Overall Framework for University Intellectual Property Information Services and Its Application and Implementation: A Case Study of Peking University Library (Postprint)

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Abstract

[目的/意义] To construct a university intellectual property information service system and improve the university intellectual property information service network.

[方法/过程] By integrating domestic and international development cases, this paper discusses the characteristics, demands, and framework system of university intellectual property information services, introduces innovative practices of university library intellectual property information services using Peking University Library as an example, and proposes future development strategies.

[结果/结论] The intellectual property information services of Peking University Library have effectively supported the creation, utilization, protection, and management of intellectual property at Peking University, and its successful experience can provide reference for university libraries, especially comprehensive university libraries.

Full Text

The Overall Framework and Implementation of Intellectual Property Information Services in Universities: A Case Study of Peking University Library

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Abstract

[**Purpose/Significance**] To construct an intellectual property information service system for universities and improve the university intellectual property information service network. [**Method/Process**] This paper discusses the characteristics, demands, and framework of university intellectual property information services by combining domestic and international development cases, introduces the innovative practices of university library intellectual property information services using Peking University Library as an example, and proposes future development strategies. [**Result/Conclusion**] The intellectual property information services of Peking University Library effectively support the creation, application, protection, and management of intellectual property at Peking University, and its successful experience can provide reference for university libraries, especially comprehensive university libraries.

Keywords: intellectual property; information service; university library; Peking University
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Intellectual property refers to the rights legally enjoyed by natural or legal persons over the achievements created through their intellectual activities [1]. Since the reform and opening up, China has successively formulated and promulgated relevant legal systems and norms such as the Trademark Law, Patent Law, Copyright Law, Anti-Unfair Competition Law, Regulations on the Protection of New Plant Varieties, Regulations on the Protection of Integrated Circuit Layout Designs, and Provisions on the Protection of Geographical Indication Products, gradually establishing a relatively comprehensive intellectual property legal system [2]. Moreover, China has maintained its position as the world leader in invention patent applications and trademark registration applications for many years, with copyright registrations, new plant varieties, and other intellectual property quantities reaching new highs, making China a veritable intellectual property powerhouse. However, the characteristics of being large but not strong, and numerous but not superior remain prominent. According to the 2019 Global Innovation Index Report released by the World Intellectual Property Organization, Cornell University, and other institutions, China's innovation index ranks 14th in the world, indicating there is still some distance to go before becoming an intellectual property powerhouse. Therefore, China urgently needs to build itself into an intellectual property power, further improve the intellectual property information service network, enhance the quality and efficiency of intellectual property, and support the national innovation-driven development strategy.

As important entities for scientific research and intellectual property creation, the improvement of quality and efficiency of university intellectual property output is of great significance to China's construction as an intellectual property power. University libraries, as the main providers of information services

in universities, need to provide full-process intellectual property information services for the creation, application, protection, and management of university intellectual property. In March 2020, the National Intellectual Property Administration and the Ministry of Education jointly issued the "Work Plan for the Construction of National Intellectual Property Pilot and Demonstration Universities (Trial)," emphasizing the need to give full play to the roles of university intellectual property information centers, libraries, and other information service departments, as well as intellectual property commissioner teams, to provide service support for the full lifecycle management of patents. The national innovation-driven development strategy and the demand for intellectual property information services in universities have jointly promoted the development of intellectual property information services in university libraries.

2. Practice and Research Progress

The United States established its intellectual property legal system relatively early. Its university libraries mainly provide intellectual property information services by joining the Patent and Trademark Resource Center (PTRC), which includes services such as access to intellectual property resources, education on intellectual property retrieval and utilization, consultation on intellectual property application procedures and fee planning, directories of local patent attorneys licensed by the U.S. Patent and Trademark Office, assistance with historical research on patents and trademarks, demonstrations on how to track current research of companies or non-profit organizations, recommendations of intellectual property information resources, and intellectual property information promotion activities [3]. Europe established the Patent Libraries (PATLIB) project to provide intellectual property information services, including public reading rooms, intellectual property information retrieval, intellectual property training, intellectual property consultation, intellectual property monitoring, patent data statistical analysis, intellectual property value assessment, intellectual property transfer and transformation support, and intellectual property strategic consultation [4]. To build itself into an intellectual property power, China has continuously improved the university intellectual property information service network by encouraging universities to establish intellectual property information service centers, join the Technology and Innovation Support Center (TISC), and become national intellectual property information public service outlets. However, due to the relatively late start of university intellectual property information services in China, how to construct a university intellectual property information service system that supports the creation, application, protection, and management of university intellectual property has become an important issue facing university libraries in China.

