

## Selling Science to the MTV Generation

At Argonne National Laboratory, interaction with local high schools and universities is a high priority. During the summer months, students and teachers are hired for eight- to twelve-week periods and exposed to the world of research and development. Last summer, our section hired Ken Helberg, a local high school science teacher who was assigned to work with me. We worked together quite well, and late that summer Ken asked me to come and speak to his classes. I put off saying yes for a time, but then read a survey of high school students who were asked what careers they would choose. To my surprise, more than 50% said they would like to be lawyers! Perhaps they were influenced by television's glamorous portrayals of wealth.

At that point, I decided that it was time to do a commercial about the joy of science and the exhilaration of discovering the unknown. I thought of the special events that had steered me to a career in science, and reasoned that perhaps I could present science in such a way as to add a few more scientists to the next survey. So I finally agreed, but rather than give presentations to six groups of 50 students each, I requested that the classes be combined. Thus my challenge was to inspire 300 freshman high school physics students.

The simplicity of Newton's laws, which can explain complex events such as a trip to the moon, was my chosen topic. The goal was to apply Newton's laws to everyday events. My introduction posed the question of what Newton's laws have to say about getting out of bed in the morning. From there, I covered Newton's three laws with my own interpretations. I also included the first two laws of thermodynamics.

Rather than use the conventional lecturing approach, I asked for volunteers. There were many, and I found that the attention-starved students all wanted to be involved in the show and that my presentation format gave them what they wanted. As a bonus, I discovered that I held more of the audience's attention when friends watched to find out what would happen to their volunteer buddies on stage. For their enthusiastic help, I rewarded the volunteers with "Atoms Family" coloring books from the American Nuclear Society, and winter-green Lifesavers<sup>TM</sup> (which are triboluminescent).

To demonstrate Newton's first law, I

had one volunteer sit in a chair on wheels and be Mr. Body. Another helper called Mr. Force gave Mr. Body a healthy push. As Newton predicted, Mr. Body kept rolling right out of view and he would have kept rolling had he not been acted on by the frictional force of the floor and his shoes. Newton's first law seemed more relevant and a little less threatening when the students saw that it is indeed related to many events in their lives.

To explain the second law of thermodynamics, I took a deck of cards that I had previously arranged in order of suit and rank. I showed the cards to the audience, shuffled them for several seconds, and gave them to a volunteer in the audience to put back in order. I asked him to call out when he was finished. I then continued with my presentation and a few minutes later when he returned the cards, everyone realized that it takes more energy to restore order than to make a mess. They more readily understood the statement that you can't clean up your room without making a mess somewhere else.

To tie all the laws together, I presented the Grand Unification of Physics, Thermodynamics, and Life. My objective was to show the students that failure is an important part of life. There are no safe, failure-free routes in life. We do learn more from our failures than our successes. I explained that 90% of research and development is failure but it is that 10% success that makes it all worthwhile. Most of the fear of failure

comes from fear of change, but if we do not try new things and change we will never grow. People who always take the safe way do not challenge themselves and never reach their full potential.

To pique the students' curiosity, I also demonstrated some interesting events that were "exceptions" to Newton's laws. The experiments were kept simple with everyday household items so the students could try them at home. A volunteer made a paper clip "float" on water.\* I demonstrated a bicycle wheel that rolls both downhill and uphill.\*\* At the end of the presentation, I invited everyone on stage to try the demonstrations themselves. This was the most gratifying part of the presentation because those students who did take the time to come up were the most motivated. As part of the audience, none of them had asked a question, but as individuals they asked many surprising and intelligent questions.

In hindsight, I will change a few things for my next presentation. First, I will start off with a bang, doing one of the best demonstrations first. I had spent the first three minutes giving a verbal introduction. It is true that if you don't grab their attention in the first thirty seconds (the length of an average TV commercial), no amount of effort will make up for the lost time.

\*If the paper clip is placed carefully on the water, the surface tension will keep it from sinking.

\*\*The wheel was weighted so that the center of mass was not at the center of the wheel. Thus, while the center of mass was falling, the wheel rolled up the ramp.

### Laws of Physics

- #1 Everybody stays in a state of rest or in uniform motion unless acted upon by a force.
- #2 Force = mass x acceleration
- #3 For every action there is an equal and opposite reaction.

### Laws of Thermodynamics

- #1 All matter has energy, and energy is neither created nor destroyed.
- #2 Everything in the universe seeks its lowest level of energy.

### Grand Unification of Physics, Thermodynamics, and Life

#### Tom's Law of Relativity: All things are relative.

- First Corollary—Life is difficult if all your relatives are successful. (No one is perfect!)
- Second Corollary—Fear of failure is fear of change is fear of growing.
- Third Corollary—Change is inherently good. Without it we'd still be swinging from trees!

### Laws of Life

- It's tough to get moving.
- If you do nothing, nothing happens.
- It's tough to get ahead!

### Laws of Life

- There is no free lunch.
- Chaos is normal.

## EDUCATION EXCHANGE

Timing is also crucial. I tried to cover Newton's laws before the students had studied them in class. Next time I will make my presentation after such material has been covered in class. Young minds show more interest in familiar things. I will also lecture less. My attempt to be philosophical was better suited to an older audience. In the future, to get my message across, I will use more events that the audience can relate to, as well as humor. But I will be sure that the humor is aimed at the specific audience. Sight gags work best during the demonstrations.

Last of all, I won't be surprised if I end up reaching only a small percentage of the audience. The stereotypical image, of the scientist has been with us for years. One lecture will not change that image but if we don't try, the scientific community will surely lose many bright minds to other "better advertised" professions. I'm looking forward to the next invitation to repeat my science commercial. I would welcome any comments or suggestions from readers to improve the next presentation.

T.C. Wiencek

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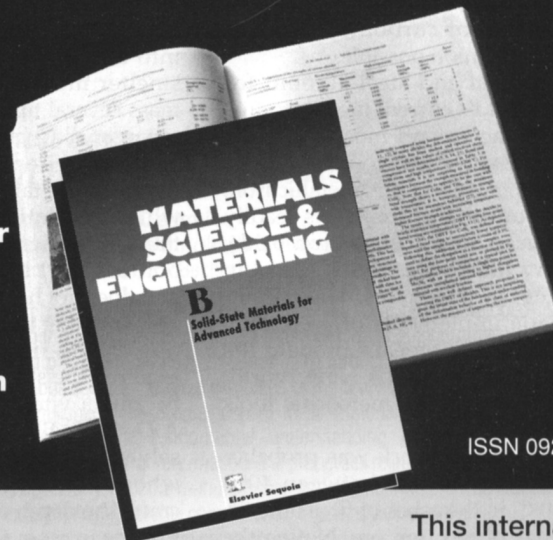
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