College of Basic Medical Sciences
Transforming the Future of Education and Research

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Message From The Director

This booklet, produced by Science/AAAS and sponsored by the College of Basic Medical Sciences (CBMS) of the Third Military Medical University (TMMU), PLA in China, highlights the 20-year history of the college’s scientific and educational development. To provide the international scientific community with a clear and comprehensive overview of these accomplishments and plans for the future, this booklet takes a collective look at CBMS’ research plans and priorities, educational innovations, and “International Talents” program that has been set up to attract researchers from around the world to help solve some of our most serious global health issues.

Ensuring the safety and security of human health is a critical issue impacting the global community and a top priority for CBMS. A newly published report from the World Health Organization entitled “Global Health Risks” indicates that turning our current medical interventions into effective and well-grounded treatments for the global community will take a concerted effort from many different countries around the world. Among them, China, as the largest developing nation, must play a vital role. The Chinese government is now implementing a national strategy to support innovations in medical science and technology. Over the past 20 years, Chinese investment in medical sciences has been nearly doubling every five years.

As an important research- and teaching-oriented center of TMMU and a National Key University in China, CBMS is dedicated to pursuing research in the basic medical and life sciences, to developing new innovations in medical education, and to attracting and cultivating talent from around the world. After more than two decades of progress, CBMS is now among the top basic medical science colleges in China.

CBMS is committed to promoting international collaborations and exchanging ideas with researchers from around the world. To that end, we intend to establish an internationally educated team of faculty, to educate our students using internationally recognized standards, and to establish collaborative research projects with scientists and clinicians at institutions overseas.

We are dedicated to developing scientific exchanges with researchers from other countries, establishing systems to jointly train young scientists, including undergraduates and graduates. Our research facilities are open to the international science community, and we welcome research collaborations between our scientists and researchers abroad as well as with clinicians who are focused on bench-to-bedside research and professionals working in the technology transfer industry.

I want to thank Science/AAAS and my colleagues for their efforts in putting together this project, which has enabled the timely publication of this booklet.

Yuzhang Wu
Director, CBMS
Growing Basic Research

CBMS operates in the fertile valley in southwestern China and has a population of more than 30 million people. It is also home to the highly regarded Third Military Medical University (TMMU) and the College of Basic Medical Sciences (CBMS). Over the past 20 years, CBMS has become known for its groundbreak- ing basic research and innovative medical education. Founded in 1992, CBMS has morphed from a simple teaching unit into a powerhouse of medical research and scientific training. In 2011, when Yuzhang Wu be- came the director of CBMS, the institution began another transformation, through which “research-based education” would become a cornerstone of the institution’s mission.

Revolutionizing Education

CBMS is also introducing innovative teaching strategies into the rigid medical education system. “In addition to the textbook knowl- edge required for board exams, we encourage critical thinking from our undergraduate students,” says Wengang Xiao, associate director of education at CBMS. Wu has tasked the institution with providing a “research-based educa- tion.” Wu has implemented a number of programs to boost students’ re- search skills and critical thinking ability, including journal clubs and inter- disciplinary co-mentors.

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Faculty Training

In his view, the gap between graduate training in China and in the West is even wider than that of undergraduate education. Many graduate students in China have simply been taught about repetitive experiments, rather than scientists in training. His gradu- ate education reform aims to change this by implementing new strat- egies. Within the new paradigm, graduate students will be expected to independently identify important questions in their field of interest and then address these questions using logical reasoning and up-to-date information from the scientific literature rather than from textbooks.

Wu believes that a shortage of research-focused educators contrib- utes to the lack of this type of education, highlighting the need for bet- ter teacher training to raise the standard of education. He encourages CBMS faculty to not only focus on writing scientific research papers but also to develop teaching strategies and publish their experiences in education-oriented journals.

