



Chapter 9.

# Science and Technology Research



9



## Chapter 9. Science and Technology Research

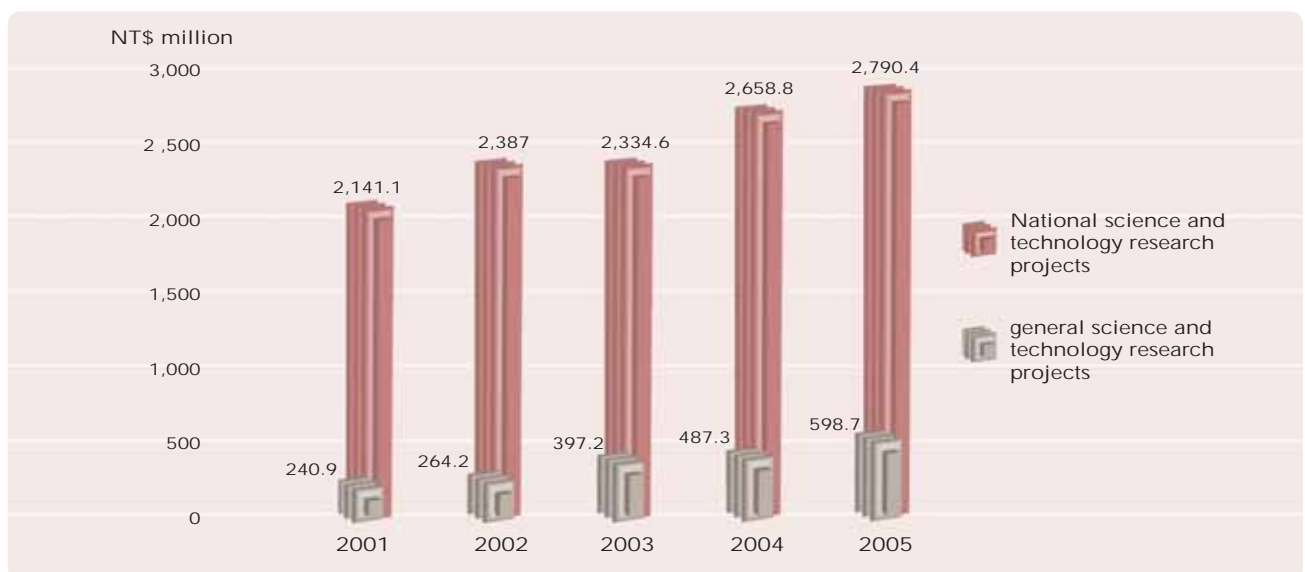
Bio-technology industries are the key point of national development; it is also the current trend of the world. The Department has attached importance to, and spared no efforts, on the development of bio-technology industries and health industries to upgrade the national standards of bio-technologies in health and medical care, and to improve international competitiveness. Success and failure in studies in genetic sciences, advancement of medical engineering, development of bio-information, clinical trial systems, and development of new medicines are key factors as to whether Taiwan can have a foothold on the international stage of bio-technology.

The development strategies of science and technology of the Department are in coordination with the health programs to plan for studies on bio-technology policies for health and medical care, to establish and integrate databanks of health and medical care, to set up core resources for the development of industries and science and technology research, to construct infrastructures and international cooperation mechanisms for the science and technology development of bio-

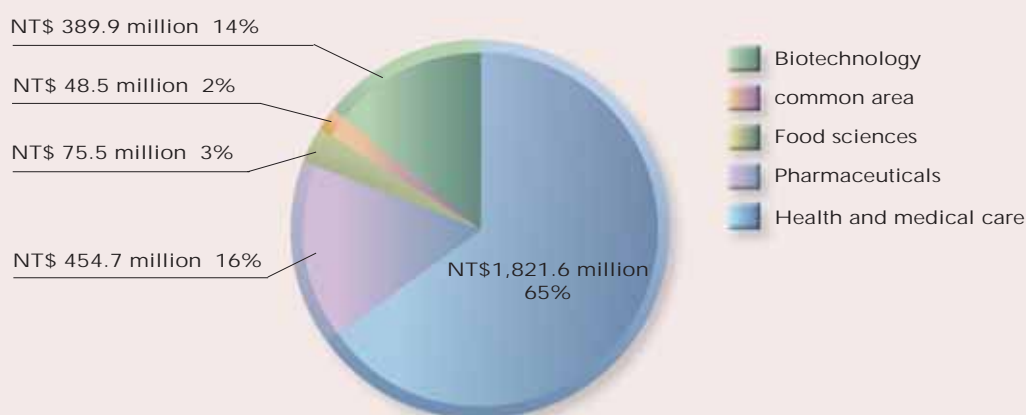
technology medicine and pharmacy, to strengthen development, recruitment and utilization of manpower in health and medical care and pharmaceuticals, to formulate relevant policies based upon evidence-science research, and thus to promote the national standards of health and medical care.

