IN CELEBRATION OF

Ruth Hubbard: Her Life and Work

A Symposium and Reception dedicated to Ruth Hubbard on the Occasion of her Appointment as Professor Emerita at Harvard University.

Photo by Margaret Randall

Saturday, June 2, 1990, 2 p.m.
Harvard University

Join us for a reception following the Symposium.

Program

Greetings:
Linda Wilson, President, Radcliff College
Olwen Hufton, Chair, Women's Studies

Part I: Inside/Outside Science
Moderator: Joan Cindy Amatniek, Einstein Medical School
Richard Lewontin, Population Biologist, Harvard University
Margaret Randall, Author, poet, photographer
Debbie Wald, Esq., Public Defender's Office, Oakland, Ca.

Part II: The Politics of Science
Moderator: Robin Mary Gillespie, Health & Safety Specialist, Service Employees International Union
Judy Norsigian, Boston Women's Health Book Collective
Terri Goldberg, Board of Directors, Council for Responsible Genetics
Margaret Burnham, Esq., Professor of Political Science, Massachusetts Institute of Technology

Part III: Responsible Science
Reflections of Former Students
Moderator: Dolita Cathcart
Nancy Krieger, Epidemiologist, Kaiser Foundation Research Institute
Mary Sue Henifin, Environmental Prosecutor and Ass't Prof., Robert Wood Johnson Medical School
Leigh Star, Prof., University of California at Irvine
Serena Yuan Volpp '92, Concentrator in Biology and Women's Studies, Co-President of the Radcliffe Union of Students

Closing Remarks:
Joan Cindy Amatniek
Ruth Hubbard

Co-sponsored by: Harvard University Committee on Degrees in Women's Studies and Biological Laboratories, Radcliffe College, Education for Action, Radcliffe Union of Students, and Harvard College

Direct Inquiries to Julie Pavlon, Women's Studies Office, (617) 495-9199.

In Celebration of Ruth Hubbard

It was probably summer 1967 when we sat in Ruths Woods Hole backyard and felt grownup in the attention of her interest, her affirmation. What are you doing, what do you think, she asked? And this is what I think, she would say.

What Ruth thought was sometimes about the morning light over Buzzards Bay. Sometimes it gave us a kind of intellectual vertigo. We were going to live in the country, angry at current applications of science. Ruth listened, then said perhaps there was no good in science at all. Oops, we thought, isn't that going too far? But Ruth is willing to go as far as necessary. She translates thought into action. I think, Ruth said, we should picket our own post office to demonstrate our opposition to the draft. Oh no, is nothing sacred? Yet, two weeks later, there we were. Ruth has that effect. Electric. Alive. Human.

For us, Ruths life and ideas have been a rock in the swamp; not always cozy, but warm and solid. Mostly we learned from her in the street, on the beach, in the backyard. I'm glad that others found her at Harvard. Thinking scientifically, and with passion, happens in all those places. How lucky we have been to know Ruth Hubbard.

Sala and Alan Steinbach

Sala Steinbach, C.N.M.
Alan Steinbach, Ph.D., M.D.
Berkeley, Ca.

My life would be totally different, and immeasurably less interesting, had it not included Ruth. We knew each other in various social and political contexts while I was a graduate student in the Harvard bio labs, but our friendship really began in the winter of 1970-71 when she invited me to her house to join "a group of women talking about things," as she so characteristically put it. That first consciousness-raising session was the closest thing I've ever had to a religious experience: just about every premise I held to be true was subjected to a 180° spin. Ruth brought us all together, held us together, and in many different ways became the catalyst and touchstone for our emerging feminism, she of course always being way ahead of the rest of us. Our friendship deepened when we found

ourselves the only two women faculty members in the biology department, and we shared numerous outrageous departmental meetings, campaigns, and causes in the ensuing seven years. We even shared the honor of being jointly vilified by Jim Watson in one of his published tirades. Ruth taught me much of what I know about courage, about honesty, about conviction. Most crucial, she taught me that if friendship isn't unconditional, it isn't worth a damn. He gift of unconditional friendship, to me and to hundreds of others, is to me her most important of many important legacies.