Research on university intellectual property information services is relatively scarce in foreign literature. Domestic literature mainly focuses on patent information services, copyright information services, and the preliminary construction of cooperation models and service systems for intellectual property infor-

mation services. In terms of patent information services, Shen Jinhua et al. constructed a competency framework for librarians' patent information services in university libraries [5]; Zhang Shanji et al. studied the competitiveness components of patent information services in university libraries [6] and strategies for patent information services under industrial technology innovation demands [7]; Wang Liping et al. studied the content, models, and trends of patent information services in university libraries [8]; Gao Yingying et al. studied the construction and application of patent information service systems in university libraries [9]; Li Feng introduced the exploration and practice of patent information services at Peking University Library [10]. In terms of copyright information services, Ye Xiuming [11], Sun Hanhan [12], E Lijun [13], and Xu Ting [14] investigated copyright information services in foreign university libraries and proposed suggestions for the development of copyright information services in Chinese university libraries. In terms of intellectual property information services, Zhang Lige [15] and Yang Meng [16] investigated the current status of intellectual property information services in Chinese university libraries; Li Binbin [17] and Zhang Chi [18] studied cooperation models for intellectual property information services in university libraries; Feng Jun constructed an intellectual property information service system for university intellectual property management [19].

It is evident that existing research mainly focuses on specific types of intellectual property information services or preliminary constructions of cooperation models and service systems, lacking in-depth research and reflection on the characteristics, demands, framework systems, and practices of university intellectual property information services. Therefore, this paper combines domestic and international development status, based on the characteristics of intellectual property information services and the demands of different stages of the intellectual property lifecycle, constructs a framework system for university intellectual property information services, and uses Peking University Library as an example to introduce the innovative practices of university library intellectual property information services and propose future development strategies.

3. Characteristics of Intellectual Property Information Services

Intellectual property has three attributes: scientific research, legal, and economic. The scientific research attribute can provide guidance for scientific research, the legal attribute can protect the rights and interests of inventors, and the economic attribute can support market layout and development strategies. These three attributes of intellectual property interact with and promote each other as the environment changes. Therefore, compared with general information services, intellectual property information services have the characteristics of being interdisciplinary, full-process, and collaborative.

3.1 Interdisciplinary

Personnel engaged in intellectual property information services must have professional backgrounds in intellectual property, library and information science, and related scientific and technological fields, be proficient in knowledge and skills such as intellectual property laws and regulations, bibliometric and visualization analysis tools, and be able to provide intellectual property information services for researchers, management decision-making departments, and enterprises and institutions.

3.2 Full-Process

Full-process means that the entire lifecycle of intellectual property requires the support of intellectual property information services. It is necessary to provide full-process intellectual property information services, including intellectual retrieval, analysis, navigation, and consultation during the creation stage; analysis, value assessment, and transfer and transformation support during the application stage; legal status monitoring and infringement search during the protection stage; and decision support and value assessment during the management stage.

3.3 Collaborative

Collaboration means that the intellectual property information service team must work closely with service objects, actively participate in their scientific research, legal, and economic activities, and jointly design and improve intellectual property information service plans with them.

4. Framework System for University Intellectual Property Information Services

Based on the above characteristics, university libraries should give full play to their advantages in talent, resources, and technology, provide full-process intellectual property information services in close cooperation with service objects according to the demands of different stages of the university intellectual property lifecycle (creation, application, protection, and management), and form their overall service framework on this basis.

