

Introduction & A Brief History of Undergraduate Research in Psychology

What Is Undergraduate Research?

In 1891, James Mark Baldwin (APA President, 1897) set up a working psychology laboratory at the University of Toronto. In 1893, he hired August Kirschmann, a student of Wilhelm Wundt, who became director of the lab. Under Kirschmann's direction, undergraduates in their senior year conducted empirical research following his dictum that "no experimental work of advanced students should be done for the mere sake of practice, but that it should contribute to the solution of some problem."

In his 1997 article in the CUR Quarterly, Tom Wenzel echoes Kirschmann's dictum by defining undergraduate research as an "inquiry or investigation conducted by a undergraduate that makes an original intellectual or creative contribution to the discipline." Wenzel goes on to point out that this definition provides a great deal of flexibility and makes no distinction between faculty or student initiated work or student faculty vs. student-student collaboration. The definition does require that the research be original in that it add to our knowledge base and that it contribute to the discipline, which requires some form of dissemination of the results.

In their definition of undergraduate research, the American Chemical Society's Committee on Professional Training suggested that an ideal undergraduate research project should:

- *have a clearly communicated purpose and potential out-comes,*
- *have well-defined objectives and methods, be substantial in scope (as opposed to a collection of small projects),*
- *have a reasonable chance of completion in the available time,*
- *require contact with the professional literature,*
- *avoid repetitive work,*
- *require use of advanced concepts*
- *require a variety of techniques and instruments (not exclusively library work)*
- *culminate in a comprehensive written report.*

The process of conducting research is another important part of the definition. Undergraduate research is not just research; it is also a pedagogical process that if done well can (a) change the students' peer group into one that values the world of ideas, (b)

increase faculty-student interaction outside the classroom, and (c) promote student engagement and intellectual development by increasing time-on-task. In conducting research, students are transformed from passive to active learners. They are better able to think critically and creatively, and they become savvier information consumers. Ideally, undergraduate research experiences provide a number of benefits beyond just the creation of new knowledge. Some of the benefits of creating new knowledge include increased self-confidence and a sense of accomplishment in being the first person to know something, learning how to persevere at a task because many experiments will not work out as originally planned, development of self-discipline and leadership skills, the ability to solve technical and procedural problems, and for many, clarification of their career goals as they get a taste of what professionals in the field really do.

In their article entitled "Seven Principles for Good Practice in Undergraduate Education," Chickering and Gamson outline seven principles that enhance the teaching/learning process. They suggest that good practices:

- *encourage student-faculty contact*
- *encourage cooperation among students*
- *encourage active learning*
- *provide students with prompt feedback*
- *emphasize time on task*
- *communicate high expectations*
- *respect diverse talents and ways of learning*

Former Psi Chi National President Peter Giordano has suggested that "research is the best way to travel" and it is clear that undergraduate research provides a meaningful opportunity to achieve the seven principles described by Chickering and Gamson.

This e-book is designed to be a hands-on publication that provides faculty, departments, and institutions with examples, suggestions, and best practices in developing, promoting, and sustaining undergraduate research in ways that foster the achievement of the goals outlined above. Our goal is that readers will be able to use this e-book in a very practical way to answer questions, generate ideas, and adapt the information to their special circumstances. The book provides models that can be

used at community colleges, commuter colleges, liberal arts schools, and comprehensive universities as well as research universities. Different ways of structuring a research program are described that should be useful for departments and colleges, while the descriptions of the different types of research that can engage undergraduates should be of considerable interest to individual faculty.

Undergraduate Research in Psychology: An Historical Overview

In 1898, Cornell University Professor E. Bradford Titchener pointed out that in the 20 years since Wilhelm Wundt instituted the first psychological laboratory at the University of Leipzig, a radical and far-reaching revolution had been inaugurated, a revolution based on the influence of the experimental method. Laboratories had been established in all the principal universities of the United States, and from the beginning, these laboratories were designed for instruction as well as research. In his *Report of the Commissioner of Education for the year 1890-'91* (Vol. 2, pp. 1139-1151), Walter O. Krohn described the facilities in experimental psychology at many of the colleges and universities in the United States.

At this very early date, it is clear that a number of these laboratories provided opportunities for undergraduate students to engage in empirical research. For example, Brown University offered an advanced elective course for seniors that consisted of "original research in the laboratory and seminary for papers and discussions." E. B. Delabarre established the psychology laboratory at Brown in 1892. At Wellesley College, work in experimental psychology began in 1891 under the direction of Mary Whiton Calkins, and in that first year, students were involved in a "statistical inquiry into cases of colored hearing and of forms for numbers, months, and the like."

At this time, the University of Wisconsin offered a course in advanced experimental psychology, in which "each student takes up a special problem and prepared an account of the results of his work." The UW lab was established by Joseph Jastrow in 1888. One of the most influential educators of the time was Harry Kirke Wolfe, who established a psychology laboratory at University of Nebraska in 1889. Wolfe encouraged all students in psychology to do laboratory work. Wolfe believed that research was the most important pedagogical tool available to a teacher and he was able to inspire his students with an appreciation of the importance of research by involving them in the process of discovery.

Many of the early pioneers in psychology began their careers with undergraduate research. Among those who would later serve as president of the American Psychological Association was Walter Hunter, (APA President, 1931) who conducted a study of the maze behavior of pigeons during his senior year at the University of Texas, which under H. A. Carr's guidance was published in the *Journal of Animal Behavior* in 1911. In 1912, Clark Hull (APA President, 1936) conducted an undergraduate research project on learning under the direction of J. F. Shepard at the University of Michigan. L. L. Thurstone's (APA President, 1933) undergraduate degree was from Cornell in engineering and while there he was involved in several research projects on the transmission of sound through a light beam, as well as machine design. When Charles Judd (APA President, 1909) was a senior at Wesleyan in 1894, he co-authored a paper on visualization with his mentor, A. C. Armstrong, which was published in *Psychological Review*.

