

The  
**BEACON**

News from  
*The Coalition for Excellence in Science and Math Education*

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June 2001

**In this issue:** Hope to See You Soon—Steve Brügge, Charter Schools—Jerry Shelton & Bill MacPherson, Who's Who of Proposed Board, Galileo, Part Two—Timothy Moy, Louisiana—Dave Thomas, No Transitional Fossils? *Acanthostega gunnari*—Dr. Jane Clack, Predicting College Outcomes, Walt Murfin, Young Scientists—Harry Murphy

### HOPE TO SEE YOU SOON

I am an enormous fan of technology. In fact, in full seriousness, I have said on many occasions that if someone took away my computer, I would quit teaching. The ability to do grades, send and receive e-mails, post my weekly teaching schedule on a school web page, and do dozens of other chores is incredibly enhanced by the use of my computer.

It's not just the teaching part of my life that has been changed by technology, however. CESE would not be what it is today without the thousands of e-mails that go out between and among members. A phone call is often a bit invasive, but e-mail fits the bill most of the time. I cannot envision going back to the not-so-good old days. To communicate at the speed of light is wonderful. It makes me a much more effective teacher; it has enabled CESE to become a major player in science and math education.

There are times when e-mail is just not enough though, and, in fact, even a phone call doesn't do the trick. Computers simply cannot take the place of a face-to-face meeting. I hope that you will come at the speed of car, van, or motorcycle to our annual meeting on Saturday, June 16, 2:30-5:00, at the First Unitarian Church, Albuquerque, NM.

While technology is great, I'm an even bigger fan of people. I look forward to seeing you in person soon!

—Steve Brügge, President

### CHARTER SCHOOLS

Part of a three-day statewide symposium on charter schools organized by the State Department of Education (SDE) was an afternoon (Friday May 4) devoted to an Employer-linked Charter School Forum. The

public was invited to phone for reservations, so we attended. Sponsors, in addition to SDE, were Charter Friends National Network, New Mexico Business Roundtable for Educational Excellence, New Mexico Charter School Resource Center (CSRC), and Greater Albuquerque Chamber of Commerce.

The master of ceremonies was Bob Perls, former state representative, and organizer of a charter school in development, the Public Academy for Performing Arts. (See *Albuquerque Journal* April 12, '01 page A1.) Perls has been a force in developing charter schools in New Mexico since he authored the original charter school bill.

Dr. Michael Kaplan, of SDE, presented a plaque to honor State Senator Mark Boitano as a "Friend of Charter Schools."

The keynote speaker, Gary King, is a supporter of charter schools, a former New Mexico state legislator, and former Director of the Office of Worker and Community Transition for the U.S. Department of Energy.

Robin Troup, Director, CSRC, explained that Employer-linked Charter Schools are independent public schools of choice that have established partnerships with business and industry. These partnerships vary widely as to type and degree of involvement. The purposes of employer-linked charter schools are career and/or college preparation, and career exposure.

Three panelists spoke about their particular schools. Each dynamic speaker was full of enthusiasm for the three very different charter schools. They told of their experiences getting up and running, and the advantages and disadvantages of the charter school format. The basic trade-off was to give up security for freedom. Charter schools are exempt from some restrictions imposed on traditional schools, but the other side of the coin is that they

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### Membership Information:

CESE annual dues are \$25 for an individual, \$35 for a family membership, and \$10 for students.

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## WHO'S WHO ON THE PROPOSED 2001 - 2002 CESE BOARD OF DIRECTORS

### OFFICERS

**PRESIDENT—Timothy Moy** is currently the Vice President/President-elect of CESE, and a professor of history of science at University of New Mexico.

**VICE PRESIDENT/PRESIDENT ELECT—Bill MacPherson**, a retired Electronics Engineer, also holds a Master's Degree in Management Science.

**SECRETARY—Marilyn Savitt-Kring** is a microbiologist, American Society for Clinical Pathologists M(ASCP), a member of New Mexicans for Science and Reason (NMSR) and the mother of (almost) eleven-year-old twins.

**TREASURER—Nancy Shelton**, retired editor from the Defense Nuclear Agency, has an MBA, is editor of the Beacon, a member of NMSR, a charter member of CESE, and has 20.66 grandchildren.