Ursula Goodenough
Washington University
St. Louis, Mo.

I salute Ruth Hubbard on this occasion of her new beginning. I have valued Ruth Hubbard throughout my twenty years on the Harvard faculty, in part as a colleague in the Biology Department, but primarily as a comrade in various (and mostly unpopular) causes. I taught courses in biology and social issues with her through the days of their greatest popularity in the early 1970's. Though we fought with administrators, these were heady days for radical perspectives, and one could act as a "summer soldier and sunshine patriot" with relative impunity. But Ruth Hubbard kept the same intensity, the same vision, the same insight through all the more difficult years that have followed (while others, myself included, may have kept the vision, but slacked greatly in practice). Ruth Hubbard has maintained her courses and her fierce commitments. She has been a beacon and a support for radical and feminist perspectives -- a focus and a gadfly for a view of life that needs constant defending and nurturing, for it is right, and human, and necessary, and must eventually prevail. Keepers of the light in times of relative darkness are among humanity's greatest heroines.

Stephen Jay Gould

Museum of Comparative Zoology
Harvard University
Cambridge, Ma.

Among Ruth Hubbard's many wonderful achievements have been her invaluable contributions to the long struggle to secure real reproductive choice for women. I and many of the feminist litigators concerned with reproductive freedom first became aware of Ruth's work through her participation in the Rutgers Women's Rights Law Reporter's 1982 Symposium on Reproductive Rights. At

rhodopsin and the involvement of cis-trans isomerization in the visual process were landmark contributions to our knowledge of the visual pigments and their functions in the eye.

Ruth Hubbard had really productive interactions with colleagues, students and visitors in our laboratory. She was ready to help with all sorts of problems, including very personal ones if she detected a need for this help. She could be depended upon for words of encouragement and good criticism on experimental and conceptual matters in all our years of research. Many overseas friends and colleagues were given crucial assistance by Ruth with scientific manuscripts and publications. This often involved translation into "scientific English." Ruth was always impatient with sloppy science and put a high demand on herself and others for better writing and figures in scientific papers. As for the actual experiments, she wanted true and intelligent scientific procedures.

I would like to thank Ruth Hubbard for all the years we shared together and for the untold occasions she gave of her time and patience to help me with research and personal problems. I am proud to have known and worked with Ruth. We will always be good friends.

Paul K. Brown
University of Massachusetts/Boston

Happily, we can all expect Ruth Hubbard's abundant professional and intellectual life to continue for many years to come. But her retirement at this time, marking the formal, institutional closure of a remarkable career, provides us with a very special opportunity, namely the opportunity to express our deep appreciation for the exemplary -- even heroic -- models she has thus far provided us.

I say models because there have been many. For women of my own generation, Ruth's confidence that women could and should be scientists shone like a beacon; but even more to the point, she showed us how to do it, she exemplified the possible in impossible times. Later, when women began to gain a toehold in the hallowed halls of science, she helped explode other notions of the impossible. By her own actions, she showed that women could enter those halls as challengers, not merely in grateful compliance. But the lessons of her example were not limited to women alone. To all her colleagues, male and female alike, she modelled a commitment -- so novel in these times -- to the moral, political, and intellectual integrity of an academic life. Indeed, every phase of Ruth Hubbard's life and career is marked by the same indomitable courage, conviction, and fearlessness. It is a deeply felt pleasure for me to join others in expressing my gratitude for the friendship and collegiality of so remarkable a woman.