4.1 Intellectual Property Creation

Intellectual property creation usually includes two stages: creating new knowledge and obtaining intellectual property rights. University faculty and students first create new knowledge through scientific research activities including topic selection, project initiation, implementation, and conclusion, and then apply to authorities such as the National Intellectual Property Administration to obtain intellectual property rights. During the topic selection stage, it is necessary to search existing intellectual property to avoid duplication; during the project

initiation stage, intellectual property analysis is needed to improve the starting point of research; during the implementation stage, continuous tracking of intellectual property development is required to provide navigation services for research; during the conclusion stage, suggestions for intellectual property application and layout are needed; during the acquisition stage, pre-search of intellectual property is needed to improve the quality of applications. Therefore, during the intellectual property creation stage, university libraries need to provide services such as intellectual property retrieval, analysis, navigation, and consultation. For example, the library of Nanjing University of Technology established a specialized patent navigation database for the research project "DHA Preparation Technology" of its School of Bioengineering, integrating patent information from the World Intellectual Property Organization, the European Patent Office, major developed countries, and China, and provided users with research reports on domestic and international technology development trends, reports on technology development priorities and hotspots by theme, reports on national competitiveness analysis of related technologies, technical analysis reports on typical companies (research institutions), and high-intensity patent mining and analysis reports [9].

4.2 Intellectual Property Application

Applying obtained intellectual property to actual production usually includes methods such as self-implementation by the patentee, external transfer, and external licensing. Since universities themselves do not have the conditions for self-implementation, university intellectual property application usually involves external transfer or licensing. This stage requires analysis of intellectual property information to identify potential transfer or licensing enterprises and evaluation of intellectual property value to provide references for transfer or licensing. For example, Tsinghua University Library screened patent documents for its Department of Automotive Engineering using information such as "inventor," "classification number," and "patentee," and from multiple perspectives including cooperation, related technology patentees, and patent citation situations, identified the technology layout of the department's scientific research to provide references for technology transfer and transformation [20].

4.3 Intellectual Property Protection

Intellectual property protection mainly refers to avoiding intellectual property invalidation or stopping infringement. This stage requires early warning of the legal status of intellectual property, reminding inventors to pay relevant fees in time, and conducting infringement searches when infringement occurs to protect the intellectual property rights and interests of the university. For example, Shanghai Jiao Tong University Library dynamically tracks the legal status of designated patents and establishes an early warning mechanism [21].

4.4 Intellectual Property Management

Intellectual property management usually runs through the entire process of intellectual property creation, application, and protection. This stage mainly provides decision-based intellectual property information services to help universities comprehensively understand their intellectual property competitiveness and existing problems, providing a basis for formulating intellectual property policies and decisions. Additionally, it is necessary to conduct value assessments of university intellectual property to facilitate hierarchical management. For example, the "Peking University Patent Competitiveness Analysis Report" released by Peking University Library belongs to this type of service.

Intellectual property information literacy education, intellectual property information consultation, and intellectual property information resource navigation services serve as foundational services throughout the entire lifecycle of intellectual property creation, application, protection, and management.

Therefore, based on the above analysis, the overall framework of university intellectual property information services is shown in Figure 1 [Figure 1: see original paper]. Additionally, according to the collaborative characteristics of intellectual property information services, university libraries should provide targeted services based on this service framework according to the different needs of service objects. For example, for school management, provide decision-oriented intellectual property information services; for university researchers, provide research-oriented intellectual property information services; for university intellectual property transfer departments and enterprises, provide intellectual property transfer and transformation support services.

In summary, the content of university library intellectual property information services includes: intellectual property information literacy education, intellectual property information consultation services, intellectual property information research services, intellectual property transfer and transformation support services, intellectual property information decision services, and intellectual property information resource navigation services.

5. Innovative Practice of Peking University Library's Intellectual Property Information Services

In September 2018, with strong support from the university and assistance from departments such as the Science and Technology Development Department and the Scientific Research Department, Peking University Library established the "Peking University Intellectual Property Information Service Center," which became one of the first batch of university national intellectual property information service centers approved by the National Intellectual Property Administration and the Ministry of Education in March 2019. The center hired renowned scholars in intellectual property law from Peking University Law School as consultants, investigated the needs of faculty, students, and functional departments

within the university as well as practical experience from domestic and international university libraries, and based on the above service framework, formed a comprehensive, full-process, three-dimensional intellectual property information service system that integrates intellectual property information literacy education, consultation services, research services, transfer and transformation support services, decision services, and resource navigation, featuring internal university-wide cooperation and social radiation.