### MEMBERS AT LARGE

**Marshall Berman**—received a PhD in Nuclear Physics, and recently retired from Sandia National Laboratories after 32 years. Marshall is the founding president of CESE, the Vice President of the New Mexico State Board of Education, and the Executive Director of the Internet Learning Network at the Council on Competitiveness.

**Stephen Brügge**—President of CESE, is Science Department Chair at Eisenhower Middle School, Albuquerque Public Schools (APS). He is the father of an 8-year-old daughter (at Inez Science and Technology Magnet School, APS), and a 2-year-old-son.

**M. Kim Johnson**—physicist, Manager Technology Development, at Quasar, International, and past president of CESE.

**Jerry Shelton**—is a charter member of both CESE and New Mexicans for Science and Reason. He holds degrees in engineering, philosophy and psychology, and theology.

**David E. Thomas**—physicist at Quasar International, active in robotic systems testing for auto parts utilizing measured resonant frequencies, and in developing pattern recognition algorithms. Thomas is president of New Mexicans for Science and Reason.

**Dr. Jonathan Weiss**—is a physicist at Sandia National Laboratories, the author of eight patents in optical sensors, and has been active in judging science fairs and tutoring students.

## Charter Schools Continued

*must perform.* The students must demonstrate significant academic improvement. A lot of discussion ensued about the consequences of non-performance. One got the impression that charter schools are founded by passionate, energetic visionaries who design schools that help students reach their potential.

Ronald R. Russo came from a background of over twenty years as principal of a Catholic High School, and a law degree earned later in life. He explained how he was recruited to create the Charter School of Wilmington [Delaware] (CSW). How was he instructed to proceed? The governing board said, "Do it!" (Or else). However, the six corporations backing the project included DuPont, Bell Atlantic (now Verizon), Hercules, and AstraZeneca. These corporate sponsors provided the "Three C's:" Cash, Credibility, and Clout, and were, among other things, helpful in persuading the state legislature to pass the enabling legislation.

CSW opened in 1966 and focuses on math, science and technology. However it is not of the "school-to-work" variety. They expect most of their students to go on to college, and most of the corporate sponsors hire mainly college graduates. The hope is that after college the students will return home, improve the general educational level of the community, and possibly go to work for one of the sponsors. This can only be called enlightened self-interest. A well educated work force is a benefit to the community, to the sponsors, and to the individuals involved.

CSW now has 1,200 students and is planning expansion to 1,800. Russo firmly believes that charter schools, far from degrading the quality of regular public schools by drawing away students and resources, actually motivate improvement. For example, when CSW began, it required several

more credits for graduation than regular public schools, particularly in math and science. In a fairly short time, regular public schools upped their requirements too. See:

<[www.charterschool.org](http://www.charterschool.org)>

Mark Kushner, another non-practicing attorney, is executive director and founder of Leadership High School (LHS) in the San Francisco Unified School District. This school is about four years old, with around 350 students drawn from 14 cities in the Bay Area as a result of heavy recruiting. LHS "provides a rigorous college prep curriculum and comprehensive leadership program," preparing students to be effective community leaders.

Establishing LHS was an uphill struggle. Those in the know gave him almost zero probability of getting approval from the San Francisco school board. So he researched the biographies and inclinations of board members, and then lobbied each one individually. Eventually he succeeded. The U.S. Department of Education has selected Leadership High as a model charter school.

As part of his effort to reduce public confusion about charter schools (i.e. they are actually public schools), he encourages use of the term "non-charter public schools" when referring to traditional public schools, and "charter public school" when referring to schools like his. See:

<[www.leadershiphigh.org](http://www.leadershiphigh.org)>

David Green is Dean of Arts at the Orange County High School of the Arts. OCHSA is about fourteen years old, has a budget of

\$9,000,000 but has been a charter school for only a year or two. Its roughly 900 students are selected by auditions from several thousand applications from 54 cities in five counties in the LA area. OCHSA prepares students for placement in higher education and employment in the professional arts industry. "Students attend approximately five hours of aca-

demical classes and three hours of art classes in their chosen department each day. (That's an eight-hour day!) OCHSA was one of eight schools in the U.S. to receive a National Blue Ribbon School award with special honors in arts education from the U.S. Department of Education and the National Endowment for the Arts.

