



Infectious Diseases Prevention and Control

China is a big country with huge regional differences in social economic development. The large population, high population density and mobility, as well as significant regional differences in life style make infectious diseases a major threat to China. With strong outburst and fast spread, infectious diseases are also more difficult to control in China. So China has to stick to a strategy which emphasizes both prevention and therapy in infectious disease control.

With open door policy, increasing commodities trading and people exchange with other countries, China will also face growing challenges of infectious diseases especially new and severe infectious diseases originated outside of China. An outburst of highly contagious flu or other fulminating infectious diseases will be a serious setback in China's strives to become a modern country.

7.1 Goals

Short-term goals (2010–2020): (1) establish a nation-wide surveillance and early warning forecast system for infectious diseases, which consists of State Centers for Disease Control and Prevention (CDC), hospitals and research institutions; (2) to establish a national high-level bio-safety laboratory network system and a national resource center and management system of bacteria (virus) strains; (3) develop rapid, sensitive, high-throughput detection technologies and methods for important infectious pathogens. In addition, China will also carry out basic and applied research for important infectious diseases in order to make breakthroughs in the research of etiology and pathogenesis, pathogens-host interaction, mechanism of cross-species spread, animal models, as well as the mechanism of drug-resistance of pathogenic microorganisms, vaccines and antiviral drugs. We would develop methodologies and technologies to reduce the infection rate and mortality of hepatitis, AIDS, and tuberculosis and establish public health emergency and anti-biothreats system with Chinese characteristics.

Medium-term goals (2021–2030): (1) improve the surveillance and early warning forecast system for infectious diseases and establish the high-level biosafety laboratory network and biosafety management system with regional nodes; (2) carry out a wide range of basic research for important infectious disease epidemiology and pathogenology systematically; (3) elucidate pathogen-host interaction and pathogenesis as well as the mechanism of cross-species spread, and (4) develop vaccines and antiviral drugs for infectious diseases including AIDS, tuberculosis, hepatitis C and influenza successfully. Establish prevention, control and biosafety network for emerging and re-emerging infectious diseases.

Long-term goals (2031–2050): (1) establish a value chain linking basic research, vaccine development and clinical diagnosis; (2) elucidate the pathogenesis of important infectious disease pathogens, the mechanism of cross-species spread, the mechanism of virus genetic variation and individual differences in susceptibility and the mechanism of immune response and immune tolerance; (3) prevent the spread of HIV and other emerging infectious diseases effectively, reduce the morbidity and mortality of infectious diseases by developing individualized infectious disease prevention and control technology as well as wide range immunization among new-born and high-susceptibility population significantly; (4) establish prevention, control and biosafety network for emerging and re-emerging infectious diseases.

7.2 Tasks

In order to effectively control the outburst and wide-spread of important and server infectious diseases, reduce the morbidity and mortality of important infectious diseases as well as put the disease prevention-focused strategy into effect, China is determined to develop rapid, sensitive and high-throughput testing and monitoring techniques for infectious diseases and emerging infectious diseases; we will establish nation-wide surveillance and early warning system for infectious diseases and carry out molecular epidemiological study of important infectious diseases to determine the distribution and natural evolution of important pathogens as well as the relationship with environmental factors; in addition, China will also establish a biosafety laboratory network system with regional nodes and an independent biological resource center for infectious bacteria (virus) strains; we will emphasize the studies on etiology, animal models, dissemination and infection mechanism for key infectious diseases like hepatitis and AIDS, virus-host interaction as well as mechanism of cross-species spread of animal-derived pathogens and the drug-resistance mechanism of clinical microbial pathogens; China will also carry out of the studies on the endemic infectious diseases, including tuberculosis and schistosomiasis for the prevention and treatment, and the immune response mechanism of key and emerging infectious diseases. The country will launch

research and development for innovative vaccine vector construction and new immunization strategy, set up the anti-viral drugs and vaccines screening and developing platforms for major pathogens, conduct research and development on small molecule compound drugs, peptide drugs, as well as therapeutic vaccines for viral and bacterial diseases; we would also establish a national antiviral drugs and vaccines reserve system for important infectious diseases.

7.3 Technologies

7.3.1 High-level Biosafety Laboratory System and Related Technologies

To establish a biosafety laboratory system with regional nodes and biosafety management system in accordance with international standards; to conduct the studies on development the technologies and equipments for personal protection sterilization, sealing and maintenance, as well as system integration of key equipments in an effort to improve the operation and maintenance of biosafety laboratory.

7.3.2 Efficient Screening System and Diagnostic Techniques

Set up a rapid, sensitive and high-throughput test and molecular diagnosis technology depend on nucleic acid or protein of pathogen and antibody; to develop new rapid detection method based on gene chip, protein chip and genomics technology; to establish cell lines, pathogen separation systems and micro-observation system which are helpful to pathogens isolation; to establish and continuously improve the databases for infectious pathogen genes, proteins, fingerprinting maps, pathogen epidemiology in order to provide reliable and comprehensive technical support to infectious disease screening, diagnosis, and pathogenic mechanism study.

