Asia-Pacific Economic Cooperation

Workshop Report

Strategies to Address Non-communicable Diseases through Science, Technology and Innovation: Nutrigenomics Approach

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Executive Summary

The Asia-Pacific Economic Cooperation (APEC) workshop titled “APEC Workshop on Strategies to Address Non-communicable Diseases (NCDs) through Science, Technology, and Innovation: Nutrigenomics Approach” (also known as APEC Nutrigenomics 2016) was held on June 15-16, 2016 in Taal Vista Hotel, Tagaytay City, The Philippines.

Attendance included speakers, experts, and representatives from APEC member economies, namely: Australia; Canada (speaker delivered his lecture via video link); Chile; People’s Republic of China; Indonesia; Japan; Malaysia; Mexico; New Zealand; The Philippines; Russia; The United States; and Viet Nam. An expert from Switzerland delivered a lecture after a clearance from the PPSTI forum was sought.

The workshop provided a venue to appreciate and understand nutrigenomics through sharing of knowledge, discussion of research results, and sharing of best practices in conducting nutrigenomics research. It also created frameworks for research collaboration among APEC economies through identification of research and knowledge gaps and discussion of opportunities for collaboration. The workshop was also an instrument in the identification of economically sound opportunities on how nutrigenomics can support the APEC economies.

There were a total of 17 speakers, 16 international delegates and 66 local participants and speakers who participated in the two-day workshop.

Introduction

As an innovative approach towards health, Nutrigenomics offers new perspectives to address the intensifying problem on noncommunicable diseases (NCDs). Analytical methods under the science of Nutrigenomics identify relevant human genes that are affected by diet while providing insights on the interaction between nutrients and genes that is in effect contributes to the development of NCDs.

Advancements in Nutrigenomics will help APEC economies to better appreciate the underlying causations of NCDs. These also create positional advantage for industries such food manufacturing and biotechnology to promote health and wellness through science-backed food innovations.

This workshop will encourage APEC member economies to communicate ideas and share best practices in doing researches in Nutrigenomics. It also aims to secure growth among APEC member economies by strengthening systems of health and innovation by creating options for substantial transformation of the food industry through regional collaboration.

The Workshop

Opening Session

Dr Cecilia Cristina Santos-Acuin, moderator for the morning session, acknowledged the delegates from different APEC economies, namely, Australia; Chile; People's Republic of China; Indonesia; Japan; Malaysia; Mexico; New Zealand; Russia; The United States; and Viet Nam; and local participants from the Philippines representing the academe, government, industry and the private sector.

Dr Mario V. Capanzana, Director of the Food and Nutrition Research Institute read the welcome message of Honorable Mario G. Montejo, Secretary of the Department of Science and Technology (DOST) mentioning some of the significant programs and projects of the Department and how these aligned to the goals of APEC on science, technology, and innovation in the past six years.

This was followed by the presentation of Dr Capanzana titled "The APEC PPSTI: Creating an Impact through Science, Technology and Innovation". In here, Dr Capanzana provided a brief background of APEC PPSTI, how the forum is able to attain its goals, including some highlights and accomplishments of the group and intercessional actions taken in the previous PPSTI meetings, particularly PPSTI 5 and 6 which were held during the hosting of APEC of the Philippines in 2015.

Dr Capanzana then provided the background of the workshop, mentioning how non-communicable diseases (NCDs) are common among APEC economies. He also cited the projection made by the APEC Business AdvisoryCouncil (ABAC) on the cost of NCDs by 2030. This increase in prevalence calls for the need to find strategies to address NCDs in the region.

He also mentioned about the timeline of the Human Genome Project and enumerated some of the gaps in the field of nutrigenomics. According to him, nutrigenomics is not yet fully utilized as a tool and its benefits are not entirely appreciated despite the presence of organizations that oversee this emerging field.

Session 1: Prevalence, programs, strategies to address NCDs in APEC economies

Speakers from the Philippines, Russia, and Chile presented the status of NCDs in their respective economies, including the programs and strategies being undertaken to address the disease conditions.

The NCD epidemic: a silent disaster

Antonio Dans
Professor, College of Medicine, University of the Philippines Manila, The Philippines

Dr Dans gave an overview of the development of NCDs using a conceptual framework describing the four major causes of NCDs: heart disease, stroke, cancer and chronic lung disease. He mentioned the biological risk factors of NCDs such as elevation in the following parameter: blood sugar, blood pressure, cholesterol and body mass index. Behavioral risk factors also contribute significantly in the development of NCDs and these include smoking, excess alcohol, unhealthy diet, and physical inactivity. He also informed that participants that mortalities due to NCDs crosses all levels of the society: affluent nations and developing countries alike. Higher rates of death due to NCDs are seen in poorer countries despite having the low risk

Dr Dans presented a conceptual framework relevant to the development of NCDs, highlighting the predisposing environmental factors such as market forces, urbanization, poverty, education and stress. According to him, the NCD poverty loop entails lack of access to prevention and treatment to those who are within the poverty line. He pointed out that this is the reason why death rate at this level of the society is high despite having lower risk to NCDs. Dr Dans concluded his talk by stating that NCDs are forgotten development goals and are pose disasters in terms of magnitude and onset.

Prevalence, programs, and strategies to eliminate NCDs in APEC economies: the Russian Federation Experience

Galina Y. Maslennikova
Leading Research Scientist, National Research Center for Preventive Medicine, Ministry of Health, Russia

Dr Maslennikova presented the situation of NCDs in Russia, highlighting the comparison of prevalence of NCDs in selected APEC economies and other countries of the world. According to her, factors such as age, gender, and family history contribute to the development of NCDs. She discussed the strategies

initiated in the Russian Federation to prevent NCDs and these target the population as a whole while putting considerable attention to the high risk group.

Dr Maslennikova pointed out that in Russia, public health priorities have shifted from the paradigm of disease treatment to disease prevention and health maintenance. Russia, currently undertakes the conception of a strategy focusing on health promotion, prevention and control of NCDs up to year 2025. She also mentioned that policies are being implemented from the federal government down to the mobile centers. Health care providers dedicated to promote health and prevent NCDs are to be employed in these mobile centers.

Prevalence, programs, and strategies to eliminate NCDs in APEC economies: the Chile Experience

Pablo Cesar Cubillos Riveros
Department of Non-communicable Diseases, Ministry of Health, Chile

Dr Riveros presented the burden of NCDs in Chile by enumerating the following relevant factors: how NCDs affect the GDP per capita, rate of mortality due to NCDs, and common NCD risk factors. He explained the various programs in Chile that are aimed to reduce the incidence of NCDs. These programs are integrated in Chile's health systems, cascading from the primary to the secondary health care systems.

One of the programs is the Cardiovascular Health Program that involves health specialists from various disciplines. The program also includes legal support, laboratory tests, rebates on medicines, and referrals to health specialists, among others.

Another lifestyle program in Chile is the Healthy Lifestyle Program (*Programa Vida Sana*) that entails legal support, health education for the community, continuing education for health professionals and awareness campaigns on model of care for people with chronic diseases. *Programa Vida Sana* is part of the National Strategies of Health 2011-2020 (*Metas 2011-2020*), a national program that involves, among others, the *Organization Mundial de Salud (OMS)* Program for the control of tobacco, reduction of sodium content of foods, food labelling law, and programs across sectors aimed to improve health in schools and public places.

Session 2: Nutrigenomics as a science

One guest expert from Switzerland and experts from Japan and the Philippines gave an overview of nutrigenomics as a science. This session proved a background on the interplay between genetics and nutrition and how the interaction optimizes health.

Nutrition and human genetic diversity

James Kaput
Senior Expert, Systems Nutrition, Metabonomics and Proteomics Unit, Nestle' Institute of Health Sciences, Switzerland

Dr James Kaput discussed the role played by migration in the overall genetic diversity of humans. He explained that the genes involved in the metabolism of nutrients differ among world populations. This also holds true for people residing within the same country but have originated from difference ancestral origins. As an example. Dr Kaput cited the case of the Philippines where genetic diversity is immensely evident.

Dr Kaput discussed gene silencing and how heritable changes in gene function can occur despite the absence of aberration in the sequence of the nuclear DNA. According to him, the systems nutrition approach in nutrition research can bring about some shift in the way how studies in nutrition are conducted, particularly on the classification and measurement of relevant study parameters. He ended his talk by putting an emphasis on factoring in genetic heterogeneity when doing nutritional genomic studies.

The reasons we do nutrigenomics: goals and objectives of nutritional genomics research

Hisanori Kato
Project Professor, Organization for Interdisciplinary Research Projects, The University of Tokyo, Japan

According to Dr Kato, nutrigenomics creates a unique addition on the perception of the function of foods. In the basic sense, foods provide nutrients and possess components that can help delay aging and prevent NCDs. With nutrigenomics, Dr Kato stressed that foods can help in the identification of the mechanisms involved in NCDs.

Dr Kato provided two scenarios where nutrigenomics can be applied. The first example deals with genistein, a substance found in soy beans. The intake of genistein partially helps in the prevention of muscle atrophy and the mechanism is achieved via the modulation of estrogen receptor alpha. The functions of genistein were ruled out through the use of omics technologies. The second example is the comprehensive analysis of the anti-obesity and anti-diabetic effect of coffee (and its components) by using three-omics analysis approach. Through this mechanism, the tricarboxylic acid (TCA) cycle was found to be enhanced by the intake of coffee.

