# The Human Genome: Structure and Function

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The year 2001 will be remembered for many years as the year when the first drafts of the human genome sequence have been published. These reports are the results of an international collaboration supported by the human genome project that started worldwide in 1990–1991. Alternatively, the year 2001 should also be celebrated as a centennial after the rediscovery of Mendel's laws that introduced the concept of *"GENE"* as a control element of inheritable phenomena. The *"GENOME"* is also a concept of genetics introduced later as a set of genetic substances, i.e., genes that specify one particular organism such as human, mouse, yeast, and etc. In other words, genome is a set of genes that control various activities of cell survival and proliferation, and is inherited by the next generation through special mechanisms.

Today, we know that genes (then genomes) consists of a chemical substance called nucleic acid, DNA, that was first discovered over a hundred years ago, and its structure was determined by Watson and Crick about fifty years ago. Since then, the structure and function of nucleic acids have been the major target of molecular biology or molecular genetics. The complete determination of the genome sequence of humans and other organisms together with development of various technologies will clearly affect many fields of life sciences.

As an organic molecule, the DNA molecule is susceptible to various chemical reagents that may cause mutations in the DNA sequence. Chemical reagents also affect gene regulatory mechanisms through cellular processes. In this workshop, we will discuss on these topics starting from the structure of the human genome itself, which tells us a lot about ourselves, to the mechanisms of genomic functions.

# Response of Periphyton to Heavy Metals Resuspended by Dredging: An In situ Microcosm Bioassay Study

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Ponggol estuary located on the northeastern coast of Singapore is heavily impacted by anthropogenic activities such as reclamation, construction and shipping activities. Year-round fortnightly monitoring carried out from July 1999 to June 2000 for 5 types of heavy metals, viz., Sn, Pb, Ni, Cd and Cu, recorded very high concentrations in the particulate fraction and in sediments, when compared to the dissolved fraction in water. Intense dredging operations undertaken in the estuary is believed to resuspend the heavy metal rich sediments in the overlying water column. To ascertain this impact, in-situ microcosms were set up using periphyton, which is important in the overall carbon budget of an ecosystem. Periphyton settlement slides, left in the field for 3 days were retrieved and exposed to different concentrations of heavy metals, observed during the monitoring study. Changes in chlorophyll a concentrations, taken as the measure of periphyton biomass, were recorded over 3 days of samplings. Results from this experiment show drastic reduction in biomass of up to 95–100% for concentrations reported for the particulate fraction and sediments when compared to the control, indicating the impact of such high levels of heavy metals on the resident biological communities. Interesting results from this study suggest that periphyton can be used as a potential bioindicator of heavy metal pollution.

# Studies on Hazardous Chemicals along the Strait of Malacca and Their Ecological Effect

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The Straits of Malacca is one of the busiest straits in the world. It links the east and the west in terms of the transporta-

tion of manufactured goods, raw materials, oil and gas, and chemicals. Major industrial countries such as Japan, Korea, China, and other small countries are the main users of the straits. These shipping activities alone create great fears of chemical pollution in the strait in the event of accidents such as oil spillage. Besides its busy shipping operations, there are many human activities along the coastal and the inland areas. In the coastal areas activities such as industries, agriculture, marinas, and urbanization cause chemical pollution to the marine ecosystem. In the inland areas, transportation, industries, agriculture and urbanization also increase chemical pollution in the Strait of Malacca through erosion and leaching in river systems, which inescapably affect the coastal ecosystem. Inland anthropogenic activities also cause air pollution and this may adversely affect the Straits of Malacca through atmospheric deposition. The coastal ecosystem is an important source of marine resources such as fisheries and recreation. The majority of the Malaysian population lives in the vicinity of coastal areas and depend on fish products for their diet. Hazardous chemicals input into the ecosystem may disturb the quality of the products of fisheries and inevitably, human health. Since coastal areas are exposed to many kinds of hazardous chemical pollution, which may affect living organisms including humans, it is very important to study hazardous chemical pollution along the Straits of Malacca and their effects on the ecosystem, organisms, and human beings. Chemicals, that are known to contaminate the coastal environment and are generated by human activities such as industries and shipping activities, include heavy metals, hydrocarbons, dioxins, tributyl-tin, pesticides and nutrients. Some of the chemicals were studied in recent years but some of them were never reported in the coastal areas of Peninsular Malaysia. In terms of scientific studies, none of the chemicals were studied in detail in terms of their effects on the local ecosystem and organisms. There were some studies on heavy metals in relation to the development of bioindicators, accumulation in tissue, toxicity and ecotoxicological studies. A lot of research still needs to be done. In the next decade, all major potential hazardous chemicals mentioned above will be studied along the west coast of Peninsular Malaysia. The studies will cover all aspects of monitoring, ecotoxicology, physiology and potential effects to the ecosystems and human beings. The studies will involve the chemistry of the hazardous chemicals, the biology and ecology of organisms related to chemicals, the effects of the chemicals on organisms at an ecological, individual and molecular level. Chemicals such as endocrine disruptors will be emphasized.

# Toxic Contaminants in Coastal and Urban Areas in the Philippines

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To elucidate the distribution and toxicological impacts of persistent man-made chemicals in the coastal and urban areas in the Philippines, contamination by butyltins (BTs), organochlorine compounds (OCs) and heavy metals was examined in green mussels collected along the coastal and aquaculture areas of the Philippines in 1994–1997. Human breast milk samples collected from a dumpsite in Metro Manila in 1998 were likewise analysed for concentrations of organochlorine pesticides including toxic coplanar congeners, polychlorinated dibenzodioxins (PCDD) and polychlorinated dibenzofurans (PCDF). Residues in green mussels revealed significant BTs concentrations and widespread contamination along nearshore marine waters. Relatively high BTs concentrations were observed in samples collected from areas with high boating activities, suggestive that antifouling paints as the source of TBT (tributyltin). TBT levels were found to be low in green mussels collected from aquaculture areas, implying minimal usage of BTs for aquaculture activities. The composition of BT derivatives in mussel was in the order of TBT>DBT>MBT, reflective of continuous input of TBT in the coastal waters. Concentrations of OCs in green mussels were less than BTs and among OCs, PCBs concentrations were found to be relatively high particularly in mussels from Manila Bay. Moreover, metal concentrations found suggest that the anthropogenic loading of Hg, Pb and Cd to the coasts is relatively low. Organochlorine residue pattern in human breast milk was in the order of DDTs (PCBs≥CHLs≥HCHs≥HCB. Among the mono-*ortho* congeners, pentachloropbiphenyl IUPAC No. 118 was the most prevalent followed by IUPAC Nos. 156 and 105. Tetrachlorobiphenyl IUPAC 77 were the highest residue noted among the non-*ortho* congeners. Concentrations of mono-*ortho* congeners were about 2 to 3 orders of magnitude greater than those of non-*ortho* congeners and estimated TEQ concentrations in human breast milk samples ranged at 9.1–16 pg/g, fat weight basis.