7.3.3 Animal Models for Important Infectious Pathogens

Develop animal models for dengue virus, HIV, hepatitis C virus infection by improving existed animal model and exploring China's unique resources; to establish animal models for new emerging infectious diseases via new technologies such as stem cells, gene knockout and knock in for vaccines and drugs development.

7.3.4 Key Technology in the Studies on Infection Mechanism for Important Pathogens

To establish infectious cDNA clones, reverse genetic system, as well as the rapid, high titer pseudotyped virus packaging system for avian influenza virus, SARS corona virus, Japanese encephalitis virus and West Nile virus; to develop functional genomics and proteomics research technology for important

pathogens such as Kaposi's sarcoma virus, cytomegalovirus and other large DNA viruses, as well as *Mycobacterium tuberculosis* and human - *Streptococcus suis*.

7.3.5 New Technologies for the Development of Drugs and Vaccines

Set up drug screening model and comprehensive drug library for important pathogens from computer molecular simulation, molecular identification to *in vivo* cell and animal infection; to develop new nucleoside and non-nucleoside drugs targeting reverse transcriptase of HIV and HBV, and innovative peptides or small molecule compounds against invasion and replication of the Japanese encephalitis virus, hepatitis C virus, influenza virus, *etc.*; to develop genetically engineered vaccines against hand, foot and mouth disease virus (EV71, *etc.*) and rotaviruses from infants and children with diarrhea, subtype-specific or region-specific prevention or therapeutic vaccines against AIDS, vaccines for human against infectious diseases originated from animals such as avian flu virus and new anti-tuberculosis vaccines.

7.3.6 Clinical Patient Typing Technology Against Infectious Diseases

To establish database for infectious bacteria (virus) strains, clinical samples and information; to conduct clinical typing of patients suffering from infectious diseases via molecular biology technologies as well as meta analysis of pathogenesis mechanism of infectious diseases; to conduct clinical and animal model studies targeting different types of patients in order to provide characteristic treatment for different types of patients as well as provide clues for the development of new drugs and vaccines.

7.4 Roadmap

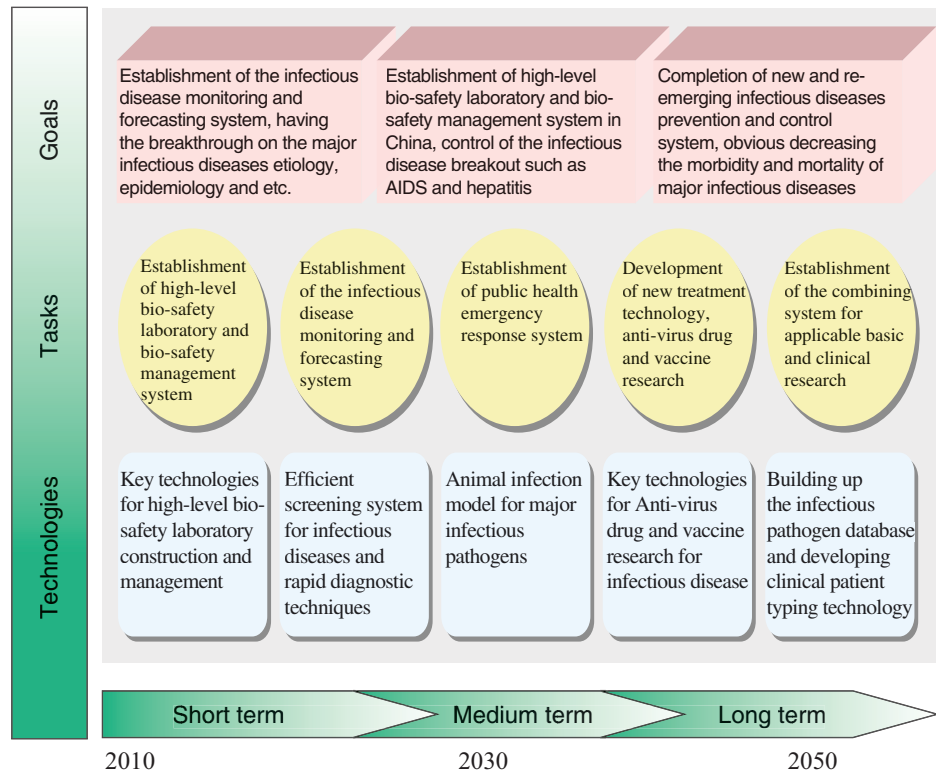


Fig. 7.1 S&T roadmap on prevention and treatment of infectious diseases and biosafety