北大高等教育文库

·学术规范与研究方法丛书·

The Ph.D. Process

A Student's Guide to Graduate School in the Sciences

[美] 戴尔·F.布卢姆 [美] 乔纳森·D.卡普 [美] 尼古拉斯·科恩 著

如何成为优秀的研究生

（影印版）

北京大学出版社
PEKING UNIVERSITY PRESS

如何成为优秀的研究生

（影印版）

[美] 戴尔·F.布卢姆　[美] 乔纳森·D.卡普　[美] 尼古拉斯·科恩 著

北京大学出版社
PEKING UNIVERSITY PRESS

著作权合同登记号 图字：01-2014-7082

图书在版编目(CIP)数据

如何成为优秀的研究生：英文 / (美) 布卢姆(Bloom, D. F.)，(美) 卡普(Karp, J. D.)，(美) 科恩(Cohen, N.) 著. —北京：北京大学出版社，2015.11
（北大高等教育文库·学术规范与研究方法丛书）
ISBN 978-7-301-26351-8

Ⅰ. ①如… Ⅱ. ①布… ②卡… ③科… Ⅲ. ①研究生教育－研究－美国－英文 Ⅳ. ①G649.712

中国版本图书馆CIP数据核字(2015)第237799号

书　　名	如何成为优秀的研究生(影印版) RUHE CHENGWEI YOUXIU DE YANJIUSHENG
著作责任者	[美] 戴尔·F.布卢姆 [美] 乔纳森·D.卡普 [美] 尼古拉斯·科恩 主编
责任编辑	周志刚
标准书号	ISBN 978-7-301-26351-8
出版发行	北京大学出版社
地　　址	北京市海淀区成府路205号　100871
网　　址	http://www.pup.cn　　新浪微博：@北京大学出版社
电子信箱	zyl@pup.pku.edu.cn
电　　话	邮购部 62752015　发行部 62750672　编辑部 62767346
印 刷 者	三河市北燕印装有限公司
经 销 者	新华书店
	787毫米×1092毫米　16开本　14.5印张　223千字
	2015年11月第1版　2015年11月第1次印刷
定　　价	38.00元

北大高等教育文库
·学术规范与研究方法丛书·

The Ph.D. Process
A Student's Guide to Graduate School in the Sciences

陈尔强序

十五年前，当我在那届于新奥尔良召开的美国物理学会年会的展厅里买《如何成为优秀的研究生》（*The Ph.D. Process*）时，这本书才刚刚出版，而我还是一名博士后，正在为回国从事教学和科研工作做准备。我到美国留学之前，曾在国内念完了硕士。比较当时美国和国内的研究生教育，我可以从整体上体会到一种巨大的差距。那种差距不仅体现在规模上，也体现在研究生教育的理念、制度以及教育体验的广度和深度上。阅读此书，加深了我对这方面的认识。

《如何成为优秀的研究生》并没有从哲学或教育学的层面入手来讨论研究生培养过程。作为一本为自然科学领域的研究生准备的指南性读物，这本书更多着眼于研究生生活的细节，相当感性。它好似要面对那些初来乍到的新生，传递一些过来人的经验之谈。即便是十五年过去了，我相信那些经验之谈仍然会对我国的研究生有益，同时对整体的研究生教育实践及教育改革有益。书中详细介绍了美国研究生培养的各个环节，包括申请研究生院、课程学习、选择导师、博士资格考试、博士论文选题、全时科研工作及学术交流、博士学位论文的撰写与答辩等。这些层层递进的环节构成了研究生培养的基本规范，有如一个严密的质量保证体系。今天，我国的许多高等教育机构也已采用这样的体系。事实证明，它行之有效，在高质量研究生培养上发挥了重要作用。我们的研究生对此也应该有充分了解，并且要设法体会其背后的教育理念。

陈尔强：美国阿克伦大学（The University of Akron）高分子科学系博士，北京大学化学与分子工程学院高分子科学与工程系教授，国家杰出青年基金获得者，高分子化学与物理教育重点实验室主任，*Polymer*杂志中国区副主编。

