

The Chemistry of Caltech

by HARRY B. GRAY

Caltech's 1975 Commencement Address — or How Commencement Speakers Are Chosen

DO you *really* want to graduate on Friday, the 13th? I don't know about you, but I was thinking about today being the 13th and also a Friday, and I got a little worried about giving this talk. So I did a little research.

I went over to the Institute archivist, Judy Goodstein, who knows everything about Caltech's history, and asked Judy and her assistant, Ruth Gordon, to dig up something good about the 13th of June. And so they rustled around in the old papers that are in the archives and came up with a giant deed — *the deed*, in fact, to the original plot of land that was given to Throop University by Old Man Throop (*Amos G. Throop*). The deed is dated the 13th of June 1892.

How about that?

You all know that Throop University is now Caltech. So this *must* be a good day for Caltech! We're 83 years old today, in one way of looking at it, and as all students know, what's good for Caltech is good for you. Right?

This is a grand occasion. It's so grand you must be wondering why I was chosen as speaker. Actually, I've been wondering that myself. And so I went back to Judy Goodstein over in the archives, and I said (*I'm getting to like Judy at this point*), "Judy, how does Caltech pick speakers for grand occasions? Do you have any material on this?"

Sure enough, she had lots of material. Albert Einstein visited here several times in the early thirties. He was our original Fairchild Scholar. (*He didn't know he was a Fairchild Scholar, but he was.*) And there's a lot of material on Einstein's visits, because there were many ceremonies and banquets in honor of him.

One item Judy dug out was particularly interesting. Something written by Richard Chace Tolman, who was professor of theoretical physics and professor of physical chemistry at

the Institute. (*That's the last time that title will ever be used here.*) Richard Chace Tolman was involved in one of the big Einstein banquets at Caltech, and he told an interesting story about how he was chosen to be the toastmaster for that occasion.

Here's what Tolman said: "Fellow scientists, first of all I should like to explain to you the reason why I happen to be toastmaster this evening.

"Three weeks ago today in the late afternoon I was strolling back and forth on the Institute campus buried in meditation, trying to find a solution for the terrible problem of the increase in entropy that appears to be taking place everywhere throughout the universe." (*You see why I picked this passage; Tolman and I have very similar interests. I continue.*) "Just at the moment when it seemed as if I were about to get a solution for the problem, my walk was suddenly interrupted by Dr. Millikan. (*You don't know about Dr. Millikan; remind me to tell you about him sometime.*)

" 'Tolman,' he said.

" 'Yes, Professor Millikan,' I replied.

" 'Dr. Millikan is an older man than I am, and he always speaks to me in that informal way. He just calls me 'Tolman,' but I am a younger man than he is, so I always reply, 'Yes, sir. Yes, Professor Millikan.' "

(*Now you must realize that Harold Brown and I greet each other in a much different manner. Harold doesn't even know my last name. He has a lot of trouble with people with colored last names. I continue.*)

" 'Tolman,' he said, 'I think it would be a good plan if we had a dinner at which the members of the scientific staff of the Institute and the neighboring institutions could meet Professor Einstein.' "

“ ‘Dr. Millikan,’ I replied. ‘I think that would be very fine for the staff members, but pretty hard on Dr. Einstein. I am sure that in the course of his life he has had to attend so many dinners in his honor that he never wants to look another filet mignon in the face. I therefore recommend strongly *against* such a dinner.’

“Two weeks ago I was again strolling back and forth on the campus and again nearly reached a solution to the problem of entropy and was again interrupted by Dr. Millikan.

“ ‘Tolman,’ he said, ‘I have been thinking about *your* suggestion that we ought to have a staff dinner in honor of Dr. Einstein, and I believe we ought to have a number of speeches at the dinner by staff members.’

“ ‘Dr. Millikan,’ I replied, ‘I think that would be fine for the speakers but very hard on Dr. Einstein and the other listeners. I therefore recommend strongly *against* any speeches.’

“One week ago today I was again strolling back and forth on the campus, and again nearly reached a solution to the problem of entropy, and was again interrupted by Dr. Millikan.

“ ‘Tolman,’ he said, ‘I’ve been thinking about *your* suggestion that we ought to have speeches at the staff dinner in honor of Dr. Einstein. Here is a list of speakers, and I’ve decided to appoint you the toastmaster.’