Dr Kato ended his presentation by stating that nutrigenomics is an efficient tool for food and nutrition science in combating NCDs. This can be further exemplified by the ability of nutrigenomics tools to discover and analyze the mechanisms of NCDs at the genome level.

The lab works: model methods in nutrigenomics research

Eva Maria Cutiongco - dela Paz
Vice Chancellor for Research & UP-NIH Executive Director, University of the Philippines Manila, The Philippines

Dr dela Paz used the article "*A flavor of the future*[1]" to describe a future where health biomarkers, smart technology and social networks hasten an e-road to nutritional needs. She discussed two strategies used in nutrigenomics: the first one is on target genes, mechanisms and pathways in relation to molecular nutrition and genomics, while the second one is on signatures, profiles, biomarkers, and nutritional systems biology. She described the omics technologies such as nutrigenomics, transcriptomics, proteomics, and metabolomics as well as the different pathways affecting the diet-gene interaction. She also enumerated some examples of experiments aimed to determine diet-related expression signatures.

Dr dela Paz pointed out that the omics platform should be integrated in the research system such that phenotypic variation and comprehensive models of cellular organization and function will be thoroughly understood. She also mentioned about the development of a systems biomarker that could link nutrigenomics (measured in a more quantitative manner) with a disease risk. Towards the end of her lecture, she pointed out that big data and bioinformatics are still big challenges in nutrigenomics research in the Philippines.

[1] Frood, A. (2010). Technology: A flavour of the future. *Nature,* S21-S22.

Session 3: Genomic centers in support of health and nutrition researches

This session provided a snapshot of APEC economies' perspectives on nutrigenomics as a tool to improve health and overall wellbeing of the population.

A primer for the Philippine Genome Center: supporting cutting-edge research towards economic development

Zenaida V. Magbanua
Deputy Executive Director, Philippine Genome Center, University of the Philippines Diliman, The Philippines

The Philippine Genome Center (PGC) is a multidisciplinary institution that combines basic and applied research for the development of health diagnostics, therapeutics, DNA forensics, preventive products, and improved crop varieties. The Center was established at the University of the Philippines during the 1246th Board of Regents meeting on July 31, 2009 to utilize knowledge of genomics to revolutionize health, forensics, agriculture, drug discovery and related researches in the Philippines. Dr Magbanua discussed the past and current research projects of the PGC, publications that were generated from these studies and how it has helped improve human health.

Nutritional genomics: scenario in Malaysia

Gui Shir Ley
Senior Assistant Director, Nutrition Division, Ministry of Health, Malaysia

Ms Gui discussed the role of nutrigenomics in Malaysia's nutrition policies.

To attain Vision 2020 for the 11th Malaysian Plan (2016-2020), Ms Gui stressed the role of nutrition in strengthening the strategic thrust of the National Nutrition Policy and National Plan of Action of Nutrition of Malaysia (NPANM) III (2016-2025) towards achieving the optimum nutritional wellbeing of Malaysians. Nutrition Research Priorities (NRP) for one, highlight the importance of addressing nutrition issues and these warrant additional or further evidences to improve public health.

Ms Gui elaborated the seven (7) NRP areas; three (3) of which have focus on nutrigenomics: (1) diet-related NCDs with focus on evaluation variability and individual responses to diet and food; (2) life course food intake and dietary practices with focus on determination of genetic factors influencing the development of overweight and obesity; and, (3) overweight and obesity with focus on molecular nutrition.

INMEGEN: towards total health for Mexico

Barbara Antuna-Puente
Laboratorio de Genómica de Enfermedades Cardiovasculares, The National Institute of Genomic Medicine (INMEGEN), Mexico

The last speaker for this session discussed how the major research centers offering third-level clinical attention impact total health Mexico. Dr Barbara Antuna-Puente disclosed that the health system in Mexico is being run by the government and has been organized in three levels. INMEGEN is the 13th national institutes of health in Mexico that was established 12 years ago. INMEGEN has developed scientific research projects that foster cutting-edge technologies, human resource trainings, and genomic innovations and applications targeted to improve healthcare.

Session 4: Nutrigenomics research in the APEC Region

The aim of this session was to provide a platform for experts and early career nutrigenomics scientists to showcase their researches in nutrigenomics. Five (5) outstanding researches from Indonesia, Malaysia and Philippines were presented.

Mitochondrial copy number was modulated by supplementation

Safarina G. Malik
Senior Research Fellow, Eijkman Institute for Molecular Biology, Indonesia

Dr Safarina G. Malik discussed the role of the mitochondria during fetal growth. The mitochondria is the major source of adenosine triphosphate (ATP) which is essential to attain proper maternal nutrition. However, proper maternal nutrition is at times compromised because of the limit in the production of placental ATP.

She presented a study that compared the effects of multiple maternal micronutrient (MMN) supplementations and iron and folic acid (IFA) supplementation among residents of Lombok, Indonesia. In this study she found that supplementation with MMN reduced early infant mortality by 18% and a decreased low birth weight (LBW) by 14%.

The project was part of the bigger project titled “Supplementation with Multiple Micronutrients Intervention Trial” (SUMMIT) which Dr Malik started in 2001. The residents of Lombok, Indonesia were chosen as participants of the study for two reasons: 1) the population is homogenous in the relatively small population of 3.2 million and, 2) the mortality rate in this area is relatively high. The study is still ongoing, however she was able to conclude that mitochondrial DNA (mtDNA) copy number is relatively correlated with birthweight. Lower mtDNA copy number in the MMN group as compared to the IFA group indicates more sufficient and efficient mitochondrial function.

Gene-diet interaction effect of angiotensin II type 1 receptor (AGTR1) and vascular endothelial growth factor receptor-2 (VEGFR-2) gene polymorphisms with dietary patterns on blood lipids in Malaysian adults

Roseline Yap Wai Kuan
Senior Lecturer, School of Biosciences, Taylor’s University, Malaysia

Dr Yap Wai Kuan discussed the increasing rate of NCDs and how it is becoming a global threat. She examined the interaction effects of *AGTR1* and *VEGFR-2* gene polymorphisms with dietary patterns on metabolism risk factors of cardio

vascular disease (CVD). Her studies on gene-diet interaction were conducted in Malaysia but she opined that her results might provide essential information for the prevention and treatment of NCDs elsewhere in the world.

This study indicated potential hyperlipidemia and hypercholesterolemia risks, and these may pose higher risks of CVD in Malays and Chinese-Malaysians. Dr Yap Wai Kuan's results were consistent with other published reports and she also plans to expand her work on other ethnic groups such as the Aborigines.

Tumor suppressing effects of Moringa oleifera on colorectal cancer polyp: a nutrigenomics approach

Marietta P. Rodriguez
Senior Science Research Specialist, Food and Nutrition Research Institute
The Philippines

At the beginning of her presentation, Miss Rodriguez introduced *Moringa oleifera* (horseradish, known as *malunggay* in the Philippines) as one of the common edible plants in the Philippines. Moringa is also called a "miracle" plant because of its many beneficial health effects. According to previous studies, *Moringa oleifera* has high nutritional components and therapeutic properties found to be effective against cancer cells and skin papilloma.

Colorectal cancer is the third leading cause of death in the world and is usually caused by consumption of diet high in animal fats, low in fiber, sedentary lifestyle, alcohol consumption, obesity and even smoking. To examine the potential of moringa as an anti-cancer plant, dried moringa leaves powder (MLP) was incorporated in the diet of rats (previously induced with an agent known to cause colorectal cancer) as 7% and 15% diet preparation, and the effect was studied via a nutrigenomics approach.

The study used Sprague-Dawley rats as animal models and the responses to diet were investigated using molecular markers such as *Kras*[2], *TGF-B*[3] and *B-catenin.* The animals were randomly distributed into four (4) groups: (1) negative control - given basal diet only and not induced with azoxymethane (AOM); (2) positive control animals - given with basal diet only and were induced with AOM; (3) test animals given 7% MLP in the diet and induced with AOM; and, (4) test animals given with 15% MLP in the diet and induced with AOM.

Results of her study showed that no evident differences were noted when using *TGF-B* and *B-catenin* as molecular markers. However, with *Kras*, gene sequences showed evident aberrations or mutations. Morphological evidences obtained via immunohistochemistry clearly identified decrease in the fluorescence in groups 2, 3 and 4 while minimal fluorescence was observed in group 1 (negative control). The fluorescence observed from the cells were proportional to the amount of 5-bromo-2'-deoxyuridine (BrdU) labeled in the cells, which is a direct indication of cell

[2]V-Ki-ras2 Kirsten rat sarcoma viral oncogene homolog

[3]Transforming growth factor beta 1

proliferation. The findings from this study proposed the mechanism of action of MLP to prevent colon cancer or inhibit the growth of colorectal polyps. It can be suggested that adding *moringa* in the diet can be a useful strategy for cancer chemoprevention.

Personalizing the diet of Filipinos: does eating brown rice benefit Filipinos' type II diabetes susceptibility genes?