Funds appropriated for science and technology research by the Department (including affiliated organizations and the National Health Research Institutes) in 2005 amounted to NT\$ 3 billion 389.17 million; of which, NT\$ 598.74 million are for the national science and technology research projects, an increase of 22.8% over the NT\$ 487.30 million of 2004; and NT\$ 2 billion 790.43 million are for general science and technology research projects, and increase of 4.9% over the NT\$ 2 billion 658.8 million of 2004 (see Figure 9-1). By fields (not including national science and technology programs), the 2005 spending was NT\$ 1 billion 821.6 million for health and medical care, NT\$ 454.78 million for pharmaceuticals, NT\$ 389.92 million for bio-technology, NT\$ 75.54 million for food science, and NT\$ 48.51 million for general purposes. For allocation of funds by fields, see Figure 9-2.

Figure 9-1 Funds for Science and Technology Research in Health



**Figure 9-2 Allocation of Funds for General Science and Technology Research Projects**



The key points for the development of science and technology come generally in two categories, the national science and technology research projects, and the general science and technology research projects. They are illustrated as follows.

## Section 1. General Science and Technology Research Projects

The general science and technology research projects include research projects in the fields of health and medical care, pharmaceuticals, food science, and general purposes, and a plan for the development of a bio-technology island. Their key issues and achievements are as follows.

### 1. In the Field of Health and Medical Care

Research projects have been conducted on issues of malpractice in Taiwan, occupational rehabilitation and job placement for the mentally disabled, consanguinity of genetic diseases in the indigenous peoples, survey of the needs of women for mental health, models for the treatment, assessment and handling of family violence and sexual assault, investigation on risk factors such as occupational groups and depression and their effective control measures, control of depression and suicide in the elderly, investigation on issues of drug abuse and alcoholism, and investigation on the domestic and

international models of drug cessation and their trends. These research projects help in the construction of management framework for the indicators of patient safety in hospitals, establish factors affecting the employment of the mentally disabled and their assessment tools, promote the feasibility of the community-based screening of genes for the indigenous peoples, realize the importance of group therapy for victims of family violence and sexual assault, establish national standards for cessation to upgrade the quality of cessation for drug abuse, and establish indigenous assessment models for the dependency on and addiction to controlled drugs.

### 2. In the Field of Pharmaceuticals

Research projects have been conducted on issues of the construction of an environment for bio-technology pharmaceutical industries and their association with laws and regulations, planning and establishment of management systems for emerging bio-technology products, promotion of GLP and GCP and establishment of operational standards for clinical laboratories, study on the quality of medicines for use of the elderly at outpatient clinics and the interaction of certain potentially fatal medicines, release of prescriptions for repeated use for chronic diseases, supervision or preparatory work for the establishment of legal service units, management of medical devices, science and technology for the laboratory testing of abused drugs,

toxicity assessment and mechanisms of some commonly seen abused drugs, epidemiology of the prevention and control of hazards of drug abuse, modernization and internationalization of Chinese medicine and pharmacy, and research projects on the laboratory testing of drugs and cosmetics and their relevant laws and regulations. Substantial policy recommendations are made for changing the health habits and behavior of the people, and thus to improve their health and welfare.

### 3. In the Field of Food Sciences

Research projects have been conducted on: an integrated study of the relationship between diet, nutrition status and diseases and their related analysis methods, integration of the development of health foods, assessment of their effects and standards of products, assessment methods on health foods in the protection of cardiovascular functions, study on the management of genetically modified food products in the era of WTO and their related international laws and regulations, analysis of the quantity of acrylamide ( $\text{CH}_2\text{CHCONH}_2$ ) in deep-fried starch foods, and development of food analysis testing techniques. Based on research findings, a management system on the monitoring of national nutrition, a sound management system meeting international specifications for genetically modified food products, and a risk management system for food safety have been established. A labeling system for genetically modified food products and their relevant regulations have been developed. Drafts on the scope and quantity of use of additives in alcoholic beverages, and assessment methods for health foods in the protection of cardiovascular functions have been formulated.

### 4. In the Field of Disease Control

Databanks on the pathogenic agents of communicable diseases (such as drug-resistant strains), serum and related specimens have been established. Clinical and epidemiological information on the communicable disease reporting system, basic information of pathogenic agents, and genomic information of pathogenic agents have been integrated. A complete monitoring and diagnosis

system for communicable diseases has been set up to promptly know about and diagnose the attacks of emerging and re-emerging communicable diseases, and thus to improve laboratory testing capabilities for diseases to effectively control diseases. An exchange system for epidemic conditions and electronic information has been established to integrate and strengthen the disease monitoring network, and to assure the capabilities in meeting and mobilizing against disease outbreaks. On the basis of behavioral science studies, health education has been intensified to improve the capacity of the public in participating in the control of communicable diseases, and thus to make disease control a duty of all.

