

# Introduction

*Ku-ming (Kevin) Chang and Alan Roche*

---

Few would question the value of advanced research today. Considered key to the health and wealth of a nation, research universities receive ample support, especially when global university rankings draw countries into a new level of international competition. Our age has come to assume that an academic career, characterized by the pursuit of new knowledge, starts with a doctorate, generically known as the PhD. Doctoral education prepares the student for a career in academia or industrial research and development, and culminates with the presentation of novel research results in a dissertation that is based on years of original research in a specialized field. This established pattern of research education, taken for granted today, first emerged in parts of the West only in the nineteenth century, and even later in the other parts of the world. This volume studies the emergence and development of research education across disciplines in major areas of the globe—Europe, North America, Latin America and Asia—over the second half of the nineteenth and the first half of the twentieth centuries.

The period that this volume studies saw many fundamental changes in the history of higher education as well as the history of science. It was an age of reform. Previously across Europe the university served to pass on traditional knowledge and prepare students for the traditional professions. After the French Revolution, European universities began to diverge from the more or less homogeneous structure that they had shared since the Middle Ages. Germany, the kingdom of Prussia especially, reformed its system of higher education by making original research imperative for professors and by providing research training to students. France and Britain held on to different systems of higher education as these modern nation-states asserted their national differences. In the middle and later decades of the nineteenth century, when the virtues of German universities became apparent, they and other European and North American countries began to reform their universities more or less

according to the German model. The pursuit for new knowledge was thus embraced as a core value of the university.

It was thus an age of institutional transformation. The university developed into the uncontested institution in which scientific researchers were trained. Previously, researchers could have received advanced training at institutions other than universities. In the eighteenth century, for instance, members of the Royal Academy of Sciences in Paris often began their career as a pupil in the academy and then worked their way up to become associates and then salaried members. These members received no university education. Even in the nineteenth century, many noted British and American scholars began their training and finished their careers in independent research institutions, museums, or libraries. By contrast, developments during the age under study have led us to expect all academics or research scientists to have received graduate university training before their careers begin.

It was an age of innovation. Ingenious discoveries were made, great scientists celebrated, and new research institutions founded. It was also a period of specialization. A remarkable number of new disciplines—anthropology, sociology, linguistics, statistics, and paleontology, among others—were established in this period. Established fields then began to subdivide into further specializations, for instance, chemistry into organic, physical, and biological chemistry. Finally, it was an age of academic globalization, even if not on a scale comparable to today. Non-Western societies in many parts of the world introduced universities at home, and constantly sent students to study in the West, assigning to them the task of transplanting at home the knowledge and institutions that transformed Western countries into great powers.

Considering the importance of research education today, it is not surprising that it has been the subject of intensive scholarly analyses. Some scholars have examined the system of a particular country, such as Arthur Levine, *Educating Researchers* (2007), Ronald G. Ehrenberg, *Educating Scholars: Doctoral Education in the Humanities* (2010), and Jonathan Cole, *The Great American University: Its Rise to Preeminence, Its Indispensable National Role, Why it Must Be Protected* (2009). Other studies are cross-national or comparative: for example, Burton R. Clark, ed., *The Research Foundations of Graduate Education: Germany, Britain, France, United States, Japan* (1993), and Philip G. Altbach and Jorge Balán, eds., *World Class Worldwide: Transforming Research Universities in Asia and Latin America* (2007). There are also important studies on the qualification for the academic profession, including Burton R. Clark, *The Academic Life: Small Worlds, Different Worlds* (1987), Philip G. Altbach, ed., *The*

*International Academic Profession: Portraits of Fourteen Countries* (1996), and Anthony Welch, ed., *The Professoriate: Profile of a Profession* (2005). However, these analyses of doctoral education and academic profession rarely go back before World War II, devoting minimal attention to the history of the academic profession and research education.

This is not to say that histories of universities are in short supply. Standard works on individual institutions (Berlin, Oxford, Cambridge, Johns Hopkins, Harvard, Princeton and many others) and national systems of higher education are numerous. Among the most important ones are those by Friedrich Paulsen, R. Steven Turner, and Charles McClelland for German universities, Louis Liard, George Weisz, and Lawrence Brockliss for France, Stanley James Curtis and R. D. Anderson for Great Britain, and Roger Geiger, John Thelin, James Turner and James Axtell for the United States. Synthetic or comparative histories of universities are also available. These include R. D. Anderson's *European Universities in the Nineteenth Century* (2004), the four-volume *History of the University in Europe* published by Cambridge University Press (general editor Walter Rüegg), Sheldon Rothblatt and Björn Wittrock, eds., *The European and American University Since 1800: Historical and Sociological Essays* (1993), Ana Simões, Maria Paula Diogo, and Kostas Gavroglu, eds., *Sciences in the Universities of Europe, Nineteenth and Twentieth Centuries* (2015), and Rainer Christoph Schwinges, ed., *Humboldt International: der Export des deutschen Universitätsmodells im 19. und 20. Jahrhundert* (2001). The last-cited work even includes Japan and China, thus extending its attention beyond Europe and North America.

