

A Statistical Analysis of College Biochemistry Textbooks in China: The Statuses on the Publishing and Usage

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This study aimed to investigate the statuses on the publishing and usage of college biochemistry textbooks in China. A textbook database was constructed and the statistical analysis was adopted to evaluate the textbooks. The results showed that there were 945 (~57%) books for theory teaching, 379 (~23%) books for experiment teaching and 331 (~20%) books for assistant teaching. Most of these books were published for science/technology-associated universities, followed by medical schools, while the books for agricultural universities were relatively few. Additionally, the first decade of the 21st century was the most productive period. Interestingly, there were 456 (~28%) textbooks with the same name of "Biochemistry", professor Airu Zhou was the most productive editor, and People's Medical Publishing House was the most productive press. The further survey showed that "Biochemistry" (3rd Edition) edited by professor Jingyan Wang et al was the most influential textbook. Overall, the findings suggest that the publishing and usage have been achieved a great success in college education along with some practical problems.

Keywords: College biochemistry, textbook, publication, usage, impact.

INTRODUCTION

Over the last 40 years, biochemistry has become so successful at explaining living processes that now almost all areas of the life sciences from botany to medicine are engaged in biochemical research (Graeme 2000, and Gul & Sozibilir 2015). The findings of biochemistry are primarily applied in medicine, industry and agriculture (Abu-Salah 1990, and Gamulin et al. 2003). In medicine, biochemists investigate the causes and cures of disease. In industry, they study how to make bioengineering products. In agriculture, biochemists investigate soil and fertilizers, and try to discover ways to improve crop cultivation, crop storage and pest control. Since

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biochemistry has been one of main branches in life sciences, biochemistry course is an integral part of life science education at the university level (Herbert & Hargrove 2012).

Textbook, a carrier of knowledge, is a crucial tool for knowledge teaching, skill experiencing and intelligence developing in the processes of the cultivation of students (Baier et al. 2011). The publishing of college biochemistry textbook is closely related to the quality of talent training (Aydin et al. 2014). Since the national college entrance examination was resumed in 1976, the publishing and usage statuses of college biochemistry textbooks have not been reported in any language in China. This study was designed to establish the college biochemistry textbook database, survey the usage status of the textbooks in different universities. We aimed to provide the international counterparts with the publishing and usage statuses of the textbooks, and also offered the professional educators the constructive references in writing and usage the related textbooks.

State of the literature

- Biochemistry is one of main branches in life sciences and biochemistry course is an integral part of life sciences education at the university level.
- The quality of publishing and the appropriate usage of textbook are closely related to the quality of talent training.
- The statuses on the publishing and usage of Chinese college biochemistry textbooks have not been reported in any language.

Contribution of this paper to the literature

- This study is carried out with the goal of analysing the statuses on the publishing and usages of Chinese college biochemistry textbooks.
- The most productive and influential books, editors and publishing houses are identified in the past 65 years.
- The comparison between Chinese books and foreign ones reveals that the biochemistry textbooks are successful in college education along with some practical problems.

Here we constructed a complete and reliable college biochemistry textbook database usage the search tool provided by national library of China (NLC). From this database, we found that most of the textbooks are published for theory and assistant teaching. The first ten years of the 21st century was the most productive period. Statistical analysis revealed the most productive three book names, editors, cities and publishing houses. The assessment of the impact of textbook suggested that the most influential textbooks usually come from the most famous professor and are widely used in different colleges. This work demonstrated that college biochemistry textbooks are blossoming and contending.

METHODS AND ANALYSIS

Construction of College Biochemistry Textbook Database in China

NLC provides the readers a united search service that namely "Wenjin" in a highly efficient, precise and professional way. In June 30, 2014, we used this online service tool (<http://find.nlc.gov.cn>) and the keyword "biochemistry" to search biochemistry-related textbooks. Then we downloaded all of the book lists (the year from 1950 to 2014) into an Excel document. By deleting the research-related books, primary and secondary textbooks, dictionary tools, et al., we only kept college biochemistry relevant textbooks.

Classification and Statistics of Textbooks

Based on the use purpose, these textbooks were divided into three different types: (a) Theory, (b) Experiment and (c) Assistant. And also based on the college type, the textbooks could be used for (a) Science/Technology, (b) Agriculture and (c) Medical Schools. We calculated the publication number in different classifications. By decades (-1950, 1951-1960, 1961-1970, 1971-1980, 1981-1990, 1991-2000, 2001-2010, 2011-2014), the change of textbook publication was analyzed. The most productive three textbooks, editors, cities and publishing houses were calculated from the database.