然而，研究生培养体系中程式化的要求并没有为每位入学者获得学位做出担保。事实上，它在每个环节都设置了淘汰机制，对研究生提出了各式各样的挑战。《如何成为优秀的研究生》强调个体如何能在研究生培养过程中实现收益最大化，强调个体的行动及其与环境的相互关系。因此，这本书有着“社会学”的意味。书中的第一个问题是为什么要读研。我在给新入学的研究生上课时也会问同样的问题。坐在课堂里的同学们本科成绩优异，他们中的许多人常常把读研视为理所当然，却没有在心中认真想过，或没有全面想过这一人生重大选择的意义。他们只是顺流而下，还没有为在前方将要遭遇的险滩和急流做好思想准备。但是，选择已经做出，选出的答案摆到了面前，那么最好还是去证明答案是正确的。借用经验科学中演绎推理方法的说法，对于一个有价值的答案，我们应该能从中引出一系列的检验性推论，并且需要用实验来检验这些推论是否正确。检验性推论的多样性增加了答案正确性的可靠程度。可以从读研引出的关于生活的推论实在是太多了。它们融入研究生培养的各个环节、各个阶段中，它们汇集成一个研究生的丰满形态。《如何成为优秀的研究生》刻画了这种形态。正如书中所说：“攻读研究生学位的过程是一个充满情感和理性的‘过程’，这一过程与学习同义。每一项决定，每一回失败，每一个错误，每一次挣扎，每一处窘境，每一种挑战，都是这个过程的一部分。”

与本科教育不同，研究生教育的主旨体现在“研究”上，研究生生活的方方面面均交汇于此。也正因为如此，在研究生培养过程中，导师和研究生密不可分。导师主导着研究的方向，决定了研究的品味，对研究的价值负责。而研究生则通过实施具体的研究实践而成长为一名能有所作为的科学家。系统完整的原创性研究成果是一位年轻人可以获得博士学位的依据。何谓原创性？有时这个问题显得十分模糊，不同专业也有不同的看法。《如何成为优秀的研究生》建议，“符合逻辑的向前一小步即可构成原创性研究”。我认为，这种观点是客观中肯的。我们已处于常规科学的阶段，那些曾在科学革命进程中随处可见的重大突破事实上已很难遇到，而广泛的科学探索活动在几乎所有的科学领域都积累了大量的知识，学科前沿相互交叉，也常常变得模糊不清，充满了动态的、不确定的尝试。在这种背景下，要选定一个适当的科学问题来做博

士论文并不是一件轻而易举的事。几年前的中国博士质量调查指出了普遍存在博士论文题目大而无当的情况。这在一定程度上反映出我国学术界在把握学科基础和学术进展方面还有所欠缺，学术积累还不够深厚。博士学位论文选题不当，自然会极大地影响博士学位论文的质量，并给博士培养的整个过程带来困难。在选题时，博士生导师承担着更为重要的角色。他必须深思熟虑，“博观而约取，厚积而薄发”。一、二年级的研究生实际上并没有能力架构一个需要三四年甚至五六年才能完成的研究工作的主题。而在选题过程中，研究生也非只需被动地等待导师的指令。他们需要参与其中，需要积极地尝试课题的各种可能性，排除那些不切实际的研究目标，从而找到真正的主攻方向，为今后成功获取原创性成果奠定基础，哪怕那只是小小的一点。对此，《如何成为优秀的研究生》的忠告是：“你的课题应该足够小，以便能进行深入彻底的研究，而那些将要被考察的问题则必须得到充分的界定。”为了能有效开展博士阶段的研究工作，那些缺乏保证和可行性的项目，即便已经得到探索，也不应列入正式的博士论文选题之中。

一位研究生的研究经历以课题为载体，不会是空洞抽象的。课题的选择应该得到高度重视，它不仅预期了研究工作的创新性，体现了学术价值，同时在很大程度上决定了研究生所要经受的学科训练是否严谨全面，是否有效，并且也关系到是否有利于激发学生的创造热情，发展创造力。在选题之后，学生们将通过对课题的全面深入的探索来反复锻炼科学思维。课题研究的曲折演进正反映了学生成长的路径。不断试错，各种猜想与反驳，使得学生能真正超越本科学习，逐渐进入独立面对未知世界的状态，开始学会发现问题，阐发新知。他们变得习惯于思科学家之所思，行科学家之所行，并要将科学研究方法及学术规范内化为一种个人的行为准则。在他们毕业时，人们可以说，他们掌握了坚实宽广的基础理论和系统深入的学科知识，具有独立从事学术工作的能力。这一点常常会写在他们博士论文的答辩决议书中，作为对他们完成博士学业的肯定。