In addition to the histories of academic institutions, there are many important works on individual scientists and disciplines (Justus Liebig in chemistry, Leopold von Ranke in history, and Emile Durkheim in sociology, for instance). Others pay close attention to scientific training in an individual discipline, such as Gert Schubring, *Seminar, Institut, Fakultät: Die Entwicklung der Ausbildungsformen und ihrer Institutionen in der Mathematik* (1983), Kathryn M. Olesko, *Physics as a Calling: Discipline and Practice in the Königsberg Seminar for Physics* (1991), Andrew Warwick, *Masters of Theory: Cambridge and the Rise of Mathematical Physics* (2003), or David Kaiser, *Pedagogy and the Practice of Science: Historical and Contemporary Perspectives* (MIT Press, 2005). In fact, several contributors of this volume have published leading research on the history of individual scientists and disciplines.

The present special issue/volume constitutes an effort to present a comparative and global history of research education that has so far not been available. The contributors survey or compare cases of a diversity and

breadth that has rarely been attempted. Indeed, few previous works have examined China, India, Japan, and Latin America in one volume, and few have covered such a great number of disciplines as this volume does. Moreover, each of the following comparative or case studies in this volume is original in its own right. They either first ask the question (for example, regarding the connection between research training and disciplinary identity, as in Chapter 1; or the ‘unruly’ disciplinary character of statistics, as in Chapter 7), or conduct the first comparative studies of the implementation of research education for an individual discipline (mathematics, for example, as in Chapter 4). They may develop a new line of inquiry based on the author’s previous research (such as John Joseph’s chapter on the disciplinary identity of linguistics that draws from his biographical study of Ferdinand de Saussure). Or they may constitute the first case studies that examine the developments of research education in individual disciplines in non-Western societies. Collectively, they complement and fruitfully complicate the available literature in three major areas: institutions, disciplines, and the roles of nations or states. They move beyond present literature in tracing the spread of the research ethos across Europe and the Atlantic, and even to societies in South and East Asia.

The primary subject of all the chapters is the foundation of research education in countries across the globe. We are careful to use the term ‘research education’ in ways that reflect national or institutional differences. Though today we readily identify doctoral education with graduate study and research training, neither identification was universally the case in the nineteenth century. In Germany, though doctoral study did indeed require training in research, the *Doctor philosophiae* (D.phil.) was the first degree after secondary education, and in that sense it was not strictly speaking a graduate degree. In contrast, the French *doctorat d’état* was a graduate degree (after the *licence* and the *agrégé*)—but research was not an essential requirement for the degree until at least the middle of the century. In Britain, short graduate programs (those for the Bachelor of Science, now obsolete, and the Master of Science) and degrees that acknowledged a record of publications (Doctor of Science, known as DSc., and Doctor of Letters, known as DLitt.) were not available until late in the century, and the Doctor of Philosophy degree not until the First World War. None of these degrees were a *sine qua non* for an academic career until even later in the twentieth century. Strictly speaking, Britain therefore had no doctoral education until the establishment of the PhD. If research education was available, it was accommodated at the undergraduate or at most the master’s level, or it was informal. This was also true in British colonies like India. Likewise, Japan and its colonies established graduate school but

provided no formal education for it. Though they established doctoral degrees, they did not require it for an academic career. China had no doctoral programs at all until around 1980. By contrast, American universities adopted the PhD earlier than their British counterparts (which had previously been their model). They introduced this degree as one above the Bachelor of Arts, making it a true graduate degree. They also required for this degree resident study of several years and a dissertation based on original research. Thus, for a considerable part of the period surveyed in this volume, although original research and publications of its result were increasingly desirable, or even required, for an academic career almost everywhere, 'graduate curricular study' in a strict sense was not applicable to Germany, France, and Japan, while resident doctoral education was not available in the French and British Empires and China.

It is for these reasons that we describe our subject as 'research education' rather than doctoral education (unless it is appropriate in specific contexts to do otherwise), for it fits all cases in this survey. There is no doubt that we place an emphasis on research training that was provided in the university, while staying well aware that research did not take place exclusively in universities in this period. This emphasis is justifiable, since over this period specialized training in the university transformed into a qualification that was required (or at least welcomed) by academia and industry alike that centered on advanced research. After this transformation, the PhD that provides education in research has become the highest degree that academia can accord and the badge that all academics wear for their career. In this sense research education is the highest education.