5.1 User- and Level-Differentiated Intellectual Property Information Literacy Education

Currently, university scientific research achievements are still mainly in the form of papers, and university faculty and students have insufficient understanding of other forms of intellectual property protection with varying demands. Therefore, Peking University Library carries out intellectual property information literacy education according to the different needs of users and levels. For undergraduates, the focus is on basic training in intellectual property fundamentals and patent data retrieval and utilization; for science and engineering faculty and graduate students, training is provided on innovative topic selection using patent resources, patent retrieval and analysis, and patent application practice; for humanities and social sciences faculty and students, academic literacy training is provided on paper writing norms, submission guidelines, and academic ethics; for librarians and staff of university functional departments, the library collaborates with professional institutions to conduct high-end intellectual property practice training. At the same time, the library integrates intellectual property information literacy education into information literacy education mobile games such as “First Encounter with the Library” and “Madman’s Plan,” the “Peking University Information Literacy Ability Assessment Platform,” and the “National University Data-Driven Innovation Research Competition” to promote the improvement of intellectual property information literacy among university faculty and students. For example, the second “National University Data-Driven Innovation Research Competition” co-hosted by Peking University Library and Peking University School of Information Management attracted 600 teams (1,704 participants) from 199 universities nationwide, covering 29 provinces, autonomous regions, and municipalities, and involving 48 disciplines including computer science and technology. Intellectual property, as an important data type, was used by numerous participants, supporting and leading intellectual property information literacy education in universities nationwide [22].

5.2 Embedded Subject Service-Based Intellectual Property Information Consultation Services

Intellectual property information consultation services usually include basic intellectual property knowledge consultation, intellectual property information retrieval consultation, intellectual property legal status consultation, and high-

end intellectual property practice consultation. Peking University Library provides intellectual property information consultation services through the joint efforts of the subject service team and the intellectual property information service team. Basic consultations are handled by the subject service team, while professional consultations are handled by the intellectual property information service team. This service model leverages the strengths of both teams. After 20 years of development, the subject service team has accumulated rich experience and formed a good service model, enabling timely responses to basic consultations on patent law, patent applications, patent resource retrieval, and copyright law. For example, subject librarians have promptly responded to intellectual property information retrieval consultations from faculty and students in schools such as the College of Engineering, School of Life Sciences, School of Advanced Agricultural Sciences, and School of Software and Microelectronics, as well as from the National School of Development. The intellectual property information service team possesses more professional intellectual property information service skills and can better complete high-end consultation services. For example, for high-end consultations from departments such as the School of Information Science and Technology, the Office of Discipline Construction, and the Scientific Research Department on patent competitiveness evaluation in the field of artificial intelligence at Peking University, the intellectual property information service team collaborated with the commissioning departments to analyze needs in detail, study relevant literature, determine search strategies, conduct searches using Innography, Web of Science, and the Peking University Institutional Repository, and perform visual analysis on the search results to form valuable analysis reports, achieving excellent service results.

5.3 Research-Oriented Intellectual Property Information Services for the Full Research Process

The research lifecycle includes stages such as topic selection, project initiation, implementation, and conclusion, each requiring intellectual property information services. During the topic selection stage, Peking University Library helps researchers sort out intellectual property information and grasp research development trends; during the project initiation stage, it helps researchers conduct intellectual property analysis to improve the starting point; during the implementation stage, it helps researchers conduct intellectual property early warnings and timely adjust research directions and technical routes; during the conclusion stage, it assists researchers in applying for patents, copyrights, new plant varieties, integrated circuit layout designs, and other intellectual property rights, and provides suggestions for intellectual property application. For example, in 2018, Peking University Library signed an intellectual property information service contract with the CALIS project team to provide full-process intellectual property information services for research, including intellectual property retrieval, analysis, mining, application, layout, maintenance, and transformation. This deep, collaborative, full-process intellectual property information research service improves the quality of research, avoids intellectual property risks, en-

hances intellectual property benefits, and is of great significance to university scientific innovation and the national intellectual property strategy.

