



Zhiyuan Innovative Research Center (ZIRC)

The objective of Zhiyuan College is to design an educational program in science and technology to signify the importance of critical thinking and independent learning with an integrated and structured curriculum and individualized mentoring by active research faculty. In this pilot and elite undergraduate program at this state supported public university, enhanced learning experience driven by students' curiosity through interactive class room teaching and readily available face to face discussions with world class scientists and engineers has been the essential goal. To further strengthen students' interest to acquire new knowledge on their own, independent research with minimal supervision has been integrated into the Zhiyuan curriculum in which students are encouraged to pursue research objectives based on their own ideas that are not limited by any particular major or discipline and team efforts with results oriented approaches have been particularly encouraged. Zhiyuan Innovative Research Center (ZIRC) is specifically designed to administer and manage the experimental/independent research aspect of Zhiyuan College. ZIRC is composed by a central office of management, a network of research laboratories to host student research programs and a central, interdisciplinary research facility under construction.





Interconnected Network of Satellite Laboratories throughout Campus. To provide students registered in Zhiyuan ample opportunity to gain hands on experience and a platform to realize their own ideas, the central office, through consultation with the representatives from the major disciplines on campus, such as physics, chemistry, biology, computer science and bioengineering etc., first established a select set of research areas to be included and actively recruits active faculty members in these fields to participate in the program. To ensure that the participating faculty members will actively involve in the program and take a keen interest in undergraduate education, a set of requirements must be set and agreed upon by the participating faculty. These requirements include full access of their laboratories, a willingness to interact with students directly and providing advices regarding the research and development of perspective students. The participating faculty is also required to join the regularly held student salons to serve as speakers, moderators and commentators. In return, ZIRC will provide certain amount of support for these activities. Satellite laboratories are also evaluated by a panel of international experts and students periodically. The underperformed will be replaced with other laboratories to maintain the momentum of the program and to improve the effectiveness of the program.

To date, 12 satellite laboratories have been formally established, covering a broad range of research areas (Table 1). Most students have participated in the ZIRC program and have had some creative results. For example, Andi Tan applied for entering Professor Xiangdong Ji's 'Dark Matter' research group, as a sophomore, he never dreamed of following the extraordinary mentor in studying the world's cutting-edge scientific research. In Andi's senior year, his thesis "Experimental Study of Proportional Scintillation in Liquid Xenon" was granted as Shanghai Jiao Tong University extraordinary undergraduate thesis. He stated, "The life in Zhiyuan College helps me find the dream and the meaning for life!" Zhiyuan College, through the effort of ZIRC, particular encourages students to participate early in these laboratory experiences and ZIRC has provide a systematic framework and information conduit between participating faculty and interested students.



Table 1 List of 12 Satellite Laboratories

Research Area	Director	Note
Dark Matters and Neutrinos	Xiangdong Ji	Instrumentation and detection
Quantum Information and Entanglement	Xianmin Jin	Micro-devices
Single Molecule Biology	Zhifeng Shao	Methodology and Applications
Neural Development and Disease	Tao Sun	Transgenic Mice
Complex Networks and Control	Xiaofan Wang	Network Science
Embedded Computing	Minyi Guo	Hardware and Software Development
Single Molecule Spectroscopy and Imaging	Jicun Ren	Novel Applications
Organic Synthesis and Catalysis	Wangbin Zhang	
Biomimetic and Functional Thermal Materials	Tao Deng	
Science and Technology of Electrochemical Energy	Junliang Zhang	
Mucosal Immune Regulation	Bing Su	
Targeted Cancer Therapy	Ruibao Ren	Nano-delivery and Other Novel Approaches

