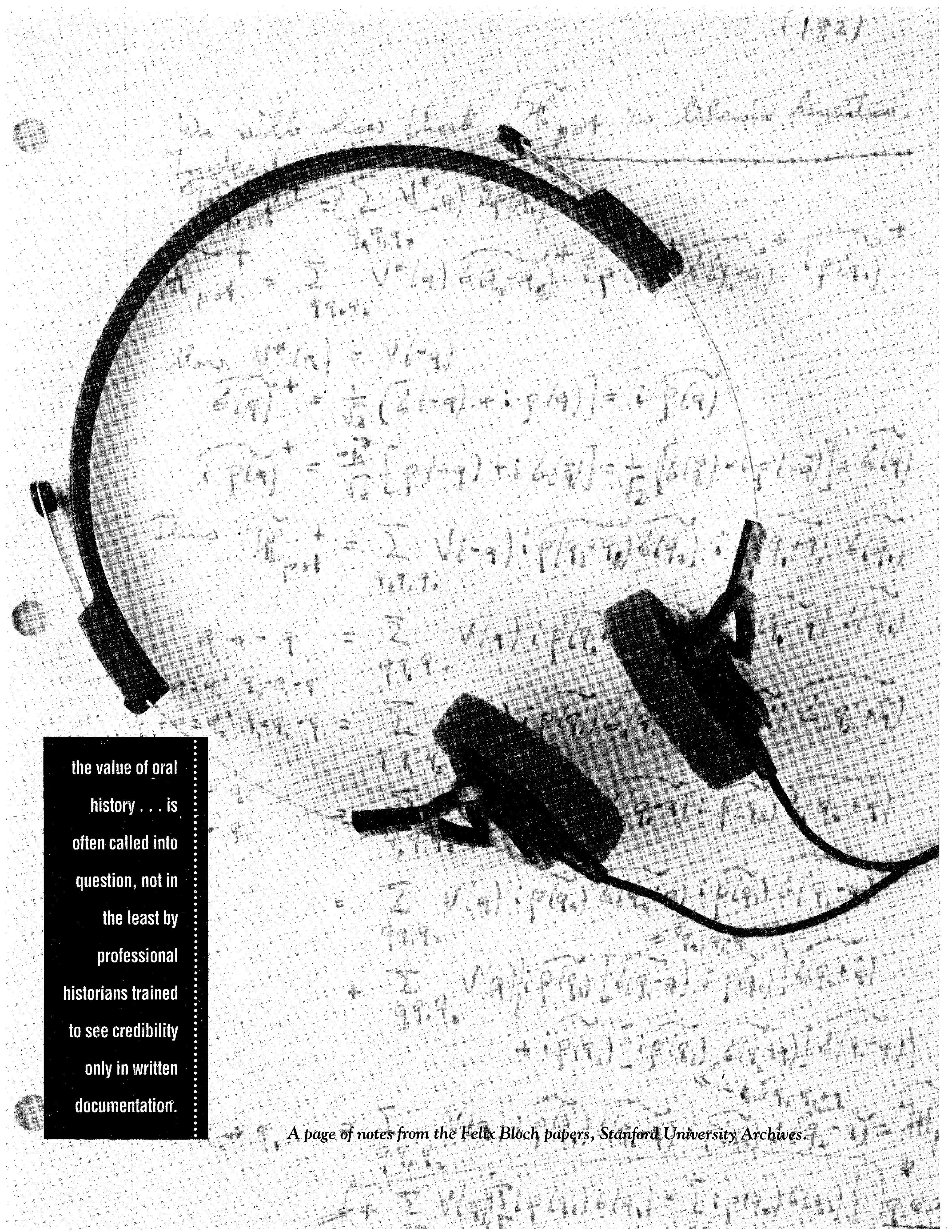

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A page of notes from the Felix Bloch papers, Stanford University Archives.