5.4 Intellectual Property Transfer and Transformation Support Services

The service objects of intellectual property transfer and transformation support services are mainly governments, universities, and enterprises. For the needs of government and university scientific and technological achievement transformation, the library helps them analyze the value of intellectual property, find targets for intellectual property transfer and transformation, and avoid intellectual property risks to facilitate the successful implementation of scientific and technological achievement transformation. For example, commissioned by the Science and Technology Development Department and other departments of Peking University, the library selects scientific research achievements with significant strategic importance or transformation value, assists in patent applications and improving patent layout, and through searching and analyzing the value of intellectual property and companies focusing on similar technologies, helps the university and inventors quickly find targets for intellectual property transfer and transformation, improving the efficiency of scientific and technological achievement transformation. For enterprise intellectual property needs, the library helps them find suitable researchers and intellectual property by analyzing the current status of university intellectual property. For example, Huawei Technologies Co., Ltd. commissioned Peking University Library to sort out patents and papers in the field of chips and integrated circuits at Peking University to help it find cooperation partners.

5.5 Branded Intellectual Property Information Decision Services

Branded intellectual property information decision services are driven by the needs of university management, collecting intellectual property information for screening and classification, data statistics, and comprehensive analysis to form a series of branded, systematic, and comprehensive intellectual property information service products for decision-makers to fully grasp information in a short time for reference in decision-making, thereby improving decision-making efficiency [23].

5.5.1 Intellectual Property Information Services Supporting University Decision-Making The intellectual property information services supporting university decision-making at Peking University Library mainly involve patent competitiveness analysis services, comprehensively using multiple patent databases and analysis tools, and employing methods such as bibliometrics, text clustering analysis, competitive bubble charts, and patent maps to conduct detailed analysis of university patent competitiveness, identify university patent competitiveness and existing problems, and help the university make decisions and formulate development plans. Peking University Library completed two edi-

tions of the "Peking University Patent Competitiveness Analysis Report" (hereinafter referred to as the "Report") in 2016 and 2018. The Report used Innography, PatSnap, and Derwent Innovation as main data sources, supplemented by the CNKI patent database and the China National Intellectual Property Administration Patent Search and Analysis System. Through searching, cleaning, merging, and deduplication, it accurately obtained patent application and authorization data, as well as patent transfer and licensing data, for teaching and research units and institutions directly under or affiliated with benchmark universities. From dimensions including patent output (patent quantity, legal status, patent hotspots, contribution, expired patents), patent quality (patent strength, patent citations, patent awards), patent geographical layout (patent application countries and regions), patent practical value (cooperative patents, patent transfer and transformation), and Peking University patent hotspots, it conducted comparisons with engineering universities ranking top in patent volume and comprehensive universities similar to Peking University to clarify advantages, identify gaps, determine positioning, promote scientific research innovation and achievement transformation at Peking University, and through patent data analysis, identify hotspot fields in advantageous disciplines to provide data support for the university's "Double First-Class" construction and discipline development direction [24].

5.5.2 Intellectual Property Information Services Supporting Discipline Development Decision-Making Through recent years of practice and exploration, Peking University Library has formed a series of branded intellectual property information products supporting discipline development decision-making, including "Peking University Patent Hotspot Analysis," "Research Trend Analysis Using Patent Resources," "Peking University Discipline Competitiveness Analysis Report," "Third-Party Report on International Discipline Evaluation of Peking University," and "Frontiers of Scientific Research at Peking University," with intellectual property information services embedded to varying degrees in these products. For example, the library completed a series of reports including "Peking University Anti-COVID-19 Related Projects and Patent Information Express," "Peking University Patent Hotspot Analysis: Artificial Intelligence," "Research Trend Analysis Using Patent Resources: Programmed Cell Death Factors," and "Research Trend Analysis Using Patent Resources: Smart Manufacturing Industry," analyzing research trends and competitive situations of research hotspots in multiple science, engineering, and medical disciplines. By comprehensively analyzing results and expert opinions, it formed research context, development directions, and suggestions for research hotspots, strongly supporting discipline development strategic decision-making. In summary, Peking University Library's intellectual property information decision services have achieved excellent brand benefits, receiving high recognition from target users and library peers. Multiple units including the National Intellectual Property Administration, Ministry of Education, relevant departments and schools of Peking University, Wuhan University School of Information Man-

agement, Tsinghua University Library, and Johns Hopkins University Library have requested the reports for reference and study. At the same time, the series of intellectual property information decision service products have identified key disciplines, hotspot fields, and main inventors of intellectual property output, becoming an important basis for the library to provide precise intellectual property information services.