In his first two years, Wu has made great strides in steering CBMS toward becoming an international center with a talented faculty, robust research output, and world-class scientific training. Already, CBMS has

Introducing CBMS: Leading Medical Research and Education for 20 Years

The director of CBMS has grand visions for the faculty. As a trained immunologist and a pioneer of epitope-based ra- tional vaccine design, Yuzhang Wu has had a successful re- search career. He is a winner of the National Outstanding Youth Science Fund and is the holder of the first National Outstanding Young Science Foundation. He has been a pioneer of epitope-based rational vaccine design and has made significant contributions to the field of immunology.

CBMS is a leader in the field of immunology and has a strong research focus on vaccine development. As a result, the faculty has made significant contributions to the field of immunology. The director of CBMS has grand visions for the faculty. As a trained immunologist and a pioneer of epitope-based rational vaccine design, Yuzhang Wu has had a successful research career. He is a winner of the National Outstanding Youth Science Foundation and is the first National Outstanding Young Science Foundation. He has been a pioneer of epitope-based rational vaccine design and has made significant contributions to the field of immunology. CBMS is a leader in the field of immunology and has a strong research focus on vaccine development. As a result, the faculty has made significant contributions to the field of immunology.

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State Key Discipline: At the Front Line of Immunology

The Institute of Immunology at CBIMS leads basic and applied immunology research for the armed forces of China. More importantly, it is designated a State Key Discipline (SKD) and is therefore eligible to receive direct government funding. Scientists at the institute focus on cutting-edge topics—from understanding the mechanisms underlying early immune responses to developing new vaccines.

Understanding and Harnessing Immune System Responses

The body’s immune response is a complex process. The Institute of Immunology has brought together scientists with research interests in understanding the cellular and molecular mechanisms underlying immune function. By studying how the immune system recognizes and responds to pathogens, researchers at CBIMS are working to unravel the critical mechanisms that underlie disease.

One of the most serious chronic infections in China is hepatitis B. It is estimated that a third of the world’s population is infected with the hepatitis B virus (HBV). Meanwhile, the CVHP, a virtual human project, is the largest virtual human dataset in the world. CVHP has a number of notable advantages over other virtual human projects. For future applications of CVHP, Zhang explains, they are looking at using the dataset in conjunction with 3-D printing technology to create 3-D printed models of the human body. These models can be used for a variety of applications, from surgical planning to medical education.

Cultivating New State Key Disciplines: Modernizing Basic Medical Sciences

At TMU, the faculty of CBIMS is responsible for the university’s basic medical education, which begins with anatomy and histology lessons. However, CBIMS educators go beyond textbook lessons and incorporate their own research into classroom learning. Some of the noteworthy projects being used for medical education at CBIMS include the world’s largest virtual human project, blood vessel engineering, and nervous system development research. As a result of this high-quality research, the Department of Anatomy and the Department of Histology and Embryology are poised to become the next State Key Disciplines at CBIMS.

Developing cutting-edge technologies and new therapies is important to many CBIMS researchers. For example, Zhiren Zhang, head of the institute, is working on advancing cutting-edge topics—from understanding immune responses to other pathogens to developing new vaccines.

Innovative approaches to medical education at CBIMS include the use of virtual human projects, which are used for medical education at CBIMS, but are also supporting the Department of Anatomy and the Department of Histology and Embryology in their quest to become State Key Disciplines.
and Technology Progress once.

Finding transmission-blocking vaccines or creating a transgenic mosquito that is immune to infection. Researchers have tried to develop efficacious malaria vaccines; however, there has been a lack of new drugs, insecticide replacements, and effective methods for controlling malaria have been diminishing and there is currently a need for new approaches.

Professor Fusheng Huang

Fusheng Huang is a member of the Chinese Insect Society Council, China Animal Society, and Chinese Agricultural and Parasitic Professional Committee. Huang’s research currently focuses on the relationship between mosquitoes and the malaria parasite. Because the effectiveness of current methods for controlling malaria has been diminishing and there has been a lack of new drugs, insecticide replacements, and effective vaccines, Huang is developing new strategies to control the spread of malaria by attempting to interrupt parasite transmission from the mosquito vector. Huang’s team is investigating the mechanisms underlying the mosquito’s own defenses against the Plasmodium parasite and innate immune function, with the ultimate goal of laying a foundation for finding transmission-blocking vaccines or creating a transgenic mosquito that is immune to infection.