In his senior year (1898), Knight Dunlap (APA President, 1922) conducted research that he remembers as involving "two terrible spring-driven color mixers" (p. 38-39) supervised by George Stratton at the University of California. Margaret Floy Washburn (APA President, 1921) conducted research on the application of Weber's Law to the two-point threshold under the supervision of J. McKeen Cattell (APA President, 1895) at Columbia and it was her work there that led to her acceptance into the graduate program at Cornell in 1892. Another of Cattell's students was Shepard Ivory Franz (APA President, 1921), who began his experimental work as a senior in 1893. In 1910, Karl Lashley (APA President, 1929) conducted research for his undergraduate thesis at the University of West Virginia on the histology of the digestive tract of chimeroid fish. This work was instrumental in his receiving a graduate teaching fellowship at the University of Pittsburg.

Walter Pillsbury (APA President, 1910) was an undergraduate student of Harry Kirke Wolfe at the University of Nebraska where he, like many students, participated in research on psychophysics that was compiled by another University of Nebraska alumnus, Joy Paul Guilford (APA President, 1950), and published after Wolfe's death. Other students of Wolfe who went on to become president of the American Psychological Association include Madison Bentley (1925) who, during his senior year, served as Wolfe's lab assistant, and Edwin Guthrie (APA President, 1945), who was a student at Lincoln High School when he first met Wolfe. Both Bentley and Guthrie commented that Wolfe had influenced them more than any other mentor.

In his 1895 *Psychological Review* article on "The New Psychology in Undergraduate Work," Wolfe extolled the value of involving undergraduate students in research. In a survey conducted in the 1920s, his undergraduate lab ranked third in producing students who would later attain doctorates and influence the field. While neither Wolfe nor his students received credit for their lab work, enrollments in the lab courses increased dramatically over the years. He once remarked that the students "came for the grade and stayed for the zest." The purpose of this book is to assist faculty in creating an undergraduate research program that captures that zest.

Exemplars Who Mentored Undergraduate Research

On the cover of this book are four individuals whose record of mentoring undergraduate student research in psychology is outstanding: Harry Kirke Wolfe (1858-1918), Mary Whiton Calkins (1863-1930), Margaret Floy Washburn (1871-1939), and Stephen F. Davis (1942-). These influential teachers possessed a teaching style that made students feel welcome in the laboratory. They encouraged students to take an active role in conducting original research, and they collaborated with an extraordinary number of undergraduate students on research projects.

Harry Kirke Wolfe



Harry Kirke Wolfe (1858-1918) was the second American to receive a doctorate in Wilhelm Wundt's lab in 1886, four months after James McKeen Cattell became the first. Wolfe returned to America and founded one of the earliest psychology laboratories at the University of Nebraska. His research interests included developmental psychology, cognitive processes, and educational issues. His greatest contribution to psychology was as a teacher who inspired a large number of undergraduates to pursue advanced degrees in psychology. Among his better known students were three presidents of the American Psychological Association: Madison Bentley, Walter Pillsbury, and Edwin Guthrie, all of whom listed Wolfe as the person who had the most influence on them before they received their doctorate. During his professional career, Wolfe worked tirelessly to enhance the education of his students, working with them individually and campaigning for better laboratory

facilities and equipment in his department at the University of Nebraska, where he founded the psychology lab in 1889.

Wolfe was a very effective teacher who from modest beginnings attracted an ever-increasing number of students to his courses. His teaching philosophy put a premium on experiential learning and he insisted that students engage in research using laboratory equipment that Wolfe often purchased with his own funds. Typically, Wolfe spent about 35 contact hours with students each week, but received no credit for the laboratory hours that he added to his courses. Students in his yearlong experimental psychology course engaged in studies of time perception, the speed of mental operations, and Weber's law. With this grounding, students could then engage in original research projects. Interestingly, his students received no academic credit for the hours they spent in research, and yet there was an ever-increasing number of students enrolled in his classes. An example of this work is a published study conducted by Frances Duncombe, who in the course of a child study class taught by Wolfe, examined children's ideas about Santa Claus. In fact, in a survey in the 1920s, Wolfe's undergraduate laboratory ranked third in producing students who would later attain doctorates and exert influence in the field. His commitment to involving undergraduate students in research is clear in an article he published in the *Psychological Review* in 1895 that encouraged other colleges and universities to include practical work, even for students in beginning classes.

Wolfe was a charter member of the American Psychological Association, although he held no offices in the organization. He also helped found *The American Journal of Psychology*, the first American journal in the discipline. Wolfe only published a few articles in the journal, devoting most of his written work to papers whose goal was to improve educational practices. He was also a leader in the child study movement that was initiated by G. Stanley Hall and engaged in research with his students to learn all there was to know about children, including their physical and mental characteristics, attention span, religious ideas, sense of humor, etc. Most of his publications were in the *North Western Journal of Education*, including works on the beginnings of speech, imagination and emotion, as well as studies of children's defects: color blindness, hearing problems, fatigue and nearsightedness.

Despite his success as a teacher and his popularity with teacher and parent groups in the region, Wolfe was frequently involved in disputes with the administrators at the University of Nebraska over laboratory space, funding, and equipment. In

1897, Wolfe was required by the University's new chancellor to explain his budget deficit of \$75.86. His defense was that he did not "consider these expenses as deficit" and that he would continue to "provide any needed inexpensive article for my work without reference to the condition of my departmental fund." Perhaps it was this attitude that led to his being fired, despite a petition from 1000 students requesting his reinstatement. In keeping with his commitment to teaching, Wolfe went on to serve as superintendent of public schools in south Omaha for 5 years and principal of Lincoln High School for another 3 years. With the acquisition of a new Chancellor, Wolfe returned to the University where he taught for another 12 years.