LISTENING TO PHYSICS:

The use of oral history in documenting modern science

BY ROXANNE NILAN

Since its opening in 1891, Stanford University has had a special affection for science and engineering. After the Second World War, its emergence as a university of world prominence was based on the aggressive development of its science and engineering faculty, curriculum and research facilities. As a result, Stanford's archivists have long been interested in fully documenting the "west side" of campus and have looked to oral history as an important part of this process. In the Stanford University Archives, oral history interviews join the official department and laboratory records, faculty research notes and student diaries, photographs and technical drawings that document the process of learning, teaching and researching that is intrinsic to an academic community.

Yet, the value of oral history as a tool to document such an articulate and outspoken community is often called into question, not in the least by professional historians trained to see credibility only in written documentation and to suspect reminiscence refined by years of hindsight. In interviewing university scientists, what can we learn that cannot already be found in their voluminous published works or in files of letters or research notes?

From my vantage point as curator of university archives at Stanford and as archivist of the Stanford Linear Accelerator Center, I would like to offer arguments in favor of the use of oral history first, as a source of information *not* contained in the written record, and secondly as a source of information *about* the written record.

THE WORLD OF PARTICLE PHYSICS

For the sake of illustration, let me describe the particular cultural group I seek to document at one of Stanford's largest and most eminent scientific facilities, the Stanford Linear Accelerator Center, or SLAC. Scientists, and especially physicists, have taken on a special image in post World War II America. Their discoveries are front page news, their opinions can influence national and international issues such as nuclear proliferation, arms control, and space exploration. Even among teenagers, the face of Albert Einstein is more universally recognized than that of Bruce Springsteen or Pablo Picasso, and Einstein remains an immediate symbol of creativity and intelligence.

Within this group, the study of elementary particles, or "high energy physics," is considered the glory field, reaping far more Nobel prizes than its numbers within physics overall would suggest. It is an international community focused on multi-institutional, collaborative research; it is also a "culture" in its own right, with distinct values and world views, with rites of passage from novice to senior statesman, with its own language and methods of communication. It is a highly articulate and outgoing culture, and an influential one whose interests affect the lives of each of us. [1]

SLAC is a mini-campus of some 15 research buildings on the northwest corner of the Stanford campus staffed by almost 1,400 people — physicists and engineers, operators and technicians, computer specialists, and support staff. Their mission is to promote and conduct basic, unclassified research in particle physics to answer a few simple questions: How did the universe come into being? What is it made of? And how is it put together? Particle physicists tell me that they find biology and chemistry too complicated since these fields seek to list, study and understand so many different organisms. Physicists, on the other hand, seek a simple, ultimate understanding of the world by studying the smallest particles and most fundamental forces of life. Is it any wonder that they have named new particles "Truth" and "Beauty?"

The field of high energy physics is, in fact, comparatively small; the total world population is less than 5,000, with about 1,700 in the United States. SLAC is one of only four major American laboratories; four more are in Europe, several in the Sovi-

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et Union, one each in Japan and the Peoples Republic of China. But particle physics, or "high energy physics," is the epitome of "Big Science." About 400 physicists, many on staff but including additional visiting physicists from around the world, work at SLAC at any one time. No longer does the lonely scientist work at his lab bench with the help of a tired, ragged graduate student to turn himself into a fly. Today, experiments involve very large teams of a variety of professions from many institutions, enormous and complex machines, multi-year schedules and multi-million dollar budgets.

Physicists share their theories and experimental results (and their differences of opinion) in lectures and colloquia and hallway discussions. But these interactions are preliminary and may be speculative. Their work is validated through the publication of the scientific paper describing the results in one of a small list of refereed scientific journals. And by this point, the collective memory of the collaboration has been shaped and refined toward a more or less commonly accepted understanding of the path to the final result as well as the logic of the conclusion.