Centralized Research Facility. To further enhance the effectiveness of student initiated research and to provide a physical space to facilitate exchange of ideas and intersection of thoughts across various research disciplines, the University, after extensive investigation and discussion, decided to establish a well-equipped research laboratory on campus devoted to innovative undergraduate research in 2015. 500 square meters of laboratory and office space has been allocated for this purpose. The university and the Ministry of Education of China through its innovation funding program, has pledged 32 million RMB to support the first phase of construction. These funds will be used to renovate the necessary lab space and classrooms in the facility. Since the most important consideration of the facility is to provide a truly interdisciplinary environment and to ignite the curiosity of participating students into disciplines beyond their own, the facility will be composed by multiple working modules (Fig. 1) under the same roof in which students can perform basic experiments from biochemistry to microelectronics to data analysis with free and full access. These modules will be managed by professional engineers or technicians with certain educational experience. The facility will also be well supported by computational capabilities so that students not only have ready access to existing knowledge through the internet but can also have the



possibility to conduct in silico experiments or dealing with extensive datasets of different variety (big data). Furthermore, the facility will also include a number of small discussion room fully equipped with multimedia systems so that student research teams can use these space to discuss and plan their own projects.

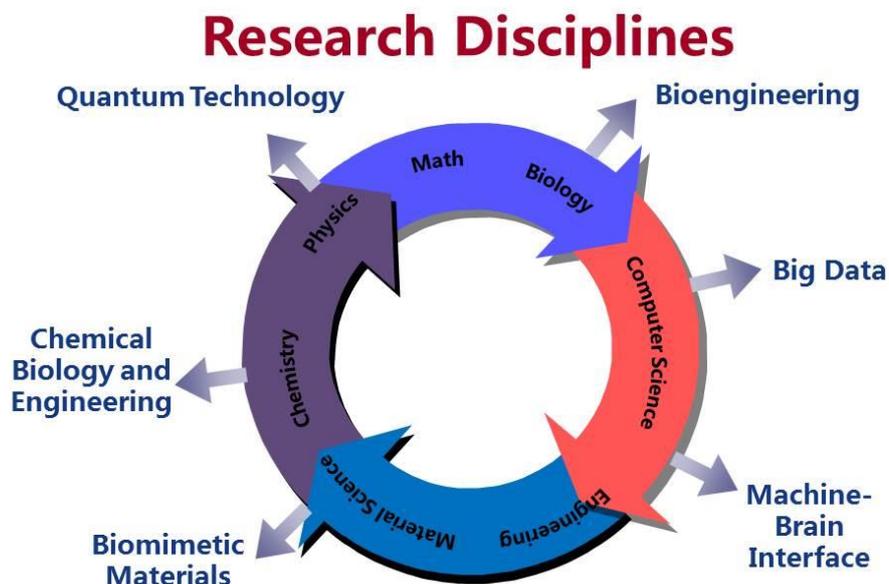


Figure 1 Research disciplines covered by ZIRC central research facility

With the completion of this centralized facility, participating students will be able to conduct their research at ease especially when the projects are interdisciplinary in nature. However, when the projects call for more advanced technologies and skills, the students can transfer their project to appropriate satellite laboratories where they can experience a more structured or advanced research environment. It is the purpose of ZIRC to facilitate the integration of these two types of platforms to provide students with the maximum expose to cutting edge research with an emphasis on their own creation and execution.

In addition to provide these research capabilities, the facility also offers entering students the opportunity to learn essential research approaches and techniques. Through hands on classes, independent practice



and other means, the facility will allow students ample opportunity master many of the basic skills that will be supplementary to their classroom learning and offer the students a different route to acquire knowledge.

Support of Independent Research Projects. In addition to provide research capabilities and information dissemination, ZIRC has also initiated a research funding program. Through the assembly of a panel of international scientists of the first caliber, ZIRC calls for proposals from participating undergraduates based on their own ideas but supported by participating faculty members serving as advisors, rather than supervisors. The purpose of this program is to give students the opportunity to “convert” their knowledge acquired through curiosity to create new concepts or devises that could improve or benefit some aspects of human society. These proposals will be evaluated based on innovation, feasibility and potential outcome by a panel of faculty and an oral defense will be organized before the winning proposals be determined which will receive funding from ZIRC. These proposals, after funded, will be managed by the central office of ZIRC, and annual research events will be held that is open to all students. Such events will only facilitate exchange between faculty and students, and is also important for ZIRC to monitor the program and to improve the program.

Although ZIRC is currently only open to students registered in Zhiyuan College, its facility and grant program will gradually open to all interested undergraduate students over time and its coverage of disciplines will also increase and remain dynamic in order to remain at the leading edge.