### 5. In the Field of General Purposes

- 1) Promotion and management of science and technology research for health and medical care: In total, 257 science and technology research projects in the fields of medical care, pharmaceuticals, health promotion, food sciences and disease control have been completed.
- 2) Management of the results of the science and technology research projects, their transformation into information, manpower development, holdings of international and regional symposiums, education and training and international cooperation have been implemented. In total, 34 international and regional academic symposiums have been held; 13 papers have appeared on international journals; three on-site verifications of research projects and three presentations of research findings have been conducted; 16 lectures on new information and 22 training courses for science and technology management personnel have been organized; and review for incentives for self-initiated research projects, and assessment of accomplishments of the DOH-affiliated research institutes (including the National Health Research Institutes) have been conducted.

### 6. The Bio-Technology Island Plan

Three special projects, the integration and establishment of the National Health Information Infrastructure (NHII), the establishment of the Taiwan

Biobank, and the establishment of a clinical trial and research system have been promoted to establish Taiwan as a regional center for genomic medicine research and also a human clinical trial center, and at the same time, to bring the superior information technologies of Taiwan into the areas of bio-technology to make Taiwan an outstanding island of bio-technology.

## Section 2. National Science and Technology Research Projects

The national science and technology research projects include the disaster prevention and rescue medical care system, genomic medicine, bio-products, bio-technology in agriculture, and digital learning in medicine. Their key issues and achievements are illustrated as follows.

1. Disaster Prevention and Rescue Medical Care System: An air emergency disaster control and rescue medical care system has been established and integrated; standard operational procedures for electronic-ambulances have been developed; and training curricula of medical care function-based emergency care and rescue and models for the adequate development of training centers have been set up. In addition, the emergency meeting models of the overall medical care institutions when facing major outbreaks such as terrorist attacks, and emergency medical care systems in meeting biological disasters, toxic chemical and nuclear disasters, and aviation accidents have been developed.
2. Research in Genomic Medicine: Genomic study and their clinical application for major diseases such as lung cancer have been conducted. A gene information databank for pathogenic agents has been set up. Genomic-related studies of Chinese medicine and pharmacy have been conducted. A strict assessment and review mechanism for the clinical trials of genomic medicine and their related products has been established.
3. Research on Bio-Products: A plan for the clinical trial of 10 Chinese herbal medicines, and a plan for the clinical trial of two western medicines have been conducted. A supervisory mechanism on exploratory clinical trials and interpretation of clinical studies has been set up. A monitoring /auditing mechanism has been set up to strengthen regulations for the good clinical trial of pharmaceuticals.
4. Research on Bio-Technology for Agriculture: A safety assessment mechanism meeting the GLP specifications, and standards of laboratories and their management regulations have been established and strengthened. In coordination with the Council of Agriculture, field experiments for the genetically transformed species have been approved. Assessment of the safety of foods is conducted to establish a Taiwan-developed model for assessment of the safety of genetically modified food products.
5. Research on Digital Learning in Medicine: Through the planning of an integrated organization, by using information technology, and together with medical centers, medical associations and professional digital learning enterprises, health and medical care resources and information professionals are integrated to use multi-media computers and the Internet information technology, to systematically establish digital learning curricula for some common chronic diseases. People can, under restrictions of time and space, learn online to gain knowledge of disease prevention, and to reduce chances of getting chronic diseases. At the same time, they can help patients of chronic diseases and their families care for themselves. Pluralistic channels of learning with high-quality are also provided to professional medical personnel.

## Section 3. Research of the NHRI

Results of research in health and medical care lay a strong foundation for the prosperity and competitiveness of a nation. The NHRI (National Health Research Institutes), since the establishment in 1996, through the promotion of mission-oriented research, has enhanced the development of science and technology in health and medical care, and also

the development of medical research manpower, and thus to upgrade the bio-technology and medical technology of the country, and the medical and pharmaceutical industries as well. Their research findings have also provided assistance to the government in formulating health and medical care policies most applicable to local conditions. Key issues of their research and achievements are illustrated as follows.

