabolism and molecular nutrition since 1974.

Expertise activities:
- European Commission “Quality of Life and Management of Living Resources” (1999-2002).
- Referee for various international journals in life sciences.

Scientific Societies:
- French Biochemical Society (President of the Lipid Group (GERLU), 1994-2001)
- French Society of Atherosclerosis (SFA)
- French Group on Lipids and Nutrition (GLN)
- International Society for the Study of Fatty Acids and Lipids (ISSFAL), President 2006-2009)
- International Conference on the Biosciences of Lipids (ICBL) (Member of the Steering Committee 1993-2009).

Organization of scientific meetings:
- NATO Advanced Research Workshop (lyon, 1986).
- 33rd ICBL (lyon, 1992).
- 3rd ISSFAL Congress (lyon, 1998).
- GERLU-SFA Joint Congress (Montpellier, 2001)
- 46th ICBL Co-Chair with M. Crestani and P. Grimaldi (Ajaccio, 2005)
- 7th Fatty Acids and Cell Signaling (Paris, 2005).

Publications:
- Author or co-author of around 350 original publications, and 7 patents.

A Celebration of 
DHA
Discovery, Achievement and Challenges for Global Health
40 Years on

Abstract:
DHA and redox potential
Michel Lagarde, Catherine Calzada, Michel Guichardant, Evelyne Véricel. Université de Lyon, UMR 870 INSERM/INSA-Lyon, IMBL, Villeurbanne, France
Docosahexaenoic acid (DHA) is a long-chain omega-3 polyunsaturated fatty acid (PUFA) which, in addition to be a major component of the brain and retina, is assumed to have beneficial effects in the cardiovascular system. However, together with its precursor eicosapentaenoic acid (EPA), its intake at doses of several grams per day may be associated with lipid peroxidation that could mask the beneficial effects.
Our team has been concerned by this issue and shown that, in contrast, daily intake of 100 to 200 mg of those omega-3 PUFA (150 mg DHA + 30 mg EPA) for one month by elderly people is able to decrease the peroxide tone in platelets (Véricel et al 1999). This was confirmed in vitro when platelets were enriched with different concentrations of DHA, as low enrichments decreased lipid peroxidation whereas high ones increased it (Véricel et al 2003).
We have recently revisited this issue in a group of human volunteers (50-65-year-old) who successively ingested 200, 400, 800, 1600 mg/day DHA as the only PUFA in triglycerides, for 2 weeks each. Various parameters were evaluated before and after each dose. The urinary isoprostane 8-epi-PGF2alpha was lowered after 200 mg whereas it was increased after 1600 mg. The highest dose was less active to decrease platelet aggregation than intermediary doses (400 and 800 mg). Platelet vitamin E was increased after 200 mg DHA but not after higher doses (Guillot et al 2009). Vitamin E in low-density lipoproteins (LDL) was also increased after 200 to 800 mg DHA and the most after 200 mg. Conversely, LDL malondialdehyde and oxidizability in response to copper were lower after 200 to 800 mg DHA and the lowest after 400 mg (Calzada et al 2009).

The mechanisms underlying such effects are not clear but plasma measurement of specific peroxidation products from the omega-3 and -6 PUFA, namely 4-HHE and 4-HNE, respectively, (Calzada et al 2009) suggests that, in contrast, daily intake of 100 to 200 mg of those omega-3 PUFA (150 mg DHA + 30 mg EPA) for one month by elderly people is able to decrease the peroxide tone in platelets (Véricel et al 1999). This was confirmed in vitro when platelets were enriched with different concentrations of DHA, as low enrichments decreased lipid peroxidation whereas high ones increased it (Véricel et al 2003).

We have recently revisited this issue in a group of human volunteers (50-65-year-old) who successively ingested 200, 400, 800, 1600 mg/day DHA as the only PUFA in triglycerides, for 2 weeks each. Various parameters were evaluated before and after each dose. The urinary isoprostane 8-epi-PGF2alpha was lowered after 200 mg whereas it was increased after 1600 mg. The highest dose was less active to decrease platelet aggregation than intermediary doses (400 and 800 mg). Platelet vitamin E was increased after 200 mg DHA but not after higher doses (Guillot et al 2009). Vitamin E in low-density lipoproteins (LDL) was also increased after 200 to 800 mg DHA and the most after 200 mg. Conversely, LDL malondialdehyde and oxidizability in response to copper were lower after 200 to 800 mg DHA and the lowest after 400 mg (Calzada et al 2009).