研究生教育是国民教育的最高层次。培养高端人才，培养那些能胜任科技创新工作要求的科学家，自然是其目的。但目的应该不仅限于此。正如朱自清先生在谈论经典训练时提到的：“经典训练的价值不在

实用，而在文化。”我们也应该在更为宽广、更为基本的意义上看待研究生教育的价值。其价值仍然要落在造就具有崇高精神追求的知识分子上，而非仅仅考虑专业知识和技能的传递。获得博士学位是真正的成人礼。在读研过程中，研究生要为完成导师的或是一个研究团队的科研项目而辛勤工作，但他们并不单纯只是劳力。他们想要从不同的模式和途径来增进自己的能力，他们渴望成功，他们想要赢得的是幸福的未来。《如何成为优秀的研究生》关注研究生的个人体验，关注个人实践与个人成功的关系，对我们全面思考研究生教育的内涵，思考理想人格和端正品性的塑造有积极的启发。研究生生活，如《如何成为优秀的研究生》所言，是一种奇妙的享有特权的生活。研究生与他们大多数的同龄人不同，他们可以有机会在知识的最前沿尽情享有自由探索的乐趣。虽然充满挑战，也有些单调枯燥，又全然不是朝九晚五的工作，但那种生活极为单纯洁净。导师有责任为营造和养护那样的生活工作环境而竭尽全力。对于研究生而言，那样的环境对养成科学的怀疑和批判精神，养成追求卓越的人生态度意义深远。其中，导师的胸怀、视野、秉性、思想和行动无疑会极大地影响年轻一代的价值观和为人处世的方式。就此而言，我也建议我们的研究生导师能认真读一下《如何成为优秀的研究生》。其中谈到的许多事，许多迷茫、不安和期待都是我们曾经有过的。如今，面对那些年轻的面容，我们能否给予更好一些的帮助和引导？而我们自身能否变得更为纯粹，更为博大？研究生成长的历程，其实也正是导师修养自身、追求至善、不断提高境界的历程。

现在是2014年冬季。我的一位行将毕业的研究生已怀揣一家荷兰公司材料研发中心的录用通知，明年此时他应该在万里之外接受公司的专业培训；而我的两位三年级的学生正在着手撰写她们的博士论文选题报告，她们对今后还不是那么有把握，她们还有些紧张，有些莫名的激动。我满心希望他们幸福。当我再次读完《如何成为优秀的研究生》时，我国的研究生教育已获得了空前的成就，它与世界上那些具有悠久传统的研究生教育体系的差距明显缩小。越来越多的年轻人来到研究生院追求他们的梦想。还是要回到那个问题：为什么读研？或者说，梦想是什么？其实要想真正回答这个问题，大概要用上整个读研时光。在研究生生活中需要分别快乐与幸福的不同。研究生生活并非一次野炊或郊

游。每一种幸福的体验都包含着艰辛的付出和全身心的投入。那种幸福来之不易，却是下一场幸福的序曲。

我们应该让生活幸福。

2014年12月8日

Acknowledgments

We are indebted to the many scientists and graduate students, too numerous to mention individually, who contributed to this book by agreeing to be interviewed or by responding to our questionnaire. Their personal accounts and thoughtful advice on all aspects of the graduate school experience truly made the book come alive. Particular thanks go to: Cynthia Carey, Snezhana Dimitrova, Barry Goldstein, Sheila Kelley, Basia Kruszewska, Julie Rehm, Elizabeth Stein, and S. ThyagaRajan, for their time and astute comments; Ted Melnechuk for providing a wealth of invaluable information; Anne Myers for her insightful and wonderful words; our agent, Richard Balkin, for believing in the project; our editor, Kirk Jensen for perspicacious observations and suggestions; and Gary Boehm, Tracy Callahan, Ineke Cohen, John Frelinger, Paula Geiselman, George Kimmich, Greg Maniero, and Rick Willis for carefully reviewing the manuscript and making perceptive and valuable recommendations.

D.F.B., J.D.K., & N.C.

