



# The **BEACON**

*News from*

## ***The Coalition for Excellence in Science and Math Education***

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**February**

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### **VIGILANCE**

As I’m sure you know, one of the primary goals of CESE is to support science teachers in their coverage of evolutionary biology. Recent developments in molecular biology and genomics make it even more important that New Mexico’s students receive the strongest background in biology our schools can provide; evolutionary biology remains as central to modern biology as the atomic theory of matter is to modern chemistry.

Nevertheless, Creationist organizations continue to try to water down or eliminate the coverage of evolutionary biology in public schools, and insist that science teachers include “Intelligent Design theory” in their biology teaching.

Such efforts are not confined to Kansas or Alabama. Members of the New Mexico State Board of Education recently received a letter that purported to “address the issue of false and misleading claims in high school biology textbooks made in support of evolution.” The letter included the following paragraph:

*I would also like to inform you that an organization (which is nameless at the moment) composed of New Mexico scientists, engineers, physicians, teachers and interested individuals in other professional fields, is in the formative stages. The proposed objectives of this*

*organization are to: (1) promote Intelligent Design as a legitimate alternative scientific hypothesis to Darwinian evolution; (2) encourage a more thorough and unbiased coverage of Darwinian evolution than that which is required by the current New Mexico science education standards; (3) provide recommendations to the New Mexico State Board of Education for revisions to the current science education standards that are designed to eliminate dogmatism and encourage critical thinking in origins science education; (4) encourage the use of supplemental materials to make up for the deficiencies in current high school biology text books; (5) provide speakers and other resources for schools and other organizations who have an interest in Intelligent Design; and (6) issue press releases as appropriate to the circumstances concerning science education in New Mexico. I will keep you posted.*

Although Creationist organizations are generally very well organized and extremely well-funded, you may rest assured that CESE will continue to try to protect New Mexico science education from the “reforms” identified in this letter. We will keep **you** posted.

**Timothy Moy**  
**CESE President**

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**WWW.CESAME-NM.ORG**

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

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**THE SHAPE OF LIFE**  
*from the PBS Series*



This spring the Public Broadcasting Service (PBS) will air a series entitled “The Shape of Life.” The New Mexico Museum of Natural History is pleased to host a pre-view and talk by Mark Shelley of Sea Studios Foundation, the Executive Producer of the program. Mr. Shelley will provide an overview of this dynamic new series during his special presentation in Albuquerque.

The television series details new research on the evolution of animal life. It is one of the greatest—and most perplexing—biological mysteries of all time. How did animal life emerge on planet earth? Ever since Charles Darwin put forth his remarkable theory of evolution, scientists have suspected that all animals—from whales to humans, clams to jellyfish, dragonflies to ants—could trace their origin to a single creature. But what could that animal be? What did it look like? How would it behave?

**FREE ! . . . . . 7:00 p.m.  
Sunday, February 10, 2002  
Extreme Screen Dyna Theater  
New Mexico Museum of  
Natural History and Science**

Now, thanks to a recent revolution in scientific understanding, it is a story that can at last be told. For the first time, scientists think that they have actually uncovered that creature—the animal that gave rise to us all.

“The Shape of Life” chronicles a revolution, where breakthroughs in genetics, paleontology, and biology are enabling scientists to rewrite—with unprecedented detail—the rise of animal life on earth. Clue by clue, scientists are piecing together how the first animals of earth have led to the astonishing diversity of creatures we know today.

Surprisingly, while millions and millions of species have evolved, only a handful of designs, or body plans, ever emerged. And as astounding as it might seem, every living animal is a refinement of one of these basic models.

Examining the few body plans that represent the templates for all animal life, and understanding the origin of these body plans, we can begin to ask: Why do animals look, behave, and function as they do? How have different species influenced each other through millions of years of animal history? And how has this history been shaped by the raw genetic material available when animals first appeared?