Huang has authored more than 80 published papers and has been awarded the Third Prize of National Science and Technology Progress Award once, the Second Prize of Military Science and Technology Progress five times, and the Second Award of Chongqing Municipal Science and Technology Progress once.

WENYUE XU

Wenyue Xu HEAD, DEPARTMENT OF PATHOGENIC BIOLOGY

Professor Wenyue Xu’s research focuses on malaria and the mechanisms underlying the protective immunity induced by administering attenuated sporozoites and whole-killed blood-stage malaria vaccines as well as on identifying the genes responsible for the different virulence phenotypes of malaria parasites. Researchers have tried to develop efficacious malaria vaccines over the past 50 years to no avail. Instead, irradiated or genetically attenuated sporozoites and whole-killed blood-stage vaccine vectors are regarded as the most efficient malaria vaccines; however, the mechanisms underlying how these vaccines work is still largely unknown. Recently, Xu and his fellow researchers discovered an essential role for the complement in the induction of optimal malaria-specific CD4+ T cell responses induced by whole-killed blood-stage vaccines. Xu’s group also provided the first evidence that sporozoite-inactivated Toll-like receptor 2 (TLR2) activation could significantly suppress the pre-erythrocytic stage of infection. The team now plans to investigate TLR2’s role in the regulation of the protective immunity induced by genetically attenuated sporozoites.

In addition, Xu’s group focuses on identifying the genes responsible for the different virulence phenotypes of malaria parasites. His team has worked in collaboration with Xin-zhan Su, chief of the malaria functional genomics section at the U.S. National Institute of Allergy and Infectious Diseases, to construct a high-resolution linkage map for Plasmodium yoelii and has identified a major locus linked to the virulence phenotype of P. yoelii. This group is now investigating the genes involved in a specific complex, cerebral malaria, sometimes seen in individuals infected with the parasite.

FUQUAN HU

Fuquan Hu PROFESSOR, DEPARTMENT OF MICROBIOLOGY

Professor Fuquan Hu studies the genomics and genetics of the most abundant organisms on earth, bacteriaophages. Bacteriophages have co-evolved with phages and host bacteria and are candidates for treating bacterial infections, especially multi-resistant bacteria. However, the use of bacteriophages as antibacterials is limited by the narrow range of hosts with which they can interact. Hu and his team are dissecting a number of different phage genomes to identify the function of the genes. His group hopes to be able to alter the phage genome to extend the host range of bacteriophages, with the ultimate goal of laying a foundation for phagotherapy.

Hu is an executive member of the China Microbiology Society (CMS), chairman of the CMS Microbiology & Immunology Branch, and the chair- man of the board for the Chongqing Microbiology Society. He has been awarded numerous scientific grants over the last 20 years, including nine from the National Natural Science Foundation of China, two from the Science and Technology Funds of Chongqing City, two from the Science and Technology Foundations of the Army, two from the National High-

Advances in imaging techniques made over the past decade have enabled scientists to conduct critical neuroscience experiments, such as monitoring the activity of multiple neurons in live animals simultaneously and determining their subcellular components. Recently, Chen, together with Arthur Konnerth at TUM, has developed a method to control image dendritic spine function in vivo. In close collaboration with Konnerth, researchers at the center are further developing such optical techniques and are aiming to construct six integrated imaging systems with the generous startup funds they received from TMMU. In addition, the center’s researchers plan to extend their research focus from rodents to nonhuman primates, with the aim of elucidating higher mammalian brain functions using high-resolution imaging. The center plans to house 100 marmosets to help achieve this goal. In addition, the center is now accepting applications from Chinese and international scientists for six new principal investigator positions.