As the chapters in the volume will collectively show, the period under study also coincided with the decline of religion in the university. This is especially true for European universities, which started in medieval Europe essentially as Christian seminaries with allied training in medicine or law, but in which the faculty of theology was almost always the most powerful faculty. In the early modern period, and even more in the nineteenth century, secular pursuits strengthened in the university, while the faculty of philosophy, to which the disciplines in the humanities and most natural sciences belonged, became the model for all the other faculties for its rigor and prestige in academic research. In France and some other European countries (such as the Netherlands), the faculty of philosophy was split into the faculties of letters and sciences, whereas in the United States it was the graduate school, instead of the undergraduate college, that represented the advanced intellectual pursuits of the university. But the results seemed

to converge in all Western countries towards the secularization of university education.

Our sensitivity to institutional cultures leads us to investigate, comparatively, different ‘instruments of research’, the second theme that runs across all chapters. Several chapters in this volume consider major instruments of research, such as the seminar, the laboratory, fieldwork, and statistics, based on our contributors’ archival work and close biographical analyses. Others point out less formal, and less studied, instruments of research. At Oxford and Cambridge, students interested in advanced study benefited from conversations in the dining hall, tutorials in colleges, essay questions in honour exams, and thesis contests for college scholarships. In France, junior humanists relied heavily on correspondence with their supervisors in Paris, since they often taught in the provinces. American, Asian, and even a notable number of European scholars took advanced study trips abroad before or after the receipt of their doctorates. All the chapters in this volume heed the different uses and local adaptations of these instruments. Along with the instruments of research we also analyze research education into different modes, as will be made clear in the conclusion.

The third major theme treated by the authors of this volume comprises the research training for individual disciplines. There are, to be sure, too many disciplines to cover in a single volume. We select representative disciplines in textual studies (classical studies, philology, and history), laboratory sciences (chemistry), theoretical sciences (mathematics and physics), field sciences (archeology, paleontology, and language studies), clinical science (medicine), and even areas of studies that were not or could not be fitted into a single discipline, such as statistics.

One crucial and little-explored issue in that relationship is *inter*-disciplinarity. Previous studies on research education have mostly focused on a particular discipline. We jointly compare a wide spectrum of disciplines, and deliberately include both the humanities and natural sciences, which together constitute modern academia.

In addition, we examine the relationship between research training and disciplinary identity. Academic disciplines constantly shape professional identities by the training that young scholars receive. They—philology, history, and mathematics, for example—solidify their identities by training advanced students in the skills, methods and questions that they consider essential. We also consider the proliferation of disciplines in the age of expansion of higher education, showing that new disciplines, such as linguistics, forged a new identity with the training in new materials (dialects or indigenous languages, for example), new methods (e.g. fieldwork), and new technologies (such as the kymograph and the

phonograph). We even explore the reproduction of disciplinary identity and the multiplication of research teaching beyond local and national settings.

We have striven to include cases in the widest possible variety of countries or societies. As summarized above, in the century of nationalism higher education in Europe developed different national features, which several chapters of this volume examine. Outside Europe, we include investigations of non-Western societies in Latin America, South Asia, and East Asia that have risen to be prominent actors in global economies and higher education—while acknowledging that Russia and Muslim countries are not represented in the volume due to length constraints. Some of these non-Western societies were sovereign states, which could choose their own systems of higher education despite political, economic, and cultural limitations. The result of their choice was always an amalgamation of different elements of foreign and domestic origins. We will see that colonized peoples often first experienced the conflict between traditional learning and Western education, and when they requested more and better access to higher education, they invariably faced racial discrimination. When higher education became available, it was usually introduced in the model of the imperial metropole.

Amid nationalism, imperialism, and colonialism, we also indicate a degree of internationalism. As will be seen in the chapters, this internationalism is reflected in the large flows of international students, missionary institutions of higher education, and philanthropic programs in non-Western countries. In an extreme case, colonized Koreans used the missionary-supported Severance Medical College and Hospital as a shelter for medical education and research to defy the discriminatory control of the colonial authorities. Many chapters in this volume are comparative or transnational (or both) in themselves. The concluding chapter especially provides a summary analysis of all the chapters in a global perspective. True to this historical internationalism, and to the global spirit of our age, we have striven to make this volume a global history of the origins, dissemination, multiplication, proliferation, and local adaptations of research education.