### 1. Promotion of Research on Major Diseases

- 1) To improve the standards of cancer cure, the first National Cancer Clinical Trial Research Center was established. The Center has cancer clinics and collaborative clinical research wards. Through the Taiwan Cancer Clinical Research Cooperation Organization, cooperation and exchanges between medical centers are promoted, and large-scale international pharmaceutical manufacturers are invited to conduct together clinical trials of new medicines.
- 2) The third stage clinical trial on the post-operation treatment with interferon for lung cancer, and the second stage clinical trial on the use of Taxol and UFT/AV for the cure of late-stage stomach adenocarcinoma have been conducted. The first stage clinical trial on the administration of Gencitabine and Oxaliplatin every two weeks and high-dosage injection of 5FU/LV in 48 hours for the cure of late-stage pancreas cancer has been completed. Participation in several new clinical trials has also been made with a hope to make contributions to the cure of some common cancers in Taiwan.
- 3) A laboratory for the testing and study of viruses has been set up. It has been discovered that HA and NA genes come separately from the B-type influenza virus reorganized from the Victoria and Yamagata sub-types, to become, for the year, the mainstream of the outbreaks of B-type influenza in southern Taiwan. It has also been disclosed that the influenza in Taiwan is two years ahead of the WHO vaccine strains. This finding is most important to the development of vaccines in Taiwan. Research findings are shared with relevant disease control institutions, the infection control and pediatrics departments of regional and district hospitals, medical care institutions, and the Center for Disease Control of the Department, for reference.

- 4) Studies focusing on the specific occupational diseases in the industrial zones of Taiwan and diseases caused by environmental pollution including dioxin, PCB, heavy metals and arsenic have been conducted. At the same time, research projects related to health risk assessment have been conducted. By using the established risk assessment models, the issue of beef imported from the US has been analyzed in a detached and professional manner and recommendations are made to let the public know more about the issue concerned.

### 2. Research in Medical Technology and Pharmaceuticals for the Development of New Products and Techniques

- 1) Molecular and genomic medicine research: Core facilities for genomes have been established; various key techniques have been developed; and the Applied Taiwan Genotyping Consortium (ATGC) has been set up. Sequencing study for patients who have not received treatment of Gefitinib has been conducted to find that the gene mutation of lung cancer patients is related to the efficacy of Gefitinib. The first laboratory capable of conducting chromogenic *in situ* hybridization (CISH) has been established to provide laboratory testing services to detect MYCN gene amplification in neuroblastoma.
- 2) Research on bio-statistics and bio-information: Through strict principles of statistical design and analysis, and the most advanced research information management system, action has been taken to promote Taiwan's research standards in bio-medicine. Ongoing projects include design and supervision of clinical trials, establishment of statistical methods for bio-pharmaceutical products, development of bio-information databanks and by using statistical models, to construct a framework for national health surveys

and a coordination center.

- 3) Research on bio-technology and pharmaceuticals: Facilities for the development of new drugs have been integrated; a laboratory for pharmacokinetics and pharmacogenetics has been set up. Participation in various projects has been made to assist in the selection of potential chemicals to serve as a basis for the further preclinical selection.
- 4) Research on medical engineering: Studies have been conducted on artificial cardiac valves, analysis of ultrasound tissue images, blood kinetics, non-invasive body surface Laplacian ECG mapping system, reconstruction of three-dimensional PET images, molecular images of cardiovascular diseases, development of position emission tomography reporter gene, mechanism of atherosclerosis, and promotion of the innovative MRI.
- 5) Research on nanometer medicine: Nano-particles and optical fiber technology have been successfully linked. By using medically associated detection, a set of quantifying standards for permeability has been set up. By the assessment of blood vessel permeability of various tissues under different physiological conditions, some important parameters can be provided for the transmission systems of pharmaceuticals in the design or relevant clinical medical information.

### 3. Research on Health Policies and Health Promotion Systems

- 1) Research on health policies: The goal is to set up a national collaborative network for research on health policies. Several important studies have been completed. For the national health surveys and their databanks, reports for the mountain areas and offshore islands have been completed; information collected from interviews and their link with information of the National Health Insurance have been analyzed to understand the medical care behavior of the people, and accidents and injuries. Findings have been submitted to organizations concerned for reference in the formulation of policies. In the studies on the control of tobacco hazards, 13 papers on Taiwan's tobacco hazards control policies and epidemiology have been compiled in one volume, the Taiwan Supplement, by the international journal, Tobacco Control. These studies should serve good examples for the evidence-based studies of health policies. A joint care network in community for diabetes has been set up; and a long-term monitoring plan has been implemented to establish indicator norms for the blood sugar, hemoglobin A1C, blood pressure and blood fat of diabetes patients for the reference of patients in the control of diabetes.
- 2) A publication, Planning for the Long-Term Care Financial System, has been published to study from various angles requirements for the establishment in future of long-term care financial systems. Studies on the development of physician research manpower recommend that the professional development of physicians should come in two areas of research and clinical practice, to allow physicians of interest in research to fully devote to research work, and at the same time, to encourage them to become involved in research. Studies on the development of specialist registered professional nurses recommend that the Department set up a Specialist Registered Professional Nurse Advisory Committee to be responsible for the systematic planning for a specialist registered professional nurse system in Taiwan; and that a set of regulations governing the classification, selection and review of specialist registered professional nurses be formulated to serve as a legal basis for hospitals in the training, selection and review of specialist registered professional nurses.