YING XIANG

Ying Xiong HEAD, DEPARTMENT OF NEUROBIOLOGY

Professor Ying Xiong’s research focuses on understanding the synaptic and cellular mechanisms underlying auditory information processing and plasticity in the brain. Currently, his lab is interested in understanding the neural circuits in the thalamus and auditory cortex. By combining a number of techniques, including in vivo whole-cell recordings, intracellular record- ings, intrinsic signal optical imaging, immunohistochemistry, and optogenetics, Xiong hopes to visualize the neural circuits that are activated during hearing-related behavior and cognitive functions. The medial geniculate body (MGB) gates the ascending auditory inputs to the cortex. Under the generous startup funds they received from TMMU, Xiong’s group investigates the cellular mechanisms underlying activity in the primary auditory cortex, which is recorded while an acoustic stimulus is presented to a rat and an electrical recording from the MGB is applied. Recently, Xiong’s team has found that low-frequency stimuli enhanced the amplitud e of sound-evoked excitatory postsynaptic potentials in auditory cortex neurons, whereas high-frequency stimuli depressed these auditory responses.

The balance between excitation and inhibition is important for the maturational process of cortical function; yet few studies have addressed the
resulted in a number of scientific findings, such as the importance of
equilibrium to different external cues, and how they are able to coexist in the same
investigates how these cells are activated and differentiated in response
homeostasis and to repairing tissue damage after injury. Yang’s group
TIAN YANG
PROFESSOR, DEPARTMENT OF PHYSIOLOGY
Professor Tian Yang’s group has studied skin biology for over 20 years. The epidermis and hair follicles periodically undergo re- generation, a process depen- dent upon resident adult skin stem cells. These stem cells, including the hair follicle stem cells and melanocyte stem cells, are essential to maintaining skin
homeostasis and to repairing tissue damage after injury. Yang’s group investigates how these cells are activated and differentiated in response to different external cues, and how they are able to coexist in the same environment.
YUN BAI
HEAD, DEPARTMENT OF MEDICAL GENETICS
Yuan Bai’s lab has funded for 27 different projects from founda- tions on the provincial, ministerial, and national level. This funding has resulted in a number of scientific findings, such as the importance of canonical Wnt signaling and non-canonical Wnt signaling in the regula- tion of hair follicle growth, the relationship of Gudam3 to the hair fol- licle cycle, Wnt7a inhibition of melanocyte proliferation and activation of malan synthesis though upregulation of the microphthalmia-associated transcription factor, and the establishment of a repertoire of mouse melano- cyte progenitors that retain melanogenic potential.
JIN YANG
HEAD, DEPARTMENT OF CELL BIOLOGY
Professor Jin Yang has devoted her scientific career to explor- ing the molecular mechanisms underlying genomic instability and tumorigenesis. The main- tenance of genomic integrity depends upon a coordinated DNA damage response. The integrity of the DNA dam- age repair and cancer predisposition. They have studied the signal trans- duction and regulation of the DNA damage response to elucidate the mechanisms underlying chromatin remodeling, cell cycle regulation, DNA repair, and apoptosis. Yang’s studies have revealed that defec- tive Xeroderma pigmentosum genes and translation DNA polymerases are associated with cancer progression and multidrug resistance, in- formation she hopes will be useful for investigating cancer biomarkers and therapeutic targets. Yang’s group is currently focused on exploring whether the DNA damage response plays a role in the areas of can- cer genetics, including the generation of cancer stem cells, cellular senescence and aging, and the maintenance of self-renewing adult stem cells.
FENGQIAN HE
HEAD, DEPARTMENT OF BIOCHEMISTRY AND MOLECULAR BIOLOGY
Professor Fengqian He is the board chairman of the Chong- qing Chinese Society of Biochem- istry and Molecular Biology and vice-chairman of the People’s Liberation Army Biochemistry Committee. His research fo- cuses on the functional mecha- nisms of nuclear receptors, es- pecially for retinoid X receptor (RXR) heterodimers such as FXR, LXR, and PPARy. Over the last eight years, he has identified 10 novel target genes of nuclear recep- tors including SR-B1, ET-1, thrombomodulin, HMBQ1, SOCS3, CISH, A2AR, BAFF, SARI, and FOXO1. These genes have been associated with many different cardiovascular diseases, inflammatory diseases, and cancers. Moreover, he’s lab has demonstrated that several noncoding RNAs (such as miR421, miR137, miR1, miR206, miR613, and tRNA Gas 5) are involved in the regulation of nuclear receptors. These findings may pave the way for developing novel therapeutics that target nuclear receptor-associated signaling pathways. He’s group has established a repertoire for preparing and characterizing a glutamate-induced complex that modulates the activation of neurotroph- in and an inflammatory induced cytokine release, determining whether the pro- or anti-inflammatory response is initiated after TBI or ALI. There are several key functions of neutrophils which have yet to be elucidated, such as how neutrophils cross the blood-brain barrier after a brain injury, and how neutrophils affect the function of neurons. Being deeply ab- sorbed in these scientific questions, Dai’s lab aims to further investigate
qiang Dai specializes in inflam- mation research. Her interests
focus on the functional mecha- nisms of nuclear receptors, es- pecially for retinoid X receptor (RXR) heterodimers such as FXR, LXR, and PPARy. Over the last eight years, he has identified 10 novel target genes of nuclear recep- tors including SR-B1, ET-1, thrombomodulin, HMBQ1, SOCS3, CISH, A2AR, BAFF, SARI, and FOXO1. These genes have been associated with many different cardiovascular diseases, inflammatory diseases, and cancers. Moreover, he’s lab has demonstrated that several noncoding RNAs (such as miR421, miR137, miR1, miR206, miR613, and tRNA Gas 5) are involved in the regulation of nuclear receptors. These findings may pave the way for developing novel therapeutics that target nuclear receptor-associated signaling pathways. He’s group has established a repertoire for preparing and characterizing
In recent years, many Chinese universities have significantly stepped up their efforts to bring their science to the international stage. CBMS is one such institution that has been implementing strategies to become more competitive in the global arena. In the last two to three years alone, CBMS has seen an uptick in bidirectional global connections, but staying competitive means being able to recruit a top-notch faculty both locally and abroad.