Evelyn Fox Keller
University of California at Berkeley

Ruth Hubbard - A Scientific Appreciation

Ruth Hubbard began her scientific studies in vision just after Word War II. She entered George Wald's lab when he was still engaged in war-related work on human spectral sensitivity, but they soon turned their efforts to the simple but exciting discovery of R. A. Morton in Liverpool that vitamin A and retinene were related as an alcohol is to an aldehyde, by the differences of two hydrogen atoms. Together they showed that the visual pigment, rhodopsin, could be synthesized in an *in vitro* system, with synthetic vitamin A and a coenzyme, which mimicked the living retina.

The anomalies of this synthetic process intrigued her. Vitamin A from fish liver oil was much more active than crystalline, synthetic vitamin A. The suggestion that the geometric structure of vitamin A might be important had been discussed in Wald's lab, especially by Jack Durell in his undergraduate thesis, but Ruth took this up in a systematic manner and in a brilliant series of studies, which are now classic, she and Wald and several students established the central role that molecular structure plays in the chemistry of vision.

In 1951 she was awarded a Guggenheim fellowship and traveled to the mecca of protein chemistry, the Carlsberg Labs in Copenhagen, which were under the inspirational guidance of K. V. Linderstrøm-Lang. Her studies on the molecular weight of rhodopsin and the solution properties of this water-insoluble protein are still referred to and could be described as prescient, considering the current intense interest in membrane proteins.

After returning to Harvard in 1953 as a research associate she worked independently on several problems, among them an enzyme for converting *trans*- retinal to 11-*cis* retinal and a beautiful study of the squid visual pigment with Robert St. George. The latter paper, which explored the photochemical changes brought about by the absorption of light by squid rhodopsin and its transformation to metarhodopsin, presaged her work with me in 1956-58 which clearly established that the only effect of light on visual pigments was to cause a change in the shape of the chromophore. These studies also cleared up the confusion over the structure of the intermediates of rhodopsin bleaching, such as lumi- and metarhodopsin. These studies of the initial photochemical steps in rhodopsin's chemistry provided a conceptual basis (the photosteady state) and an appealing molecular picture so that a large number of physically minded biologists and biophysical chemists were able to identify interesting problems in this area and establish a flourishing field of study, the molecular photochemistry of visual pigments, retinal, and now bacteriorhodopsin.

She continued to pursue her studies of the molecular changes in the bleaching process, and was instrumental in the discovery of the different forms of metarhodopsin. Her work helped clarify the complexities of the bleaching process and delineated the intermediates in a way that made the path to further progress easier for others to follow. The studies on the bleaching intermediates and the photochemistry of vitamin A and retinal culminated in a very influential paper presented by Ruth at the Cold Spring Harbor Symposium on Sensory Receptors, held in 1965. This paper traces the molecular events in rhodopsin bleaching from the initial change in shape of the chromophore, where independent studies by Ruth are brought to bear on the question, to the molecular structures of the intermediates of bleaching. The clarity and breadth of her studies are well exhibited here and the paper ends with a provocative suggestion for the initiation of electrical activity in vision. Though the details of the suggestion have been outdistanced by the rush of later research, her influence is still felt in the problems being pursued today by workers in visual biochemistry and by the concepts they use in thinking about rhodopsin's role in vision.

I cannot end without adding a more personal note. When I came to the Wald lab as a young postdoctoral fellow in 1956, confident as a physical chemist but woefully ignorant of the enormous range of natural science encompassed by the field of vision, it was Ruth more than anyone else who helped me to bridge the gap separating my ignorance from my competence. She was an intellectually demanding critic but an enthusiastic supporter of my fumbling efforts to learn about visual pigments, from the details of how to cut open an eye, to how to interpret an experiment, to how to draw a figure for a paper which forcefully presented the idea we were trying to get across. Though we published a number of papers together as peers, I regarded her as my scientific mentor. I remain grateful for those happy, untroubled days of our scientific collaboration. Thanks Ruth.