Vanessa Joy A. Timoteo
Science Research Specialist I, Food and Nutrition Research Institute, The Philippines

This study aimed to investigate if consumption of brown rice will benefit the type II diabetes (T2DM) susceptibility genes found among Filipino adults. Miss Timoteo used single nucleotide polymorphisms (SNPs) associated with T2DM as biomarkers. The SNPs she studied include: transcription factor 7-like 2 (*TCF7L2)* with reference SNPs rs7903146, rs12255372, and rs11196205; glucose transporter type 4 (*GLUT4)* rs121434581; peroxisome proliferator-activated receptor gamma (*PPARG)* SNPs rs1801282 and rs1805192; adiponectin, C1Q and collagen domain containing (*ADIPOQ)* rs17846866; and cyclin-dependent kinase inhibitor 2A/B (*CDKN2A/B)* rs10811661.

White rice (preferred by Filipinos because of its good taste) was used for the control group and brown rice was used for the intervention group. Her study compared the effects of six months of feeding with brown rice and white rice among selected employees of the Department of Science and Technology (DOST) at Taguig City University (TCU), The Philippines. Biochemical, anthropometric and clinical parameters were measured at baseline, midline and end-line and were further analyzed based on the genotypes of the participants.

Her findings showed that the presence of risk alleles was rare (<10%) except for *CDKN2A/B* rs10811661 where homozygous risk allele CC was 8.6% and the heterozygous CT was at 45% - suggesting that the risk C allele is common among Filipinos. Her findings also showed that the group fed with brown rice exhibited greater decrease in the levels of fasting blood glucose, postprandial blood glucose and glycosylated hemoglobin as compared to the participants fed with brown rice. Genotyping results showed that the carriers of the risk C allele in the *CDKN2A/B* rs10811661 appears to negate the lowering effect of brown rice intake on blood glucose levels and other risk factors.

Implications of polymorphisms related to the first 1,000 days of life

Joko Pambudi
Researcher, Center for Public Health Research and Development, National Institute of Health Research and Development, Indonesia

Mr Joko Pambudi presented the polymorphism on *MTHFR* (methylenetetrahydrofolate) gene and its implication in the first 1,000 days of life.

The first 1,000 days of life starts from pregnancy up to 24 months of age (two years). The idea behind this concept has attracted attention as it posits blueprint of life. The first two years of life is considered as the “golden period” for human growth and development and in this period are the critical windows of opportunity to address childhood malnutrition.

In Indonesia, nutritional status such as underweight, stunting and wasting in the population were recorded from 2007 to 2013. Anemia among pregnant women in both the rural and urban areas was observed to remain high during this period. Polymorphism involved in the metabolism of folic acid in the *MTHFR* gene (677CT) results in the deficiency of 5,10-methylenetetrahydrofolate reductase, thereby decreasing its activity. Folate is crucial in fetal development because of its critical role in nucleic acid synthesis.

Results of Mr Pambudi’s study showed that individuals with 677CT polymorphism have lower levels of plasma folate and higher homocysteine levels. The prevalence of *MTHFR* 677CT varies across races; 5-15% among the white population in North America, 20% in Northern China, and 26% in Southern Italy. Mr Pambudi highlighted that marginal folate consumption will impair cellular growth and fetus replication. According to him, folate status of women does not only depend on supplements and dietary intake but also on their genotypes.

Mr Pambudi also presented the mechanism of each polymorphisms in relation to the increase in levels of blood homocysteine as well as the molecular mechanisms affected by folate. As he ended his talk, he emphasized the insufficient folate intake will pose threat to the survival of the growing fetus, and this often results in spontaneous abortion.

Session 5: Challenges and opportunities in nutrigenomics research in Asia-Pacific

As nutrigenomics is anticipated to grow in the region, it is but fitting to look into views that transcend not only within the perspectives of laboratory methods and theories underlying nutritional genomics but also on societal implications of this emerging science.

Nutrigenomics in Asia-Pacific: risks, opportunities and implications

Michael F. Fenech
Director/Team Leader, Genome Health and Personalized Nutrition Laboratory, CSIRO Food and Nutrition Laboratory, Australia

Prof Fenech demonstrated the risks, opportunities and implications of nutrigenomics in Asia-Pacific by highlighting the importance of obtaining knowledge in nutrigenomics to optimize dietary recommendation for subgroups that are genetically susceptible to nutrient deficiencies or excesses. Prof Fenech illustrated how genetic and dietary diversity in the Asia-Pacific region may provide opportunity to understand how populations have evolved to thrive on traditional dietary patterns and how to use these (dietary patterns) are impacted by the ongoing shift in food habits, availability and affordability.

Prof Fenech also showed evidences on the severity of DNA damage caused by folate deficiency which, according to him is comparable to the damage brought by the unsafe levels of ionizing radiation. He further expressed that a coordinated and collaborative approach in the region is needed to clearly define the major nutrigenetic differences between populations and determine the nutriome, transcriptome, proteome, metabolome, and genome integrity profiles associated with optimal health, undernutrition, and over-nutrition. This fundamental knowledge will provide a stronger scientific foundation to guide public health professionals and policy makers in the region to assess the progress of nutrigenomics in its thrust to improve wellbeing of the people. According to Fenech, the field of nutrigenomics is essential to understand the impact of diet in the genome.

Ethico-legal and social implications of nutrigenomics research: the Asia-Pacific perspectives

Mary Ann R. Abacan
Medical Specialist I, Institute of Human Genetics, National Institutes of Health, University of the Philippines Manila, The Philippines

Advances and innovations in technology have helped research and healthcare practices to evolve over the years. This was strongly demonstrated by Dr Mary Ann R. Abacan of the Institute of Human Genetics-National Institutes of Health.

Dr Abacan quoted the saying “what is one man’s meat is the other man’s poison” to show the bi-directionality of genes and foods. There has been a lot of literature trying to differentiate nutrigenomics from nutrigenetics, however, at the end of the day, this bi-directionality will leave two important goals: (1) to come up with a genome-wide analysis of variations of the DNA sequence; and, (2) to check an exhaustive analysis of the effect of food or food component to provide optimal health.

Nutrigenomics is subject to the same basic ethical principles that apply to biochemical studies and pharmacogenetics research, which means that same tenets of ethics must be followed. Dr Abacan further articulated that the difference in the genome influences how the body reacts to nutrients, which in turn have implications to the overall health.

In terms of information and consenting prior to a study, it is always emphasized that proper informed consent must be obtained from the participants (voluntary and not coercive). It is also important that the participants know all the information that they need to know in a level that suits their comprehension. The right to withdraw must also be emphasized and the vulnerable populations such as children and elderly must be protected.

Session 6: Social, economic and human health dimensions of nutrigenomics

This session aimed to tackle the wider dimension of nutrigenomics as it impacts health and wellbeing of an individual. Speakers from the Philippines, New Zealand and Canada provided a closer look into how nutrigenomics creates promise to trade and economic boost.

The economic cost of NCDs in Asia and the Pacific

Eduardo P. Banzon
Senior Health Specialist, Sustainable Development and Climate Change Department,
Asian Development Bank

In his lecture, Dr Banzon revealed that the population in Asia Pacific is getting older and fatter. According to him, this demographic is alarming given that being old and fat are two risk factors highly associated with the development of NCDs. He further lamented that the rate of increase of NCDs in the region is growing quite fast.

The economic burden of NCDs may be quantified at the household, country and regional levels. At the household level, individuals may not be able to finance healthcare through difficulties to pay taxes or fees, mandatory or voluntary health insurance premiums, and mandatory individual savings. At the country level, the cost of healthcare may be attributed not only on the effect of health or any disease condition on the population but also on labor supply and capital accumulation. Meanwhile, at the regional level, the burden of NCDs has been found to continually increase, even surpassing the rate of infectious disease such as malaria.

Dr Banzon highlighted that the economic burden of NCDs in Asia-Pacific region entails expensive treatment and loss of labor, causing substantial dent in productivity. New innovative ways such as tools used in nutrigenomics may be supported by the Asian Development Bank (ADB) to control NCDs and trigger substantial economic development.

More than just the price tag: the value of nutrigenomics as a science

Lynette Robin Ferguson
Professor of Nutrition, Auckland Cancer Society, Research Centre and Discipline of Nutrition and Dietetics, Faculty of Medical and Health Sciences, The University of Auckland, New Zealand

At the start of her lecture, Dr Ferguson established the difference between nutrigenomics (the effects of diet on gene expression) and nutrigenetics (matching diet to genotype) to create a distinction on how these concepts should be applied to the food industry and to health professionals.

Prof Ferguson discussed the role of inflammation as a catalyst for diseases like Alzheimer's, heart disease, and some cancers. She further discussed the studies conducted at the University of Auckland involving the use of Mediterranean-style diet utilizing fruits, vegetables, nuts and fishes and a local commodity called a purple *kumara.*

Dr Ferguson conducted two studies under this context. The first study found that a change in diet can lower susceptibility to chronic diseases in less than two months. Her team examined the effect of Mediterranean-style diet in inflammation. They found out that there was a significant reduction in inflammation as early as six weeks of being into the said diet.

Her second study revealed more that 160 genes that are involved in Inflammatory Bowel Disease (IBD). The results of this study provided innovative approach to control IBD through diet. This development allowed Dr Ferguson and her team to employ transcriptomic techniques to test the ability of a Mediterranean-inspired diet to reduce inflammation in people with IBD. After a six-week diet, a reduction was noted in the recognized biomarkers such as C-reactive protein (CRP) and micronuclei numbers and there was an evident trend exhibiting the normalization of the intestinal microbiota. There was a notable increase in *Bacteroides* and *Clostridium* clusters and a significant decrease in *Bacillaceae* and *Proteobacteria*. Yet again, a systemic approach and additional studies are needed to employ targeted diets and nutritional interventions as possible therapies for IBD.