Wolfe cared about the personal as well as the intellectual development of his students. He was a supportive and engaging teacher who gave enormously of his time and energy. One of the messages his students received was the importance of ethics. Wolfe had a well-defined code of ethics that caused some people to think of him as brave and courageous while others considered him merely difficult and self-righteous. Wolfe was never one to "go along in order to get along." During the First World War, Wolfe's patriotism was questioned and he was tried, albeit acquitted, for "not showing full support for the United States government's actions in the war with Germany." Some University faculty were forced to resign, but Wolfe was not among them. Still, the process was painful to Wolfe and may have contributed to his early death at age 59 from a heart attack. For more about this fascinating teacher, I recommend Ludy Benjamin's book: *Harry Kirke Wolfe: Pioneer in Psychology*, published by University of Nebraska Press, which although now out-of-print, is available from used book dealers (see <http://www.abebooks.com/>)

Mary Whiton Calkins (Founded the Wellesley College Lab in 1891)



Mary Whiton Calkins began her college education at Smith College but was forced to return home for her junior year in order to tutor her younger siblings after her sister's death in 1884. She completed her education with degrees in both philosophy and the classics and

upon graduation joined her family for a yearlong excursion to Europe. After her return to America, she got the chance to teach Greek at Wellesley College where she proved her teaching skills in instructing students in Greek as well as philosophy and psychology. Though she had no formal training in psychology, she was appointed to the newly created

position in experimental psychology. To fully qualify for the position, she attended Clark University to study psychology with Edmund Sanford, and Harvard University to study philosophy with William James and Josiah Royce. At Harvard, she also studied with Hugo Munsterberg, investigating memory processes. While Calkins completed all of the requirements for a Ph. D., Harvard refused to grant her the degree because she was a woman, although Radcliffe, Harvard's sister school, offered her a doctoral degree which she politely refused, citing the fact that all of her work had been done at Harvard.

Calkins set up the psychological laboratory in an attic room at Wellesley in 1891, which was one of only 12 labs in North America and the first lab at a women's college. In the Fall of 1892, Calkins offered a course in Psychology including Experimental Psychology. In this inaugural year, fifty-four students worked in Calkins' lab, where they conducted research on sensation, attention, association, space perception, memory, imagination, and reaction time. Student co-authored articles published in the *American Journal of Psychology* covered a broad spectrum of topics including aesthetics, children's emotions, moral consciousness and dreams. For example, one student conducting research on imagination, studied the presence of a "continued story" which was never written down, seldom discussed, but very significant in a person's emotional life. In the area of dreams Calkins and her students found that dreams had content traceable to either external or organic stimuli. Two of her students, Florence Hallam and Sarah Weed conducted research on the relative proportion of pleasurable vs. disagreeable dreams that was praised by Sigmund Freud.

Calkins was a prolific scholar who published close to 70 articles in psychology and almost 40 articles in philosophy, as well as books such as "The Persistent Problems in Philosophy." Her most innovative work was in self-psychology, which emphasized the social nature of the self. In a series of papers published in the *Philosophical Review* in 1900, she denounced "the misleading treatment of the self as metaphysical presupposition" and maintained that selves "may be treated as facts for Science, since they are taken for granted without inquiry about their bearing on 'reality,' and... are critically observed and classified on the basis of their relation with each other and with facts of every other order." She went on to relate the self to both consciousness and perception.

In 1903, Calkins was ranked 12th in a list of the 50 most important contributors to the field. She was elected president of the American Psychological Association in 1905, its first woman president and in

1918 became president of the American Philosophical Society. She received honorary degrees from Columbia University as well as Smith College and received an honorary membership in the British Psychological Association in 1928. For more information on Mary Whiton Calkins, consult her autobiography, published in Carl Murchison's *History of Psychology in Autobiography*, available at <http://psychclassics.yorku.ca/Calkins/murchison.htm>.

Margaret Floy Washburn (Founded the Vassar lab in 1903)



Despite her early love of chemistry and French, in her senior year at Vassar, Margaret Floy Washburn's dominant intellectual interests were in science and philosophy, which led to her decision to pursue a career in Psychology. She studied with James McKeen Cattell at Columbia who initially put her to

work in determining whether Weber's Law held for the two-point threshold on the skin. Washburn improvised an apparatus, used a metronome to provide a constant rate of stimulation and found that it did not hold. Despite Cattell's support, Washburn was not allowed to enroll for graduate study because she was a woman.

Eventually, she went to Cornell University where she studied with Edward Titchener. While there, she worked on tactual space perception, which, after a 3-hour oral examination by Titchener, resulted in an MA *in absentia* from Vassar. Cornell University awarded her a Ph. D. in 1894. She was the first woman in America to receive a doctorate in psychology. After a six-year sojourn at Wells College and a year at the University of Cincinnati, she was offered an Associate Professorship at Vassar where she spent the rest of her academic life.

By the time she returned to Vassar in 1903, Washburn was listed among the 1000 most important "men of science" and had been appointed cooperating editor of the American Journal of Psychology, a title she held until her death in 1939. Her choice of Vassar was based partly on her desire to be near her parents who lived 16 miles away, as well as the opportunity to be close to several friends including William James, Josiah Royce, and Robert Woodworth, as well as Leta and Harry Hollingworth. She was a popular teacher whose students reported that her "lectures were brilliant, exact, clear with a wealth of references." In 1903 she established the psychology lab at Vassar.

Between 1905 and 1938 Washburn published 68 studies from the Vassar Psychological Laboratory

with 117 undergraduate students as joint authors. Washburn would determine the problem and method of study while the students conducted the actual experimentation and formulated the results. For example, Anna Taylor conducted a study on "The Sources of the Affective Reaction to Fallacies" in which students were asked to introspect the impressions produced by considering several logical fallacies. Hazel Leach conducted another study that also appeared in the American Journal of Psychology. Her study, entitled "Some Tests by the Association Reaction Method of Mental Diagnosis," used a word association, reaction time procedure to study deception. In 1912, one of her students proved red-color blindness in rabbits and also discovered that rabbits react to the relative rather than the absolute brightness of colors. Another student, Edwina Kittredge, proved that a bull-calf was also red color-blind, which supported the finding that it was not the color that angered bulls in the bullring. During the late 1920s, Washburn and her undergraduate students undertook research on human emotions that examined sources of pleasure, anger, and fear in groups of Italian and Russian Jewish women in New York and Chicago.

Washburn's most notable research was in the area of animal psychology and her book, *The Animal Mind*, published in 1908, was the first book in the field by an American and became the standard textbook in comparative psychology for the next 25 years. Washburn was elected president of the American Psychological Association in 1921, served as chair of Section I of the American Association for the Advancement of Science in 1927, and was elected to the National Academy of Sciences in 1931, the second woman ever chosen for that honor. In 1932, she was the U. S. delegate to the International Congress of Psychology in Copenhagen. Margaret Washburn's autobiography was published in Carl Murchison's *History of Psychology in Autobiography*, available at this website provided by Chris Green: <http://psychclassics.yorku.ca/Washburn/murchison.htm>.