Allen Kropf

Professor of Chemistry, Amherst College

Ruth Hubbard, an outsider inside

A Harvard biologist challenges the way science looks at the world

THE BOSTON GLOBE

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By Madeline Drexler
SPECIAL TO THE GLOBE

Biologist Ruth Hubbard, the first woman tenured in the sciences at Harvard, has always known her place in academia: on the outside, asking thorny questions. But it wasn't until she was in her late 40s that she arrived at the renegade philosophy that changed her life.

Hubbard came to believe that, despite science's claim to be above politics, it frames and examines the world in ways that have far-reaching political effects. Science's conventions, she concluded, entrench those currently in power and further disenfranchise those on the outside. With her own vision of science as an agent for social justice, Hubbard quickly became an apostate among the scientific "priesthood," as she calls it.

Hubbard has since moved away from actively practicing science to an active criticism of science's approach to and place in society. "When we open the daily paper and look at what's going on, the problems are not scientific," she says. "They are problems of social organization, of things having gotten too big, of people going after profit and ignoring human needs, and so on." For these views, she is sometimes lauded and sometimes dismissed. Her detractors include Harvard colleagues, a number of whom are the leading intellectual forces in this country behind gene mapping, genetic engineering and sociobiology. But she has always been true to her sense of herself as an outsider whose very alienation allowed her to see through the assumptions of the establishment.

On a recent, brilliant New England morning, Hubbard sits in the bedroom vacated a few years ago by her son, Elijah Wald, a music reviewer and traveling folk and blues musician. "You know, I have no idea what my colleagues think of me," she says. "I think at best they're puzzled. At worst, they think I've gone off my rocker." Her voice drops in pitch at the end of each sentence, making each utterance a crisp assertion.

Ruth Hubbard can be arrogant. She says so herself. She ascribes her temperament partly to the wrenching exper-

Inside but still an outsider . . .

■ HUBBARD
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years old and a novice to the rituals of Brookline High School students. "It was a disaster," she recalls. "My adjustment to the shift was to become somewhat withdrawn and self-reliant. To look to myself for resources. Not to expect much to come from the world out there."

The move also conferred a permanent sense of being an outsider. "And it's made me see any insider status I've gained as a set of forays into insiderland. As though: 'But that's not really me.' In a sense, it's given me the internal right and freedom to shape my life according to my needs. Not to have to fit models of what it means to be a professional or wife or mother or hostess. When I look at some of my friends, I think I've had an easier time shucking off things that I haven't wanted to participate in. I call it arrogance, and it is in a certain sense. But it comes out of lack of identification with a model that I must fit."

A pretense of objectivity

At 66, Hubbard is about to embark on an "extended sabbatical," as she calls her retirement. She looks less like a weary academic than an ageless grad student: straight, shining silver and white hair reaching below her hips, corduroys and rough woolen sweaters on a lithe frame, ruddy cheeks and bright hazel eyes, a heavy crimson knapsack and no time for chitchat.

But appearances deceive. On Harvard's red-brick campus, Hubbard's ideas are controversial. In typically acerbic style, for instance, she characterizes most scientific research as "pretended objectivity." Why "pretended"? Because scientists, she says, are like the rest of us: They see what they want to see. And what they see is shaped by their culture.

Darwin's theory of natural selection, to take a famous example, mirrored laissez-faire economics and the British embrace of meritocracy, Hubbard explains. And in doing so, it reinforced the politics of mid-19th-century England by offering a biological justification for class divisions of the time.

Hubbard also believes that science is made "by a self-perpetuating, self-reflexive group: by the chosen few. For the past few centuries, mostly Western European and North American upper-class men, a group with their own interests and points of view.

Still the only tenured woman in her department, Hubbard has written copiously about the gender biases in science. In her most recent book, "The Politics of Women's Biology," published earlier this year, she cites the field notes of a contemporary animal behaviorist named Wolfgang Wickler. While studying Rocky Mountain bighorn sheep, Wickler found it "curious" that males and females showed no striking physical or behavioral differences during the course of their lifetimes. To his chagrin, he couldn't even tell the sexes apart. And so, with a hint of exasperation, he concluded: "The typical female behavior is absent from this pattern."