Do our genes determine what we should eat?

Ahmed El-Sohemy
Associate Professor and Canada Research Chair in Nutrigenomics, Department of Nutritional Sciences, University of Toronto, Canada

Dr El-Sohemy delivered his lecture via a weblink and discussed the increasing awareness among researchers, healthcare professionals and consumers about the personalized genetic testing services now available in the market. The one-size-fits-all, population-based approach to nutritional guidance that has been used in the past was proven to be inefficient and often ineffective and this became the precursor of the personalization of diets via genetic testing.

He demonstrated that coffee increases the risk of heart attack among individuals who carry a version of the gene that make them ‘slow’ caffeine metabolizers, but has no effect among individuals who are ‘fast’ caffeine metabolizers. Discoveries such as this that uses genomic information can be translated into a more effective dietary strategies to improve overall health. In fact, DNA-based dietary advice led into a greater interest among consumers.

He further discussed his affiliation with Nutrigenomix, Inc., a startup company dedicated to empower healthcare professionals and their clients with comprehensive and reliable genomic information with the ultimate goal of improving health through personalized nutrition.

According to Dr El-Sohemy, DNA-based dietary advice gathers acceptance from the scientific community due to the following reasons: (1) scientific evidence is robust; (2) advices are independent of the ethnic background; (3) improved compliance; (4) information is actionable and personalized; (5) increased consumer awareness; and, (6) focus on wellness and prevention.

Session 7: Perspectives towards nutrigenomics-based initiatives

The last plenary session tackled the plans and actions that must be undertaken in order to secure the growth and progress of nutrigenomics in the region. Prof Fenech of the Asia-Pacific Nutrigenomics and Nutrigenetics Organization (APNNO) and Dr Mario V. Capanzana of the Food and Nutrition Research Institute (DOST-FNRI) provided the relevant information towards the creation of collaborative research in nutrigenomics in the region.

Experiences in founding the Asia-Pacific Nutrigenomics and Nutrigenetics Organisation (APNNO) to promote research and collaboration in APEC region

Michael F. Fenech
Director/Team Leader, Genome Health and Personalized Nutrition Laboratory, CSIRO Food and Nutrition Laboratory, Australia

The Asia Pacific Nutrigenomics and Nutrigenetics Organisation (APNNO) was founded in December 2005 in Singapore. The missions of APNNO include: (1) promotion of science of nutrigenomics and nutrigenetics in the Asia-Pacific region; (2) facilitation of communication and collaboration amongst researchers, clinicians, and (the) nutrition industry working in this field in the region; and, (3) organization of the biennial APNNO conference.

Prof Fenech acknowledged that there is a need to update and identify the knowledge gaps in nutrigenomics. He also emphasized the need to maximize resources and capabilities through sustainable collaboration. This can be done through exchange of knowledge via lectureship and symposia, exchange visits of scientists within the region and conduct of public lectures on nutrigenomics and personalized nutrition.

Moving forward: the Philippines as an ally in nutrigenomics in Asia Pacific

Mario V. Capanzana
Director, Food and Nutrition Research Institute, Department of Science and Technology, The Philippines

Dr Capanzana shared the initiatives of the Food and Nutrition Research Institute (DOST-FNRI) as the lead implementing agency in nutrigenomics research in the Philippines. Researchers in DOST-FNRI started to venture into nutrigenomics in 2009, and this has been hallmarked by the establishment of the Philippine Nutrigenomics Study Group (PNSG). PNSG was formed to formulate a national

platform on nutrigenomics R&D, with a goal to improve the health status of Filipinos. The multidisciplinary group aimed to prioritize areas for nutrigenomics research, generate collaborative research efforts that will tackle the relationship between genes and disease conditions, as well as to make policy recommendations based on research outputs.

Dr Capanzana also discussed the researches at DOST-FNRI and these are aligned towards the improvement of the health condition in the economy. DOST-FNRI houses the first Nutritional Genomics laboratory in the Philippines and is being managed and maintained by trained researchers in the field of biochemistry, molecular biology, and medical technology. The laboratory is currently being groomed for ISO17025:2005 accreditation.

At the end of his talk, Dr Capanzana encouraged all APEC member economies to work together and come up with strategies that shall intensify nutrigenomics studies in the region.


NUTRIGENOMICS

Proceedings of the workshop/breakout sessions

The participants were grouped according to their affiliation. Three groups were formed as follows:

Group	Number of members
Academe	24
Government	15
Private/Industry Sector	18

Each group answered the following guide questions during the breakout session:

1. In your field of expertise, what are the existing programs on NCDs and is nutrigenomics integrated in these programs?
2. What are the research gaps and challenges in the application of nutrigenomics in your sector?
3. How will your sector address the gaps and challenges identified?
4. What are the opportunities that can be generated in responding to the gaps?
5. What policy recommendations can be formulated?

Summary of Discussions

Academe Group:	**Moderator:** Heralde, Frank (The Philippines) Discussants: 1. Abdul Zaibunnisa, Haiyee (Malaysia) 2. Alcausin, Ma. Melanie Liberty (The Philippines) 3. Arquiza, Jose Ma. Reynaldo Apollo (USA) 4. Atienza, Liezl (The Philippines) 5. Bagamasbad, Pia (The Philippines) 6. Carrillo, Ma. Constancia (The Philippines) 7. Cutiongco-dela Paz, Eva Maria (The Philippines) 8. Ferguson, Lynette Robin (New Zealand) 9. Jimeno, Cecilia (The Philippines) 10. Magbanua, Zenaida (The Philippines) 11. Maningat, Ma. Patricia (The Philippines) 12. Manuel, Ma. Carmina (The Philippines) 13. Nicodemus, Nemencio (The Philippines) 14. Kato, Hisanori (Japan) 15. Medina, Paul Julius (The Philippines) 16. Othman, Azizah (Malaysia) 17. Saloma, Cynthia (The Philippines) 18. Serrano, Augusto (The Philippines) 19. Sharif, Razinah (Malaysia) 20. Trinidad, Trinidad (The Philippines) 21. Valdez, Marcos Jr. (The Philippines) 22. Yap Wai Kuan, Roseline (Malaysia) 23. Yu, Gracia Fe (The Philippines)
Q1: In your field of expertise, what are the existing programs on NCDs and is nutrigenomics integrated in these programs?	According to the members of this group, there were initiatives already in place to address NCDs with genomics tool already employed. Here are the existing programs in the academe group where Nutrigenomics has already been integrated: • Studies in cardiovascular diseases, diabetes and colorectal cancer; • Identification of SNPs associated with cardiovascular diseases, diabetes and colorectal cancer; • Study on bioactive compounds on gene expression related to inflammatory responses; • Study on functional foods for specific use; • Advocacy on active nutrition to address NCDs; • Profiling of specific genes; • Listing of relevant NCD genes on public databases

Q2: What are the research gaps and challenges in the application of nutrigenomics in your sector?	The Academe Group listed the following gaps and challenges: • Lack of key genes for a specific NCD; • Lack of standardized methods in research with respect to varietal differences of plans and food sources and dosage effects; • Lack of training; • Poor recognition of the interaction between nutrients and genes with disease risks; • Lack of expertise and manpower on bioinformatics and nutrigenomics; • Lack of funding and awareness; • Need for a focused agenda and national program on nutrigenomics
Q3: How will your sector address the gaps and challenges identified?	With the gaps and challenges enumerated above, the Academe group vowed to address them through the following strategies: • Set the time frame and establish baseline data on relevant disease-gene interaction; • Conduct small scale nutrigenomics experiments involving identified genes relevant to NCDs; • Perform literature review on publications on candidate genes of interest that are significant in the APEC region; • Conduct of trainings for government decision-makers and health professionals; • Secure funding; • Establish national programs on nutrigenomics; • Identify priority areas; • Establish a HapMap database for autosomes
Q4: What are the opportunities that can be generated in responding to the gaps?	In responding to the gaps, the Academe Group enumerated the following opportunities that the group can venture into: • Trainings on methodologies and protocols to acquire knowledge on nutrigenomics; • Collaboration and data sharing among APEC member economies; • Secure international and local funding; • Collaborate with government agencies and other institutions
Q5: What are the policy recommendations that can be formulated?	The Academe Group, after thorough discussions, recommended the following policy statements for consideration by the body: • Harmonize strategic protocols to analyze panel of genes to address a specific NCD; • Create a national program with clear priority areas for the study of nutrigenomics and its effect on NCDs; • Create a joint international funding committee within the APEC region