Stephen F. Davis



Our final "pioneer" pictured on the cover of this book is the author of the Foreword, Stephen F. Davis. Until his retirement in 2001, Dr. Davis was a Roe R. Cross Distinguished Professor at Emporia State University, Emporia, Kansas. Currently, he is a visiting distinguished psychology professor at Texas Wesleyan University in Fort Worth, Texas.

Dr. Davis received his Ph.D. in General Experimental Psychology from Texas Christian University. When he left TCU for King College (Bristol, TN), followed by an appointment at Austin Peay State University (Clarksville, TN), he was a hard-core rat runner trained in the Hull-Spence tradition. Fortunately, he was able to attract several students to work with him on olfactory communication and several co-authored presentations and publications resulted from these efforts. However, as additional students became involved with his lab group, he found that not all of them shared his burning passion to investigate olfactory communication in animal maze learning. In fact, a few of his students began to propose some of the “strangest” (at least to an old-time rat runner) research he could imagine, including “personality characteristics of civilian and military policemen,” “an analysis of the size of human figure drawings and level of self-esteem in school-age children,” “the Type A behavior pattern and level of self-esteem,” and “death anxiety in military couples.”

Dr. Davis had the presence of mind not to dismiss these, and similar, research ideas brought to him by his students. During his incredibly productive career, he found his research focus shifting, and to the dismay of his dissertation director, all of those hours invested in teaching him the importance of programmatic research seemed wasted. Dr. Davis had come to the realization that his laboratory and professional interests did not exist for any specific type of research; they existed for the training of quality students. As a result, his research and most of his professional activities were student driven and rather eclectic. In a short note written on the occasion of his retirement from Emporia State, he noted, “the trip has been superb!”

Dr. Davis's research interests include academic dishonesty, student professional development, student responsibility, conditioned taste aversion learning, and olfactory communication in animal maze learning. Since 1966 he has published over 270 articles and textbooks and presented over 800 professional papers; the vast majority of these publications and presentations include undergraduate and graduate student co-authors. Two of his presentations that highlight his involvement with undergraduate student research are “Academically Dishonest Rats Consume Yucky Tasting Stuff Before Engaging in Discrimination at the Shopping Mall,” and “The Elixir of Professional Development for You and Your Students.” Steve Davis's career has been spent in schools that do not have a competitive admissions policy, national reputation, or sizeable endowments. Thus, his considerable record of research activity has been maintained by the

reinforcing value of continued interaction with his students.

Dr. Davis is a Fellow of the American Psychological Association Divisions 1 (General), 2 (Society for the Teaching of Psychology), and 6 (Behavioral Neuroscience and Comparative Psychology). He has served as the President of APA Division 2 (Society for the Teaching of Psychology), the Southern Society for Philosophy and Psychology, the Southwestern Psychological Association, and Psi Chi (the National Honor Society in Psychology). In 1987 Dr. Davis received the first annual Psi Chi/Florence L. Denmark National Faculty Advisor Award. In 1988 he received the American Psychological Foundation Distinguished Teaching in Psychology Award, and in 1989 he received the APA Division 2 Teaching Excellence Award. In 2004, he received the Society for the Teaching of Psychology Presidential Citation for Career Contributions

In support of the publication of undergraduate research, Dr. Davis served as the inaugural editor of *The Psi Chi Journal of Undergraduate Research*. In his inaugural editorial he articulated the purpose of the journal, which also describes his personal philosophy regarding undergraduate research: “The twofold purpose of this journal is to foster and reward the scholarly research efforts of undergraduate psychology students and to provide them with a valuable learning experience. The reader should bear in mind that these studies are possibly less complex in design, scope, and sampling than professional publications and are not limited to significant findings. The basis for accepting a paper for publication is the agreement among three professional reviewers that the project, hypothesis, and design are well researched and conceived for someone with an undergraduate level of competence and experience.”

Dr. Davis's impact did not end in lab with his students; he spread his passion for student research to others when he founded both the Association for Psychological and Educational Research in Kansas and the Great Plains Students' Psychology Convention. Today, more than 500 students and faculty gather each year in March to celebrate student research largely due to Steve Davis's vision and passion that has ignited colleagues across several States.

Purpose of this E-book

Over the past several years, there has been an increase in the emphasis on conducting research as part of the undergraduate educational experience in many disciplines including psychology. Organizations such as NCUR (National Conference

on Undergraduate Research) have provided a national forum for presenting research. CUR (Council on Undergraduate Research) has provided guidance to institutions and faculty for fostering undergraduate research in many disciplines. In addition, Sigma Xi: The Scientific Research Society, has added an undergraduate research showcase to their annual meeting, and undergraduate research is displayed annually in the U.S. Capitol and in many State Capitols in the Posters on the Hill program.

In psychology, the national and regional conventions have featured undergraduate research sessions and a number of regional student conferences have emerged. Psi Chi has established a journal that publishes only undergraduate research and the Society for the Teaching of Psychology (STP) has various programs that support undergraduate research at both regional and national conventions as well as teaching institutes that emphasize the importance of undergraduate research. The underlying notion is that we learn psychology by doing psychology and one way to do psychology is through research.

As this surge in undergraduate research has occurred, it is clear that there are many different models for conducting research with undergraduate students. The purpose of this book is to provide a comprehensive overview of the many ways to conduct undergraduate research in psychology with practical suggestions and models for how one can both develop and enhance a research program that involves undergraduate students.

Organization of the Book

The book begins with a panel discussion in which leading experts in the area of the teaching of psychology address the question: Why engage undergraduates in research? Several topics are discussed including how to structure the curriculum to promote undergraduate research, the departmental resources needed to support undergraduate research, ways to excite students about conducting research, rewarding faculty who promote undergraduate research, and the benefits of undergraduate research. The book is then divided into seven sections that each address a different aspect of the undergraduate research experience.

Section 1: Institutionalizing Undergraduate Student Research

This section of the book addresses undergraduate research on a grand scale as part of the academic

culture and provides information on support mechanisms available for undergraduate research.

In the opening chapter, Steve Barney reviews the literature that suggests the status of American higher education is in a state of crisis. Unlike the academy of the past, colleges and universities seem to be less sensitive and responsive to the needs and demands of society. Moreover, undergraduate students who pay the lion's share of tuition are often given the least amount of experiential learning and mentorship with faculty. Barney asserts that the time may be at hand for a large-scale cultural shift in higher education. Establishing undergraduate research as a standard may help meet the growing needs of society and fulfill the social contract institutions of higher learning have with undergraduate students.