See: <[www.ocsarts.net](http://www.ocsarts.net)>

In all, the presentation was very encouraging. Charter schools seem to offer opportunity for innovation without stirring up the highly emotional responses generated by proposals for school vouchers. (Although the Socorro school board did at first refuse to honor our State Board's granting of a charter school in their district.)

New Mexico now has eleven charter schools operating (five in Albuquerque), and nine more approved but not yet operating. About fifteen groups are exploring the idea of writing charter school applications. Both SDE and CSRC are ready and eager to help anyone interested in starting a new charter school.

CESE has informally agreed to consult with CSRC about possible ways to support math and science education in New Mexico charter schools. They are under pressure to produce, and welcome assistance. (505-291-8149 and email [rtroupe@nmia.com](mailto:rtroupe@nmia.com)).

Other web sites: (Recommended by Employer-Linked Charter School Project:

<[www.employercharterschools.com](http://www.employercharterschools.com)>, National Alliance of Business <[www.nab.com](http://www.nab.com)> (Includes Business Coalition for Excellence in Education),

Public Policy Associates, Inc. <[www.publicpolicy.com](http://www.publicpolicy.com)>, Charter Friends National Network <[www.charterfriends.org](http://www.charterfriends.org)>

**Jerry Shelton**

**And**

**Bill MacPherson**



# SCIENCE, RELIGION, AND THE GALILEO AFFAIR

## Part Two

*In the last issue, Galileo had run afoul of the Church when she was vulnerable to the incursion of Protestantism.*

Unfortunately, Galileo's trouble with the Church later became a popular archetype for the historical relationship between science and religion. Nothing could be farther from the truth. For most of the medieval and Renaissance periods, and even stretching into the 18<sup>th</sup> century Enlightenment, the primary supporter of research and teaching in the sciences was the Roman Catholic Church. In fact, one historian of science, John Heilbron, has recently published a book entitled *The Sun in the Church* that documents how the Church, in the aftermath of the Galileo affair, continued to promote research into evidence for heliocentrism, even to the point of turning entire cathedrals into giant pin-hole cameras to measure the apparent diameter of the solar disk at various times of the year. By a mathematical quirk, Copernicus's system would actually produce slightly different variations in the sun's apparent diameter than the old Ptolemaic-Aristotelian system; the experiments run by the Church in the 1650s and 1660s produced measurements that clearly supported Copernicus.

So, even this classic story of conflict between science and religion is far more complex than most people realize. For me, one of the greatest culprits in the tale is something that still plagues us: a confusion of boundaries between these two ways of understanding the world, and the false belief that expertise in one grants an authority to speak in the other.

*For further information, see:*

Mario Biagioli, *Galileo, Courtier: The Practice of Science in the Culture of Absolutism* (Chicago: University of Chicago Press, 1993).

Owen Gingerich, "The Galileo Affair," *Scientific American* 247, no. 2 (1982): 132-143.

Giorgio de Santillana, *The Crime of Galileo* (Chicago: University of Chicago Press, 1955).

—**Timothy Moy**  
**CESE Vice President**

*Dr. Moy teaches History of Science at the University of New Mexico.*

# LOUISIANA LEGISLATOR TRIES TO BLAME DARWIN FOR RACISM

Louisiana state Representative Sharon Broome, D-Baton Rouge, recently sponsored a resolution condemning Charles Darwin's theory of evolution, saying it would "shine a light on the history of racism." The original resolution stated "Be it resolved that the Legislature of Louisiana does hereby deplore all instances and ideologies of racism, and does hereby reject the core concepts of Darwinist ideology that certain races and classes of humans are inherently superior to others..." The resolution was approved 9-5 by the state's House Education Committee, and forwarded to the full Louisiana House. There, it was passed, but only after all references to "Darwinism" were removed, making the bill simply a generic statement against racism.

In light of the charges leveled in the original bill — namely, that the theory of evolution actually supports racism — it is instructive to ponder the comments of individuals prominent in the creation/evolution arena.

Here are contrasting comments from Henry Morris, founder of the Institute for Creation Research (ICR) and Charles Darwin, founder of the theory of Evolution.

