

# Undergraduate Research Experiences During January Academic Sessions

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**Abstract:** The benefits of undergraduate research in chemistry are well known. Most of these experiences occur either as summer research experiences at a National Science Foundation (NSF) funded institution, a summer experience at one's home institution, or through a senior capstone project. This paper discusses the creation of a mini-research experience during the January academic session. At least 101 undergraduate institutions offer an academic session during January. The Hastings College Chemistry Department was able to send students to four separate research institutions over the past eight years to conduct research and work alongside graduate students, post-docs, and faculty members with research appointments. These opportunities do not replace the other types of undergraduate research, but provide students with an additional research opportunity. This program could become a model for other undergraduate students offering a January session or other short session to work with research labs to gain more opportunities for undergraduate research.

## Introduction

Developing a consistent and high quality undergraduate research program in chemistry is challenging, especially at a small liberal arts college. The benefits of undergraduate research are well documented and extensive [1–4]. A primary means of undergraduate research is through summer programs such as a National Science Foundation (NSF) funded research experience for undergraduates (REU) [5, 6] or institutionally run programs and partnerships [1, 4]. A second means of undergraduate research is through capstone or senior projects completed during the final year of one's undergraduate program [4, 7].

Both summer REU programs and capstones have their own set of problems. The NSF funded summer programs are outstanding and can provide one of the best experiences to a potential graduate student. Most of the programs are 8–12 weeks in duration; they involve interactions with faculty members, graduate students, and post-docs, and are typically at an institution where the undergraduate student is not enrolled. For students at a small liberal arts college, the exposure to a research lab and extensive instrumentation is something to which they most frequently do not have access. The major problem with these programs is that they are extremely competitive. Many outstanding students are being declined simply due to the low capacity in these programs, and in some cases, this can discourage solid students who were not accepted into one of these programs from pursuing a graduate research program.

Summer programs completed at an undergraduate student's home institution can also be a tremendously valuable experience. When available, these opportunities are typically much less competitive and the acceptance rate is greater. One main advantage to this type of program is that a student may be able to conduct research over a longer period of time; 8–12 weeks or even longer than an academic year [4]. The stipends, if any, are typically much more modest and institutional support may be limited. And, especially for students at small liberal arts colleges, the exposure to a research lab, different instrumentation, graduate students, and post-docs cannot be done in the same fashion as the NSF-REU programs.

Senior capstone projects are the most common and universal research experience for undergraduate students, especially those from small liberal arts colleges. These experiences are often two semesters in length and can provide a longer term research project than the other experiences. Problems with these programs may include a lack of dedicated research space, heavy faculty teaching loads, and heavy student course loads [4, 7].

## January Academic Sessions

Along with the usual undergraduate research opportunities, Hastings College has developed a new and creative way for students to gain additional research experience using its 4-1-4 academic calendar. This means a three-week session with enrollment in a single course is placed between the fall and spring semesters. The following statement is made in the Hastings College academic catalog about the January (J-Term) session (ref. 8, p. 5).

Beginning early in January, this three-week term provides maximum opportunity for creative imagination in techniques and methods of instruction not always feasible in the longer 14-week semesters. Work during the J-Term includes field trips to art, music, and drama centers of the United States, study tours at home and abroad, independent study both off and on campus, and regular classes, seminars and independent research projects on campus.

January academic sessions began in 1960 at Florida Presbyterian College, now Eckerd College [9]. Many additional colleges and universities began January sessions in the late 1960s and 1970s. According to the Integrated Postsecondary Education Data System (IPEDS) [10] and cross checked with current academic calendars at these institutions, there are 101 reported 4-year institutions with January academic sessions in 36 states (Table 1). There may be more institutions with January sessions which are not listed since January Sessions that are not required for all undergraduate students may not be considered as an official 4-1-4 calendar.