“That, my fellow scientists, is the reason why I am toastmaster tonight, and the reason why the problem of the entropy of the universe still remains unsolved.’ ”

I hate to tell you, but I was chosen to give this talk in a much less devious way (*and in a much less interesting way*). Several months ago the chairman of the convocations committee, Jon Mathews, who is also a professor of physics, called me and said, “Harry, I’ve got to talk to you privately in your office.”

I said, “Come on over, Jon.”

He came over, looked very nervous, shut the door, made sure it was shut, and he said, “Harry, you were the third choice of the students this year. We want you to give the commencement address. Will you do it?”

I said, “I’ll do it.”

He never told me who finished first and second. But I suspect it was either Diana Rigg, Burt Reynolds (*who’s my main competition*), Linda Lovelace, or possibly Mr. Spock. At any rate, I’m very delighted and honored to be able to speak to you. I’ve had most of you in class, as you know, unfortunately. Most of you were in Chem 1, in fact. Let’s hear it for Chem 1! (*I thought I flunked most of you, but obviously there are a few left.*) Those of you who were in Chem 1 expected me to come out here in some stupid outfit. Well, here I am.

(*You know, they thought I was crazy when I dressed up like a horse and like a leopard. Look at the costumes on the people up here — it looks like a zoo.*)

I was very impressed by Dick Feynman’s talk last year. You remember — the main message was about scientific

integrity. You know, you report *everything*, not just what agrees with your particular theory. You report everything, so people can evaluate all the facts and make their own judgments. You lean over backwards to be scientifically honest. Scientific integrity. That was the message last year.

The press was obviously impressed too. Because in announcing this year’s commencement talk, most of the space was devoted to last year’s speaker. Hell, it takes eight lines just to write “Richard P. Feynman, Richard Chace Tolman (*you remember him*) Professor of Theoretical Physics and Nobel Laureate, and he spoke last year about blah, blah, blah, and — by the way — this year’s talk is by Harry Gray.”

I had to retaliate! I had to one-up Feynman. How could I do it? Well, I thought briefly about getting some material from my sidekick, Murray Gell-Mann, but I know Murray too well. I know he’s fallible, so I discarded that theory right away. Then it hit me — *Einstein*. There’s the one guy who’s smarter than Feynman. I’ll get some material from Einstein.

So I went back for the third and final time to the archives and I said, “Judy, did Einstein ever speak to the student body at Caltech?”

And she said, “Sure he did, but he always spoke in German at Caltech back in the thirties.”

I got a little nervous until she told me that there was, in fact, a translation of his speech. Here’s part of what Einstein said:

Why does this magnificent applied science, which saves work and makes life easier, bring us so little happiness? The simple answer is because we have not yet learned to make sensible use of it. In war, it serves that we may poison and mutilate each other. In peace, it has made our lives hurried and uncertain instead of freeing us in great measure from spiritually exhausting labor. It has made men into the slaves of machinery, who for the most part complete their monotonous long days’ work with disgust, and must continually tremble for their poor rations.

You will be thinking that the old man sings an ugly song. I do it, however, with a good purpose, in order to point out a consequence.

It is not enough that you should understand about applied science in order that you may increase man’s blessings. Concern for man himself and his fate always forms the chief interest of all technical endeavors. Concern for the great unsolved problems of the organization of labor, for the distribution of goods, in order that the creations of our minds shall be a blessing and not a curse.

Never forget this in the midst of your diagrams and equations.

That was Albert Einstein on February 16, 1931, to the Caltech student body, translated by somebody and slightly retranslated by me. (*Sorry, Judy.*) Obviously, what he said over 40 years ago has relevance to our situation today.

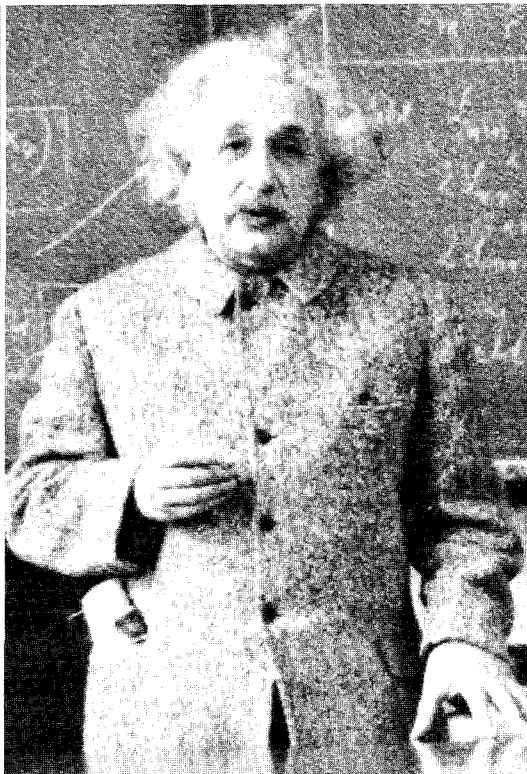
Einstein’s whole talk was not much longer than the passage I quoted. If it were printed in *Engineering and Science*, it would occupy less than a full page. In contrast, last year’s talk by Dick Feynman ran four full pages in *E&S*. And if you think about that comparison for a moment, you will realize that poor old Harry Gray will have to give a talk that is