Survey the Status of Usage in Colleges

We obtained the textbook-related information from the teaching plans at different colleges. The main information includes teaching object (major), periods (theory and/or experiment), prescribed textbooks, reference or supplementary books. Fifty-five of science/technology colleges, 35 of medical schools and 20 of agricultural universities were randomly selected as respondents from 1700 colleges. The status of usage was analysed by different college type.

Assessment of Textbook Impact Factor

To evaluate the impact of a specific textbook in colleges, we introduced a new concept of "Impact Factor (IF)". In detail, if a textbook was used as a prescribed textbook, the direct IF (DIF) of this book would be set 1. If this book was used as a reference textbook, the DIF would be set 0.2. Then the total IF (TIF) of this textbook was added together. In certain type college, the relative IF (RIF) of one book with the highest TIF would be set 1. The RIF of other textbook was defined as the ratio of its TIF to that of the highest one.

Textbook Content Comparison between China and Foreign Countries

The Chinese textbook (8th edition, 2013) edited by Airu Zhou and the Classical biochemistry book (7th edition, 2012) written by Lubert Stryer et al were respectively chosen as the representative books for comparison. The differences in content structure and editing style were listed in a table.

Statistical Analysis

The data analyses were performed usage SPSS 13.0 software and expressed as means \pm SD.

RESULTS

The College Biochemistry Textbook Database is Complete and Reliable

The NLC has a collection of over 31.1 million items and is the largest library in Asia and one of the largest in the world. It holds the largest and most diverse collection of Chinese literature and historical documents in the world. Usage the online search tool provided by NLC, we established the college biochemistry textbook database with a total of 1655 textbooks.

To detect the reliability of the database, we checked 50 textbooks that came from the Ningbo University Library and two online bookstores usage our database. All of the textbooks were found in the database. In detail, 26 textbooks from the Ningbo University Library, 13 textbooks from Dangdang (www.dangdang.com) and 11 textbooks from Amazon (www.amazon.cn) were retrieved in the newly constructed database. These results suggested that the college biochemistry textbook database is complete and reliable.

Most of the Textbooks are Published for Theory and Assistant Teaching

From 1950 to 2014, we identified 1655 biochemistry-related textbooks published in China.

Among these books, there were 945 books (~57%) for theory teaching, 379 books (~23%) for experiment teaching and 331 books (~20%) for assistant teaching (Figure 1A). For theory teaching, we found that there were 646 books (~68%) used in science/technology-associated universities, 265 books (~28%) used in medical schools and 34 books (~4%) used in agricultural universities (Figure 1B). For experiment teaching, there were 233 books (~61%) used in science/technology-associated universities, 132 books (~35%) used in medical schools and 14 books (~4%) used in agricultural universities (Figure 1C). For assistant teaching materials, there were 171 books (~52%) used in science/technology-associated universities, 143 books (~43%) used in medical schools and 17 books (~5%) used in agricultural universities (Figure 1D). These results showed that more than one half of the textbooks were used for theory teaching and about one fifth of textbooks were used as assistant teaching materials. Most of the assistant materials were usually used for better understanding of the theoretical knowledge. In fact, this phenomenon is associated with emphasizing theory teaching and examination in Chinese colleges.

The First Decade of the 21st Century is the Most Productive Period

Since the first college biochemistry textbook was published in China in the 1950s, the number of