In chapter 2, Mike Nelson and Mitch Malachowski describe the Council on Undergraduate Research's *Institutionalizing Undergraduate Research Institutes*. Participants attend these weekend workshops to enhance the research programs on their campuses. The benefits and challenges that institutions in attendance realize are discussed and evaluated and the outcomes described. The authors focus the majority of their attention on those issues that are important to many different kinds of colleges and universities in order to draw generally applicable lessons that other institutions can employ.

In the chapter on institutional support mechanisms, John Falconer presents an overview of institutional mechanisms for supporting undergraduate research. Examples are drawn from several public and private colleges and universities around the United States, offering a range of approaches that can be adapted to various campus cultures. The chapter suggests methods of integrating students into existing research infrastructure, explores several approaches to administrative support, and describes campus-level programs that support student research. While every institution must develop student research mechanisms appropriate to its own mission, resources, and culture, this chapter will give the reader an understanding of common approaches in contemporary higher education.

In his chapter, Vincent Prohaska reviews the various sources and programs that fund and support research projects by undergraduate students. Included are descriptions of each program, eligibility criteria, deadline dates, and links to web sites.

The final chapter in Section 1 is on research ethics. Rick Miller outlines some of the issues that the student researcher and his or her mentor need to keep in mind when conducting research, and describes online training programs available for

teaching research ethics. Some of the issues addressed are ethical concerns in recruiting participants, informed consent, the use of deception, maintaining confidentiality, debriefing, and ethical issues in conducting research with vulnerable populations.

Section 2: Successful Models of Undergraduate Research

This section describes several successful models of undergraduate research in psychology at a variety of institutions. In the first part of this section, university-wide models are described and in the second part, departmental models are described.

Christopher Lind provides an in depth look at the University of Wisconsin-Eau Claire as a model public institution for supporting undergraduate research. The university is a Center of Excellence for Faculty/Student Research Collaboration and has been recognized by the *Chronicle of Higher Education*, *USATODAY*, *U.S. News & World Report*, and the National Conference on Undergraduate Research. This chapter describes the growth and development of the Center of Excellence, its current programs, and a unique student approved “differential tuition” mechanism to fund faculty/student collaborative research at the University of Wisconsin-Eau Claire.

Kenya Taylor presents a detailed description of the evolution of undergraduate research at the University of Nebraska at Kearney. She describes the growth and development of undergraduate research and current programs and opportunities available to students and faculty. An analysis of activities and direction for future expansion and sustainment of the undergraduate research culture is provided.

Ken Keith, Lisa Baird, and Michael Ichiyama describe the Summer Undergraduate Research Experience (SURE) program of the University of San Diego. SURE is a program of competitive research grants that fosters student-faculty collaboration and encourages involvement of undergraduate students in meaningful scientific activities. The program is multidisciplinary in nature, and is managed by faculty coordinators chosen from the participating departments. The Department of Psychology has been a key player in SURE, and student participants have presented and published their research in a variety of venues.

Based on her experience at Utah State University, Joyce Kinkead describes a fellowship program for undergraduates that places them in intensive research experiences from day one of their undergraduate careers. Fellows may study any field, ranging from

biochemistry to violin performance. She explains the nuts and bolts of fellowship selection, oversight, and mentorship as well as noting grant programs to support the research and disseminate the results of their projects.

In his chapter, John Mateja describes the creation of the Undergraduate Research and Scholarly Activities (URSA) office and the range of activities that he and the URSA Advisory Board have worked to develop at Murray State University. Included among the programs is *Posters-at-the-Capitol*, a program organized by Murray State that enables undergraduates from all of Kentucky’s public universities to present their research to members of the Kentucky legislature and governor, *Scholars Week*, an annual celebration of the scholarly work of over 1000 MSU students, and the *Distinguished Mentor Award*, which recognizes faculty for their mentoring efforts. He concludes his chapter with a discussion on “lessons learned.”

Lynn White provides a detailed description of the evolution and impact of Southern Utah University's successful departmental model for a culture of undergraduate research. Intradepartmental and central administrative demographic variables and policies are discussed which both helped and hindered the development of this culture. Among them are faculty attitudes, workload and curricular issues, student attitudes, opportunities for faculty development leave, rank, and tenure policies, and centralized programmatic administrative support.

Susan Burns' chapter describes the research opportunities provided to students at Morningside College in Sioux City, Iowa, a predominantly undergraduate teaching institution with 1,400 students enrolled from 25 states and 8 countries. Within this chapter she discusses the variety of characteristics that make Morningside College’s Psychology Department a successful model for undergraduate research: integration of research in a variety of lab (research-based) courses, group research opportunities, the senior thesis requirement for all psychology majors, and student coordination of and presentation at a cross-discipline campus-wide student research symposium. A description of each of these features discussing details and benefits for students and faculty is offered.

Bill Krantz and his colleagues describe the psychology major at Hanover College and its integration of student research. The major is designed to have students design and conduct research several times in the course of the major. At a minimum, students design and conduct four research projects. These research projects occur in a wide variety of courses exposing students to

numerous designs and statistical methods. The major culminates with a year-long research project.

Christie Cathey and Gwen Murdock present Missouri Southern State University's model for engaging undergraduates in psychological research. They first describe the Department of Psychology's curriculum for majors, which includes a three-course research preparation sequence and a required senior thesis research project. They then discuss additional opportunities for undergraduate research and for funding this research, including opportunities for students to travel and conduct research abroad, which is supported by Missouri Southern's Institute for International Studies. Finally, they provide evidence for the success of this model.

In his chapter, Roy Smith describes a long-standing undergraduate research program at the University of Mary Washington. After explaining how the faculty has carefully integrated research experience into all levels of the undergraduate curriculum, he lists the particular advantages that justify investing in a comprehensive program of undergraduate research.

Collaborative research among psychology students and faculty members has a long and distinguished history at Furman University. Brewer, Einstein, and Pontari highlight certain aspects of this critical component of their curriculum that is available to all qualified psychology majors. These research opportunities arise from several facets of Furman's program, including independent research and internships. In addition, the authors discuss funding sources for remunerating students and faculty members engaged in collaborative research. A local research and internship conference celebrates research and is a smashing success.