Helping achieve this talent recruitment goal is China’s “Go West” strategy, which has been encouraging economical, educational, scientific, and technological developments in the country’s western region and providing policy and funding support over the last decade. Given this increased focus on the West, Chongqing—the largest city in China—is poised to become a new center of international outreach.

Professor Xiaowei Chen, who graduated from CBMS several years ago and recently returned from his postdoctoral training at the Technische Universität München in Germany to be the head of the Brain Research Center, says the livability of Chongqing compared with Beijing or Shanghai, “especially in the era of the Internet and frequent air travel,” is particularly impressive by the leadership at CBMS and TMU. “The director of the college works harder than us,” he says. “We can bring bureaucratic issues, such as difficulties navigating complicated procedures, directly to him,” and he provides strong support to young investigators at TMU, says Zhou. “Once he replied by e-mail after midnight, and my problem was resolved before the next day started,” he explains. CBMS has also set specific recruitment goals to help strengthen its faculty. “We want [to recruit] junior-level talent who are not afraid of challenging the existing paradigms and exploring new theories,” explains Yuzhang Wu, director of CBMS, “rather than transplanting established research groups from overseas.” Wu hopes these free-thinking scientists will bring the scientific cultures from the countries where they were trained to China. Evidence of this can be found in many of the innovative teaching methods and evaluation systems CBMS has implemented in recent years, which have their roots in the places where CBMS researchers have been educated, such as Europe or the United States.

Scientists returning home to China don’t leave their professional lives behind. Maintaining connections and collaborations with scientists outside China is very important to CBMS researchers. “There are no real differences between being located in Chongqing and being in Beijing or Shanghai,” says Chen, “especially in the era of the Internet and frequent air travel.” He still communicates regularly with former colleagues in Munich about collaborative projects.