The mechanisms underlying such effects are not clear but plasma measurement of specific peroxidation products from the omega-3 and -6 PUFA, namely 4-HHE and 4-HNE, respectively, (Calzada et al 2009) suggests that DHA might be a privileged target of oxidation that would, within some concentration range, protect against consumption of other natural antioxidants.
Graduate Education:
Oslo University (Chemistry, Physics, Mathematics, Biology) degree: B.S.) 1958-1962.


Academic Appointments:
1) Research Associate, Department of Physiology, The Veterinary College of Norway, Oslo, Norway, 1961-1964.
2) Instructor, Institute of Thrombosis Research, Oslo University, Oslo, Norway, 1970-1974.
3) Assistant Professor, Department of Medicine, Temple University, Philadelphia, Pennsylvania, 1974-1977.
4) Associate Professor, Institute for Thrombosis Research, Oslo University, Oslo, Norway, 1969-1970.
7) Professor, Department of Biochemistry, University of Bergen, Bergen, Norway, 1982.

Guest Research:
Howard Hughes Medical Institute, University of Washington, Seattle, 1989.

Society memberships:
Biochemical Society, American Society of Biological Chemists, International Society of Haemostasis and Thrombosis, Norwegian Society of Biochemistry, Norwegian Biochemical Society, American Heart Association

Miscellaneous:

Awards:


Major Funding:

Research articles:

Book Chapters: 41

Abstracts for meetings: Over 150

Invited lectures: Over 70

Supervision of Ph.D. students:
Flemming S. Vassbotn: Platelet-derivered growth factor (PDGF), signal transduction and autocrine stimulation: a study using three different PDGF antagonists ( UiB 1994).
Mohamad Osman: Biosurfactants: Their molecular assembly, secondary structure and the significance of hydrogen bonding (UiB, 1997).
Anita Rynningen: Mechanisms of platelet activation induced by particulate versus soluble agonists (UiB 1998).
Vidar A. Thorsen: Effects of stimulated phospholipase D activity on phosphatidylcholine turnover and activation of signal transduction in murine C3H/10T1/2 fibroblasts (UiB 1999).
Eirik Søfteland: Porcine platelet activation: Aspects on diving and establishing an animal model (UiB, 2002).
Presently supervising Baard Olav Jensen, Marta Vorlan and Ramadhan Oruch.

Supervision of more than 30 master degree students/ medical students
I am a professor of biophysics at the University of Southern Denmark. My general fields of specialization are statistical mechanics and thermodynamics, computer simulation techniques, phase transitions and critical phenomena, biomembrane physics and chemistry, surface and interface physics, and nano-scale materials science.

I have over the years been taking a strong interest in translating insight from basic sciences into applications, e.g. within biomedicine, food science, and drug delivery. My particular research interests are currently focused on lipids, fats and membranes. In 2005 I published a book on the fundamental role of lipids for life, *Life as a Matter of Fat* (Springer-Verlag, 2005).

In my spare time I am interested in gastroscience and gastronomy and in 2009 I published two popular science books, one about seaweeds as foodstuff and one about the science of sushi, *Sushi. Food for the Eye, the Body & the Soul* (Springer, New York, 2009).

**Abstract:**

*The Magic Bullet – as a matter of fat*

One of the key problems in the treatment of serious diseases like cancer is that many potent drugs are very poisonous and not only kill the diseased cells but also healthy ones. The term ‘magic bullet’ was coined by Nobel Laureate Paul Ehrlich, the father of modern medicinal chemistry, who in the beginning of the twentieth century envisioned the perfect drug as a ‘bullet’ that automatically targets and selectively kills the diseased cells without damaging healthy tissue. – Recent research into the physics and physical chemistry of fats (lipids) has suggested that it may be possible to construct nano-scale particles, so-called liposomes that encapsulate and mask potent drugs.