Government Group:	**Moderator:** Sumayao, Rodolfo, Jr. (The Philippines) Discussants: 1. Acuin, Cecilia Cristina (The Philippines) 2. Antuna-Puente, Barbara Patricia (Mexico) 3. Baurile, Ladylove Mae (The Philippines) 4. Cubillos-Riveros, Pablo Cesar (Chile) 5. Espose, Kelvin R-Jay (The Philippines) 6. Fenech, Michael (Australia) 7. Gui, Shir Ley (Malaysia) 8. Huang, Zenwu (People's Republic of China) 9. Maslennikova, Galina (Russia) 10. Mendoza, Teresa (The Philippines) 11. Orense, Consuelo (The Philippines) 12. Pambudi, Joko (Indonesia) 13. Perlas, Leah (The Philippines) 14. Santos, Ma. Socorro (The Philippines)
Q1: In your field of expertise, what are the existing programs on NCDs and is nutrigenomics integrated in these programs?	The members of this group opined that amidst the number of programs and policies in place to address NCDs across all institutions, nutrigenomics is not yet integrated in these endeavors
Q2: What are the research gaps and challenges in the application of nutrigenomics in your sector?	The following are the gaps and challenges identified by the Government Group: • Lack of economy-specific gene map; • The cost of nutrigenomics research is still expensive; • The need for a prospective (designed) studies rather than the existing paradigm on cross-sectional designs to attain sustainability of nutrigenomics data
Q3: How will your sector address the gaps and challenges identified?	With the gaps and challenges enumerated above, the Government Group declared to address them through the following strategies: • Substantiate national surveys by conducting prospective cohort studies to capture the nutrigenomics and nutrigenetics dimension; • Develop economy-specific dietary guidelines based on nutrigenomics and nutrigenetics information; • Initiate partnerships within and between APEC member economies; • Identify panel of candidate genes known to influence NCDs

Q4: What are the opportunities that can be generated in responding to the gaps?	The Government Group enumerated the following opportunities that the group can undertake: • Utilize national core laboratories on genomics; • Build a network and collaborate to develop a consortium; • Establish mentoring from experts among APEC member economies
Q5: What are the policy recommendations that can be formulated?	The Government Group recommended the following policy statements for consideration by the body: • Generate nutrigenomics-based evidences in pursuit of economically-sound strategies to address NCDs; • Adopt and test economy-specific dietary guidelines; • Create a nutrigenomics consortium

Private/Industry Group:	**Moderator:** Tanchoco, Celeste (The Philippines) Discussants: 1. Austria, Julieta (The Philippines) 2. Banzon, Eduardo (The Philippines) 3. Barba, Corazon (The Philippines) 4. Cruz, Ma. Cecile (The Philippines) 5. Dema-ala, Jeomarie (The Philippines) 6. Duatin, Jenina (The Philippines) 7. Florentino, Rodolfo (The Philippines) 8. Florentino, Purita (The Philippines) 9. Gonzales, Ma. Josephine (The Philippines) 10. Kaput, James (Switzerland) 11. Kim, Kenneth (The Philippines) 12. Orbeta, Sanirose (The Philippines) 13. Pedro, Ma. Regina (The Philippines) 14. Ragudo, Aileen (The Philippines) 15. Ramirez, Katherine (The Philippines) 16. Sarmiento, Catherine (The Philippines) 17. Tiongscon, Maebelle Anne (The Philippines)
Q1: In your field of expertise, what are the existing programs on NCDs and is nutrigenomics integrated in these programs?	According to this group, policies and programs on NCDs are currently in place but there are limited works or researches done in nutrigenomics.
Q2: What are the research gaps and challenges in the application of nutrigenomics in your sector?	The Private/Industry group identified the following as gaps and challenges in Nutrigenomics in their sector: • The cost of doing nutrigenomics research is expensive; • Lacking or limited number of experts in nutrigenomics; • Limited knowledge and techniques in nutrigenomics that can be leveraged with the existing or available facilities in the region; • The need to equip the industry and R&D laboratories with the state-of-the-art genomics platform; • Research data on nutrigenomics are not readily available for the perusal of the private/industry sector

Q3: How will your sector address the gaps and challenges identified?	The Private/Industry group affirmed to address the gaps and challenges identified through the following approaches: • Expand the research ideas that emanated from the government/national genomic centers; • Demand for an open access of information and data generated from nutrigenomics research; • Request the government to expand the collaborative opportunities for the industry/private sector to foster partnership on nutrition and nutrigenomics research
Q4: What are the opportunities that can be generated in responding to the gaps?	As a response to the gaps, the Private/Industry Group enumerated the following opportunities: • Equip research laboratories with advanced facilities on nutrigenomics; • Market nutrigenomics as a new field that has a great potential towards the understanding the health and wellness; • Establish pool of experts to do work on ethical, legal and social implications of nutrigenomics; • Utilize nutrigenomics as a new tool for sustainable nutrition; • Train young scientists on the tools and methods used in nutrigenomics research; • Develop new products to address the needs and gaps as results of nutrigenomics researches
Q5: What are the policy recommendations that can be formulated?	The Private/Industry group recommended the following policy statements for consideration by the body: • Establish a clearer policy on the mechanisms to strengthen the Public-Private Partnership (PPP): • Strengthen the communication and collaboration between government agencies and the private sector, particularly on the utilization of data and information obtained from nutrigenomics research; • Provide incentives to companies conducting nutrigenomics research; • Promote nutrition and nutrigenomics research and create a conducive environment for the utilization of the private sector and the industries

Closing

Dr Jose Ma. Reynaldo Apollo Arquiza of the USA summarized the main conclusions of the workshop.

The Project Overseer, Mr Jacus S. Nacis from the Philippines delivered the closing remarks and highlighted the importance of collaboration and follow through activities of the workshop. He thanked the delegates and speakers for their participation.

Policy Statement

The *APEC Workshop on Strategies to Address Non-communicable Diseases (NCDs) through Science, Technology and Innovation: Nutrigenomics Approach* provided a venue to integrate scientific and economic aspects of nutrigenomics science and elevate these into the research and policy agenda of the APEC Member Economies. Information and knowledge sharing during the workshop sessions and discussions highlighted the profound consequences of NCDs on health, social and economic development in the Asia-Pacific and the opportunities in nutrigenomics to optimize human health.

On this, delegates from APEC Member Economies (Australia; Canada; Chile; People's Republic of China; Indonesia; Japan; Malaysia; Mexico; New Zealand; The Philippines; Russia; The United States and Viet Nam) together with guest economy (Switzerland) are encouraged to support the call to develop nutrigenomics-based research strategies and collaborations between different stakeholders in the academe, private sector and government organizations in the Asia-Pacific through the following policy recommendations:

- Prioritize NCDs to target utilizing the omics approach: obesity, cardiovascular diseases, hypertension, diabetes, cancer, neurodegenerative diseases;
- Characterize major nutrigenomics and nutrigenetics similarities and differences between populations in the Asia-Pacific and identification of genomic and genetic profiles associated with health and disease process;
- Harmonize research platforms and protocols in the context of legal, social, ethical, economic and environmental dimensions;
- Enhance capacity building in nutrigenomics through resource and knowledge sharing among APEC member economies;
- Establish nutrigenomics hub (to be known as the APEC Virtual Center for Nutritional Genomics) in the Asia-Pacific as a repository of genomic and genetic data for the APEC Member Economies;
- Explore collaboration between public and private sector to increase resources for nutrigenomics research and for its commercialization and popularization as a tool in addressing NCDs;
- Sustain dialogues and commitment for promotion of programs in nutrigenomics research in APEC and other regions;
- Translate nutrigenomics and nutrigenetics data and perspectives in the development of economy-specific health and nutrition recommendations, guidelines and programs.

Summary of Evaluation

Overview

Majority of the participants strongly agree that the objectives of the workshop were clearly defined (64.3%) and that the workshop has achieved its intended purpose (55.6%). In terms of agenda items and topics covered, majority of the participants strongly agreed that it was relevant (64.3%). All agreed that the topics were well-organized and easy to follow and that experts and facilitators were well-prepared and knowledgable about the topic and the materials that were distributed were useful and effective. However, 18% of the workshop participants opined that the time allotted for the workshop was not sufficient. Meanwhile, 71% of the participants strongly agreed that the venue was conducive for the workshop.

Q: How relevant was this workshop to you and your economy?

When asked about the relevance of the workshop to the participants' economy, more than half answered that the workshop was indeed relevant to their respective economies.

Q: In your view what were the workshop's results/achievements?

Participants noted that the achievements of the workshop were as follows:

- The presenters communicated/presented the gaps, updates, and future directions of nutrigenomics;
- The workshop provided collaboration, opportunities and network from different APEC economies;
- The workshop developed policy statement in support of the development of platform for exchange of views and information in nutrigenomics;
- The workshop raised the awareness about the emerging sciences to determine and possibly avoid the risk of NCDs

Q: What new skills and knowledge did you gain from this event?

According to the workshop participants, there were a lot of skills and knowledge gained from participating in the workshop:

- Nutrigenomics as a tool to combat NCDs;
- Awareness that we should take a look on NCDs and what is the proper diet as required by the genotype;
- Latest developments in the frontier of nutrigenomics were discussed;
- Nutrigenomics in general; study designs on nutrigenomics research, protocols for diversity studies and new experimental designs as well as comparison of efforts in nutrigenomics done by countries other than the Philippines;
- A broad picture of the effects and costs of NCDs on different populations;

- Direct applications of nutrigenomics;
- Gaps needed to address

Q: Rate your level of knowledge and skills in the topic before and after participating in the event.

There were around 82% of the participants who responded that their knowledge and skills on nutrigenomics was improved after participating in the workshop.

Q: How will you apply the content of the workshop and knowledge gained at your economy?

Most of the participants provided scenarios on how they could apply the content of the workshop and the knowledge they have gained from participating in the workshop. Most of them said that they would organize workshops and trainings to support nutrigenomics research and write research proposals incorporating nutrigenomics as a tool to combat NCDs. Some also responded that they would write articles about the workshop.

