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fore ending up as a theoretical physicist working in nuclear physics, solid-state physics, particle physics and basic quantum mechanics. I have had many opportunities to compare my background with those of colleagues and students in Europe and Israel who had learned much more science and mathematics in high school than I had. I generally found that mine was far superior.

In high school I learned how to think, how to study and how to express myself in acceptable English. I learned enough of two foreign languages, Latin and German, to provide a basis for learning two more later on when I needed Hebrew in Israel and French in France. I picked up some typing skill, just for the fun of it, when typing was considered a subject only girls who had no hope of a college education and would need to work as secretaries. I now type and edit directly into a terminal with a speed that surprises today's computer whiz kids, who do not expect such skills from my generation. Above all I learned how to learn new things, to pick up new ideas and new concepts, and to abhor rote learning of facts without understanding something about the reality behind them and the relations between them. I learned that there was always more than one way to solve a given problem and that it was more fun to look for new ways instead of blindly following the standard method in the textbooks.

When I entered Cornell in 1938, the curriculum in electrical engineering included only one semester of electronics. The faculty assured us that although we students were enthusiastic about ham radio, there was no future in electronics. All the jobs were in power engineering, power transmission and so on. Fortunately I had learned from my high school experience not to be constrained by such rules and studied extra physics. Thus I learned Maxwell's equations (then actually opposed by the engineers) by listening to physics courses not in the electrical engineering curriculum.

Physics and technology have changed a great deal since 1938, when the computer terminal did not exist, even in dreams, and the faculty of one of the best American engineering schools believed that there was no future in electronics. Even more dramatic changes can be expected in the next half-century. High school education should be aimed at giving students the broad background and flexibility that they will need to face this changing future and to go beyond the subject matter that today's best teachers think is important.

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Is Resonant Tunneling Transistor a Reality?

In their article "Quantum Electron Devices" (February 1990, page 74), Federico Capasso and Supriyo Datta note that "conceptually, the simplest way to build a resonant tunneling transistor is to form a contact with the heavily doped quantum well of a double barrier." The authors state that "this approach is, however, fraught with major technical difficulties, and attempts in this direction have not yet succeeded."

On the contrary, this approach, first proposed by Bruno Ricco and Paul Solomon,[1] *has* been used to fabricate resonant tunneling transistors.[2,3] In these devices, the quantum well of an AlGaAs/(In)GaAs resonant tunneling double barrier was doped heavily p-type, and ion implantation was used to make contact to the quantum well.

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Capasso replies: The statement in our article quoted by William R. Frensley, Mark A. Reed and Alan Seabaugh accurately reflects the experimental situation in that neither their reference 2 nor reference 3 describes a working resonant tunneling transistor. The device of reference 2 exhibits negative transconductance ($dI_C/dV_{BE} < 0$, where I_C is the collector current and V_{BE} is the base–emitter voltage), while no peak is observed in I_C as a function of the base current I_B (at constant collector–emitter voltage V_{CE}). Since physically the effect of increasing I_B must be the same as that of increasing V_{BE} (that is, suppression of resonant tunneling and attendant decrease of I_C above a critical V_{BE} and I_B), the claim that the observed negative transconductance is a manifestation of resonant tunneling transistor action is unsubstantiated. In the device of reference 3, on the other hand, no negative transconductance is observed. Finally, both devices have unacceptably large base resistances ($\gtrsim 1\ k\Omega$) for III–V bipolars. This has serious consequences for the operation of the device, as shown, for example, by the large collector-to-emitter offset voltage in the collector characteristic.

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Oratory and the Overhead Projector

The opinion expressed by John Rigden (March, page 73) that the overhead projector has caused us to lose our oratory abilities is off-target. I question first his assumption that physicists and other scientists *used to be* good orators. I also note that the primary purpose of an oration or speech is quite different from that of a talk or lecture accompanied by transparencies. A well-turned speech should inspire an audience to action or to a new frame of mind. Imparting information or understanding is secondary. Oration is of great importance to religion and politics, for example; Winston Churchill and Adolf Hitler come to mind.

A lecture or talk accompanied by transparencies has a different purpose: to convey information, of which a fair fraction should be *understood* and *remembered*. Understanding and knowledge are clearly not an objective of most speeches. (I venture to say that oratory can be a danger to science, as illustrated by the movement of "scientific" topics such as nuclear power, pollution and the greenhouse effect into the realm of political and religious oratory.) Visual aids greatly enhance our ability to remember spoken words. The effective use of an overhead projector can be invaluable in imparting understanding in science.

What Rigden could complain about is the frequent misuse of transparencies. Eighty percent of the transparencies used at scientific conferences are not "well turned," and 80% of the verbiage accompanying the remainder is also not "well turned" and has never been rehearsed. Though the fraction of good talks is small, I wager that things would be worse without overheads. The real problem began when our future scientists decided not to pay attention to high school English and writing classes, and few ever