Who is more friendly to racism? You decide.

*"The descendants of Ham were marked especially for secular service to mankind. ... These include all nations which are neither Semitic nor Japhetic. Thus, all of the earth's 'colored' races,—yellow, red, brown, and black—essentially the Afro-Asian group of peoples, including the American Indians—are possibly Hamitic in origin and included within the scope of the Canaanitic prophecy, as well as the Egyptians, Sumerians, Hittites, and Phoenicians of antiquity. ... Somehow they [Hamites] have only gone so far and no farther. The Japhethites and Semites have, sooner or later, taken over their territories, and their inventions, and then developed them and utilized them for their own enlargement. Often the Hamites, especially the Negroes, have become actual personal servants or even slaves to the others. Possessed of a genetic character concerned mainly with mundane matters, they have eventually been displaced by the intellectual and philosophical acumen of the Japhethites and the religious zeal of the Semites."*

Henry M. Morris, *The Beginning of the World* (1991), pp. 147-148. (Master Books; ISBN: 0890511624)

*"... It is often attempted to palliate slavery by comparing the state of slaves with our poorer countrymen: if the misery of our poor be caused not by the laws of nature, but by our institutions, great is our sin; but how this bears on slavery, I cannot see; as well might the use of the thumbscrew be defended in one land, that men in another land suffer from some dread*

disease. Those who look tenderly at the slave-owner and with cold heart at the slave, never seem to put themselves into the position of the latter; - what a cheerless prospect, with not even a hope of change! Picture to yourself the chance, ever hanging over you, of your wife and your little children - those objects which nature urges even the slave to call his own - being torn from you and sold like beast to the first bidder! And these deeds are done and palliated by men, who profess to love their neighbors as themselves, who believe in God, and pray that his Will be done on earth! It makes one's blood boil, yet heart tremble, to think that we Englishmen and our American descendants, with their boastful cry of liberty, have been and are so guilty..."

Charles Darwin, "The Voyage of the Beagle"  
(Modern Library; ISBN: 0375756809)