"Typical of what?" Hubbard retorts. "Obviously not of bighorn sheep." Yet she contends that this kind of sexism pervades biology, from observations of algae (fast-moving varieties have literally been described as having "masculine" features) to the new study of sociobiology, which argues that "universal" human traits, such as male aggression and female nurturance, have been genetically selected over time.

One of the cornerstones of modern science is that the more we know about smaller and smaller components of nature, the better we can fathom life. Cells reveal more than tissue, molecules more than cells, and so on. Among other things, this "reductionism" has led to the Human Genome Initiative, the herculean federally sponsored project to map, or "sequence," the 50,000 to 100,000 genes in our 23 pairs of chromosomes and, theoretically, pinpoint the sources of health, diseases and what it means to be human.

Hubbard and many other scientists believe the Genome Initiative is a giant boondoggle. To begin with, DNA is not a "chemical blueprint," as popularly portrayed. Nearly all human traits, Hubbard points out, are mediated by many genes and then shaped by the environment. A "genetic susceptibility" to lung cancer still usually depends on cigarette smoke or polluted air to show up as disease. Even such well-charted afflictions as sickle-cell anemia or cystic fibrosis – each linked to a single gene – can range from mild to painfully disabling or fatal, proving again that many factors must be at work.

Hubbard's more damning criticism is that the Genome Initiative raises genes to mythic proportions, diverting attention from social issues. "Are we looking at how people live or how they were born?" she asks. Her implied answer reverberates in many ways.

Prenatal genetic testing, for example, is increasingly urged upon pregnant women as a means of detecting genetic abnormalities in the fetus. Many women welcome this option because it quells anxieties about having a mentally retarded or physically disabled child. And Hubbard supports a woman's right to abort a fetus at any time and for any reason.

But she cautions that the ability to "choose" a better baby – on the basis of disability or even gender – is double-edged. A society that selects out genetically suspect babies may doubly stigmatize those who are born disabled – or female, if boys remain the preferred sex. And if accidents or exposure to chemicals or radiation harm more people in coming years, as Hubbard suspects they will, all the more reason to regard mental and physical disabilities as conditions that require social preventions.

Many researchers reject Hubbard's assessment of the Genome Initiative. Walter Gilbert, Nobel laureate and chair of Harvard's biology department, believes that sequencing the human genome is the inevitable next step in genetics, laying the groundwork for a revolution in medicine. But his opposition goes deeper. What's alarming about Hubbard's stand, he says, is the suggestion that pure science is inherently less valuable than social initiatives.

"The view that you solve all things by immediate application is a shortsighted view," he asserts, though he adds that science's findings and technologies usually do improve people's lives. In Gilbert's mind, what defines an enlightened country is the understanding that future productivity is shaped by research decisions made today. "Because of applied biology," he says, "we aren't scraping the soil for food."

The dawning of consciousness

The Harvard Biological Laboratories are ensconced in a plain brick building behind Harvard Yard, off Divinity Avenue. The entrance is flanked by a pair of life-size bronze rhinoceroses. Down the main hallway on the left, one passes 30 black-and-white portraits of emeritus professors dating from 1934: all male, all white.

How does Ruth Hubbard feel walking past that assemblage? She smiles her disarming smile. "That's Harvard," she says brightly.

In 1944, immediately after graduating from Radcliffe, Hubbard went to work in George Wald's laboratory at Harvard. She was 20 years old and married to an American GI named Frank Hubbard, with whom she shared a bohemian life and a cold-water flat in Cambridge after the war. Wald, 37 at the time, was married as well, with two children.

Together and separately, they investigated molecular aspects of photochemistry: how pigments in the human eye change light into sight. Wald received a Nobel Prize in 1967 for describing the role of Vitamin A in the retina, while Hubbard explained how light interacts with visual pigments. "She was the best graduate student I ever had," Wald says.