To the scientist, the "act" of science is documented in the published paper, but to the archivist and historian this is only the umbrella. It is the stage prior to, and following, publication that fascinates us. Long before publication of the final results, and before any attempt is made to suggest their significance to the general public, important information has been shared, argued, reconstructed, reviewed, and celebrated. In this process, reputations have been made and younger physicists have learned the pathway. Questions are asked, paths taken and reversed, more than one answer explored. Already the next scientific questions are being asked and new experiments proposed. New collaborations already are in the making.

Some of this activity is recorded — in individual and group research log books, in collaboration meeting minutes and "technical memos." But just as often, it is lost over the phone lines or through electronic mail. Thus, we are keenly interested in oral history as a valuable key to understanding the full range of scientific activity and culture.

THE PITFALLS OF ORAL HISTORY

However, to use oral history methods effectively, we must recognize what oral history does not do well in this context.

Physicists are a highly literate group, providing the historian with a solid core of published documentation regarding their research. In a field where the dialogue of scientific inquiry (the argument and counter-argument) is carried out rapidly in published form, we easily can trace scientific methodology through the process of question, result, reaction and counter-question. Oral history interviews conducted decades after a major discovery cannot rely on memory for the level of detail best found in the scientific papers completed shortly after the fact.

In addition to leaving a written record of their scientific work, physicists have a strong sense of larger interest, at least among their own colleagues, in the historical importance of their work. They live in an egocentric community of strong opinions and strong personalities. It is better to do bold physics and guess wrong than to do dull or mediocre physics. Good experiments are "elegant" as well as accurate and innovative. Great discoveries are personally claimed and credited: Heisenberg's uncertainty principle, Gell-Mann's scheme, Higg's particle, Feynman's diagrams. Unlike other segments of American society for whom we have little written record, biographies and autobiographies of physicists abound. Can oral history add much to this record?

Also consider an ironic problem. Trained to carefully formulate an argument and seek a simple, elegant answer, even the objective and well-meaning scientist may unintentionally provide the unwary interviewer with a highly structured, linear explanation of what is, in fact, a web of wrong turns, almost right or lucky guesses along with the well reasoned decisions. Formal presentation in the *Physical Review* will not, and cannot, mention the dynamics of personal interaction and the subjective decisions typical of any group behavior; such speculations are unprofessional in the official scientific record.

THE VALUE OF ORAL HISTORY

It is not in the area of individual, free form reminiscence that oral history serves the historian, but in its ability as a technique to probe other kinds of broader questions, what we might call the "heuristics of science," and in its usefulness in directing the historian to issues, concerns and questions that may have been missed or hidden in a voluminous paper trail. Charles Weiner, historian of physics and a practitioner of oral history for over 20 years, recently wrote: "Used with other sources, oral history can help to penetrate the mystique of science as a neutral, value-free enterprise solely concerned with the disintersted search for truth about the natural world through the application of rational methodology." Interviews provide information about the scientist's relationship to his work, to other scientists, and to the larger community.

"These probes can help shed light on the ideological, institutional, financial and political contexts that make scientists' work possible and influence its content, methods, and direction. Oral testimony rooted in the details of an individual's life and work can thus provide insight on the origins and functions of personal and communal perceptions of the role of scientists and their relation to society."[2] Just as we would like to know of any culture, we would like to know how the scientist (and "science" for that matter) came into being, why it matters, and what an individual scientist represents in American society as a whole. We must ask how and why scientists work, what they do (or think they do) in teaching, studying, researching, consulting, patenting, testifying, advising, fundraising, administering, and explaining.

A series of interviews exploring the context of science provides an invaluable supplement to the archival and published sources. Weiner's particular interest has been in the role scientists played in post-war federal policy making. It is not surprising that he encourages us to do a better job at exploring issues of social accountability, such as the individual scientists' awareness of the impact of their research on people affected by the results — just how have scientists, and their institutions, responded to these issues or ignored them?

This is not to say that physicists hesitate to record their views on non-scientific subjects. Emeritus director of SLAC Wolfgang K. H. Panofsky has made very clear his views on the need for nuclear arms control, his arguments against classified research in academia, and his concern for the safety of dissident fellow physicists in the Peoples Republic of China and the Soviet Union. The question is, how can oral history provide us with additional insight into the source and impact of his concerns and into his impressions of their reception among scientists and politicians as well as the public at large?