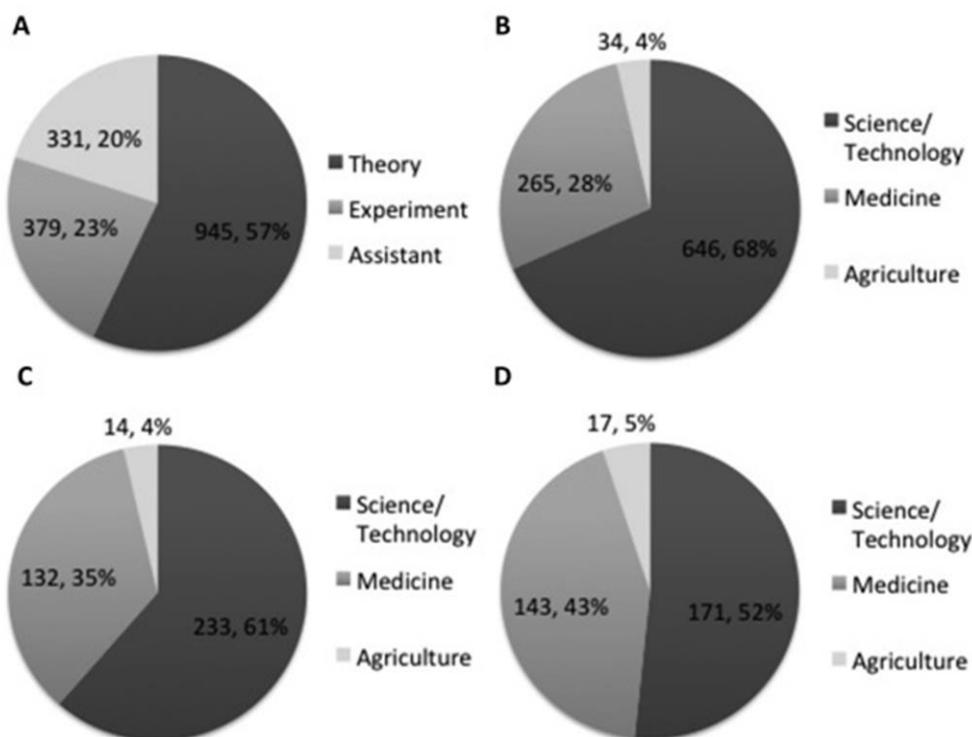


Figure 1. The classifications of college biochemistry textbooks. (A) 1655 textbooks can be divided into three subgroups: theory, experiment and assistant teaching. In the theory (B), experiment (C) and assistant teaching (D) subgroups, these textbooks are used in science/technology, medicine and agriculture related colleges.

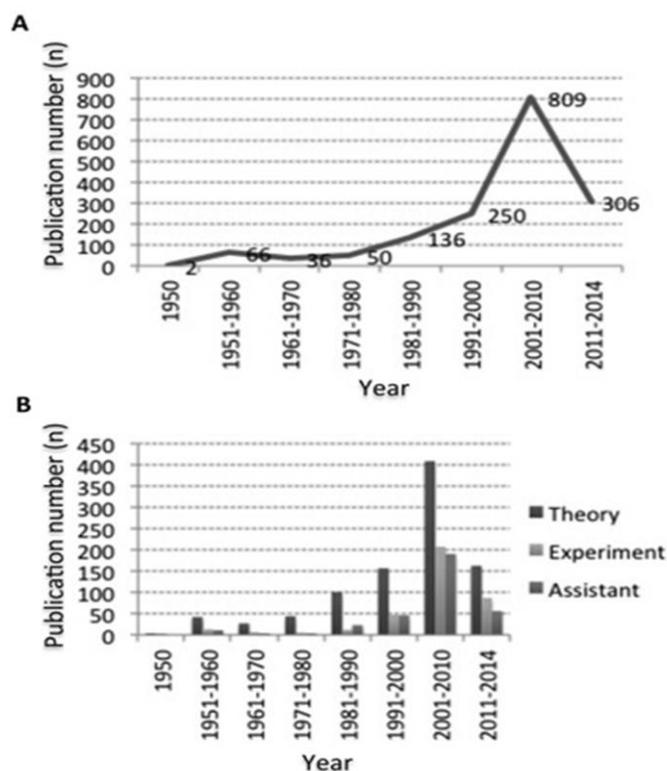


Figure 2. The total publication number change of college biochemistry textbook in the past 65 years (A) and the change according to different use purposes (B).

biochemistry textbooks published continued to grow each decade. Although there were only two books published in the second year of post-liberation (in 1950), the publication number increased in tens or hundreds of times by decades. In the 2000s, the first ten years of the 21st century, a large number of textbooks were published and the peak reached 809 books (Figure 2A). Even in the 2010s, there were 306 books published in the first four years, the publication number was more than that of the 1950s-1980s (Figure 2A). Among the growth rates of publication for different teaching purposes, the publication for experiment books grew at rate was more than double the growth rate of theory or assistant books (Figure 2B). Interestingly, the total publication number dropped significantly from the 1960s to 1970s (only 36 and 50 in the 1960s and 1970s respectively) compared with that in the 1950s and that in the 1980s (Figure 2A and 2B). This was probably because the Great Proletarian Cultural Revolution (commonly known as the Cultural Revolution, took place in China from 1966 until 1976) delayed the development of the publishing industry.