I am indebted to wonderful scientists who made my experiences as a graduate student at UCLA so meaningful and memorable: Art Arnold, who by example and instruction first taught me how to think like a scientist; George Bloch, who as a postdoc gave so much of his time and was a true mentor; and Roger Gorski, who wisely guided me through the intricacies of systems neuroscience and gave me unusual freedom to explore. Emilio Decima, Carlos Grijalva, Wendy Macklin, Irv Maltzman, Paul Micevych, Charles Sawyer, Elizabeth Stein, and David Whitmoyer are talented and spirited researchers who inspired me and provided assistance and counsel. Fellow graduate students, so much a part of the educational experience, delighted me with their inquiring minds and enthusiasm. It was a joy to be in the company of Laura Allan,

Gayle Boyd, Hao-Dong Cai, Robin Dodson, Julian Levy, Fredricka Martin, Greta Mathews, Andrea Moskowitz, Rich Nahin, Laura O'Farrell, Yehuda Shavit, and June Stapleton. For years of encouragement and support, I wish to recognize with appreciation and love my family: Betty, Richard, Steven, and Ronnie Bloom, Harry Mann, and Maisie Samuel. Finally, I acknowledge my dear friend Thea Iberall, who at the moment of initial indecision, e-mailed those crucial and deciding words: "Go for it!"

D.F.B.

Heartfelt thanks to my mentors: Gerhard Fankhauser and John Boner who introduced me to research; Hans Holtfreter who taught me to ask questions of Nature; Bill Hildemann, a role model whose life remains intertwined with mine; and my past and present graduate students and postdocs who now understand what it's all about.

N.C.

The present form of this book would not have been possible if it were not for the "graduate school underground": the collective students, postdocs, and faculty members who agreed to speak openly. I am privileged to have participated in their catharsis. With them, I proclaim that this book is for the graduate students of the future, from the graduate students of the past.

J.D.K.

Preface

The world of a graduate student in the sciences is privileged and wondrous. One is surrounded daily by skillful researchers bustling about confidently doing science—people who are making genuine strides in the understanding of nature, discovering the knowledge that will fill the textbooks of the future. Some of these researchers may be world leaders in their fields; others may be relatively unknown, but on the verge of great discoveries. In this high-tech environment, at the very forefront of knowledge, life is exciting, challenging, and stimulating. Every day can bring new insights, new directions, new revelations.

And here you are, a new graduate student, about to become an important participant in this restricted and extraordinary world. Surely you are excited and thrilled by the opportunity granted you. But you are likely also to be feeling somewhat confused and perhaps anxious at the prospect. Exactly where do you fit in? What is expected of you? What will your daily life be like? What is the best way for you to proceed to insure the successful completion of your education, and future success in your chosen profession?

Your confusion about these issues is understandable. In fact, it may even persist for quite a while after you arrive. Some students never figure it all out, and their careers suffer or never begin. The confusion and uncertainty stem from a peculiar characteristic of graduate school: *the rules of the game are rarely talked about!*

Contrary to what you might be expecting, unless you have a wonderful mentor, you are unlikely to receive explicit guidance as to what you should or should not be doing in grad school. A graduate program has a certain vague and open-ended character. There is no rigid agenda, no circumscribed plan of action, no set timetable. Little is mapped out for you. You will not take any specific courses on how to be a scientist, and no one will stand by you and

teach you all the tricks. How, then, do you learn? Yes, there are some classes that you will be required to take, but will these be your main source of information, and are grades really important? What about research, that singularly most important aspect of graduate school: In whose lab will you work? What will you work on? How do you gain expertise? Who can help you? How hard do you have to work?

Logical reasoning, critical analysis, scientific writing, public speaking, networking, and other such skills are also elements to be mastered during graduate school, but how are they perfected? There are so many components to a graduate education, but which ones are critical for future success, and deserve most of your energy and time? What decisions can make or break your career? Keep in mind that graduate school is not an experiential extension of undergraduate education, where the passing of a sufficient number of courses guarantees one a degree. Nor is it medical school or law school, where a delineated and set curriculum gives order, structure, and time limits to the educational experience. This is graduate school in the sciences, where each student in the program has a different experience, learns different skills and different information, and finishes at a different time; where poor choices can delay the degree by years; where you are relatively free to use your time as you see fit; and where you will sink or swim, depending upon *your own interpretation* of how the system works. It can be startling. Self-discipline and self-initiative rule—you are pretty much on your own, as you will soon find out.