Humanity faces difficult, complicated choices about its relationship with the natural world. The loss of biological diversity is often referred to as one of the world’s most critical environmental issues, and we are facing choices affecting biological diversity without understanding its

*Continued on Page 3.*

## ***Shape of Life continued. . .***

nature. The “Shape of Life” presents the animal kingdom in its full diversity: interconnected, largely invertebrate, and the result of millions of years of evolution

The “Shape of Life” series is eight one-hour episodes produced by Sea Studios Foundation and presented by National Geographic Television.



***Cambrian Ayshaeia worm checks out a sponge***

*Courtesy of Sea Studios Foundation© 2001*



***Candystriped worm struts its stuff***

*Courtesy of Sea Studios Foundation© 2001*

Mark Shelley’s appearance is co-sponsored by:

- Coalition for Excellence in Science and Math Education (CESE)
- New Mexicans for Science and Reason (NMSR)
- New Mexico Academy of Science (NMAS)
- KNME-TV
- The Albuquerque Journal

Find more information at PBS

<http://www.pbs.org/>

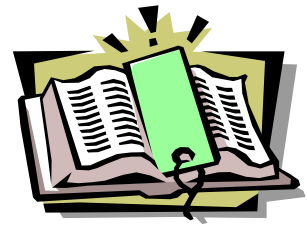
and

Sea Studios Foundation:

<http://www.seastudios.com/pages/soloverview.html>

## **BOOK REVIEW**

### ***UNIVERSE IN A NUTSHELL***



**By Stephen Hawking**

This book is a delight to read. Hawking explains some very arcane ideas in a reader-friendly style and does so with intelligence and humor.

Hawking starts out with explaining Einstein’s ideas on Special and General relativity. Einstein did away with both space and time and replaced them with “spacetime” and explained that gravity was warping of spacetime. The problem with Newton’s theory of gravity was that it allowed the effects of gravity to be felt everywhere instantaneously. This was a violation of Special Relativity, which set the limit at which any effect could be propagated to the speed of light. General Relativity explained the phenomenon of gravity while obviating the necessity of any instantaneous action at a distance.

Einstein’s theoretical equations called for an expanding universe, but neither Einstein nor any other theoretical physicist of his day could accept that. The universe was considered to be infinite and unchanging. So Einstein added the “Cosmological Constant” to his equations to make things work out the way he and everyone else thought they should, sort of a cosmic fudge factor. It wasn’t until Edwin Hubble’s observations in the 1920’s with the 100-inch telescope on Mt Wilson that everyone realized that the universe was indeed expanding. Einstein dropped the Cosmological Constant from the equations, and said that it was his biggest mistake. If he were alive today, he would be amazed at the turn of events. The universe is expanding, but at a slightly different rate than the bare theory predicts it should be. The Cosmological Constant is alive and well, but one of the hottest debates in cosmology today is its value. String Theory

*Continued on Page 4.*



## **UNIVERSE IN A NUTSHELL**

may be able to determine what it is. (See my review of *Elegant Universe* by Brian Greene.)

Einstein, though he made many contributions to Quantum Mechanics was not a fan of that theory for philosophical reasons. He believed in a more deterministic universe, not one governed by probability. Einstein's famous line that God does not play dice is countered by Hawking who states, "all the evidence is that God is quite a gambler." Quantum mechanics rules the realm of the extremely small, on the order of the "Planck length" ( $10^{-33}$  cm.) With the Universe at its current immensity there are a great many rolls of the dice and the results average out to something predictable by classical methods. When the universe was very young, (near in time to the Big Bang) there were many fewer rolls of the dice, and the Heisenberg Uncertainty Principle came very strongly into play. Quoting Hawking, "Because the universe keeps rolling the dice to see what happens next, it doesn't have just a single history, as one might have thought. Instead the universe must have every possible history, each with its own probability. There must be a history of the universe where Belize won every gold medal in the Olympic Games, though maybe the probability is low."