Q: What needs to be done by APEC? Are there plans to link the project's outcomes to subsequent collective actions by fora or individual actions by economies?

According to the workshop participants, here are the actions that need to be undertaken by all APEC economies related to nutrigenomics:

- Focus on issues and challenges on nutrigenomics and harmonize data from nutrigenomics that can be translated to nutritional guidelines and to include policy-making to lobby nutrigenomics as an agenda;
- Exert effort to reach out to industry and let them understand the importance of nutrigenomics and how businesses can benefit from it;
- Make the concept of nutrigenomics more understandable for the common people;
- Prepare strategic and operational plan for implementation and sustainability of the field;
- Provide support to member economies to implement strategies and scale up interventions;
- Propose a project where each economy can set a timeline to finish each project;
- Give details on the policy recommendation and its intended implementation;
- Facilitate the improvement and acceleration of nutrigenomics research in the region in terms of providing training and technical know-how

Q: What needs to be done by APEC? Are there plans to link the project's outcomes to subsequent collective actions by fora or individual actions by economies?

Workshop participants pointed out some activities that can be done to improve the workshop in the future. Some also suggested that projects be given to each economy each economy and set a timeline for these projects to be completed. Participants also requested that the outputs of the workshop need to be communicated periodically and the

‘way forward’ among APEC economies needs to be discussed such that related policies will be crafted. For some, inclusion of regulating bodies in the workshop could further substantiate the workshop.

Q: Overall, how would you rate the workshop?

With excellent, good, fair, and poor as the choices to evaluate the overall rating for the workshop, 96.4% of the participants gave a rating of excellent to the workshop.

Workshop Agenda

APEC Workshop on Strategies to Address Non-communicable Diseases (NCDs) through Science, Technology and Innovation: Nutrigenomics Approach
15-16 June 2016
Taal Vista Hotel, Tagaytay City, The Philippines

June 15, 2016	
8:00 - 9:00	Registration
9:00 - 9:10	Safety Briefing
Opening Session	
9:10 - 9:15	**Presentation of Delegates** Dr Cecilia Cristina Santos-Acuin *Chief Science Research Specialist* *Food and Nutrition Research Institute* *The Philippines*
9:15 - 9:20	**Welcoming Remarks** Hon. Mario G. Montejo *Secretary* *Department of Science and Technology* *The Philippines*
9:20 - 9:30	**Group Photo**
9:45 - 10:00	**Coffee Break**

Session 1: Prevalence, Programs, Strategies to Address NCDs in APEC Economies	**Objective:** To enhance the understanding on the current status of NCDs among APEC member economies and to showcase the efforts undertaken by different sectors of society.
10:00 - 10:20	**The NCD epidemic: a silent disaster** Dr Antonio Dans *Professor, College of Medicine* *University of the Philippines Manila* *The Philippines*
10:20 - 10:30	**Prevalence, programs and strategies to eliminate NCDs in the APEC Economies: Russian Federation Experience** Dr Galina Y. Maslennikova *Leading Research Scientist* *National Research Center for Preventive Medicine* *Ministry of Health, Russia*

10:30 - 10:40	**Prevalence, programs and strategies to eliminate NCDs in the APEC Economies: Chile Experience** Dr Pablo Cesar Cubillos-Riveros *Office of the Undersecretary for Public Health* *Department of Noncommunicable Diseases* *Ministry of Health, Chile*
10:40 - 10:50	**Open Forum**

Session 2: Nutrigenomics as a Science	**Objective:** To provide a background on the interplay between genetics and nutrition and how it contributes to the optimization of health.
10:50 - 11:10	**Nutrition and human genetic diversity** Dr James Kaput *Senior Expert* *Systems Nutrition, Metabolomics and Proteomics Unit* *Nestle' Institute of Health Sciences, Switzerland*
11:10 - 11:30	**The reasons why we do nutrigenomics: goals and objectives of nutritional genomics research** Dr Hisanori Kato *Project Professor* *Organization for Interdisciplinary Projects* *The University of Tokyo, Japan*
11:30 - 11:50	**The Lab Works: Model Methods in Nutrigenomics Research** Dr Eva Maria Cutiongco-dela Paz *Vice Chancellor for Research and NIH Executive Director, University of the Philippines Manila* *The Philippines*
11:50 - 12:00	**Open Forum**
12:00 - 13:00	**Lunch Break**
Session 3: Genomic Centers in Support of Health and Nutrition Research	**Objective:** To establish the role genomic centers in APEC economies in strengthening the role of genomics in the improvement of health and wellbeing.
13:00 - 13:15	**A Primer for the Philippine Genome Center: Supporting Cutting-Edge Researches Towards Economic Development** Dr Zenaida V. Magbanua *Deputy Executive Director* *Philippine Genome Center, University of the Philippines Diliman* *The Philippines*
13:15 - 13:30	**Nutritional Genomics: Scenario in Malaysia** Ms Gui Shir Ley *Senior Assistant Director* *Nutrition Division, Ministry of Health, Malaysia*

13:30 - 13:40	**INMEGEN: Towards Total Health for Mexico** Dr Barbara Antuna-Puente *Laboratorio de Genomica de Enfermedades Cardiovasculares, The National Institute of Genomics Medicine (INMEGEN), Mexico*

Session 4: Nutrigenomics Research in the APEC Region	**Objective:** To provide a platform for experts and early career nutrigenomics and nutrigenetics scientists to showcase their researches in nutrigenomics.
13:40 - 14:00	**Mitochondrial DNA Copy Number was Modulated by Supplementation** Dr Safarina Malik *Senior Research Fellow* *Eijkman Institute for Molecular Biology, Indonesia*
14:00 - 14:20	**Gene-diet interaction effect of angiotensin II type 1 receptor (*AGTR1*) and vascular endothelial growth factor receptor-2 (*VEGFR-2*) gene polymorphisms with dietary patterns on blood lipids in Malaysian adults** Dr Roseline Wai Kuan Yap *Senior Lecturer* *School of Biosciences, Taylor's University Malaysia*
14:20 - 14:40	**Tumor-suppressing effects of *Moringa oleifera* on colorectal polyp: A Nutrigenomics Approach** Ms Marietta P. Rodriguez *Senior Science Research Specialist* *Food and Nutrition Research Institute, Department of Science and Technology, The Philippines*
14:40 - 15:00	**Personalizing the diet of Filipinos: does eating brown benefit Filipinos' Type II diabetes susceptibility genes?** Ms Vanessa Joy A. Timoteo *Science Research Specialist I* *Food and Nutrition Research Institute, Department of Science and Technology, The Philippines*
15:00 - 15:20	**Polymorphisms implications related to the first 1,000 days of life** Mr Joko Pambudi *Researcher* *Center for Public Health Research and Development National Institute of Health Research and Development, Indonesia*
15:20 - 15:40	**Open Forum**
15:40 - 16:00	**Coffee Break**

Session 5: Challenges and Opportunities in Nutrigenomics Research in the Asia-Pacific	**Objective:** To understand the current status and potentials of nutrigenomics in the Asia Pacific region.
16:00 - 1:20	**Nutrigenomics in Asia-Pacific: Risks, Opportunities and Implications** Prof Michael Fenech, PhD *Director/Team Leader* *Genome Health and Personalized Nutrition Laboratory, CSIRO Food and Nutrition Laboratory, Australia*
16:20 - 16:40	**Ethico-legal and social implications of nutrigenomics research: the Asia-Pacific perspectives** Dr Mary Ann R. Abacan *Medical Specialist I* *Institute of Human Genetics, National Institutes of Health, University of the Philippines Manila,* *The Philippines*
16:40 - 17:00	**Open Forum**
17:00 - 17:40	**Wrap Up and Synthesis** Dr Jose Ma. Reynaldo Apollo Arquiza *Lecturer* *School of Biological and Health Sciences Engineering, Arizona State University, USA*
Moderator:	Gracia Fe B. Yu, PhD *Associate Professor V* *Department of Biochemistry and Molecular Biology* *College of Medicine, University of the Philippines Manila, The Philippines*
18:00 - 20:30	**Networking Dinner**

June 16, 2016	
Session 6: Social, Economic and Human Health Dimensions of Nutrigenomics	**Objective:** To provide thorough appreciation about the societal benefits from engaging in nutrigenomics research.
9:00 - 9:20	**The economic cost of NCDs in Asia and the Pacific** Dr Eduardo Banzon *Senior Health Specialist, Sustainable Development and Climate Change Department, Asian Development Bank*
9:20 - 9:40	**More than just the price tag: the value of nutrigenomics as a science** Prof Lynette Robin Ferguson *Professor of Nutrition* *Auckland Cancer Society and Research Center and Discipline of Nutrition and Dietetics, Faculty of Medical and Health Sciences, The University of Auckland, New Zealand*
9:40 - 10:00	**Do our genes determine what we eat?** Dr Ahmed El-Sohemy *Associate Professor and Chair, Canada Research in Nutrigenomics* *Department of Nutritional Sciences, University of Toronto, Canada*
10:00 -10:15	**Open Forum**
10:15 - 10:30	**Coffee Break**