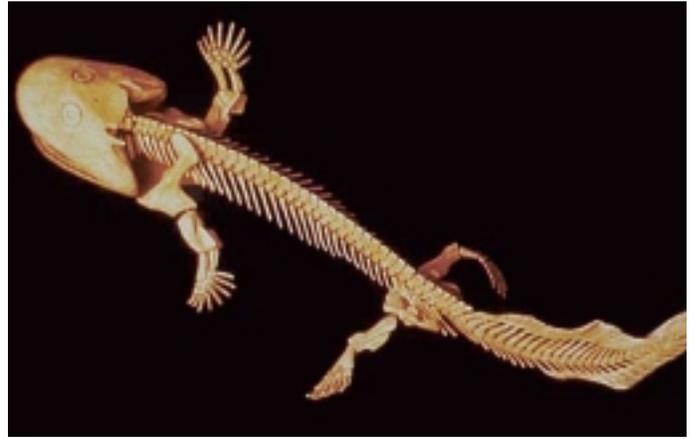
—DAVE THOMAS

## NO TRANSITIONAL FOSSILS?

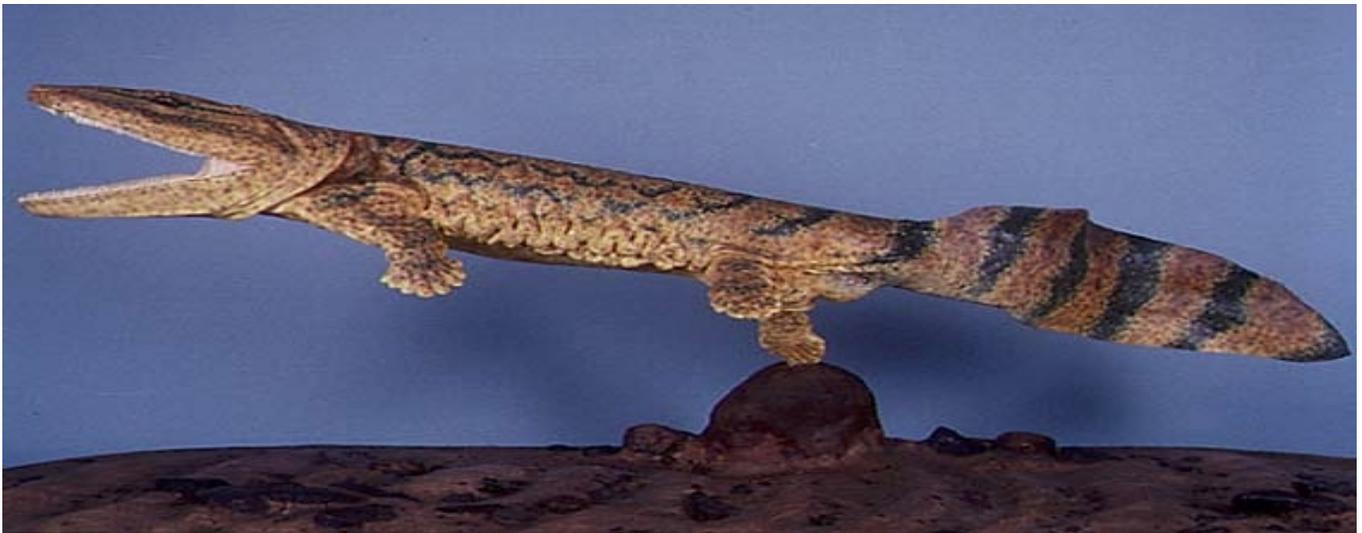
In *Fins Made for Walking*, "Oleg A Lebedev, Nature, Vol 390, 6 November 1997. pgs 21,22.writes about Acanthostega gunnari which lived some 365 million years ago, had a fish-like skull, a tail fin "just like a fish," but also had limbs with eight digits!. "The mixture of fish-like and tetrapod-like (four-legged animal) features in Acanthostega shows that it is a genuine transitional form which, as such, sheds much light on the transition from water to land."

**Photos reproduced from the web page—and with permission—of Dr. Jennifer A. Clack, Paleontologist, Cambridge University, U.K.**

<http://phylogeny.arizona.edu/tree/eukaryotes/animals/chordata/acanthostega/acanthostega.html>



Skeletal model of Acanthostega gunnari. Model and photo by Eliot Goldfinger. Reproduced with permission. Copyright © 1997 Eliot Goldfinger.



Reconstruction of Acanthostega. Model by Richard Hammond. Reproduced with permission. Copyright © 1997 Richard Hammond.

## WHY IT'S SOMETIMES DIFFICULT TO PREDICT COLLEGE OUTCOMES

College admissions officers would like to predict which applicants have a chance of success. Some colleges are required to accept all state residents. Others would like to restrict admission to those who have a fair chance of graduation. Still others have far more applicants than available admissions, and would like to restrict admissions to the very best students.

High School Grade Point Average (HSGPA), High School ranks, SAT or ACT scores are some of the quantitative criteria used for predicting success. College GPA, persistence, and graduation rate are some of the possible outcome measures. Cumulative college GPA might be thought to be the best outcome measure. However, there is so much variability in choice and difficulty of majors and grading criteria beyond freshman year that freshman GPA has overwhelmingly been used as an outcome measure in studies of predictability.

The difficulty raised by restricting the range of admissible applicants can be seen on the hypothetical chart below. The horizontal axis represents the entire range of HSGPA for applicants to a college that accepts all in-state applicants. The vertical axis represents college freshman GPA. You see that the prediction is not bad. With a few exceptions, HSGPA predicts freshman GPA within a grade point or less. The college GPAs are within about 0.5 grade points of the thin diagonal line. The prediction error is only a fraction of the total range of GPA.