The Most Productive Books, Editors, Cities and Publishing Houses

By statistical analysis, there were 456 textbooks entitled “Biochemistry”, 128 books named

“Biochemistry experiments” and 92 books published under the name “Biochemistry and molecular biology” (Table 1). The publication number of the top 3 book names as mentioned above accounted for more than 40% (676/1655) of all textbooks. This result showed that there are many textbooks published as the same name and the book names are very repetitive.

The most productive three editors were Prof. Airu Zhou who compiled 14 textbooks, Prof. Ji Zheng who published 13 books and Prof. Ssu-Chih Lia (Sizhi Liu in Chinese) who wrote 7 textbooks for college students (Table 1). Moreover, it’s worth mentioning that Prof. Ssu-Chih Lia (1904-1983) was one of the founders of immunochemistry and wrote the first biochemistry outline in China. Prof. Ji Zheng (1900-2010) was the founder of biochemistry and had been engaged more than 70 years on biochemistry teaching in China. Prof. Airu Zhou (1937-) wrote many versions of biochemistry textbooks for medical students.

The most productive three cities were Beijing, Shanghai and Wuhan. There were 970, 106 and 68 biochemistry textbooks published in these three cities respectively (Table 1). The result indicated that approximately 70% (1144/1655) textbooks were published in these areas. It is associated with that a large proportion of colleges/universities locate in these regions. At the same time, the most productive three publishing houses were People’s Medical Publishing House, Science Press and High Education Press. These

Table 1. The Most Productive Three Book Names, Editors, Cities and Publishing Houses

	1st	2nd	3rd
Book name	Biochemistry (456)	Biochemistry experiments (128)	Biochemistry and molecular biology (92)
Editor	Airu Zhou (14)	Ji Zheng (13)	Sizhi Liu (7)
City	Beijing (970)	Shanghai (106)	Wuhan (68)
Publishing house	People's Medical Publishing House (177)	Science Press (163)	High Education Press (108)

The number in brackets indicates the publication number.

Table 2. The Usage Status of Biochemistry Textbooks in Colleges

College type	Theory periods	Experiment periods	1st Prescribed book author	1st Reference book author
Science/Technology (n=55)	48±3	33±2	Jingyan Wang	Robert Horton
Medicine (n=35)	65±6	48±3	Xiliang Zha	Libo Yao
Agriculture (n=20)	52±4	30±2	Guoqin Liu	Jingyan Wang

houses had published more than 27% (448/1655) biochemistry textbooks in a national wide market (Table 1). It is obvious that all of the three publishing houses locate in Beijing, the culture and education centre of China.

The above results showed that there are many biochemistry textbooks with the same name and the most productive editors are very famous scientists. In addition, the most productive cities and publishing houses are mainly distributed over the developed regions in education and culture.

The Most Influential Textbooks are Edited by the Most Famous Professors and are Wildly Used in Colleges

To investigate the usage status of biochemistry textbook, 110 colleges were randomly selected to obtain the textbook-related information. The results showed that the course of biochemistry and/or experiment part was introduced with more than 48 periods for theory teaching and 30 periods for experiment. Among the three types of colleges, medical school has the maximal periods of biochemistry course (Table 2). This is probably associated with biochemistry being one of the most important contents in medical license examination. The most popular prescribed textbooks were usually the newest editions of the state uniform textbooks in different colleges (Table 2). Some of the most popular reference books were world famous English textbooks, because many colleges had introduced bilingual education (in English and Chinese) or all-English teaching.

By evaluation of the impact of the currently used textbooks, the statistical analysis indicated that the TIF and RIF of Prof. Jingyan Wang (editor-in-chief)'s textbook was much higher than other editors' textbooks in science/technology colleges. At the same time, Prof. Xiliang Zha's textbook was overwhelmingly dominant in medical schools (Table 3). This could be because both of these two editors are the members of the committee for national uniform textbooks. Their textbooks are very popular in different colleges. It was obvious that Prof. Guoqin Liu's textbook enjoyed the absolute advantages in agricultural colleges (Table 3). These results showed that the most influential textbooks usually come from the famous professors and are widely used in subject-associated universities.