5.6 Intellectual Property Information Resource Navigation Services

Peking University Library has published an intellectual property information service homepage in a core position on its main page and has collected and organized nearly 30 resources including purchased commercial patent databases and some commonly used public patent databases to establish a patent resource navigation homepage, providing patent resource navigation services to support scientific research innovation. The library also relies on the Peking University Academic Achievement Ecosystem (institutional repository and scholar homepage) to collect, organize, and count the works, papers, and patents of university researchers for centralized display, improving the visibility and influence of researchers' various intellectual property achievements and promoting scientific and technological achievement transformation.

6. Future Development Strategies

6.1 Strengthen Self-Construction and Consolidate the Development Foundation

Currently, university library intellectual property information services are in the initial stage and need to continuously strengthen self-construction and consolidate the development foundation as follows: (1) Strengthen the construction of intellectual property information resources by collecting and organizing commercial and public intellectual property information resources to provide resource navigation for readers; collect and organize university intellectual property information and related data to build and improve the university institutional repository and scholar homepage to display, publicize, and promote university intellectual property achievements. (2) Formulate talent development plans by hiring intellectual property experts as consultants to guide daily work; formulate career development plans and training programs to support the development of intellectual property information service personnel. (3) Improve space construction to provide space for faculty and student innovation and entrepreneurship. (4) Strengthen team collaboration and improve cooperation mechanisms among intellectual property information service teams, subject service teams, and publicity and promotion teams to enhance service levels. (5) Increase publicity efforts to expand influence.

6.2 Enhance Cooperation Levels and Expand Service Breadth and Depth

University intellectual property management and services involve multiple departments. Taking Peking University as an example, the Scientific Research Department is responsible for patent statistics and management, the Social Sciences Department is responsible for the management of humanities and social sciences copyrights and other intellectual property, the Science and Technology Development Department is responsible for scientific and technological achievement transformation, the Law School has senior intellectual property law experts, and the library is responsible for intellectual property information services. The library should cooperate closely with these departments to expand the breadth and depth of intellectual property information services as follows: (1) Establish intellectual property information service working groups for timely communication and adopt flexible forms to exchange and cooperate on intellectual property practice issues. For example, help functional departments screen core intellectual property in advantageous disciplines and key fields, find the most promising transferees or cooperative enterprises; track intellectual property legal status, provide early warnings for intellectual property about to expire, and help find potential transferees to avoid expiration. (2) Cooperate with functional departments to find breakthrough points when teachers apply for research projects and transform scientific and technological achievements, and provide in-depth intellectual property information services throughout the entire research process of project application, initiation, implementation, conclusion, and scientific and technological achievement transformation. (3) Jointly apply for or undertake relevant projects with university functional departments to strengthen research on related issues.

6.3 Strengthen Alliance Construction to Achieve Scale and Standardization

Establishing alliances plays an important role in promoting the development of university library services. In June 2015, Tongji University Library, Tsinghua University Library, Peking University Library, and Shanghai Jiao Tong University Library established the "University Library Patent Information Service Promotion Group" to promote libraries' greater role in university intellectual property service system construction. In June 2018, the University Intellectual Property Information Service Center Alliance was established at Tongji University [25], further promoting the development of Chinese university library intellectual property information services from scattered to scaled and standardized. In the future, university libraries should continue to strengthen the role of the University Intellectual Property Information Service Center Alliance in intellectual property resource construction, talent cultivation, service case sharing, system construction, work standardization, and service performance evaluation, playing an important leading and exemplary role in achieving scaled and standardized development of intellectual property information services in Chinese

university libraries.

Intellectual property information services have become a new business growth point for university libraries. University libraries should follow the requirements of the "Intellectual Property Management Standards for Higher Education Institutions" (GB/T33251-2016) and the "Implementation Measures for the Construction of University Intellectual Property Information Service Centers," combine their own characteristics, construct intellectual property information service systems, strengthen cooperation with relevant departments, consolidate service foundations, innovate service content, and support university intellectual property management and "Double First-Class" construction.

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Author Contributions:
Liu Xiuwen: Overall research framework design, writing and revising the paper;

Li Feng: Paper revision.

Note: Figure translations are in progress. See original paper for figures.