Sometimes the social issue is remarkably close to home, such as the changing perception of personal safety and danger in the laboratory setting over the last five decades. One Berkeley physicist remembered in an interview about his cyclotron research at the pre-war Berkeley Radiation Laboratory, "We could always tell when the particle beam at our feet had been turned on because our ankles would get hot."

In some cases it is precisely *because* of the bulk of the written record that archivists and historians greatly appreciate the clues that skillful interviews can provide in pinpointing topics, issues and actual documents lying in hundreds of linear feet of paper. In other cases, oral histories can document information that is unlikely ever to be found in the written record. Two kinds of examples immediately come to mind. The field of Operations Research grew out of American scientists' efforts during World War II to utilize computer technology. While many of these scientists today work in academia, much of their war work was supported by military contract and as a result, where written documentation does exist, fascinating and important details have been purposefully eliminated from classified documents or lost in proprietary documents unavailable to the public.

A second example of current interest is the study of *who* participates in scientific activity. Scientists, working in what they assume to be a world of objectivity in the headlong search for knowledge, hesitate to write about the personal ingredients and subjective choices that can affect the success of a research collaboration or the acceptance of a new discovery or theory. Sex, race, even religious background and the impact these might have on scientific methodology are invisible in the scientific literature and may even be ignored in autobiographical writings. These sensitive issues can be delicately explored through oral history.

The importance of oral history to archivists and historians of science is evident in the number of strong American programs which use oral history alongside traditional archival techniques to actively document fields of scientific endeavor or technological development. Some of the more notable practitioners include:

- *The American Institute of Physics' Center for the History of Physics*, whose many projects have documented astrophysics, solid state physics, laser physics, and high energy physics, and, in the coming year, geophysics and space science;
- *The Beckman Center for the History of Chemistry* (University of Pennsylvania) has focused on the field of polymer chemistry;
- Oral histories documenting the development of corporate computer science at the *Charles Babbage Institute for the History of Computing* (University of Minnesota);
- *The Silicon Valley Project* focuses on the development of micro-electronics and the personal computer revolution (Stanford University).

Each of these projects represents two key characteristics. First, the framework is, one might say, scientific: a well planned series based on background research. These are not stand-alone single interviews of famous, male scientists recollecting famous discoveries, but a number and variety of interviews in series utilizing a common and carefully thought-out question outline. Similarly, the overall selection of representative scientists is carefully cal-

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culated. Questions and lists of narrators are often researched with the help of an advisory group of people familiar with the field.

Second, each project or interview series is done in tandem with an effort to locate, select and collect archival resources brought to light during the interview. Such efforts are aimed at building comprehensive collections; not a small selection of delectable tidbits, but that critical mass of material necessary to illustrate the activity and experiences of a way of life as well as the contributions of a particular field of science or technology. In this context, the oral history interview provides the archivist with the opportunity to speak with the scientist to fill in gaps in the historical record, to get on tape valuable information about the topics that should be sought out elsewhere, and to document the location of potentially valuable primary source material.

Ample experience has shown that archival sources and oral history interviews are inseparable — one cannot research the history of science without using all available resources: the *oral history* for the clues, the hidden information, the insights and personal viewpoints; the comprehensive *archival record* for the inside story, the details, the material stuff of history; and the *published record*, for the formal, approved summation and contemporary conception of the what and how.

Nor can the professional archivist or historian charged with documenting a scientific field or an institution do without both. Oral history in fields of science or engineering is best constructed through the interviewer's familiarity with the unpublished and published sources, and by a well thought-out series of interviews that seek to provide breadth of detail about issues of how and why science is done and its impact on society. The only way to understand a community is to get to know its members—this is as true in a highly sophisticated and articulate group of scientists as it is in any group defined by culture, ethnicity, gender or geography.