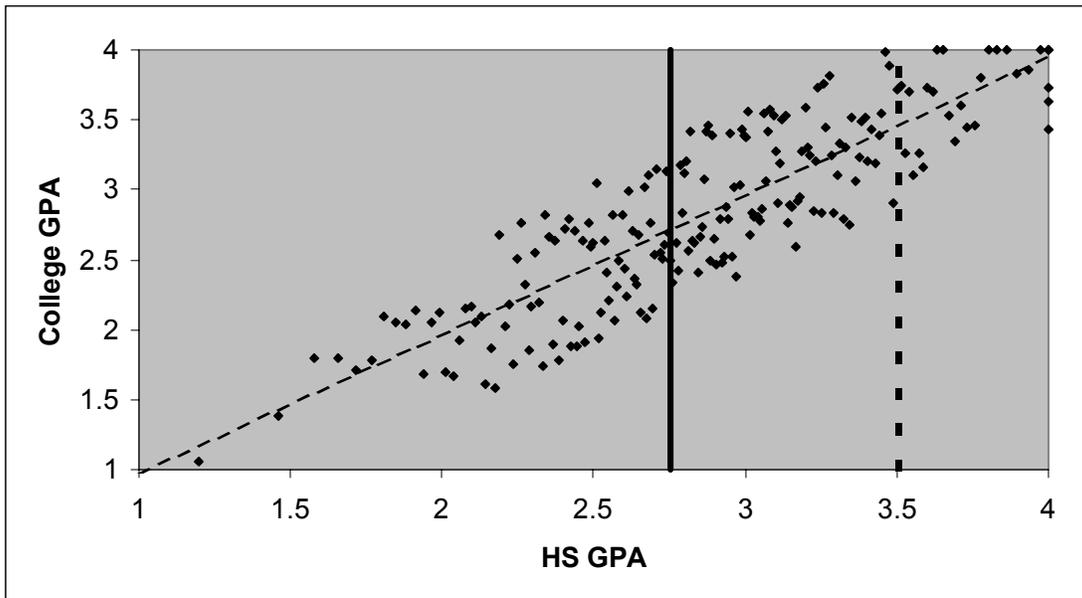
A somewhat more restrictive school might insist that all admitted freshmen have at least a 2.75 HSGPA to be considered. That is represented by the solid vertical line. The prediction is now a little fuzzier. We have cut the number of admissible students in half. The prediction error is now a large fraction of the GPA range. An even more restrictive college will not consider any applicant with a HSGPA below 3.5. This is shown by the dashed vertical line. The prediction error is now as large as the range of HSGPA, and prediction is impossible. This is the “restriction of range” problem.

The situation is even more complex. The restrictive school may have more rigorous freshman course offerings and less generous grading criteria than the college that accepts all applicants. This is the “variability of criterion” problem.

We have only looked at a single set of high school students and a single college. This is too small a sample to generalize to all high school students. We would need to have a much larger sample to be able to predict college success reliably. Although each individual study might only have a sample of a few hundred or a few thousand students, there are methods (“meta analysis”) for combining the results of many studies. There are statistical methods for correcting for restriction of range and variability of criterion, provided the individual studies give enough detailed information. When many studies are corrected and combined, HSGPA turns out to be a fairly good predictor of freshman GPA for all students.

The prediction can be improved by using several

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predictors. The combination of HSGPA, SAT, high school honors, athletic or artistic achievement, extracurricular activities, and community service gives a better picture than any one predictor does. When many predictors for many studies are combined and corrected, the predictability is quite reasonable. The predictability of graduation rate is also fairly good. An SAT score typical of minority students combined with a C average in high school predicts a graduation rate of about 20%. An SAT score typical of the best boarding schools combined with an A average predicts a graduation rate of about 80%. It is not perfect, but much better than guesswork.

So why don't admissions boards rely exclusively on these criteria? One reason is that admissions boards do not want to be thought replaceable by a machine. A more compelling reason is that experienced admissions officers develop an intuitive sense about which applicants will be successful. An even more compelling reason is that relying solely on the quantitative criteria results in the best (hence most restrictive) schools admitting only Asians and affluent Caucasians. There are also some people with an axe to grind. When you are told that SAT or ACT scores and HSGPA do not predict college success well, you have probably been the victim of selective use of data. There are studies – mostly of small samples or with other statistical problems – that do indeed show poor predictability. Presenting only the ailing studies is a questionable tactic, but it exists. You might also be the victim of simple ignorance. The person reporting might not realize that more complete studies are available.