Bill Lammers describes a comprehensive strategy to promote undergraduate research at the University of Central Arkansas, which includes an emphasis on research at Psi Chi and Psychology Club meetings, an informal seminar to prepare the best majors for graduate school, research participation in the General Psychology course, research proposal development in the Research Methods course, a separate (three credit hours) Research Methods Lab course, availability of Independent Readings and Independent Research courses, an Undergraduate Scholar program, student travel and presentation at conferences, financial support and recognition of student research, and a departmental atmosphere that supports student research.

Section 3: Conducting Undergraduate Research

In this section, many of the ways in which the undergraduate research experience can be promoted are presented. This section will be particularly useful for individuals who want to establish an undergraduate research program in their department and are in need of concrete examples.

In their chapter, Emily Balcetis and Rick Miller suggest that small group research improves the undergraduate first-year experience by promoting student engagement through collaborative research. This chapter describes institutional programs that implement small group research designed to recruit freshmen in general and specific factions of the freshmen class including honors students, at risk students, students from underrepresented groups, and those with clearly defined career goals. In addition, they discuss benefits and problems of implementing such programs including educational gains, personal development, social loafing, time management, and negative social outcomes. They end by suggesting strategies for optimizing the benefits and avoiding common pitfalls.

Eric Amsel and Theresa Kay address the nature and justification of a new lower-division undergraduate course in psychology. The course is titled *The Science and Profession of Psychology* and is designed to promote student's understanding of the discipline and engagement in undergraduate research. They review the conceptual barriers preventing psychology students from understanding the science of psychology and address the importance of students having meaningful but scaffolded research experience early in their academic careers so they can adequately grasp the scientific nature of the discipline.

Research methods and statistical skills are important for all undergraduate psychology majors, and faculty want to maximize student understanding and acquisition of these skills. Cathy Grover and Kenneth Weaver describe an integrated, sequential two-course approach the department at Emporia State University adopted in 2003. In this approach, descriptive methods and descriptive statistics constitute one course and experimental methods and inferential statistics constitute the second. Thus far, the benefits of this approach include students completing correlational and experimental studies, writing two research papers in APA format, and presenting orally to their peers and in poster format to the department.

Bernard Beins outlines a successful three-semester program of undergraduate research in the undergraduate curriculum at Ithaca College. This Research Team program, which is required of all psychology majors, provides students with the opportunity to develop research skills over time while working closely with a faculty member and other students. Students value this experience as part of their learning. Although the program is costly to the department in terms of faculty resources, there is strong support from both students and faculty. The outcomes include significant numbers of student conference presentations and successful admissions to graduate programs.

Bill Wozniak describes a model that incorporates advanced undergraduate psychology laboratory courses as a vehicle for conducting undergraduate research. Although not identical to traditional laboratories in the natural sciences, these labs afford students the opportunity to work with faculty in developing, implementing, and writing up a research project. The advantages and disadvantages of advanced psychology labs are presented.

Cal Garbin and David Hansen describe the undergraduate research process at the University of Nebraska at Lincoln. At UNL, students engage in research using large multivariate data sets provided by various agencies to conduct sophisticated analyses in a quantitative methods course.

In his chapter on Mentoring Undergraduate Research in a Principles of Assessment Course, Steve Barney describes his efforts to inspire a culture of undergraduate research in his psychometrics class. Students participate in research teams and complete projects examining the reliability and/or validity of measurement instruments, surveys, or tests. He writes about how his class serves as a data collection site for various publishing companies who are continually developing and assessing new instruments. The student projects often contribute to developing the norms and initial psychometric properties that appear in published test manuals. This real-world application of students' findings makes the research projects more interesting and relevant.

Undergraduate independent research projects offer an exceptional opportunity to truly immerse students in the understanding of psychology as a science. Because the actual process of involving students in independent study should be tailored to the specific advisor and student pairing, Susan Burns' chapter offers suggestions regarding broader issues of selecting students, planning and supervision of independent research projects, common pitfalls and warnings for students and faculty, and benefits associated with independent study.

Community colleges present distinctive challenges for faculty desiring to provide early mentoring of students interested in research. Jennifer O'Loughlin-Brooks and Valerie Smith offer suggestions for overcoming the obstacles particular to the two-year campus in establishing a research program. Offered are strategies for student recruitment, engendering institutional support, and creating an agenda and calendar that is manageable for both traditional and non-traditional students.

Vincent Prohaska discusses the unique challenges involved in conducting research with non-traditional students at commuter colleges. Included are tips for recruiting students who might not know that research experience is valuable, helping students with work and family responsibilities manage their time, and getting the research completed.

Holly Tatum and Beth Schwartz describe the Summer Research Program at Randolph College, including its history, goals, and unique characteristics. They highlight the participation of the psychology faculty and students and describe how the summer research program complements and extends the psychology curriculum. Finally, they review recent research demonstrating the benefits of participation in a summer research program for undergraduate students.

The task of managing student research projects often becomes problematic, especially as class size increases. In his chapter, Ed Kardas describes the creation, design, and use of a password-protected FileMaker Pro Web database he has used since 2000. It allows the instructor to monitor and provide feedback about research ideas to students outside of class time. Students willingly submit their ideas without fear of broadcasting them over the entire Internet. Instructors can display the database periodically while they ask students for progress reports. Having an on-line repository of ideas helps develop a sense of community, both within the class and with previous classes. Analyzing the accumulation of research topics over time helps the instructor understand the kinds of research topics that interest undergraduates.

Beth Schwartz and Holly Tatum provide a review of the type of capstone courses found in undergraduate psychology programs and the types of institutions that include these courses in the curriculum. They include details of the Randolph College capstone course, in which students enroll in a two-semester course and gain experience with all aspects of the scientific process. Full details of the assignments and requirements for the course are included. Finally, they review the assessment methods used and refinements made in response to assessment results.

Section 4: Special Types of Research Opportunities for Undergraduates

This section describes special research situations and how students and faculty can use these.

Joanne Altman discusses utilizing zoos as research partners. This allows students to study animal behavior at institutions that do not maintain animal facilities. She describes a variety of research topics students can investigate in a zoo setting and shares examples from the literature. Dr. Altman offers suggestions for how to forge a relationship with a nearby zoo and addresses some of the methodological and logistical challenges of working in a zoo environment. Despite the challenges, she advocates developing a research relationship with a local animal park. Zoo research on visitors or animals can be a transforming experience for the student researcher.