This idea of multiple histories may sound bizarre, but it is now accepted as fact. It was formulated by Richard Feynman. Hawking states that Feynman's multiple histories and Einstein's General Relativity would both be part of a final ToE (theory of everything), based on M theory (see *Elegant Universe*.) Inflationary theory (an excellent book on this theory is *The Inflationary Universe* by Alan Guth), the Anthropic Principle, and imaginary time would also be included. As Hawking says in chapter 3, "...we can see how the behavior of the vast universe can be understood in terms of its history in imaginary time, which is a tiny slightly flattened sphere. It is like Hamlet's nutshell, yet this nut encodes everything that happens in real time. So Hamlet was quite right. We could

be bounded in a nutshell and still count ourselves as kings of infinite space."

This is a rich and rewarding book; Hawking delves into the possibilities of time travel and our ability to predict the future. His last chapter is titled *Brane New World* a play on words involving M theory. In M theory there are theoretical constructs called p-branes. P=1 is a string, P=2 is a 2-dimensional surface or membrane, P=3 is a 3-dimensional surface, etc. M theory is seen as the nascent ToE. We have a fairly good idea what the edges of M theory look like but there is a gaping hole in the middle that is still terra incognita. The six (or seven) extra dimensions of M theory have been considered as being curled up in an extremely small space, so that the most powerful accelerators available today, or at any time in the future would be unable to probe them.

However, there has recently been an idea that one or more of the dimensions might be fairly large, or even infinite. This idea has the advantage that it could be tested. As Hawking says, "Large extra dimensions are an exciting new development in our search for the ultimate model or theory; they would imply that we live in a brane world, a four dimensional surface, or brane, in a higher dimensional spacetime." If we do it is presumably because the Anthropic principle has singled out brane worlds from the innumerable universes allowed by M theory. Again quoting Hawking, "We could well paraphrase Miranda in Shakespeare's *The Tempest* :

'O Brane new world  
That has such creatures in't"

The book is beautifully illustrated and the paper is of very high quality and in a large format, which makes the \$35 price understandable.

**Bill MacPherson**  
**CESE Vice President**

# Dive into Science

## 2002 New Mexico Science Bowl

**The 2002 New Mexico Science Bowl will be held on February 16, 2002** at the Albuquerque Academy. Sandia National Labs, Lockheed Martin, PNM, and the Albuquerque Academy are sponsoring the event this year.

The Science Bowl is a round robin/double elimination tournament for New Mexico high school science students. Almost 50 teams from more than 20 New Mexico high schools will compete to represent the state at the National Science Bowl in Washington DC.

**Moderators and officials are needed to conduct the competitions.** Moderators read the questions while the officials keep the time, interpret the rules, and keep score. The competition will start at 8:30 a.m. and end in the afternoon with snacks and lunch provided. An optional training session will be held in February at Sandia Labs for those who are unfamiliar with the competition or for those wanting a refresher.

Please contact **Patrick Milligan at 844-5150** if you have any questions or would like to volunteer. You will meet some great students and learn a little science.



**Yes, I would like to help with the 2002 New Mexico Science Bowl.**

Name: \_\_\_\_\_

Address: \_\_\_\_\_

\_\_\_\_\_

Phone: \_\_\_\_\_

FAX: \_\_\_\_\_

Email: \_\_\_\_\_

**FAX this form to 284-5210 or return by mail on or before February 8, 2002 to:**

Patrick Milligan  
Sandia National Laboratories  
PO Box 5800, MS 1313  
Albuquerque, NM 87185



**THE NORTHWESTERN NEW MEXICO  
REGIONAL SCIENCE & ENGINEERING FAIR**

**The NWNM Regional Science and Engineering Fair has served students, teachers,  
and parents since 1959.**

**Our Mission**

The mission of the Northwestern New Mexico Regional Science and Engineering Fair is to work directly with middle- and high-school teachers and students to encourage young people to become interested in engineering and science and participate in Science Fair competition.