Using principles from polymer physics, the liposomes can be constructed to effectively invade the human immune system and carry the drug to the target. By taking advantage of specific biophysical properties of the liposomes on the one side and the peculiar pathophysiological and biochemical properties of e.g. cancer cells on the other side, it is possible in an intelligent way to target the liposomes to the diseased cells and with a particular mechanism, involving certain enzymes, to open the liposomal carriers and unload the drug precisely where the drug is supposed to act. – This approach to drug research, which currently is subject to clinical trails, is rather unconventional since it is predominantly based on physical sciences.
Abstract:

**Omega-3 and Heart Disease**

Numerous epidemiological and controlled interventional trials have supported the cardiovascular benefits of long-chain omega-3 fatty acids in the form of docosahexaenoic acid (DHA, 22:6n-3) plus eicosapentaenoic acid (EPA, 20:5n-3) from fish/fish oils as well as DHA (devoid of EPA) from algae. Supplementation with DHA/EPA has indicated beneficial effects in risk factor management associated with primary prevention and particularly in the secondary prevention of cardiovascular disease (CVD) and events. It is noted that the DHA:EPA ratio in fish as typically consumed in most population studies approaches 2.5:1 and that the average dose of DHA/EPA (sum) used as supplementation in the patient trials has ranged from 1-3 grams/day. Interestingly, lower levels of DHA omega-3 in the hearts of cadavers (wherein DHA:EPA ratios are typically 20:1 or higher) have been associated with a considerably higher risk of cardiac mortality in those with a history of coronary heart disease (CHD). The beneficial effects on CVD and related mortality (including sudden cardiac death) and the favourable attenuation of various risk factors (including blood triglyceride-lowering) have been observed in the absence of any concomitant lowering in LDL-cholesterol levels. Increased blood levels of DHA+EPA have been inversely related to the risk of fatal ischemic heart disease and sudden cardiac death. Higher DHA levels in serum (plasma) phospholipid have been associated with a lower risk of CHD and a reduced progression of coronary atherosclerosis. Controlled clinical trials have demonstrated the ability for algal DHA supplementation to favourably attenuate various risk factors for CVD including triglyceride-lowering (with dose-response effects similar to EPA), reductions in postprandial lipemia, with moderate effects on blood pressures, resting heart rates, and inflammatory factors at appropriate dosages. In most countries, there appears to be a wide ‘nutrition gap’ between actual and ideal daily intakes of DHA omega-3 for optimal cardio-protection.
Abstract:

Past (Passed) Opportunities in Quantitative Nutrition of Essential Fatty Acids

The past 80 years provided many “milestones” in the study of essential fatty acids and their quantitative impact on human health. The opportunity to apply that knowledge constructively is not fully passed if we re-examine the recorded evidence with fresh rigor and motivation.

- Burr&Burr (1930) saw similar responses for linseed, fish and corn oils in vitamin assays.
- Greenberg (1950) noted different dose-response results for n-3 and n-6 PUFA.
- Thomassen (1953-1955) used “restricted water” for n-6 and n-3 quantitative vitamin assays.
- Mead (1956) identified 20:3n-9 to begin reassessment of triene/tetraene in tissue HUFA.
- Klenk & Mohrhauer (1960) described n-3 and n-6 PUFA conversions to tissue HUFA.
- Mohrhauer & Holman (1963) quantitated n-3 and n-6 vitamin assays related to tissue HUFA.
- Privett (1969) showed hypophysectomy impairs accumulation of tissue HUFA.
- Leat (1983) quantitated effect of dietary n-3 and n-6 on hormonal actions.
- Lands et al (1990-1992) quantitated dietary n-6 and n-3 PUFA effect on maintaining tissue HUFA.
- Lin & Salem (2007) quantitated dietary n-3 and n-6 PUFA flow into accumulated tissue HUFA.
- Smith (Wada et al. 2007) compared n-3 and n-6 dynamics during eicosanoid formation and action.

The evidence indicates that in the future, people will likely improve their health by altering their current food choices to eat more n-3, less n-6 and fewer calories per meal.
Dr. Norman Salem, Jr.
Emeritus Prof., Univ. of La Plata. Argentina, Chief Scientific Officer & VP, Research, Martek Biosciences Corp

Abstract:
DHA – a required nutrient in health and cognition

Docosahexaenoic acid, DHA, is a major component of organisms like C Cognii and Schizochytrium. The fermentation of these organisms can provide for a high quality, sustainable and environmentally friendly source of DHA for animal and human foods. Recent human studies indicate that a benefit for episodic memory may be obtained from a short term (6 mo) supplementation of 900 mg of DHA during aging. A recent NIH multi-center trail finding indicated, in secondary analyses, that 2 g/d DHA may provide a benefit for cognitive scores in APO E4 negative Alzheimer’s patients. These human trials thus support suggestions from epidemiological and cross-sectional studies as well as animal studies that DHA can provide a benefit for cognition and healthy aging of the nervous system. Many other studies have indicated health benefits for DHA for adults including, for example, those related to CVD risk reduction and inflammatory diseases. It would seem prudent then for Westerners in particular who take in less than 100 mg of DHA/d on average to significantly increase their dietary DHA either through supplements or fortified foods.
CAPT Joseph R. Hibbeln