THE FEG FORMULA

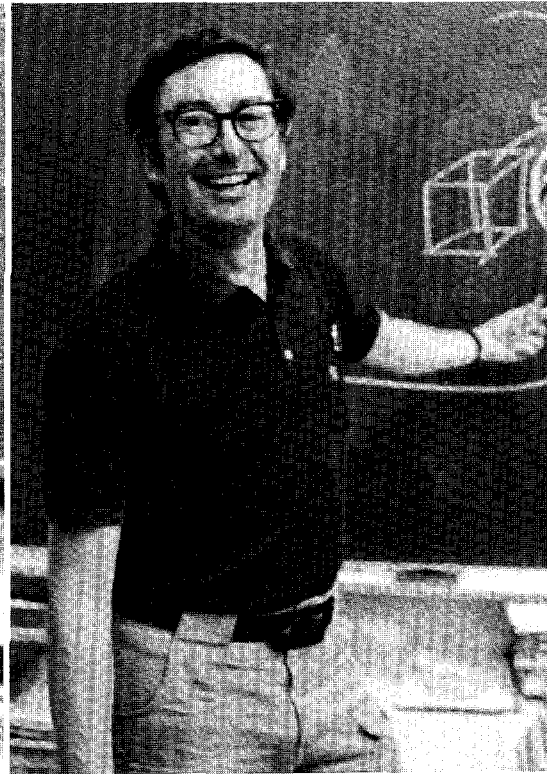
Dr. Gray's Handy Three-Part Prescription for Graduating Seniors



F Feynman—"Have absolute scientific integrity."



E Einstein—"Do science, but with concern for mankind."



G Gray—"If you don't love it, don't do it."

infinitely long. I'm not going to do that. I'm simply going to add just one important bit to what Feynman and Einstein have already told you.

There's plenty of challenge today. In fact, there's more challenge than there's ever been, both in pure science and in applied science. For example, everybody knows the big energy crisis is here; everybody knows we're running out of juice to run the world. This problem will not go away. We've got to do something about it. In the next 25 years we will have to find fundamentally new ways to make fuels and materials, and at the same time we have to protect the place we live — the environment. That's a *big* challenge.

There are equally large challenges in all areas of science and applied science right now. You're going to be in the middle of all this excitement, and there's going to be a lot of pressure on you in the next 25 years.

And so my advice is — to add to Feynman's and Einstein's — you'd better love what you're doing. Don't do it if you don't love it. Find a field that you can really live with all the time, that you really like. If you've found such a field, stick with it; don't let anybody talk you out of it. If you haven't found what you really want to do yet, keep searching. And

when you find it, don't let anybody talk you out of it.

That's the third part of a three-part formula that I will leave you with. Feynman's part: Absolute scientific integrity. Einstein's part: Do science, but with concern for mankind. Gray's part: If you don't love it, don't do it.

In order that you can really remember the message, I hereby give you the Feynman-Einstein-Gray formula: F-E-G, FEG. The FEG formula. You can add it to your special Caltech vocabulary. You know, "trolling," "snaking," "flicking," and now I give you "fegging." You can also see why I had to use Einstein in this talk; I couldn't use my friend Archimedes, or Aristotle, or the chairman of the board — or certainly not Amedeo Avogadro.

Now's it's time for you to graduate. (*Actually, it's time for the Glee Club.*) I wish you all much success. I hope you come back to campus many times. We need you. We need you to help us keep Caltech the place where, for example, Page House can outsmart McDonald's; where a lousy Chem 1 lecturer can be dumped in Millikan Pond; and where students and faculty and staff and administrators can continue to work together closely. That's what I mean by the chemistry of Caltech. Thank you. □