The Chinese Textbook Needs More Improvements for Better Understanding

To investigate the difference between the Chinese biochemistry textbook and the foreign one, we compared the contents in two classical textbooks. As shown in Table 4, the comparison suggested that the Chinese textbooks are short of single-concept illustrations and first-hand artworks.

Chinese editors would like to revise the foreign illustrations and tables, not to produce the original with the art programs. The problems for each chapter were only set as the type of questions without answers. Only Power Points for the contents were provided as a web-based media. These materials were too simple for teaching and learning. Compared with the foreign textbook, the content integrations and recent advances

Table 3. The Impact of Top 3 Textbooks in Different Colleges

College type	Jingyan Wang [#]		Xiliang Zha [#]		Guoqin Liu [#]	
	TIF	RIF	TIF	RIF	TIF	RIF
Science/Technology	51.2	1.00	12.4	0.24	6.8	0.13
Medicine	22.6	0.70	32.2	1.00	2.4	0.07
Agriculture	14.8	0.84	8.8	0.50	17.6	1.00

[#] The names indicate the top3 authors of currently used textbooks; IF, impact factor; TIF, total impact factor; RIF, relative impact factor.

Table 4. The Comparison between Chinese and Foreign Textbooks[#]

	Chinese	Foreign
Clear writing	Excellent	Good
Concept-illustration	Abundant and consistent	Insufficient
Physiological relevance	Sufficient and concrete	Not enough
Clinical insights	Appropriate	Sufficient
Answers to problems	Yes	No
Web-based media	Plentiful	Simple
Recent advances	Appropriate	Insufficient

[#]Biochemistry and Molecular Biology (8th edition, by Airu Zhou *et al.*, in Chinese), and Biochemistry (7th edition, by Lubert Stryer *et al.*, in English) were Chosen as representative textbooks.

in Chinese book were not updated as soon as possible. These results indicated that more improvements are encouraged for Chinese biochemistry textbooks.

CONCLUSIONS AND DISCUSSION

The rapid expansion of knowledge and novel techniques in biochemistry has made it a difficult task to learn and teach students within the already heavy curriculum in college students (Gong et al. 2011). A proper textbook plays an important role in teaching quality and talent training. Although the present research demonstrated that there are more than 1600 different textbooks published for biochemistry learning and teaching in the past 65 years, we are facing some problems in writing and publishing.

Biology education in China is different from that in foreign countries (Gul & Sozbilir 2015). The writing style and content usage of Chinese textbook may be different from that in Turkey (Eren et al. 2015). The renewal period was rather long. In China, many colleges and editors attached great importance to textbook publishing. Nevertheless, the content updates of biochemistry textbooks were ignored. For example, the first edition of biochemistry textbook (Editors-in-chief: Tong Shen & Jingyan Wang) was published in 1980, the second edition was published in 1990 and the third edition was in 2008 (Shen 1980, 1990, and Wang et al. 2008). The renewal period ranged from 10 to 18 years, which was much longer than that in western countries. Except the long renewal period, the changes for textbook contents were very small (Zheng & Zhao

2013). Such result was believed to that Chinese education system enthusiastically focuses on science cited index (SCI) papers, not college textbook publishing.

There were many textbooks with the same names (Dai 2007). From Table 1, there were 456 textbooks published as the name of “biochemistry”. The editors didn’t use the subtitles for their own textbooks, even if their contents were inconsistent with others. This will result in these books without the distinguishing features. Some of the published textbooks would like to present the knowledge, not to tell a beautiful story that benefits better understanding (Aydin et al. 2014, and Whittington et al. 2014). To enhance learning and teaching, the different textbooks telling different stories in different colleges should be encouraged.

The modern biochemistry textbooks were short of multimedia materials. The English textbooks written by foreign editors usually include many vivid and attractive figures (Jeremy et al. 2002). Although most textbooks are only published in printed format, many are now available as online electronic books (Teri et al. 2014). There are a lot of cartoons and videos embedded the online books. Since the rise of the massive open online courses (MOOCs) in 2012 (Karen 2013), the multimedia and MOOCs should be introduced into the Chinese college biochemistry textbook publishing and usage.

In summary, the publishing and usage of college biochemistry textbooks have achieved a lot of success in college education. However, we are also facing many problems in publishing high-quality textbooks. If we pay more attentions to textbook writing, publishing and

usage, we believe that the distinguish textbooks will play important roles in learning and teaching in colleges.

Authors' Note

The first two authors contribute equally to this study.

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