Session 7: Perspectives Towards Nutrigenomics-based Initiatives	**Objective:** This session will provide insights and visions of a learned society and how instituting a center in nutrigenomics can bolster the promises of the science in the region.
10:30 - 11:00	**Experiences in founding the Asia Pacific Nutrigenomics and Nutrigenetics Organization (APNNO) to promote research collaboration in APEC region** Prof Michael Fenech, PhD *Director/Team Leader, Genome Health and Personalized Nutrition Laboratory, CSIRO Food and Nutrition Laboratory, Australia*
11:00 - 11:30	**Moving forward: the Philippines as an ally in nutrigenomics in the Asia-Pacific** Dr Mario V. Capanzana *Director* *Food and Nutrition Research Institute, Department of Science and Technology, The Philippines*
11:30 - 11:40	**Open Forum**
11:40 - 13:00	**Lunch Break**

Session 8: Workshop Proper/Breakout Session	
13:00 - 15:00	**Workshop Proper** Academe Group: Ballroom 1 Government Group: Dahlia Function Room Private/Industry Group: Santan Function Room
15:00 - 15:15	**Coffee Break**
15:15 - 15:30	**Reporting of Workshop Results** Group Leaders
15:30 - 15:45	**Discussion on APEC Nutrigenomics 2016 Results** Mr Jacus S. Nacis *Project Overseer/ Science Research Specialist I* *Food and Nutrition Research Institute, Department of Science and Technology, The Philippines*
15:45 - 15:50	**Synthesis** Dr Jose Ma. Reynaldo Apollo Arquiza *Lecturer* *School of Biological and Health Sciences Engineering, Arizona State University, USA*
15:55 - 16:00	**Presentation of APEC Nutrigenomics Declaration** Dr Mario V. Capanzana *Director* *Food and Nutrition Research Institute, Department of Science and Technology, The Philippines*
15:55 - 16:00	**Closing Remarks** Dr Amelia P. Guevara *Undersecretary for Research and Development* *Department of Science and Technology,* *The Philippines*

List of Workshop Participants

A. International Delegates

Economy		Full Name	Job Title/ Organization / Email Address
Australia	Prof	Michael Fenech	Director/Leader Commonwealth Scientific and Industrial Research Organization (CSIRO), Australia michael.Fenech@csiro.au
Canada	Dr	Ahmed El-Sohemy	Associate Professor & Chair Canada Research in Nutrigenomics, University of Toronto, Canada a.el.sohemy@utoronto.ca
Chile	Dr	Pablo Cesar Cubillos-Riveros	Professional Department of Noncommunicable Diseases, Ministry of Health, Chile pablo.cubillos@minsal.cl
People's Republic of China	Dr	Zhenwu Huang	Director Division of Nutrition and Metabolism, Chinese Center for Disease Control and Prevention, PR China zhenwuhuang@sina.com
Indonesia	Mr	Joko Pambudi	Researcher National Institute of Health Research and Development, Ministry of Health, Indonesia jpambudi@gmail.com
Indonesia	Dr	Zafarina Golfiani Malik	Head of Laboratory Genome Diversity and Diseases Laboratory, Eijkman Institute for Molecular Laboratory, Indonesia ina@eijkman@go.id
Japan	Prof	Hisanori Kato	Project Professor Organization for Interdisciplinary Research Projects, The University of Tokyo, Japan akatoq@mail.ecc.u-tokyo.ac.jp
Malaysia	Dr	Azizah Othman	Lecturer Universiti Teknologi MARA, Malaysia azizah973@salam.uitm.edu.my

Economy		Full Name	Job Title/ Organization / Email Address
Malaysia	Ms	Shir Ley Gui	Senior Assistant Director Ministry of Health, Malaysia guishirley@moh.gov.my
Malaysia	Dr	Razinah Sharif	Lecturer Universiti Teknologi MARA, Malaysia razinah@ukm.edu.my
Malaysia	Dr	Roseline Wai Kuan Yap	Senior Lecturer Taylor University, Malaysia roselinewaikuan@taylors.edu.my
Malaysia	Dr	Zaibunissa Abdul Haiyee	Senior Lecturer Universiti Teknologi MARA, Malaysia nisha@salam.uitm.edu.my
Mexico	Dr	Barbara Patricia Antuna-Puente	Researcher Instituto Nacional de Medicine Genomica (INMEGEN), Mexico bantuna@inmegen.gob.mx
New Zealand	Prof	Lynette Robin Ferguson	Professor of Nutrition The University of Auckland, New Zealand l.ferguson@auckland.ac.nz
Russia	Dr	Galina Maslennikova	Leading Research Scientist Ministry of Health, Russian Federation gmaslennikova2014@gmail.com
Switzerland	Dr	James Kaput	Senior Expert Nestle' Institute of Health Sciences, Switzerland james.kaput@rd.nestle.com
USA	Dr	Jose Ma. Reynaldo Apollo Arquiza	Lecturer Arizona State University, USA jaa5@cornell.edu / jarquiza@asu.edu
Viet Nam	Dr	Tuyet Mai Truong	Vice-Director National Institute of Nutrition, Ministry of Health, Viet Nam troungmai1976@gmail.com

B. Local Delegates

	Full Name	Job Title/ Organization / Email Address
Dr	Amihan Arquiza	Lecturer University of the Philippines Los Baños
Dr	Maria Socorro Santos	Medical Officer IV Department of Health socci.santos@gmail.com
Dr	Cecilia Jimeno	Professor and Chair University of the Philippines College of Medicine, University of the Philippines Manila cajimeno@up.edu.ph/ ceciledoc@hotmail.com
Ms	Jenina Duatin	Member Diabetes Philippines, Inc. diabetesphilippine@pldtdsl.net
Ms	Consuelo Orense	Supervising Science Research Specialist Food and Nutrition Research Institute, Department of Science and Technology con_orense@yahoo.com
Ms	Teresa Mendoza	Planning Officer IV Food and Nutrition Research Institute, Department of Science and Technology techieaug8@yahoo.com
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Dr	Maria Melanie Alcausin	Research Faculty Institute of Human Genetics, National Institutes of Health, University of the Philippines Manila mbalcausin@up.edu.ph
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Mr	Kenneth Kim	Genomics Product Specialist Lifeline Diagnostics Supplies, Inc. kenneth_kim@lifelinediag.com
Dr	Maria Regina Pedro	Associate Director Mead Johnson Nutrition regina_pedro@yahoo.com; regina.pedro@gmail.com

	Full Name	Job Title/ Organization / Email Address
Ms	Katherine Ramirez	Field Application Specialist Medical Test Systems, Inc. kramirez_medtest@pldtdsl.net
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Speakers' Profile

Hon Mario G. Montejo

Secretary, Department of Science and Technology, The Philippines

Secretary Montejo worked on redesigning policies, aiming to increase the economy's science and technology capabilities. Secretary Montejo believes that by doing this, the economy would be able to produce diverse and world-class products, processes and services which can be enjoyed by the Filipinos.

Among his notable programs in the DOST are the Automated Guideway Transit (AGT) project, the mosquito ovicidal/larvicidal trap, and the Nationwide Operational Assessment of Hazards (NOAH).

Since his appointment in 2010, Secretary Montejo has initiated policies focusing on the development of technology-driven programs to address persistent national problems, countryside development, healthy competition among industries and the efficient delivery of government and social services.

Mario V. Capanzana, PhD

Director, Food and Nutrition Research Institute, Department of Science and Technology, The Philippines

Dr Mario V. Capanzana is a Chemical Engineer who has chosen to share his knowledge and skills in the field of food and nutrition as his contribution to the economy's development. He pursued further studies in the field of food science and technology. He obtained his Postgraduate Diploma in Applied Food Science and Technology from Hawkesbury Agricultural in Richmond, New South Wales, Australia as an ASEAN Protein Project Scholar and MSc in Food Technology from Mysore University, Mysore, India as a Colombo Plan Scholar. In 1996, he was awarded PhD in Food Science from the University of New South Wales as an AUSAID fellow. He has been working with the Food and Nutrition Research Institute (FNRI) for more than 30 years where he started as a Science Research Associate.

His research interest is on food fortification, functional foods, technology transfer, food quality and safety, and food product development. Dr Capanzana is the former President of the Philippine Association of Nutrition (PAN), President-Elect and Founding Member of the University of New South Wales Alumni Association-Philippines Chapter. He is also the Former President of the Philippine Institute of Chemical Engineers (PICHE), President/ Convenor of the Food Science and Technology Council, and a member of the Philippine Association of Food Technologists (PAFT).

Antonio Dans, MD

Professor, College of Medicine, University of the Philippines Manila
The Philippines

Dr Dans is an Academician at the National Academy of Science and Technology (NAST) in recognition of his significant contribution in advancing the field of internal medicine and clinical epidemiology in the Philippines.

Galina Maslennikova, MD

Leading Research Scientist, National Research Center for Preventive Medicine, Ministry of Health, Russia

Aside from being a Leading Research Scientist, Dr Maslennikova also serves as an Expert on Noncommunicable Diseases for the World Health Organization and the APEC Health Working Group. She has several publications in international and Russian journals. Her research works focus primarily on noncommunicable disease epidemiology and prevention, public health education, and promotion for disease prevention.

Pablo Cesar Cubillos-Riveros, MD

Office of the Undersecretary for Public Health, Department of Noncommunicable Diseases, Ministry of Health, Chile

Prior to this post at the Office of the Undersecretary for Public Health at the Ministry of Health in Chile, Dr Riveros served in several capacities for technical reference and medical support roles at Dr Amador Neghme de Pedro Aguirre Cerda in Santiago, Chile. His expertise in medical profession includes clinical research, public health, epidemiology and health management.