And finally, archivists should appreciate that they have a powerful tool for finding those hidden archival resources or for filling in documentation where it may never have existed. Archivists, too, must remember that researchers cannot rely on one type of documentation without the other and they must be prepared to help the researcher relate the one to the other.

Archivists, however, must be willing to do battle for an interview program that many administrators, fellow archivists and librarians think of as too costly and time consuming, and that many historians suspect. The best way to do this is to learn it, do it, and enjoy it.

ENDNOTES

1. For an interesting view of high energy physicists as a cultural group by an anthropologist, see Sharon Traweek, *Beamtimes and Lifetimes: the World of High Energy Physics*, Harvard University Press; and for a view by a physicist, see Michael Riordan, *Hunting for the Quark: a true story of Modern Physics*, Simon & Schuster, 1987
2. Charles Weiner, "Oral History of Science: A Mushrooming Cloud?" *Journal of American History* 75:2: (Sept 88 p. 549)

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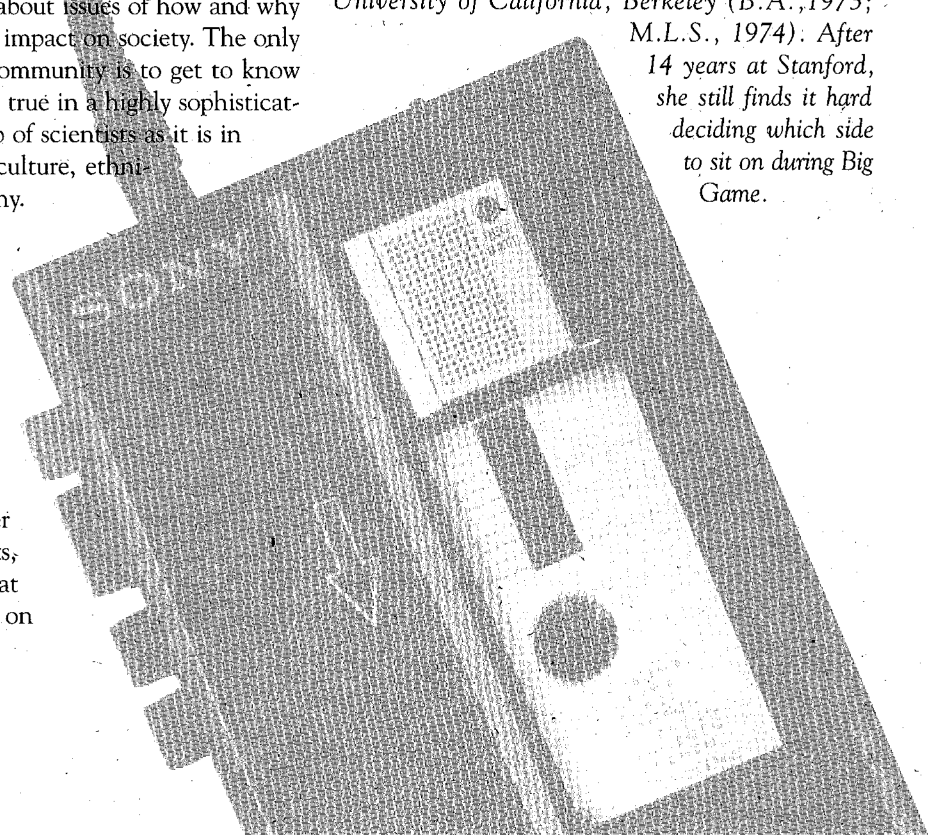
Roxanne Nilan came to Stanford in 1976 and served as University Archivist from 1979 to 1990, when she resigned to pursue her doctorate in American history at Stanford. From 1989 to 1990, she took a leave of absence to create an archival and oral history program for the Stanford Linear Accelerator Center and continues as SLAC Archivist. An active member of the Stanford Historical Society, she also chairs its Stanford Oral History Project and co-edited Sandstone & Tile *with Karen Bartholomew. She was the first archivist named to the Committee for History of Physics of the American Institute of Physics. A recognized authority on the history of Stanford University, her book* The Stanford Album: A Photographic History, 1885-1945, *was published by the Stanford University Press in 1989. Ironically, she is also a devoted alumna of the University of California, Berkeley (B.A., 1973; M.L.S., 1974). After 14 years at Stanford, she still finds it hard deciding which side to sit on during Big Game.*