By the late '40s, after some years spent apart when she worked in Europe, the two acknowledged they were in love. Hubbard later amicably separated from her husband. She and Wald kept their affair a secret for 10 years, finally marrying in 1958. Today, they are a pair of popular eminences on campus, outspoken activists and opinionated teachers.

On the leafy Harvard campus, Hubbard did not always pursue what came to be her political work. Early on, as a research fellow in Wald's lab, "My thoughts about the future were sort of stereotypic women's views," she says. She recalls, in the mid-'50s, telling a man at a party that she considered it her "prerogative as a woman" not to have to live up to some lofty idea of success, that she didn't "need" to hustle for a faculty job. "In part it had to do with the fact that there were no women, and I wasn't identifying with the folks I was seeing out there," she says.

Soon after their marriage, Hubbard and Wald had their son, Elijah, and their daughter, Deborah. And until the mid-'60s, Hubbard devoted herself largely to work and motherhood. (Today Elijah tours in Europe and Africa; Deborah Wald is a public defender in Oakland, Calif.) While Hubbard had taken the unpopular position of opposing the Korean War in the early '50s, Vietnam actually set off her dormant political activism. She marched, got arrested, and wrote against American military excursions in Asia and later Central America.

But it was feminism that ultimately changed the course of her professional life. Until the late '60s, "I really thought men were smarter, more interesting, better company, and I played up to them. I had one woman friend."

That began to shift in 1969. She even remembers the moment: a demonstration at the American Academy of Arts and Sciences meeting in Boston. The marchers were protesting discrimination against women in the sciences. "I was absolutely flabbergasted. *I* was a scientist. And they allowed *me* to work at Harvard. So how come there was discrimination?"

Soon, her exploration with other feminists of how women were blocked in the practice of science led her to ask how they were mis-portrayed in its literature. "That's when I started reading Darwin." And that, in turn, steered Hubbard on the path from looking at nature to looking at science. As Wald remembers it, she simply turned to him one day in the lab and announced: "The next experiment can wait."

Turning a feminist eye on science

By the time Hubbard and several other women received tenure in 1973, after organized pressure on the university from faculty members and outside feminist groups, she belonged to the enemy camp. When she stopped doing lab work around 1976, many in the biology department labeled her move from pure science to social criticism a waste of talent – and a wasted faculty appointment. "She's an extremely bright woman who had done marvelous biology," says John Dowling, who chaired the department in 1973 and is now a professor of natural sciences. Adds Walter Gilbert: "I expected her to remain active in science. I'm sort of disappointed she isn't."

Instead, with a feminist eye, Hubbard re-evaluated science and technology. Her Biology 109 – Biology and Women's Issues – was the first and perhaps last of its kind at the university, a course about the absence of women from the making of science and medicine, and its consequences. In addition to her latest book, she has co-edited four others whose titles attest to her beliefs: "Women Look at Biology Looking at Women"; "Biological Woman – the Convenient Myth"; "Genes and Gender II: Pitfalls in Research on Sex and Gender"; and "Woman's Nature: Rationalizations of Inequality." In 1988, she published a correspondence with the poet Margaret Randall titled "The Shape of Red: Insider Outsider Reflections."

"She's a perceptive person who has listened to women before she jumped to conclusions," says Judy Norsigian, a member of the Boston Women's Health Book Collective, authors of "The New Our Bodies, Ourselves." For instance, Hubbard observed that ultrasound, which gave women a new picture of the fetus, also contributed to "fetal rights" policies that devalued pregnant women. She commented on the paradox of new contraceptives being foisted upon women rather than designed for men, whose reproductive systems are infinitely simpler. She noted that knowledge about fetal susceptibility to noxious chemicals and radiation has mostly been used to keep women out of better-paying jobs, while women at the bottom of the economic ladder who are equally at risk – beauticians, nurses, X-ray technicians – are not deemed worthy of protection.