Maya Khanna discusses points to consider when conducting a community-based research project with students. Specifically, she provides suggestions for how to ensure that a project is appropriate for community-based research and how to ensure that students are ready for conducting this type of research. In addition, she stresses the importance of approaching community-based research as a joint venture between the researcher/instructor, the students, and, most importantly, the members of the community. In her discussion of community-based research, Dr. Khanna brings in aspects of her research experience to highlight both the benefits and difficulties of conducting community-based research with students.

Joseph Benz describes the techniques of field research and gives examples of how it is used to educate students about both non-humans and non-experimental research. He briefly describes the annual Sandhill crane migration through the Platte river valley and how it can be used as a mechanism for teaching naturalistic observation. He also provides a list of resources for teachers who want to use these techniques.

Kevin Klatt describes the development of the University of Wisconsin-Eau Claire Campus Autism Program (UWEC-CAP) and the role of undergraduate research in the program. The CAP serves children ages 1-5 who are diagnosed with a pervasive developmental disorder, usually autism. The program therapists include only undergraduate students who are pursuing a psychology major and are enrolled in a behavior analysis emphasis.

Mark Zrull discusses undergraduate research in a traditional behavioral neuroscience lab. He describes

some goals of the research experience for students and faculty as well as some space, equipment and policy requirements typical for behavioral neuroscience research settings. He also describes the process by which undergraduates might find their way into this research setting. In addition, he offers the different skill sets an undergraduate may use and provides some thoughts about building and mentoring a well-functioning behavioral neuroscience research team.

The Chimpanzee and Human Communication Institute (CHCI) provides a unique opportunity for research and education about human's sibling species, chimpanzees. CHCI provides sanctuary for three chimpanzees that use American Sign Language in communication with each other and their human caregivers. Jensvold and Fouts describe research projects and data collection at the institute that involve undergraduate students. This includes archival written records, videotape records, and live observation of the chimpanzees. Research projects range from the study of chimpanzee sign language to environmental enrichment.

The chapter by Matthew Huss focuses on his experience involving students in a research experience at a maximum-security forensic hospital. Conducting forensic research with undergraduate students can be extremely rewarding and provides a real-life experience for them, which few other students are afforded. Working as part of a research team provides them an opportunity to learn the true capabilities of human beings, while learning a great deal about the interaction of the mental health and legal systems. Despite the challenges of working with young men and women on this sensitive research, the benefits certainly outweigh the costs.

Cindy Gibson provides information about opportunities for engaging undergraduate students in neuroscience research, advocating the collaborative apprenticeship model and supplying a variety of ideas and specific resources. She specifically addresses animal research considerations, summer research opportunities, and undergraduate neuroscience publishing. Dr. Gibson also discusses strategies for engagement in teaching laboratories and independent research projects that focus on undergraduate neuroscience skill development while taking challenges such as facility and budget resources into consideration.

John Krantz and Bill Altermatt discuss the nature of online research as well as the advantages and disadvantages of using online research for undergraduate projects. They outline the necessary resources for conducting online research and cover some common concerns, including recruitment, participant motivation, and ethics.

Britton Mace details several research opportunities for undergraduates in the National Parks. Successful projects focused on alternative transportation systems, soundscapes, and night sky visibility are provided as examples. Dr. Mace then reveals many of the challenges and obstacles involved in completing a field-based research project in the parks. Despite the trials and tribulations, students have found research in the parks to be one of the most educational and rewarding experiences of their undergraduate career.

Ruth Ault articulates practical folk knowledge about doing research with preschool aged children including such topics as securing a sample, locating research space, framing the experience to yield children's cooperation, coping with participants' (mis)behavior, considering safety and health concerns, and practicing the procedure. These suggestions should help instructors supervise undergraduates who want to work with 2- to 5-year-olds.

Jill Brown and Dan Foy discuss the epistemological questions that psychologists interested in qualitative work grapple with, providing a framework within contemporary constructivist worldviews. They review the literature about teaching qualitative methods in psychology and address challenges of teaching qualitative methods in the age of empiricism. Five major techniques are discussed (case study, phenomenology, life history, grounded theory, and ethnography) along with recommendations for readings within each technique.

Lizette Royer discusses the need among undergraduates to develop and use higher level critical thinking skills and points to the use of primary source materials as a way for students to do so in a history and systems of psychology course. She suggests that instructors must first teach students what primary source materials are, how to interpret them, and how the evidence obtained from them can fit within a greater historical context before bringing the material to the classroom. Examples of course work in which archival material/primary source documents were used by the instructor and the students are discussed.

Section 5: Faculty/Student Roles

This section provides information on the various roles that students and faculty play in the research world. This section includes papers from both students and faculty.

Theresa Wadkins and Rick Miller discuss the process of mentoring that leads to the development of students' research skills. They describe mentor characteristics, the expectations of mentors and

protégés and the challenges of mentoring. In general, they review many of the practical details to be considered as one decides whether or not to engage in mentoring undergraduate student research.

William Douglas Woody discusses collaboration with undergraduates from a faculty perspective. He defines collaboration and distinguishes it from other modes of working with undergraduates. He presents processes for selecting students along with goals, challenges, and advantages of collaborative work. He illustrates these processes with examples from his work with an outstanding undergraduate student. He concludes with specific recommendations about teaching ethical behavior, ethical concerns in collaboration with undergraduates, and recognition of the larger mission of collaboration.

Joseph Hamm discusses his first research collaboration experience under the mentorship of Dr. William Douglas Woody. Joe explains the process from a student perspective from his initial meeting with his mentor through decisions about topics and procedures, data collection and analysis, and eventual presentation and writing. He identifies effective practices and potential challenges within the context of that process to help both faculty and students develop the same fulfilling experience.

In the beginning of their chapter, Krista Forrest, Bradley Stastny, and Jennifer Bruns discuss the major differences between faculty driven and student driven research programs by focusing specifically on the conditions under which faculty driven programs are better suited. The authors then discuss the various costs and benefits associated with faculty driven research programs and the impact that these programs can have on professors and the undergraduate students who work with them. In closing, the authors present some practical advice for the implementation of faculty driven programs by using current research programs as examples.