Acting Chief, Section on Nutritional Neurosciences, LMBB, NIAAA, NIH

CAPT Joseph R. Hibbeln, M.D is Acting Chief, Section of Nutritional Neurochemistry in the Laboratory of Membrane Biophysics and Biochemistry at the National Institutes of Health. Dr. Hibbeln originated the field of omega-3 fatty acids in depressive and aggressive disorders and has contributed more than 75 peer-reviewed scientific papers. His interests include the benefits of fish consumption during pregnancy in supporting higher IQ among and more optimal social behaviors among the children. He is a co-author of the US Food and Drug’s recent evaluation that the benefits of seafood during pregnancy outweigh the risks of typical methyl mercury exposure. He participated in developing American Psychiatric Association treatment recommendations by the for omega-3 fatty acids in 2006. His interests have included the cross-national comparisons of seafood consumption to rates of psychiatric illnesses, epidemiological comparisons with in countries, depletion of omega-3 fatty acids during pregnancy as a reversible cause of depressions associated with pregnancy. In human studies, he as examined how omega-3 deficiencies cause changes in neurotransmitters and peptides regulating the stress axis which are thought to underlie increased risk of violence and aggression. Since excessive alcohol use depletes brain stores of DHA this deficiency may significantly contribute to aggression, suicide, and addictive behaviors common among alcoholics. Among his numerous awards are the T.L Cleave Award from the McGarrison Society, London for furthering the public health nutrition work of Surg. T.L. Cleave, R.N., the Gerald Klerman award from the National Association for Research in Schizophrenia and Depression, USPHS Crisis Response Awards for deployments in response to hurricanes and suicide clusters among Native Americans and the Outstanding Service Metal, the third highest award in the USPHS and, early in his career, as an Eagle Scout, BSA.

Professor Letten F. Saugstad

Institute of Neuroscience, University of Oslo, Norway

Professor Saugstad’s research at the Institute of Neuroscience at the University of Oslo, Norway, considers multifactorial inheritance, the neglect of epigenetic factors – marine fat (Omega-3), and associated raised risk of CNS disorders (mental illness, Parkinsonism, Alzheimer). A particular interest is taken in epigenetic factors. Professor Saugstad has pioneered a better understanding of psychosis. She challenges the conventional view with a proposal the excitability is central to various psychoses with over pruning of the brain during leading to schizophrenia whilst under pruning leading to over excitability as in epilepsy. Professor Saugstad founded the Letten Foundation in 1986 and has stimulated research on the brain and HIV in Africa. Her Foundation has allocated funds to establish International Awards for outstanding scientific contributions. International scientist received awards in 1992, 1995, 1996, 2000, 2004 and 2006. For example in November 2004 The Foundation arranged a conference for HIV positive activists from different parts of the world and gave the award of USD 50 000 to Dr. Krisana Kraisintu from Bangkok for her development of generic AIDS drugs and 7 HIV positive activists were also awarded USD 10,000 each. Her aim is to better understand brain development and function. When the Tsunami hit, Koffi Amman called her asking for help. She has been extremely generous in her support and even contributed to the resolution of the Tsunami by funding the construction of new fishing boats so people could return to the sea for food.


Abstract:
Changes in 20th Century fat intakes and mental health
Deficiencies in DHA and other highly unsaturated omega-3 fatty acids (n-3 HUFAs) are likely to manifest as abnormal or suboptimal neuropsychiatric functions. While depression aggression and increased risk of suicide may be more obvious manifestations, deficits in more normative personality measures and social interactions may also be manifestations of dietary induced deficits of neuronal n-3 HUFAs. Fish are rich sources of n-3 HUFAs, which have psychotropic properties of reducing depression, anxiety and calming disruptive states. N-3 HUFA deficits and sufficiency’s affect regions of the brain critical to symbol formation. It is now widely recognized that visual symbols acquire meaning by strengthening associations between the visual cortex, (for visual recognition) the amygdala and limbic forebrain (for emotional valance) and the hippocampus (memory formation). We have posited that symbolic representations of fish have become attached to the beneficial emotional states induced by n-3 HUFAs. Furthermore, fish symbols embedded in cultures can promote regular consumption and may have profound benefits for social cohesion and cultural identity. For example, adherence to early Christian dietary abstinence laws promotes fish consumption 2-3 times per week and identifies Eastern Orthodox Christians and devout Roman Catholics. Fish consumption on proscribed days and for specific feasts is found in Judaism, Islam and many other religious traditions. In traditional Chinese medicine, “hot” or “Yang” emotional states and illnesses, which disrupt family order, are treated “cooling” or “Yin” foods, e.g. cold water seafood. Deficits of n-3 HUFAs induced by excessive dietary intakes of the omega-6 linoleic acid from seed oils over the last century may have had pervasive and insidious effects on emotional states, disruptive behaviors and social cohesion.
Dr. Robert K. McNamara
Associate Professor of Psychiatry, University of Cincinnati College of Medicine, Cincinnati, Ohio, USA