In 1976, Hubbard organized opposition to a recombinant DNA laboratory on the campus, a lab that Walter Gilbert was to direct. Her concern centered on the possibility of spreading genetically engineered organisms among students and employees. After stormy debate in the Cambridge City Council, the lab was eventually approved. But the per-

sonal and professional antagonisms engendered by Hubbard's rebellion live on.

"I think she exaggerated the potential problems tremendously," Gilbert says. "The issue was raised that maybe the research was inherently dangerous. In afterthought, almost 15 years later, that view was mistaken. It wasn't inherently dangerous. In fact, it is grandiosely innocuous."

But more fundamental questions also arose from the debate. Who decides the direction of science? And when is it justified, if ever, to halt basic research? "She picked essentially the anti-science side of that," says Gilbert. "I do have a fundamental disagreement with her there. I think the leading thing that drives scientists is an intellectual joy in new knowledge and a drive to understand the world. All scientists are looking for new things. And if you deny that, as Ruth did, that is a profound denial of all the forces of science."

Hubbard argues that intellectual joy is not the only driving force of science; the ingrained interests of those who fund research are equally crucial. "Let him do something that the power structure disapproves of, and he'll find that his enjoyment will no longer be sufficient reason for his doing it," she says. She goes on to mention a scientist friend who "has a joy in working with the unions in the province of Quebec to find out the effects of the workplace on employee health"; because those interests do not align with the powers that be, the researcher has had trouble getting funded.

Hubbard emphasizes that she is not anti-science. Nothing is wrong, she says, with a scientist following his or her heart's content, "as long as social concerns are part of their heart's content." But she would also like to see the definition of science broadened to include empirically based inquiries that "don't have to be done by PhD professionals in academic institutions" – in other words, more in-the-field research such as the women's health movement has done for the past 20 years.

The problems science can't solve

In February, Harvard's graduate colloquium on social issues in biology invited Ruth Hubbard to dinner. On the third floor of the bio-sciences building, in a small meeting room tucked between labs labeled "yeast genetics," "worm genetics," "bacteria," "mammalian development," Hubbard used the occasion to expound her main point: that scientists must become political agents for change. "Maybe we should be out there organizing instead of sitting in our labs."

A week later, at home, she conceded that "At this point I've stopped being a scientist. . . . I don't really think that in a rational allotment of resources, science is likely to solve any or many of the problems that most trouble people in the world."

Yet, she says, scientists still set the agenda. And when they talk about educating the public, what they really mean is asking people to trust that their decisions are wise. "What I'm asking for is that the people be part of the decision-making process." But how? And what makes her think different groups would agree on priorities? Hubbard acknowledges she doesn't have all the answers. But her idealism endures.

Always, she has stressed political analysis in her teaching. "Ruth was not out to impress students, but to ask them to think critically," says Nancy Krieger, a former student and now an epidemiologist in the Kaiser Foundation Research Institute in Oakland, Calif. "'Who's asking the questions? Who has power? And what does that mean about the knowledge that will be produced?' She took you through those steps again and again."

Today, Hubbard says she feels heartened by the results. Of the students with whom she has kept in contact, most have gone on into public health or law, "almost none have gone into [laboratory] science, and only one or two have gone into straight medicine."

And now, at this bureaucratic turning point called retirement, she is thinking of her own future. She's planning to co-write a book on the new genetics. Her daily walks, twice-weekly yoga sessions, talks with friends will continue. Her political work and heavy speaking schedule will go on. She may even try her hand at poetry.

And she will continue to insist that science need not be mystifying. "There's a whole state educational apparatus involved in discouraging children from being interested and asking questions and feeling at home in the world," she says.

"It's important for people to understand that these ideas are not very complicated. That they're available. That you don't have to be oh-so-smart in order to be a scientist. That people are taught to be dumb." And with that, clad in soft gray moccasins and a comfortably rumpled outfit, she got up to do some work.