This special issue starts with James Turner's analysis of the formation of disciplines and research training, exploring the possibility of a causal relationship. He covers subjects and themes central to this volume, though not all contributions consider the causal relationship between scientific training and disciplinary identity. Then comes Kasper Risbjerg Eskildsen's study of the historical seminar in Germany and its role as a model for historians in other European and American countries. Chapter 3, by Alan Locke, presents an international comparison of chemical education and

research in nineteenth-century Europe, starting with the case of Justus Liebig at the University of Giessen. Karen Parshall offers a similar comparison for mathematics, though placing an emphasis on the learning experience of the American mathematical community. Next, Janet Howarth, based on a close analysis of the careers of members of the British Academy, presents a synthetic account of their training. Then Daniela Barberis analyzes the training for emerging social sciences in France, which, like England, did not provide formal training that required resident study; her focus is on Émile Durkheim and the junior scholars around him. In Chapter 7 Theodore Porter demonstrates what the author calls the 'unruly character' of statistics that did not fit into a disciplinary mold.

In his chapter, John Joseph traces the extraordinary trajectory of Ferdinand de Saussure's study amid those of ordinary German and French students in the field that eventually became linguistics. Chapter 9 compares research training in language studies in four major Western countries. These two chapters therefore delineate the development of a discipline across World War I, a watershed of sorts for international politics as well as academia.

The rest of the volume investigates the beginning of research training in non-Western countries. In Chapter 10, Ana M. Alfonso-Goldfarb, Márcia H.M. Ferraz, and Silvia Waisse offer a concise survey of higher education in Latin America, ending with a close study of the first generation of Brazilian research chemists. Yoshiyuki Kikuchi studies laboratory teaching and training in Meiji Japan in Chapter 11. Then John Mathew and Pushkar Sohoni review the scientific teaching and research in Colonial India, taking Bombay as their example. Chapter 13, by Danian Hu, examines the undergraduate and master's teaching, which supported students to take up research, at the Department of Physics at Yenching University in Republican China. Hsiao-pei Yen investigates the start of paleographical research and fieldwork, also in Republican China, in Chapter 14. Next, In-sok Yeo surveys the training of medical researchers at the imperial university and the missionary medical college in colonial Korea. Wei-Chi Chen, Wan-yao Chou, and Ku-ming (Kevin) Chang analyze the formal and informal research training in Southeast Asian history and ethnology during Taiwan's colonial rule and a few post-war years. The volume closes with a conclusion that summarizes the major findings of the contributions to the volume.

As no one author can cover all the different disciplines and countries, we have assembled here a group of specialists who are interested in comparative and global studies. Most of them met at the Academia Sinica in Taipei, Taiwan, in a two-day conference in December 2015, which established the groundwork for this volume. We organized a program that



comprised diverse senior as well as junior historians of the humanities and the social and natural sciences. The present volume is the product of the conference and the subsequent vigorous exchanges and revisions. It is thus a joint product not only of written studies, but also of in-person discussions and collaboration.

We hope that this addresses the interests of at least four groups of readers. This first is of course the readership of the *History of Universities*, since it is first and foremost a history of research universities. By extension we hope it also addresses the concerns of government officials, educators, college students, and the public at a time when no country or university can ignore global university rankings. This collection of essays presents an analytical account of the genesis of modern research universities and academic disciplines in representative countries and regions, and tells the history of the foundation on which global rankings of research universities are based.

Another group of readers consists of scholars and students of the history of the humanities and science, and of science and technology studies. The history of science has become a discipline in its own right, and the closely related field(s) of science and technology studies have gained academic programs or research centers that bring together historians, social scientists, natural scientists, and engineers. The history of the humanities as a field, growing rapidly, has won its own journal and society. It thus has its semi-independent readership, though sometimes overlapping with that for the history of science.

Finally, this project addresses the community of global studies. The expansion of higher education across Western and non-Western countries was an integral part of what is now called the first wave of globalization (ca. 1870–1914). The internationalism of higher education described above is just an example that demonstrates that the pursuit for research education, by junior scholars or governments sovereign and colonial alike, was interwoven with many other dimensions of globalization, thus warranting a prominent place in global studies. It will be pointed out in the conclusion of this volume, however, that the globalization of research education was not always at the same pace as economic globalization. Still, the patterns distilled from the study of this period can then be compared with those of academic exchange in the second and third ages of globalization.

In sum, our goal with this volume has been to enrich our understanding of modern higher education in its historical, institutional, disciplinary, national, and transnational contexts, to fruitfully complicate the history of science and the humanities that has often been based on studies of individual scientists, disciplines or countries, and to augment global

studies with cases on research education and academic exchange. We hope that it will generate productive dialogues with the readerships in these areas, and continue healthy internationalism in academic pursuits, analyzed in this volume, at a time when the global spirit is under attack.

*Academia Sinica, Taiwan*

*Case Western Reserve University, Cleveland, USA*