Dr. McNamara received his PhD from the University of Victoria, Canada (1992), and was awarded the Natural Sciences Engineering Research Council Doctoral Dissertation Silver medal. He then completed postdoctoral training in neuropsychopharmacology at Northwestern University (1994) and University of Florida (1996) before receiving a junior faculty position in the Department of Psychiatry at the University of Pennsylvania School of Medicine. He then transferred to Eli Lilly and Company to the Clinical Neuroscience Laboratories (2000) where he received additional training in antidepressant clinical trial development. He then accepted an Associate Professor position in the Department of Psychiatry in the Division of Bipolar Disorders Research at the University of Cincinnati College of Medicine (2004). His laboratory currently investigates the role of DHA deficiency in the pathoetiology of recurrent neuropsychiatric disorders using animal models, postmortem brain tissue, and preclinical and clinical neuroimaging techniques. A recently completed fMRI study found that DHA supplementation increased functional activity in the prefrontal cortex of children during sustained attention, and that erythrocyte DHA levels are positively correlated with prefrontal cortex activity. Using this and other imaging paradigms, his lab is currently investigating the effects of omega-3 fatty acid supplementation on functional brain activation patterns and symptom severity in children and adolescents with recurrent affective disorders, including major depression and bipolar disorder.

Abstract:

**DHA and prevention of mood disorders**

There is now a substantial body of evidence from cross-national and cross-sectional epidemiological surveys, controlled prospective longitudinal intervention and observational trials, peripheral and central membrane fatty acid composition studies, and myriad results from preclinical neurochemical and behavioral studies that implicate DHA deficiency during perinatal development as a preventable risk factor for mood and psychotic disorders. As is suggested by preclinical studies, interventions with DHA will have the greatest protective impact when initiated early in postnatal development, prior to the onset of the disorder. Recent studies in our lab have found that children and adolescents with major depressive disorder (MDD) exhibit significant and selective DHA deficits in erythrocyte membranes compared with healthy controls. Furthermore, children and adolescents at high-risk (having a parent with bipolar disorder) or ultra-high risk (have DSM-IV MDD and a parent with bipolar disorder) for developing bipolar I disorder (i.e., mania) exhibit DHA deficits in erythrocyte membranes compared with healthy low-risk controls. Therefore, erythrocyte DHA deficiency may precede the onset of mania and may therefore represent a risk biomarker. Importantly, chronic supplementation with omega-3 fatty acids have been found to normalize erythrocyte DHA deficits in at-risk patients and to be efficacious, safe, and well tolerated in the treatment of manic and depressive symptoms in children. Together, this evidence strongly endorses treating subjects at elevated risk for developing mood disorders with omega-3 fatty acids in the prodromal phase in an effort to prevent or delay onset. This approach recently received empirical support from a controlled prospective longitudinal trial conducted by Amminger et al (2010) finding that treatment with omega-3 fatty acids prevented or delayed transitioning to psychosis in ultra-high risk adolescents. Ongoing NIMH- and foundation-sponsored neuroimaging studies in our lab are evaluating the neuroanatomical foundation of the protective effects of DHA in children and adolescents at high- and ultra-high-risk for developing mood disorders. For the first time in the history of psychiatry, we stand poised to achieve the 'holy grail' of prevention and the potential opportunity to improve the lives of millions currently projected to develop these chronic and debilitating psychiatric disorders.

David James
Food and Agriculture Organization, United Nations (Retired)

David James is a food scientist from Australia who has retired from the Food and Agriculture Organization of the United Nations where he specialized in promoting the use of fish as food, particularly in developing countries.
Prof. John Stein read Animal Physiology at New College, Oxford, then an MSc in Neural Control of Respiration in the University Laboratory of Physiology, Oxford, then clinical medicine at St Thomas’ Hospital, London. He then started training in Neurology, continuing in London, Leicester and Oxford.