The purpose of this book is to provide you with some insight into this novel system, insight that will help you succeed and make the most of your graduate years. The contents are what a "best friend" would tell you about graduate school and how it should be approached. We describe and explain the "rules of survival and success," for although generally unspoken and cloaked, "rules" they surely are; we believe that many of those who eventually drop out of a graduate program or fail to succeed, just never "got it."

Also described is the daily experience itself: the research, classes, seminars, journal clubs, lab meetings, interactions with peers and professors, manuscript preparation, qualifying exams, professional meetings, oral exams, dissertation preparation, and other elements that comprise this necessarily compulsive existence. Anxiety, frustration, and joy—all normal responses to a grad student's life—are also examined. So, too, are the special

problems of foreign students who are strangers to our culture and educational system.

An important part of this book is the inclusion of quotes about graduate school (obtained via questionnaire or personal interview) from numerous people across the country in a diversity of scientific fields, who have been through the process or are now going through the process—professors, scientists in industry, postdoctoral fellows, and current graduate students. These people describe their own experiences and emotions, and offer advice on the variety of challenges and circumstances that constitute graduate school in the sciences. (Unless otherwise indicated, the university listed under each quote represents the graduate school attended, and not the institution in which the respondents now work. The comments do not reflect upon the university or department denoted, as they are the views solely of individuals, and may not be representative; furthermore, some of the respondents graduated a number of years ago, and departments do evolve.)

This is not a book about science (although some helpful hints concerning particular scientific endeavors are given). If anything, it is a book on the "sociology" of academia, and on graduate education in the sciences in particular. Most of the issues we discuss are timeless, and apply to students of all the sciences, biological and physical. Beginning students have many misconceptions about graduate school and what it takes to succeed there. Once you know how the game is played, once you realize what your advisor is really asking from you, once you are familiar with what your life will be like for the next four to seven years, your graduate experience should be predictable, surmountable, and for the most part, enjoyable! We suggest that you read this book in its *entirety* at an early stage in your career planning, so that you can take steps in advance and make wise decisions as choices arise.

The making of a scientist is a slow and sometimes painful process, and how it happens is neither straightforward nor easily described. But it does happen, over many years, from the subtly combined influence of formal discourse, informal chats, observation, successful and unsuccessful experimentation, error, criticism, and praise. The result of this education is a person who thinks deeply, logically, and especially critically, who is knowledgeable in the area in which he or she works, who knows how to correctly design experiments to test his or her hypotheses, and who is technically proficient enough to carry these experiments out—in short, a scientist.

A Note on Organization

This book is organized in a largely chronological order, although beginning students may have some difficulty in seeing this. Opening chapters (Chapters 1 and 2) discuss the decision to go to graduate school and the application procedure, as well as the task of choosing a research advisor. The latter topic is necessary to bring up early, as advisors are sometimes selected *before* a student arrives at the university, or shortly thereafter. These chapters are followed by an overview of the stages of graduate school (Chapter 3), so that the reader can get a general feel for the framework of the educational process, and is thus prepared for the more detailed discussions that follow. Chapter 4 delves into activities that students participate in early on: classes, journal clubs, seminars, etc. As many students also start working in a lab shortly after arrival on campus, we felt it important that they realize beforehand that they are unlikely to be working side-by-side with their research advisor, and we explain why this (sometimes resented) state of affairs is so (Chapter 5). Because their advisors are typically absent from the lab, students may wonder how it is that they ever learn to be scientists; the interesting answers to this complex question are enumerated in Chapter 6. The tricky business of choosing specific research projects for the dissertation, the pressures to specialize, and the necessity for interacting with other scientists and making contacts in the academic community (networking) are issues that the developing scientist must confront (Chapters 7 and 8); ensuing responsibilities, including choosing a dissertation committee and preparing for the preliminary oral exam (Chapter 9), mark the student's entrance into focused research. Following this general account, Chapter 10 focuses on the nature of a graduate student's daily life, with much of the emphasis placed on the trials and tribulations of the student's research years. Elements that are part of that life, such as note-taking, lab etiquette, competition, luck, stress, and the challenges of scientific writing, are discussed in Chapters 11 through 14. Chapters 15 and 16 consider the should-be goals of a student as he/she progresses through the program. Discussed here are objectives to be accomplished *before* graduation that will help ensure career success during these times of limited employment opportunity in science. Finally, the end stages of the graduate process, writing the dissertation and passing the final oral exam, are covered in Chapters 17 and 18.

目 录