Submit this form to be invited as a judge for the NWNM Regional Science and Engineering Fair on Friday 3/15/02. (Information given will be verified.)



First Name \_\_\_\_\_ Middle Initial \_\_\_\_\_

Last Name \_\_\_\_\_

e-mail Address \_\_\_\_\_

Mailing Address \_\_\_\_\_  
\_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_

Zip \_\_\_\_\_

Employer \_\_\_\_\_

Work Phone No. \_\_\_\_\_

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Postal Address:

University of New Mexico

Oñate Hall Room 131

Albuquerque, NM 87131

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scifair@unm.edu

**Judging Area of Expertise:**  Chemistry  Computer Science  Earth & Space Sciences  Engineering  
 Environmental Sciences  Mathematics  Medicine and Health  Microbiology  Physics  Zoology

**Minimum of a Bachelors Degree is required in related judging area. Please identify degree and field.** \_\_\_\_\_

January 14, 2002

Michael Davis, Superintendent of Public Instruction  
State of New Mexico Department of Education — Education Building  
120 South Federal Place  
Santa Fe, NM 87501

Dear Mr. Davis:

We have read with both interest and enthusiasm the set of proposals laid out in the legislative proposal document, *Making a Difference Through Leadership*. We applaud the effort the board made to set out an integrated program for delivering truly high quality education to all of New Mexico's citizens. Our organization endorses the document as a vision for New Mexico.

At the same time, we are concerned that the proposal calls for a considerable amount of new spending in what is likely to be a fiscally stressful year, and we therefore encourage you to revisit the document prior to its submission to the State Legislature. If all of the money requested were available, the document could stand as it is. However, it is highly likely that the available funds will be much smaller than would be required to fund all programs in the document. We believe that the proposal would be much stronger if you and the state Board of Education took a proactive role in prioritizing the programs, as a way of trying to prevent a less than ideal political process from completely undoing your valuable work.

If you identify CESE as supporting these proposals, we ask that you do so only with this caveat: please prioritize the requested items, and identify them as such.

Please understand that we are not recommending that you remove any of the programs from the document. In fact, it is important for the Legislature and the public to know what it would cost to build a more successful public education system. Rather, we recommend that you and the SDE prioritize these programs in a way that is more likely to succeed with the Legislature and the public. Some examples would be systems based on price/performance ratio, or on assessing the most crucial needs.

We realize that what we are asking will be a painful and possibly divisive process. However, education is simply too important to leave to the vagaries of political budgeting without firm guidance from your Board.

Please let us know if CESE can assist in any way with this process. As always, we remain eager to donate our time and energy to improving public education in New Mexico.

Sincerely,

Timothy Moy, Ph.D.  
CESE president;

(Marilyn Savitt-Kring, secretary, signing on behalf of Timothy Moy, and the CESE Board)

cc: *Ruth Williams*

## HOW MATHEMATICS CAN COMPLICATE YOUR LIFE

This article has absolutely nothing to do with science education. It does tell us how mathematics can be used to mystify almost anything. Probably most of us have heard about the “wonderful” calendrical systems of ancient Mesoamerica. That big Aztec calendar stone gets shown frequently on TV and in magazine articles as an example of the perfection of calendrical art. Well, it is attractive, but maybe a little impractical to carry in your wallet. Of course, the people of ancient Mesoamerica didn’t really have to deal with the calendar themselves. The priests would tell them when there was an important date coming up, and how many captives needed to be sacrificed, or how much gold and jade the priests and kings absolutely had to have, and when the people needed to have it ready.

The Mayans had one of the most complete systems, and we have the advantage that they also had writing, so they could put historic dates on stone monuments. Do you suppose their system was actually that much better than ours? When you have heard what their system was, you will probably agree that it beats ours for complexity, and surely gave employment to lots of priests and astronomers. It probably kept a lot of stone carvers busy, too, because every date took many characters to represent it.