—Walt Murfin



## Young Scientists

Children are amazing, as they go about discovering their new world. So much to see, hear and especially taste. Then comes school, and something changes. The late Carl Sagan said,

*“Every now and then, I’m lucky enough to teach a kindergarten or first-grade class. Many of these children are natural-born scientists although heavy on the wonder side and light on skepticism. They’re curious, intellectually vigorous....questions bubble out of them. They exhibit enormous enthusiasm. I’m asked follow-up questions. They’ve never heard of the notion of a ‘dumb’ question.”*

*“... But when I talk to high school seniors, I find something different. They memorize “facts.” By and large, though, the joy of discovery, the life behind those facts, has gone out of them. They’ve lost much of the wonder, and gained very little skepticism. They’re worried about asking ‘dumb’ questions, they’re willing to accept inadequate answers, they don’t pose follow-up questions, the room is awash with sidelong glances to judge, second-by-second, the approval of their peers. They come to class with their questions written out on pieces of paper, which they surreptitiously examine, waiting their turn and oblivious of whatever discussion their peers are at this moment engaged in.”*

What’s happening that squelches our kids’ early curiosity? Is it our schools or our society’s obsession with sports, and instant gratification? I don’t know, but we can’t blame it all on puberty. The late Richard Feynman noticed something similar when he lectured on physics to college students in a foreign country:

*“I discovered a very strange phenomenon: I could ask a question, which the students would answer immediately. But the next time I would ask the question—the same subject, and the same question, as far as I could tell — they couldn’t answer it at all! After a lot of investigation, I finally figured out that the students had memorized everything, but they didn’t know what anything meant.”*

We need to restore that early sense of wonder to our young people the need to explore and understand our world. And school is the place to start. We need science-trained teachers, freed of stifling

bureaucratic paperwork, free to teach, and free to impart the joy of discovery. We need to show that science is more than a mere accumulation of “facts”. We need to show how important a basic knowledge of science is to every day life. And, we need to show our kids that science is FUN!

Current emphasis on performance testing can be counterproductive. In preparing test questions, the temptation is to ask for memorized facts, rather than test for an understanding of such facts. Such tests are easy to score; either the student gets the right answer, or not, e.g., a typical exam question might be, “What is the atomic weight of oxygen?” This can be phrased as a multiple-choice question, beloved by testers for its ease in scoring; but selecting the right answer doesn’t reveal any understanding of what “atomic weight” means, nor the significance of the atomic weight of oxygen. The student can respond “16” without really knowing what it implies. Similarly, asking, “What is Avogadro’s Number?” in a multiple-choice format doesn’t test the students knowledge of Avogadro’s principle, nor its applications. It’s just another dry and dusty “fact” that turns students away from learning what science really is.

Change comes slowly in school systems especially those constrained by politics, administrators, etc., but change must come if we are to avoid having a scientifically illiterate population making critical decisions in the 21st Century.

—Harry Murphy

### References

(1) Sagan, Carl, *“The Demon-Haunted World,”* Random House, NY, 1996, page 322.

(2) Feynman, Richard, *“Surely You’re Joking, Mr. Feynman!,”* W.W. Norton & Co., NY, 1985, pp 211-219.

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## Return Service Requested

### **Annual Meeting**

*(Bring a Friend)*

**Saturday, June 16, 2001**

**2:30 pm**

**First Unitarian Church**

**3701 Carlisle Blvd. NE**

*(southwest corner of Carlisle & Comanche)*

### **Light Refreshments**

**Please call 296-1467 and leave  
your name and number attending so  
we can plan accordingly.**

## Working Overtime

Marshall Berman has agreed to speak to the Economic Forum on September 7 at 7:00 AM at the Sheraton Old Town.

He was also invited to discuss Education Reform with the Executive Growth Council, another group of business people, at La Pepe's on May 22nd (again at 7:00 AM). (This is *not* Marshall's favorite time of day to give speeches.)

More than 100 delegates to the 38th Annual New Mexico Federation of Educational Employees State Convention met in Albuquerque May 4-5 and elected Christine Trujillo as their new president.

Ms. Trujillo, a 20-year veteran elementary classroom teacher, ran unopposed and was elected by acclamation to serve a two-year term. Trujillo will replace outgoing Federation President Don Whatley on July 1. Ms. Trujillo is a CESE member.



## Speaker

**Rick Miera**

**Chair, NM house Education Committee  
Chair, Legislative Education Study  
Committee**