James Kaput, PhD

Senior Expert, Systems Nutrition, Metabonomics and Proteomics Unit
fzNestlé Institute of Health Sciences, Switzerland

Dr Kaput is the Senior Expert of the Systems Nutrition, Metabonomics and Proteomics Unit at the Nestlé Institute of Health Sciences. Aside from this post, he also fulfills various academic appointments: he is an Adjunct Assistant Professor at the Division of Genetics, University of Kansas for Medical Sciences, and as a Visiting Professor at the Adinovo Center for Genetic and Genomic Medicine, Zhejiang University in China. He is also a Visiting Professor at the Service D'Endocrinologie, Diabetologie et Metabolosime du CHUV, University of Lausanne. Dr Kaput had a distinguished career in the academe prior to advancing to the corporate world. His expertise and research works on cell biology, biochemistry, and nutrition are integrated to highlight the present and expected future value of nutrigenomics in enhancing human health.

Hisanori Kato, PhD

Project Professor, Organization for Interdisciplinary Research Projects
The University of Tokyo, Japan

Dr Kato has been working with the University of Tokyo sine 2009. He graduated from the same university in 194 and was appointed as Assistant of the University of Tokyo in 1988. He received his PhD in 1990. He served as Guest Researcher at Diabetes Branch, National Institutes of Health, USA in 1991 until 1993 and then became an Associate Professor at Utsonomiya University in 1993 and at the University of Tokyo in 1999. Dr Kato is the Secretary General of Federation of Asian Nutrition Societies (FANS) and the Chair of the Organizing Committee of the 22nd International Congress of Nutrition (ICN 2021). He is also Japan's delegate economy representative for the Asia Pacific Nutrigenomics and Nutrigenetics Organization (APNNO). Dr Kato is the President of the Japanese Society for Amino Acid Sciences and a member of the Science Council of Japan. His research focus is the evaluation of the effects of food components by making use of various -omic technologies.

Eva Maria Cutiongco-dela Paz, MD

Vice Chancellor for Research & National Institutes of Health Executive Director,
University of the Philippines Manila, The Philippines

Dr Cutiongco-dela Paz is a Research Professor at the National Institutes of Health and a Clinical Research Professor and Head of the Section of Genetics at the Department of Pediatrics of the Philippine General Hospital. She was a Board Certified Fellow of the Canadian College of Medical Geneticists in 2000. Dr Cutiongco-dela Paz was among the Ten Outstanding Young Men (TOYM) awardee in the field of Genetic Medicine in 2002 and was also recognized by the National Academy of Science and Technology as one of the Ten Outstanding Young Scientists in the same year. She was also awarded as one of the Ten Outstanding Women in Nation's Service (TOWNS) for Medicine in 2007. She has received the 2011 UP Manila's Outstanding Researcher and the Professorial Chair for Excellence on Teaching and research in Pediatrics and Genetics.

Zenaida V. Magbanua, PhD

Deputy Executive Director, Philippine Genome Center, University of the Philippines Diliman, The Philippines

Aside from being the Executive Director of the Philippine Genome Center, Dr Magbanua is also the Project Development Officer at the Philippine-California Advanced Research Institutes (PCARI) and an Associate Professor at the National Institute of Molecular Biology and Biotechnology, University of the Philippines Diliman. She has been invited as a speaker in various national and international conferences as an expert in molecular biology and genetics.

Gui Shir Ley (Ms)

Senior Assistant Director, Nutrition Division, Ministry of Health, Malaysia

Ms Gui is primarily involved in the development of nutrition standards and in the evaluation of nutrition programs in the government. Her expertise includes planning and management of nutrition and health promotion and education programs and services.

Barbara Antuna-Puente, MD

Laboratorio de Geńomica de Enfermedaddes Cardiovasculares, The National Institute of Genomics Medicine (INMEGEN), Mexico

Dr Antuna-Puente is a Research Scientist and a member of the Institutional Review Board of INMEGEN, Mexico. She was the former Chief of the Regulatory Affairs in Clinical Research at the Medica Sur Hospital and has been involved in several clinical studies at the Instituto Nacional de Ciencias Médicas y Nutricíon Salvador Zubirán. Her scientific works focus on the interplay of genomics and human physiology and metabolism.

Safarina Malik, PhD

Senior Research Fellow, Eijkman Institute for Molecular Biology, Indonesia

Dr Malik has an extensive list of publications in international journals and has served speakerships in a number of conferences. Her primary research interests are the study of genetic diversity, gut microbes, lifestyle diseases, early life nutrition, fetal programming, molecular pathology of inherited disorders, mitochondrial genetics and dysfunction associated with complex and polygenic diseases. She also contributes actively in reviewing research proposals for the Risbin Iptekdok and at the Indonesian Danone Institute.

Roseline Yap Wai Kuan, PhD

Senior Lecturer, School of Biosciences, Taylor's University, Malaysia

Dr Yap Wai Kuan has received international academic honors and awards and has scientific publications as chapters in a book, conference proceedings, and as peer-reviewed papers in major journals. Her research interests are directed towards public health nutrition and nutritional epidemiology with emphasis on analysis of dietary patterns, food consumption and lifestyle, and incorporation of nutrigenetics to identify metabolic risk factors associated with diet-related chronic diseases.

Marietta P. Rodriguez (Ms)

Senior Science Research Specialist, Food and Nutrition Research Institute, Department of Science and Technology, The Philippines

Ms Rodriguez actively participates in the research and promotion of nutrigenomics. She is involved in various local researches focusing on dietary and genetic factors as applied to the management of lifestyle diseases. Her dedication has allowed her to publish a number of scientific articles in peer reviewed local and international journals as well as other technical papers.

Vanessa Joy A. Timoteo, MSc

Science Research Specialist I, Food and Nutrition Research Institute, Department of Science and Technology, The Philippines

Ms Timoteo has been involved on several researches on nutrigenomics and has been invited as a presenter in a number of scientific conferences. Her primary research areas are biochemistry and molecular biology. She is also a Lecturer on Environmental Chemistry and Biotechnology at the Adamson University, Manila.

Joko Pambudi (Mr)

Researcher, Center for Public Health Research and Development, National Institute for Health Research and Development, Indonesia

Prior to his post at the National Center for Health Research and Development in Indonesia, Mr Pambudi has served as a Nutrition Programmer at the Health Office of the Purwakarta District. He has several publications in national journals focusing on the evaluation of nutrition programs and interventions in different population groups. Mr Pambudi has an extensive training and experience in food and nutrition planning and management at the national level.

Michael Fenech, PhD

Director/Team Leader, Genome Health and Personalized Nutrition Laboratory, CSIRO Food and Nutrition Laboratory, Australia

Prof Fenech has published numerous scientific papers in international peer-reviewed journals. His research works are highly cited and received international recognition for their scientific value. His primary research interest is to understand how environmental factors affect the integrity of the human genome at the chromosomal, telomere and mitochondrial DNA level. Prof Fenech is frequently invited in international conferences as a recognized, effective and visionary leader in breakthrough science in the fields of environmental and nutritional genomics.

Mary Ann R. Abacan, MD

Medical Specialist I, Institute of Human Genetics, National Institutes of Health, University of the Philippines Manila, The Philippines

Dr Abacan is also a Clinical Associate Professor at the Department of Pediatrics, College of Medicine, UP Philippine General Hospital. Dr Abacan has published scientific articles in national journals in health and has been invited in several national and international conferences. Her primary fields of expertise are on clinical research, healthcare management, epidemiology and public health.

Eduardo P. Banzon, MD

Senior Health Specialist, Sustainable Development and Climate Change Department, Asian Development Bank

Dr Banzon was the former President and CEO of the Philippine Health Insurance Corporation (PhilHealth). He also served as a Regional Adviser for Health Financing at the World Health Organization (WHO) and was the Senior Health Specialist at the World Bank for the East Asia Sector in Health, Nutrition and Population. Dr Banzon is also a faculty member of the University of the Philippines College of Medicine and the Ateneo de Manila University Graduate School of Business. Dr Banzon has championed the Universal Health Care Program in the Philippines and has long provided technical support to countries in Asia and the Pacific in pursuit of this goal.

Ahmed El-Sohemy, PhD

Associate Professor and Canada Research Chair in Nutrigenomics, Department of Nutritional Sciences, University of Toronto, Canada

Dr El-Sohemy is a member of the Health Canada's Science Advisory Board and Chief Science Officer of Nutrigenomix, Inc. Dr El-Sohemy obtained his PhD from the University of Toronto and completed his postdoctoral fellowship at the Harvard School of Public Health. His fields of expertise include biochemistry, bioinformatics, epidemiology, molecular biology, biochemistry, clinical research and genetic testing.

Lynette Ferguson, PhD

Professor of Nutrition, Auckland Cancer Society Research Centre and Discipline of Nutrition and Dietetics, Faculty of Medical and Health Sciences
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Dr Ferguson authored and co-authored several peer reviewed publications and chapters in books an articles in international journals. She also served on the Editorial Boards of various major international journals. Her expertise on genetic toxicology, environmental mutagenesis, and environmental carcinogenesis are translated into remarkable researches to better understand gene-diet interactions in the development of prostate and colorectal cancer and inflammation-related disorders.

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