No Time For Dabbling

What physicist Glennys Farrar covets is more hours in the day

IF THERE'S one thing Glennys Reynolds Farrar hasn't time for, it's just dabbling around. Whatever she does, she does thoroughly — and she knows most of what there is to know about it before she's through. Coupled with a high degree of intelligence and no small amount of charm, this industrious tenacity has resulted in considerable accomplishment in her 30 years.

Vocationally, the object of Glennys's attention is theoretical physics, and she's one of Caltech's young and promising assistant professors in that field. ("She's a first-rate scientist," says a senior colleague, "full of original ideas; young, but learning fast.") But she also brings persistence and determination — and competence — to such diverse pursuits as cooking, hiking, cross-country skiing, and playing the piano. In fact, she recently demonstrated these qualities in buying a piano. She enlisted the aid of her piano teacher — Caltech's "pianist-in-residence," James Boyk — in helping her find the right instrument for her. He describes her approach to the project as "wanting to learn *all* about it, right now, in detail — and giving 100 percent of her attention to finding out. In no time she became a kind of lay expert in what to look for in a piano."

For Glennys, one bit of fallout from this kind of attitude has been the efficient abbreviation of some of the standard academic timetables. For example, her College Entrance Examination Board tests — taken for "practice" at the end of her junior year in high school — resulted in scores in the 800 neighborhood and a hurried decision to skip her senior year. UC Berkeley was happy to admit her after only three years of high school (a 40-student high school for children of American Army personnel in France).

Though she had gone only as far as trigonometry in math and had had no physics, Glennys, characteristically, signed up for advanced freshman physics. She knew she wanted to be a physicist, so anything elementary seemed a waste of time. This is a good example of what she calls her "compulsion to do the 'best' thing — which usually means the hardest — and do it well." (Today, when Caltech students ask her advice about whether to take track A or B physics, she finds it difficult not to recommend the advanced — and more difficult — track B for anyone who plans to go into the field.)

For a few weeks, advanced freshman physics at Berkeley almost defeated her. ("I'd think I understood the lectures, and then I wouldn't be able to do the problems.") A very obliging TA gave her a lot of help in the way of explanations and extra problems, and by the end of the first term she ranked second in the class. She still has the grade card on which the TA inscribed her "A" and his congratulations.

If finishing college took the regulation four years, the record also shows that she was one of the first physics undergraduates at Berkeley to take graduate courses. In her senior year she was allowed to enroll in two first-year graduate courses and a second-year one. She was also a TA, and she wound up graduating at the top of Berkeley's class of 1967.

Glennys had married Stanley Farrar, a first-year law student, at the end of her sophomore year, and the two finished their Berkeley stints at the same time. While Stan studied for the California bar that summer, she acted as a TA and studied Hindi, and in August the Farrars left for a year in India — he to do a research project, she to try to do a first-year graduate independent studies program. Though she took along books on electricity and magnetism, elementary particle theory, and field theory (all of which she studied faithfully), carried on an extensive question-and-answer correspondence with her adviser in Berkeley, and occasionally took the "long, uncertain bus ride out to Delhi University" to consult, Glennys doesn't feel she learned much physics. She did enjoy the total experience and appreciates what she learned about India.

Not learning much about physics, Farrar style, didn't result in serious delays in her academic progress. She entered Princeton as a graduate student in the fall of 1968, took the General Exam the following June, and turned in her dissertation in December of 1970.

After spending the spring term as a postdoctoral fellow, Glennys became a member of the Institute for Advanced Study. In the next two years she feels she did a "lot of good work, but it was all cooped up inside." While she felt the need to make a change, it was a somewhat complicated problem because she had to reconcile her own continuing desire to be at the "best" place, the available openings, and the fact that her husband's job with a prestigious Wall Street law firm was one he had no desire to leave.

When Caltech offered her a senior research fellowship, there was no doubt in Glennys's mind that she wanted to take it, but she did consider several other offers closer to New York. Finally, the Farrars agreed that Glennys would accept the Caltech position, even if it meant living apart for a year. Fortunately, it didn't come to that. Stan was offered an exciting job in a Los Angeles law firm, and the Farrars were able to move to Pasadena together.

Glennys's recollection that good ideas were bottled up inside her while she was at the Institute for Advanced Study may have some validity because a productive period began for her in the spring of 1973, which she spent at SLAC (Stanford Linear Accelerator Center). She and Stanley Brodsky of the SLAC staff recognized that if protons, pions, and other "hadrons" are indeed made of quarks, then when they are scattered off each other through some fixed angle, the scattering probability should follow some simple scaling laws; that is, it should have a definite dependence on the total energy of the collision. Since the particular energy dependence to be expected depends on the number of quarks in the particles being scattered, the prediction provides a test of whether the particles are actually made of quarks.