Should full employment be one of the goals of mathematics?

First off, their number system was vigesimal. Ten fingers plus ten toes gives us a count of 20, right? The number 13 was also important for them. Now let’s look at three completely different kinds of year. The “tzolkin” or sacred calendar combined 20 day names with 13 day numbers. Because 13 and 20 have no common factors, it takes a full 260 days to get through all combinations of names and numbers. However, a 260-day year does not hit the seasons very well. They had a 365-day year, the “haab”, for that. That’s 13 months of 20 days each plus an extra month of 5 days. Any day in that year was named by a number plus a month name, just as we might say 7 November.

Imagine that you have a big gear wheel with 365 teeth, and a smaller wheel with 260 teeth. Now put a dab of paint on the teeth that match, and start cranking the gears around. Those painted teeth will come together again after 73 revolutions of the smaller gear and 52 revolutions of the big gear. That 52-year cycle is somewhat analogous to our centuries. They would name any day in the cycle by its number and name in the 260-day year followed by the day number and month name in the 365-day year. Then 52 years later, the same name combination would pop up again. Anthropologists call this system the “short count.”

Of course, when it became obvious that their civilization would last a lot longer than 52 years, they had to come up with something that would handle longer time spans. They counted days from a zero date. We use the supposed birth year of Christ as our zero year; Romans used the mythical date of the founding of Rome. The Mayans apparently just picked a zero year out of the air. The basic measure was the year, but not the 365-day year. Oh no! They used a 360-day year, just to make things completely impossible for ordinary folks to keep track of. Each year (a “tun”) had 18 months of 20 days each. Then (vigesimal, remember) they had a 20-year “katun”, a 400-year “baktun”, an 8,000-year “pictun” and so on ad inf. Their zero year was 13.0.0.0.0. That is 13 X 400-years, zero X 20-years, zero X years, zero X months, and zero X days. Remember that these folks had a zero a thousand years before we got around to it. The next day after the zero-date was 0.0.0.0.1. Then, to make things really complicated, they append the designation of the day in the 260-day/365-day years. The zero year was actually 13.0.0.0.0, 4 Ahau 8 Cumku, and in our system it was August 11, 3114 BC. Their designation is called the “long count.” You can see that the system required lots of writing. Actually, it required more than I have indicated, because they wrote dates out in full. The full long count in our calen-



dar system for 1/15/2002 would be 2 millennia, zero centuries, zero decades, 2 years, 1 month, 15 days, Tuesday. You just imagine carving that in stone without metal tools! Their number system really was pretty simple; a bar for 5, a dot for 1, an oval for zero. So “26” is a dot and the word for “twenties” followed by a bar and a dot and the word for “units.

Here’s an example: January 1, 2000 fell on 12.19.6.15.0, 9 Ahau 8 Kankin. I like our system better. On December 23, 2012 AD we will once again be at 13.0.0.0.0, and can start the whole system over again. Apparently they supposed that there would be an endless succession of long counts just as there are an endless succession of 52-year short counts. You might hear from New Agers that the Mayans

predicted the end of the world when that rolled around. That’s nonsense. They just predicted that a whole lot of new calendar stones would have to be carved. We might need to sacrifice a few extra prisoners, as well.

The earliest long count date found so far corresponds to 292 AD, but they probably were using their system long before that. The latest dates in the long count cluster around 900 AD, but there are later dates in the short count. Apparently, they found better things for stone carvers to do. However, just as a date of January 22, ’02 could be 1702, 1802, 1902, etc., so any date in the short count tells us where it is within the 52-year cycle, but doesn’t tell us which cycle. The guys who study this have spent their lifetimes trying to pin these dates down, but there are

hardly any two who will agree on any of the dates.