Another strategy for CBMS in acquiring top talent is recruiting domestically. Jun Zhang, a principle investigator in the Department of Physiology, who specializes in sensory-motor integration, moved from Nanjing University (800 miles east of Chongqing) to CBMS in 2011. Zhang says that “Chongqing, and the surrounding Sichuan region, has always been a resource-rich area in China, and this is also true in terms of scientific research support thanks to ample funding and talent from all over the world.”

More than 1,300 years ago, poets wrote about how quickly one could travel from Chongqing (the “White Emperor Castle”) to Nanjing via the Three Gorges and Yangtze River, in only one day. With today’s technology, the distance between Chongqing and other cities has become virtually nonexistent, making Chongqing a great location to conduct world-class research as well as stay connected to the global community.

International Talents: Fostering a Global Reach

Xiaoyan Shang just received his Ph.D. from CBMS this summer. He worked in Director Yuzhang Wu’s lab studying vaccine design. “The most important lesson I have learned here is critical thinking,” says Shang. “There is so much knowledge beyond the textbooks we used in college. I’ve learned the importance of identifying key questions and applying up-to-date technical knowledge to answer these questions,” he says. His work has accepted a postdoctoral fellowship in the United States, where he hopes to gain additional skills to advance his career in therapeutic cancer vaccines research.

Kaijun Liu is a second-year Ph.D. student in the lab of Shaoshiang Zhang, vice president of TMU and the project leader for the Chinese Virtual Human Project (CVHP) (see page 5). Liu also did his undergraduate work at TMU and has worked in Zhang’s lab since 2005. “Back then, we did not have the innovative education platform put together recently by Director Wu, so there has been some trial and error in the process [of learning to be a critical-thinking scientist],” says Liu, who equates the transition from undergraduate research to studying for a Ph.D. to climbing a mountain. “You see the field more broadly and clearly as you climb,” says Liu, explaining that as he advanced toward completing the degree, he began to see the bigger picture questions in his field. In Zhang’s lab, Liu learned about computer reconstruction and image processing, but has recently become interested in immunology, and now wants to combine these different fields to create new ideas, such as creating a model of the lymph system using the CVHP dataset. Overall, “the ultimate goal [of this education reform] is to break old habits, the inertia, and the short-sightedness of the traditional medical education,” says Professor Zhongliang Yao, who has over 25 years of teaching experience. Fundamental changes in guidelines and evaluation systems are necessary to ensure that undergraduate and graduate students can develop a productive career, and CBMS is dedicated to hastening the reform and inspiring the next generation of scientists.
CBMS Seeks Talent From Abroad

The College of Basic Medical Sciences (CBMS) at the Third Military Medical University (TMMU), China, is seeking highly motivated talent. TMMU, with a history of over 70 years, is a National Key University, and one of the first universities authorized to grant doctoral degrees by the Chinese government. As a convergence of basic medical fields and a research- and teaching-oriented center, the College of Basic Medical Sciences now offers faculty positions for principal investigators (PIs) and junior PIs in the areas of immunology, microbiology, neurobiology, cellular and molecular biology, and regenerative medicine.

For candidates who are members of the national “1000-Elite Program,” tenured associate professors who are serving in one of the world’s top 200 universities, “Changjiang Scholar” professors, chief scientists for the national “973 Program,” “National Outstanding Youth Fund” winners, or those who have published an article in Cell, Nature, or Science as the first or the corresponding author or an article in any SCI journal with an impact factor over 20, we will offer an 8-million-yuan research fund and other research support, including positions for 1-2 assistants, modern office equipment, a well-furnished apartment or the option to buy an apartment newly built for the staff, and a relocation allowance of 1 million yuan, as well as a salary, allowance, and other financial support consistent with those in the similar positions.

Salary and support are negotiable for extraordinarily excellent candidates.

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