He was appointed tutor in Medicine at Magdalen College, Oxford, in 1970, where he teaches neuroscience. His research focuses on the visual control of attention, eye and limb movements in animals, neurological patients and dyslexic children with particular interest in the roles of the posterior parietal cortex, cerebellum, basal ganglia and brainstem.

With Mitchel Glickstein he discovered that visual (magnocellular) motion signals project strongly to the posterior parietal cortex and cerebellum. With Sue Fowler, orthoptist, he found that impaired development of these visual magnocellular neurones can explain the attentional and eye control problems of dyslexics. Simple visual treatments or omega-3 fish oils can often improve M-function greatly, hence help dyslexics to improve their reading. With Tipu Aziz, neurosurgeon, he found that deep brain stimulation (DBS) can relieve both akinesia and dyskinesia by preventing spontaneous oscillations of a brainstem motor network including the globus pallidus, cerebellum and pedunculopontine nucleus (PPN). Likewise spontaneous oscillations of the pain matrix seem to cause central neuropathic pain and eliminating these by DBS can alleviate the pain.

His senior colleague and mentor at Magdalen was Hugh Sinclair who was one of the first to recognise the importance of essential fatty acids in human nutrition, and also mentored both Michael Crawford and David Horrobin.

John’s daughter, Lucy, is a synaesthetic expressionist painter. He doesn’t cook fish and his brother, British TV fish chef, Rick Stein, does not do neuroscience!

Rachel V. Gow obtained a First Class BSc in psychology at Kingston University, and was awarded distinction for her MSc in psychological research methods at Birkbeck, University College London. Her MSc thesis topic explored the relationship between red blood cell concentrations of essential fatty acids (EFA’s) and emotional processing using Event Related Potentials (ERPs) in adolescent males with ADHD and has subsequently been published in Prostaglandins, Leukotrienes and Essential Fatty Acids (PLEFA: 2009). She is currently in the second year of her PhD in the department of child and adolescent psychiatry at the Institute of Psychiatry, Kings College London. Rachel’s doctorate project is investigating the relationship between blood measures of EFA’s and assessments of brain function using electroencephalography (EEG) / ERPs and neuropsychological testing in both mainstream school children and children with Attention Deficit Hyperactivity Disorder (ADHD). Part of Rachel’s PhD study also involves an adult study in collaboration with Professor Philip Asherson (IoP) investigating fatty acid metabolism in ADHD and controls using stable isotope analysis. Rachel has been a co-researcher on the Maudsley ADHD Adolescent Fatty Acid (MAAFA) led by Professor Eric Taylor since 2006. This involved evaluating the efficacy of essential fatty acids supplementation in reducing clinical symptoms of ADHD.

Rachel is a fully trained and certified EEG administrator. Rachel’s primary supervisors are Professor Katya Rubia from the Institute of Psychiatry, Kings College and Professor Michael Crawford from the Institute of Brain Chemistry and Human Nutrition (IBCHN). All fatty acid analyses are being undertaken by the IBCHN under supervision of Professor Keb Ghebremeskel, Dr Allain Amador Bueno and Professor Crawford.
Dr. Izzeldin Hussein
IBCHN, London Metropolitan University, United Kingdom

Dr. Izzeldin S. Hussein lives in the Sultanate of Oman. He originally came from Sudan where he was educated at Marawi High School, and Medical Sciences and Master of Science in Pharmacognosy at University Nicolae Balsescu, While at University in Hull, he obtained his MBA Degree and specialized in Micronutrition and obtained a certificate in Herbal Medicine from Hilsham school of Herbal Medicine UK, and a certificate in Microbiology, and in food fortification and diploma in communication from UK, and joined the Institute of Brain Chemistry and Human Nutrition at London Metropolitan University for a Ph.D in Nutrition.

He has been assigned by WHO, UNICEF and ICCIDD to accomplish several nutritional assignment in over 15 countries. He is researcher and faculty member of Supercourse USA presently he works with Professor Michael Crawford on several programmes to promote the fatty acids –omega 3 benefits on health in the Middle East and IDD. He is member of ICCIDD Board and participates in the effort of elimination of Iodine Deficiency Disorders in the World.