**Table 1.** A comprehensive list of all 4-year institutions in the United States offering a January session

Institution	State	Institution	State
Birmingham Southern College	AL	Gustavus Adolphus College	MN
Samford University	AL	Hamline University	MN
International Baptist College <sup>a</sup>	AZ	St. Catherine University	MN
Biola University	CA	St. Olaf College	MN
California State University-Stanislaus	CA	University of St. Thomas	MN
Chapman University	CA	Lindenwood University	MO
Hope International University <sup>a</sup>	CA	Elon University <sup>a</sup>	NC
Saint Mary's College of California	CA	Salem College	NC
University of La Verne	CA	Hastings College	NE
University of San Diego	CA	Midland University	NE
Whittier College	CA	Hartwick College	NY
University of New Haven	CT	Hofstra University	NY
University of Delaware	DE	Keuka College	NY
Eckerd College	FL	Molloy College	NY
New College of Florida	FL	Mount Vernon Nazarene University	OH
LaGrange College	GA	Oberlin College	OH
Toccoa Falls College <sup>a</sup>	GA	Otterbein University	OH
Buena Vista University <sup>a</sup>	IA	Oklahoma Baptist University	OK
Graceland University-Lamoni	IA	Linfield College-Adult Degree Program	OR
Drake University	IA	Linfield College-McMinnville Campus	OR
Luther College	IA	Linfield College-Nursing & Health Sciences	OR
Mount Mercy University	IA	Albright College	PA
University of Dubuque	IA	Mercyhurst University	PA
The College of Idaho	ID	Millersville University of Pennsylvania	PA
Elmhurst College	IL	Washington & Jefferson College	PA
Greenville College	IL	Wilson College	PA
DePauw University	IN	Rhode Island School of Design	RI
Franklin College	IN	Converse College	SC
Huntington University	IN	Erskine College	SC
Manchester University	IN	Wofford College	SC
Taylor University	IN	Augustana College	SD
Bethany College	KS	University of Sioux Falls	SD
Bethel College-North Newton	KS	Maryville College	TN
Central Christian College of Kansas	KS	Union University	TN
McPherson College	KS	Austin College	TX
Sterling College <sup>a</sup>	KS	Dallas Baptist University	TX
Tabor College	KS	The University of Texas at Arlington	TX
Centre College	KY	Bridgewater College	VA
The Southern Baptist Theological Seminary	KY	Hollins University	VA
Hampshire College	MA	Randolph-Macon College	VA
Harvard	MA	Virginia Wesleyan College	VA
Massachusetts Institute of Technology	MA	Middlebury College	VT
Massachusetts Maritime Academy	MA	Pacific Lutheran University	WA
Williams College	MA	Trinity Lutheran College	WA
McDaniel College	MD	Whitworth University	WA
Salisbury University	MD	Carthage College	WI
University of Maryland-Baltimore	MD	Edgewood College <sup>a</sup>	WI
University of Maryland-Baltimore County	MD	University of Wisconsin-Stout	WI
Colby College	ME	Bethany College	WV
Alma College	MI	Davis & Elkins College	WV
Calvin College	MI		

<sup>a</sup>Institutions with a 2-week January session

### January Research Experience

During January sessions, visiting professors often teach courses. In 2008, a Hastings College alum who is a faculty member at the University of North Dakota offered a course which met a few days on campus, and then traveled to Grand Forks, ND, to complete a laboratory research experience.

Three Hastings College students participated, and the concept of a January research experience began. Over the past six years, and 14 students later, the concept was refined and expanded.

What has been learned is that it is essential to adapt the experience to student's personal needs and to the various research labs that host students. Since its existence in 2008,

students have been sent to the University of North Dakota, the University of Nebraska-Lincoln, the University of Kansas, and the University of Northern Colorado. Some campuses were able to accommodate students on campus while others could not, and off-campus weekly rental housing was substituted. Some campuses had no dining hall during part or all of the session, and all campuses required visitor parking permits. Once the logistics of room and board and parking were determined, the primary contact at each university was able to ask researchers to host a student and provide either a mini-project or some sort of other meaningful research experience which the student could not attain at his or her home institution. Since there were typically no more than four Hastings College students enrolled per January, student placement was not a problem.

At Hastings College and many institutions with a January session, tuition is part of the fall semester and each student enrolls in a three credit upper-division course (CHM320, Chemistry Research Experience) that could be applied to his or her major or as an elective. Grades for the credit earned were determined from an evaluation from the host lab. Students were responsible for room and board, parking fees, and travel expenses. Most students carpoled and had a roommate, and in some instances the host university would cover some of the expenses. Although there are internal standards for grade point average and a prerequisite of at least a year and a half of college level chemistry, the clear advantage for students is that participation is not as competitive as NSF summer REU programs and could provide a meaningful off campus experience in a research lab. Since the small cost is absorbed by the students or host institutions, this program is also fully sustainable without external funding.

We have seen a direct impact on students that have taken the January research experience course. Half of the students ultimately enrolled in a graduate research program, in part because the experience confirmed their interest in such a path. The main purpose is exposure to a graduate research laboratory, something we cannot provide. Many of the successful projects were ones that allowed students to work directly with graduate students, post-docs, and research grade equipment. The scope of the projects mostly involved smaller studies such as synthesizing one compound as part of a larger study or finishing up loose ends of summer programs. Since we are the only institution in our area providing this opportunity it sets us apart from a recruiting standpoint and also provides our students an additional in-person networking tool.

There are obvious shortcomings to this program: 1). Clearly, it is only a three-week experience and there is no stipend. 2). There is a small financial cost for the experience. 3). Travel in January is also unpredictable in the Great Plains Region. On two occasions, travel days were modified by a day to avoid winter weather. However the benefits greatly outweigh the shortcomings, especially for students who were unable to

participate in an NSF summer REU program because they were not selected or were unable to participate for some other reason.

This model for an undergraduate research opportunity during the January session does not apply to only January or only to chemistry. Many institutions offer a May session; however, with end of the semester activities, there are possible unforeseen problems. With that said, there are certainly similar possibilities with a similar program during a May session. This model could also be used in all areas of the sciences and even many departments outside of the sciences. Experiences for undergraduate students to interact with graduate students in disciplines outside of the sciences appear to be minimal. This model could provide that opportunity.

There is no perfect recipe for an undergraduate research opportunity. What has been done at Hastings College is to develop a new and creative undergraduate research opportunity. It in no way replaces any of the other experiences which are available to undergraduate chemistry students. However, it gives an example of how there can be additional opportunities for undergraduate research, partnerships, and collaboration between institutions, especially with institutions that offer a January session.

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