A (tall) tale of two biddies

In addition to taxes and death, Benjamin Franklin could well have added innuendo to his list of life's inevitables.

No place on earth where two or more gather seems immune from the rumor mill. Even Stanford University is no exception. And perhaps the University's tallest tale is that of two wanna-be sorority sisters, who leaped to their deaths from atop Hoover Tower when they learned they'd received no bids to pledge. Their suicides, so the story has it, led to the ban on sororities at Stanford in 1944.

It is true that the Stanford Board of Trustees and President Donald B. Tresidder abolished sororities in '44, but the suicide story —for which no evidence exists—is a little bit harder to trace.

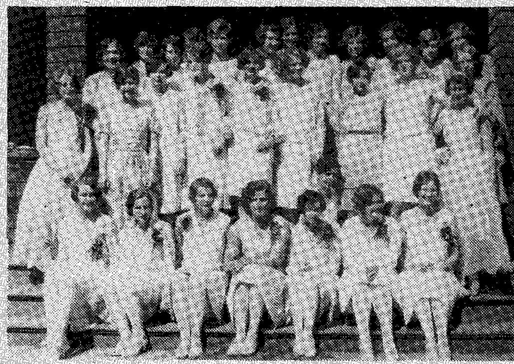
Some have suggested its basis can be found in a *Stanford Daily* editorial published in 1943, when many young men were off to war, and many college class spaces were allotted to women. Such was the case at Stanford, where enrollment for women was up markedly, but space in sororities was the same as the days when women's enrollment was limited to 500.

(In the Grant Founding and Endowing the University, Jane Lathrop Stanford insisted on limiting women's enrollment to 500 students so that the memorial erected in her son's honor would never run the risk of becoming a "women's school.")

In fact, there was room for only one in three Stanford women who wanted to join a sorority in those World War II years to do so, and the aforementioned *Daily* piece refers to their plight:

"We all had a good time Saturday night . . . but a lot of us still couldn't forget that for every exuberant young freshman pledge we danced with, there were two back at Roble that weren't so happy . . . it detracted from our fun to realize that some of these girls may consider themselves failures when we know they are not."

It is possible, as some have suggested, that the anonymous "two back at Roble" took on names over time, and, eventually, the desperation that led to their mythological life-ending leaps from the 285-foot Hoover Tower.



Members of Kappa Alpha Theta, 1928.

In truth, Stanford's Dean of Women first suggested doing away with the campus' nine sororities in 1919. Other efforts followed in '25, '30, '34, and '38, but it was not until 1943, when the Board of Trustees appointed a special committee to look into the matter, that anything was done about it.

"At the end of rushing, a lack of unity develops at Roble Hall and at Casa Ventura (the two women's dormitories)," the Trustees' committee report dated Feb. 28, 1943, stated. "A few of the women who have not been chosen leave Stanford. Some who remain in the halls tend to lose confidence in themselves because they have not been selected to join a sorority. The interests of some of the women change focus. To many, life now centers around the sorority. This has its effect on the former companions who remain in the halls. The division between non-sorority and sorority women then starts. The students themselves freely acknowledge this."

The recommended action: abolition of sororities.

This being a university, it took another 14 months for the Board committee's recommendation to reach President Tresidder, who abolished sororities on April 26, 1944.

The news that sororities at Stanford were no more made *Time Magazine* on May 8, 1944.

Thirty-four years later, in the Spring of 1978, the news that sororities had been reinstated at Stanford did not.

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