Since 1997 a tenured consultant in Micronutrition, he has authored or edited some publications and reports, the majority of which focus on Iodine Deficiency Disorders and Micronutrients in general, he recently published with UNICEF Egypt the first IDD guideline and salt fortification in Arabic Language for programme managers in the Arab world. He attended and took active part in many Regional and international conferences and seminars such as the Roundtable Joint conference – UNICEF/WHO/ICCIDD/WHO 2009 in Cairo and Istanbul, and the 1st International conference on the Economic importance of Fisheries and their impact on Public health. March 2008, jointly organized by Oman Government and IBCHN, UK.

He is member in numerous academic, professional societies and activities in civic, public or international affairs, he is -member Governing Board of the International Council for Control of Iodine Deficiency Disorders (ICCIDD), and Life membership of Indian Micronutrition Association- and Child health and Nutrition Research Community.

I have for the past 25 years been employed as the Chief Inspector to the Fishmongers’ Company which is an ancient City Livery Company that has an unbroken association with the fish industry for around 1000 years.

In my capacity as chief inspector I am primarily responsible for the quality control of all the seafood sold at London’s Billingsgate Fish Market, the premiere inland wholesale fish market in the UK, but I also serve on several advisory panels for the industry.

In 1998 I established the Billingsgate Seafood Training School at the market. The School was set up as a charitable enterprise providing courses for the industry, the public and school children. All the courses for the children are funded out of the other commercial activities and charitable donations. The school has an outreach programme going into various schools in the greater London area teaching the children about the benefits of seafood consumption.

I have helped to set up quality control systems for companies both home and abroad. I have also been involved in several EU funded projects in developing countries running several training courses for the industry and Government personnel.

In 2004 I was the main author for a book entitled Fish and Shellfish: A comprehensive guide to seafood and the industry. The book was aimed as a training tool for the industry and enforcement officials wishing to gain a greater understanding of the industry.

For several years I have been an executive board member of IAFI, the International Association of Seafood Professionals, and at the recent World Seafood Congress in Morocco I was nominated as the President elect of IAFI and will assume the presidents role at the next world seafood congress due to take place in Washington in October 2011.
Rick Stein
The Seafood Restaurant, Padstow, Cornwall, United Kingdom

Rick owns and runs four restaurants in the small Cornish fishing village of Padstow with his ex-wife, Jill. He has written 11 cookery books, recorded several cookery series and a couple of one off documentaries. His passion is still for seafood; as he says, "nothing is more exhilarating than fresh fish simply cooked."

It is the daily bounty of local fishermen of perfectly fresh fish which is the reason for the success of The Seafood Restaurant. He has cooked for many famous people including the Queen and Prince Philip Tony Blair and French President Jacques Chirac.

Rick Stein is somewhat misleadingly labelled a ‘Celebrity Chef’. In fact, with his ex-wife Jill, he has four restaurants, a delicatessen, a patisserie, a seafood cookery school and forty hotel bedrooms in the small fishing port of Padstow on the north coast of Cornwall, which have developed over the past 34 years. Two of his sons are currently working in the business. The Seafood Restaurant had a major refurbishment in January 2008, the new look restaurant now includes a convivial seafood bar right in the middle. The latest enthusiasm has been taking over a pub. The Cornish Arms, a couple of miles outside Padstow at St Meryn, is definitely not a gastro pub but maintains a busy public bar for the locals and features dishes like fish pie, grilled cod with mushy peas and scampi in the basket. Rick has also become a joint partner in a hotel and restaurant at Mollymook about three and a half hours drive from Sydney in Australia. Rick Stein at Bannister’s has a menu similar to The Seafood Restaurant but celebrating the seafood of the south coast of New South Wales.

Rick attributes the success of all this to a simple observation "Nothing is more exhilarating than fresh fish simply cooked." It was this enthusiasm for seafood that led him to make his first TV cookery series Taste of the Sea in 1995. Since then he has made eight more. The first four were exclusively about fish and shellfish. After which he made two series in Great Britain and Ireland about small food producers who value the taste and quality of what they grow or make above everything, who he called his Food Heroes. After this he set his sights on the food and cooking of France which he discovered on a leisurely voyage down the canals of Southern France on a canal barge. The series, French Odyssey, and the book which accompanied it, were extremely successful partly because everyone loves rural France from Bordeaux to Marseille and the produce, particularly in the little local country markets, is so good.