The point of all this is that there are simple ways and complicated ways to do almost anything. If you thought our system of leap years and non-leap centuries was complicated, I hope I have left the impression that it is a marvel of simplicity compared with the Mesoamerican system. Mathematics can be used to make life better. Mathematics can also be used to complicate life to an absolutely hideous degree. Some people (myself included) think quantum mechanics is hard to follow. It should now be obvious that we could make keeping track of the calendar even more difficult.

**Walt Murfin**

**CESE Statistician**

## **Board Meeting Highlights**

Nov. 28, 2001.

The CESE board meeting convened at 6 pm at Quasar International. Attending were T. Moy, B. MacPherson, N. Shelton, S. Brugge, K. Johnson, J. Shelton, D. Thomas, J. Weiss, and M. Savitt-Kring.

J. Shelton passed around copies of the revised “Consensus Agenda for the 2002 New Mexico prepared by the New Mexico Education Partners, a statewide coalition of various organizations whose goal is “collaboration with policy makers and one another on behalf of public education for New Mexico’s students.” We voted to continue our association with this organization and to have CESE

included in the list of Partners supporting the “Consensus Agenda.”

## **Board Meeting Highlights – Jan 2, 2002.**

The meeting convened at 6 pm at Quasar International. Attending were T. Moy, B. MacPherson, N. Shelton, M. Berman, S. Brugge, K. Johnson, J. Shelton, D. Thomas, M Savitt-Kring and visitor, A. Edwards.

Moy, Berman and Johnson agreed to meet that following Sunday to revise CESE’s white paper.

J. Shelton, CESE’s representative in the Education Partners, received a letter from state school superintendent Michael Davis, writing on behalf of the State Board of Education, asking for

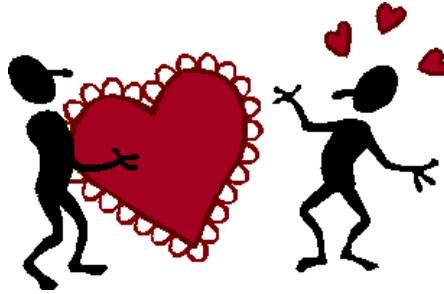
support of the SBE legislative recommendations. We decided to write a letter endorsing their recommendations, but suggesting they be prioritized. (See page 7 for a copy of the letter.)

Berman circulated a letter he received, as a member of the State Board of Education, from a Los Lunas resident. An Intelligent Design organization is forming in NM that is attempting to “encourage a more thorough and unbiased coverage of Darwinian evolution than that which is required by the current New Mexico science education standards.” The letter writer said he has reviewed “false and misleading claims in high school biology textbooks made in support of evolution.



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**RETURN SERVICE REQUESTED**



## WHAT'S HAPPENING

The Ohio Board of Education will hold a panel discussion featuring both advocates and opponents of including intelligent design (ID) in the newly drafted statewide science standards at its March meeting. The decision to hold the discussion came after a contentious meeting on Sunday, January 14th, at which lawyer John Calvert, of the Kansas based Intelligent Design Network, made the case for inclusion of the controversial field in the standards. Opponents of ID were not allowed to speak at the meeting.

On January 7, 2002, the US Supreme Court denied the appeal of Minnesota teacher Rodney LeVake to have his case for teaching "evidence against evolution" heard at the highest level. Mr. LeVake has no further appeals.

### ***The Court said . . .***

1. A school board's decision to assign a public school teacher to teach a different class because the teacher refused to teach his former assigned class according to the curriculum established by the school board *did not violate* the teacher's right to free exercise of religion. (emphasis added)
2. A public school teacher's right to free speech as a citizen *does not permit the teacher to teach a class in a manner that circumvents the prescribed course curriculum* established by the school board when performing as a teacher. (emphasis added)
3. A public school teacher's due process rights are not violated when a school board's established curriculum and a course syllabus provided the teacher with sufficient notice that his method of teaching a high school biology course was inconsistent with the curriculum requirements.