Section 6: Sharing the Results of Research

This section describes the many types of forums available to undergraduate students in which they can share the results of their research.

Donna Stuber-McEwen and Kristina Thielen-Belveal explore the beneficial impact of undergraduate conventions on students, faculty, and the profession. An overview of the common conference formats (i.e., national, regional, local, and asynchronous), along with alternative opportunities for presentation experience, is presented. Additionally, the barriers to student participation in conferences and the ways in which faculty may help overcome these are addressed. The authors contend that students' experience in attending and presenting

at undergraduate conferences is vital to their professional development

Undergraduate research forums are becoming more popular both at the department and university levels and are a great way to showcase undergraduate research for other students, friends, and faculty/administration. Participating students can also practice giving a professional poster or oral paper for future conferences or classes. Diane Martichuski describes an undergraduate research forum in the Department of Psychology at the University of Colorado at Boulder. She explains the logistics for her department, including an organizing timeline and poster display options, and also mentions other university departments, which have forums with aspects different from her own.

Organizing a campus-wide event celebrating undergraduate research can be a frustrating, yet extremely rewarding endeavor. In her chapter, Roxanne Sullivan provides examples of different approaches to campus-wide research days, as well as the benefits and challenges of these events for the university community.

Isabelle Cherney describes the benefits of participating in the yearly Posters on the Hill conference in Washington D. C. It provides background information on this conference sponsored by the Council on Undergraduate Research (CUR), an overview of the application process and tips on how to prepare for it, as well as a detailed description of what happens during the conference. It illustrates how this unique forum has contributed to building a culture of undergraduate research at Creighton University. In addition, several undergraduate students who presented at the conference for the past six years share their learning experiences.

Robert Rycek discusses student research presentations at professional conventions. He examines the benefits, challenges and responsibilities of presenting at a professional convention as opposed to a student conference. Recommendations for students and faculty mentors are made.

Rick Froman surveys the varieties of locally published undergraduate research journals in a wide range of institutions. These publications are designed to encourage high standards of scholarship in a department or college by rewarding excellence with publication. Some are also designed to provide advanced students with an opportunity to have real life experience in the peer review process. They also encourage a culture of scholarship and get students excited about doing research. They can also be used to provide guidance to new students, allowing them to build on the example of more experienced student researchers. A case study detailing the development of such a journal and the embedding of the

publication process within the curriculum of a psychology department is described.

Mark Ware and Susan Burns examine the benefits to students and faculty of scholarly publication in journals whose primary goal is to publish the research of undergraduate students. Benefits for students include promoting critical thinking skills, encouraging collaborative learning, and refining communication skills. Benefits for faculty include reinforcing and extending their own scholarly skills, increasing motivation for teaching and scholarly undertakings, and enhancing knowledge and skills for teaching research. Their personal experience and the published literature indicate that students and faculty accrue numerous benefits from such interaction; faculty involvement in student scholarship is a win-win situation.

Section 7: Assessment and Evaluation of Undergraduate Student Research

This section of the book emphasizes the overall value of undergraduate research and how to assess the outcomes of the undergraduate research experience.

CarolAnne Kardash, Michael Wallace, and Linda Blockus summarize data regarding science undergraduates' perceptions of the value of participation in undergraduate research experiences (UREs). Forty-four female and 28 male interns who engaged in UREs in various science disciplines at the University of Missouri-Columbia responded in writing to the question, "What are the most important things you learned from the research internship?" The top three responses were gains in scientific dispositions and habits of mind (78%), gains in research skills and insights into the research process (51%), and gains in general knowledge and skills (40%). These student-identified benefits are generally consistent with the gains presumed to result from participation in UREs.

Bryan Saville and Tracy Zinn discuss the role of research experiences in undergraduate psychology education and identify five important goals that research experiences help achieve: (a) knowledge of research methods, (b) the ability to think critically, (c) acquiring the values of a psychologist, (d) the ability to communicate effectively, and (e) personal and professional development. Saville and Zinn also provide tips for enhancing students' research experiences and discuss how these experiences can enhance students' personal and professional lives.

George Spilich discusses the benefits that a department can derive from careful assessment of student outcomes. He identifies the following major

steps in assessing the effects of an undergraduate curriculum upon students: (a) pre-planning the assessment in light of the institutional and departmental mission, (b) designing the assessment plan, (c) implementing the plan in a sustainable fashion, and (d) using the assessment to build a culture of continual curricular development. Common obstacles to success are identified and strategies to avoid such impediments are suggested. A list of web-based resources is provided for departments to consider as they conceive of and implement an assessment program that best suits their unique needs.

Linda Rueckert describes a variety of existing tools that can be used to assess the outcomes of student involvement in research. She discusses which tools are more appropriate for given outcomes and lists a number of published and online resources for faculty interested in locating existing tools or creating their own.

In his chapter on the value of undergraduate research in the workplace and community, Christopher Koch shows that the skills employers are looking for in employees correspond to the skills that students develop while engaged in the research process. He also presents strategies to help students identify and market these skills to employers.

Jennifer Johnson reflects on her research experiences as an undergraduate psychology student. She notes the necessity of beginning early as a “trained monkey” (completing the tasks of a research project that are so easy a trained monkey could do them) in order to learn the ropes and deal with the frustrations of each new task. She points out that the knowledge gained in helping other students with their research projects can help the student develop the ability to scientifically complete a personal research project.

In the final chapter in the section, Christopher Koch examines the importance graduate school admission committees place on undergraduate research. He suggests that graduate schools value undergraduate research for at least four reasons. Undergraduate research can help a student determine his or her area of interest in psychology, thereby allowing for a more focused search of graduate programs. Second, working with a faculty member on research can help yield better letters of recommendation. Third, undergraduate research provides an excellent opportunity to enhance several secondary criteria for graduate school admission. Lastly, engaging in research helps develop research-based skills that are important for success in graduate school.

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I want to thank our authors for their generous and thoughtful contributions to the e-book and our section editors for their careful critiques of the authors' work. The authors have had first hand experiences, and in their chapters they share their successes as well as the challenges in implementing the undergraduate research process. Our goal is that the reader will be able to use this e-book in a very practical way to answer questions, generate ideas, and adapt the information to their special circumstances. I hope you will find that this book achieves its goal.

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