Rick and his producer David Pritchard enjoyed making the French series so much that they decided to carry on where they had left off, in Marseille, by setting out into the Mediterranean for a series of Mediterranean Escapes. This TV series and book has Rick journeying by ferry and Land Rover through Corsica, Sardinia, Sicily, Puglia, Majorca, Catalonia, Corfu, Eastern Turkey and Morocco asking the question ‘what is so special about Mediterranean cuisine?’ He finds, in the local traditional cuisines of those countries, food of vibrancy and colour. His latest venture has been Far Eastern Odyssey a journey through Malaysia, Cambodia, Thailand, Vietnam, Bali, Bangladesh and Sri Lanka where, again, he celebrated the attraction of local food in a part of the world where the cooking is becoming ever better known for its light, healthy, spicy flavour. The TV series and accompanying book came out in July 2009 with a final programme due out just before Christmas. He starts filming a series about the food of Spain and Portugal next April.

In the last few years Rick has also been commissioned by the BBC to make a number of one-off documentaries not all to do with food. They include Betjeman and Me - Rick Stein’s Story (2006), celebrating the life and work of the much-loved English poet who knew Cornwall well; Rick Stein and the Japanese Ambassador (2006) a programme where Rick went to Japan to learn about Japanese fish cookery and Rick Stein in du Maurier Country (2007) where Rick paid a personal tribute to the novelist Daphne du Maurier who lived most of her life in his beloved Cornwall. Rick’s one off special, Memoirs of a Seafood Chef, was broadcast by the BBC in January 2009. Rick is currently working on a programme about Italian food and Opera which goes out in April 2010.

In a long career as a chef, Rick has cooked twice for Tony Blair at 10 Downing Street, once for the French President Jacques Chirac and, on another occasion, for the Queen and Prince Philip to celebrate the Golden Jubilee in which all her past prime ministers were invited. He was awarded an OBE in 2003 for services to West Country Tourism.

“I’ve always felt there was something exhilarating about fresh fish, simply cooked. The success of our business rests chiefly on the fact that we have access to such a good supply of wonderfully fresh, sustainable, local seafood. At last the importance of fish in our diet is becoming widely recognised: mackerel, mullet, salmon and trout, all rich in omega 3 fatty acids. It’s also a great source of protein, lean and easily digestible. I love fish it’s really my favourite dish.”
Vital Choice Wild King Salmon (oncorhynchus tshawytscha) from Alaska’s famed Copper River is among the rarest, richest and most flavorful of all Pacific salmon species. Copper River is 480 kilometers of rushing, glacier-fed waters producing salmon that are true “Superstars” of the omega-3 world, boasting more than 2 grams per 100 gram serving! Certified sustainable by the Marine Stewardship Council.

According to the USDA Nutrient Data Lab here is a breakdown of the fatty acids in Alaska Chinook (King) salmon per 200 g portion)*:

- EPA: 2.02g
- DPA: .6g
- DHA: 1.45g
- Fatty acids, total saturated: 6.4 g
- Fatty acids, total monounsaturated: 11.5g
- Fatty acids, total polyunsaturated: 5.3g

*Due to the extreme conditions of Alaska’s Copper River (rapid current & icy cold water), King Salmon originating there have evolved to be among the fattiest of all wild Pacific salmon, so the above figures may be conservative.

For complete nutritional information:
http://www.nal.usda.gov/fnic/foodcomp/search/
(Search string: "Chinook Salmon"/ "Fish, salmon, chinook, cooked, dry heat"/2 x 100g)

www.vitalchoice.com

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Contribution of Wild Salmon to Evening Meal by Vital Choice

Vital Choice Wild King Salmon (oncorhynchus tshawytscha) from Alaska’s famed Copper River is among the rarest, richest and most flavorful of all Pacific salmon species. Copper River is 480 kilometers of rushing, glacier-fed waters producing salmon that are true “Superstars” of the omega-3 world, boasting more than 2 grams per 100 gram serving! Certified sustainable by the Marine Stewardship Council.

According to the USDA Nutrient Data Lab here is a breakdown of the fatty acids in Alaska Chinook (King) salmon per 200 g portion)*:

- EPA: 2.02g
- DPA: .6g
- DHA: 1.45g
- Fatty acids, total saturated: 6.4 g
- Fatty acids, total monounsaturated: 11.5g
- Fatty acids, total polyunsaturated: 5.3g

*Due to the extreme conditions of Alaska’s Copper River (rapid current & icy cold water), King Salmon originating there have evolved to be among the fattiest of all wild Pacific salmon, so the above figures may be conservative.