"These scaling laws are based on some very elegant and fundamental notions about the quark model," say Thomas Appelquist and Adam Schwimmer, who were visiting associates in theoretical physics at Caltech last year. Appelquist is from Harvard and Schwimmer is from the Weizmann Institute. "It was a very nice observation, which made it possible to account for some experiments that had been done, and to predict the outcome of some that hadn't yet been tried."

Most of the theoretical work Glennys does has immediate consequences for experimental results. ("She stays close to the real world," says Appelquist.) Since she has been at Caltech, much of her work has been devoted to formulating a consistent theory of the very small distance interactions between quarks, and determining their consequences for the behavior of ordinary particles. Sometimes she wonders whether this is the best approach to attack what she considers to be the outstanding problem of theoretical physics: Why are quarks confined inside protons, mesons, and the other known particles? There is a lot of evidence that they are

there. Particles made out of them can be hit together so hard that many new particles (but never quarks) are created in the collision. Why don't the quarks ever break loose? Some fundamental force — not yet understood — must be keeping them confined.

"That problem may well be solved by someone who is working on it directly, rather than with my backhanded approach," Glennys says. "I tend to go about it by asking myself, 'If we assume that this or that is true, what consequences would it have? Would we still have a consistent picture? I try to get as much guidance as possible from physical rather than mathematical arguments."

For Glennys, the most important quality a theorist can have is good judgment about what problems to work on, and how to attack them. "What would be really fabulous," she says, "would be to have a Feynman or Gell-Mann kind of intuition about the right questions to ask — not just what is important, but what it may be possible to answer — as well as an ability to solve problems."

Needless to say, any theorist occasionally finds himself following a blind alley, and Glennys ruefully recalls one example: "Adam Schwimmer and I worked out a beautiful explanation for all the strange things that had been observed when an electron and a positron are annihilated with enough energy to produce the new particles discovered at SLAC in 1974. It agreed with everything that had been seen and, best of all, had a very definite consequence that could be easily tested. We called one of the SLAC experimentalists who was studying the process and asked him to look at the data and see if our 'prediction' was true. About a week later he called back: It wasn't."

But she's philosophical about it. "Of course the news was disappointing, but we still learned a lot from the thinking we'd done, and we enjoyed it. Besides, the fact that nature is not so easily explained is why it's such a challenge to try to understand it. That particular problem remains unsolved — but that gives you an even healthier respect for nature's ingenuity."

Glennys doesn't spend even all of her Caltech time in research, of course. She has graduate students, and she thoroughly enjoys working with them. Last year she began working with undergraduates as one of the team of physicists in charge of track B of freshman physics. She worked very hard at this assignment, but it wasn't until third term that she felt she'd hit her stride. By then she was less anxious about whether the students would feel she knew what she was doing, and she'd found her own informal and egalitarian style. Now she really relishes the give and take in her classes.

This year she is a member of the faculty committees on Institute programs and student housing — probably at least partly as a result of having volunteered several suggestions to members of these committees in the past. But she believes in lobbying for what she wants, and in giving her time to making it work. She also believes in — and practices, in spite of inner trepidation — asking questions when she doesn't understand. ("I may sound dumb, but that won't kill me.")

She attends national and international conferences when she can to hear reports of the work of her colleagues and to announce her own; and she visits various national research laboratories to work and observe. The fall term of this year, for example, was spent at CERN (Centre Européen pour la Recherche Nucleaire) in Geneva, Switzerland. This kind of experience is very important professionally as well as scientifically, so she is fortunate to have some of it financed by an Alfred Sloan Fellowship for Basic Research in the amount of nearly $20,000 to be spent over the next four years.

For recreation Glennys plays tennis (about once a week), gardens (most weekends), and (every chance she gets) goes hiking, backpacking, and (in season) cross-country skiing. Playing the piano is a fairly recent, and very important, activity. Though she had brief periods of music lessons on the piano and violin as a child, serious study of the piano is something she started less than three years ago. She is rapidly improving the level of her skill but faces the fact that the amount of time she has for music will tend to vary inversely with how intensely her research is going.

She loves to cook, and guests of the Farrars testify that the food — provided by both Glennys and Stan — is ambrosial. Glennys thinks she probably started acquiring her interests and skills as a result of her mother's turning partial responsibility for the cooking of family meals over to her when Glennys was about eight years old. This was Mrs. Reynolds's way of handling Glennys's complaint that she only got to help with the "grungy things like washing lettuce." The passage of time, incidentally, has not cured her of loathing that job.

Unfortunately, the combination of her schedule and her self-imposed demands for performance doesn't give Glennys as much time as she'd really like for anything. What she covets is more hours in the day. In fact, the only people she envies are those who don't need the eight hours of sleep a night that she requires. She once tried to train herself to do with less, but in that project determination, for once, failed her. A dismayed and exhausted Glennys Farrar found that those hard-earned extra hours were a total waste of time. □