In July of this year, Richard Dawkins, the evolutionary biologist who holds the Charles Simonyi Chair for the Public Understanding of Science at Oxford, wrote a scathing review of Michael Behe’s latest book, The Edge of Evolution: The Search for the Limits of Darwinism, in the New York Times Book Review. “Poster boy of creationists everywhere,” Dawkins wrote, “he has cut himself adrift from the world of real science.”

For those who haven’t been following this longstanding debate, Behe is a biochemist at Lehigh University, best known for his bestselling anti-evolution book, Darwin’s Black Box, which appeared in 1996. The main thrust of that book is that living organisms are simply too complex to have evolved by natural means. As an objection to the Darwinian mechanism of natural selection, Behe invoked a principle he called the “irreducible complexity” of living processes. The gist of his contention is that complex biological systems need all their parts to function and could not have evolved from simpler devices. This argument goes back to Darwin’s time when the challenge of how a human eye could ever have evolved was first raised.

Behe makes no secret of the fact that his views on evolution and the need for an Intelligent Designer are consistent with his being devoutly religious and the father of nine children. Dawkins, by contrast, is a declared atheist. He is a gifted biologist and a prolific writer whose many books have been generally well received over the years. His provocative 1976 book The Selfish Gene was critically acclaimed by biologists of all persuasions and was extremely influential in evolutionary genetics. A decade later he published The Blind Watchmaker, a book largely intended for a lay audience, that won a Los Angeles Times book award. Since then he has published numerous articles and books, the most recent of which is the widely discussed bestseller, The God Delusion.

I have to say frankly that I was by no means altogether pleased by Dawkins’ review of Behe’s latest book. In my view, he engaged in a needlessly ad hominem attack on Behe. A little ridicule here and there is fair game in this business, but humiliation ought to be off limits. You may wonder why I would I seem sympathetic to Behe, or, indeed, why anyone would be interested in what I think about the matter anyway.

As it happens, Behe devoted an entire chapter of his first book to ridiculing some of my research that deals with the evolution of one of those complex processes that he claims could never have evolved. This research concerns blood clotting, which is a process that involves a complicated interplay of more than a dozen genetically controlled proteins. Many years ago (oh, so many!) I asked myself the same question that Behe did a generation later: How did this process evolve? Unlike Behe, I came up with some reasonable scenarios, mostly depending on the phenomenon known loosely as “gene duplication.” In Darwin’s Black Box, Behe dismisses gene duplications as though they were figments of the imagination, noting only that “it was theorized that in the past the gene was somehow duplicated.” In fact, gene duplications, which are at the heart of molecular invention, can be viewed in “real time,” and the mechanisms by which they occur are well understood.
I worked on the clotting evolution problem off and on over the years, publishing the occasional article. In 1993, I was asked to give a talk at a large meeting of a group of blood clotters, and although they were mostly physicians and clinically oriented, I thought they might be interested in a talk outlining how the blood coagulation scheme might have evolved. Clotting is a very delicately balanced business, a constant tug-of-war waged between tendencies to coagulate and the need to keep the system fluid. There are numerous processes at work, forward and backward, activating and inhibiting. In the lecture, I described these events metaphorically in terms of a “yin and yang” scenario.

These presentations, which were billed as “state of the art” lectures, were published as a supplement to one of the blood clotting journals, and, arcane as they may be, in this marvelous electronic age they are accessible to the whole world. Behe apparently came across the yin and yang lecture while writing his first book and, perhaps surprised that someone was actually trying to answer what he thought was an unanswerable question, felt the need to destroy the thesis. In his chapter 4, he lampooned my efforts from every direction, referring to my findings as something “out of the world of Calvin and Hobbes” and reminding readers that the article was billed as “state of the art.”

Behe’s book quickly stirred up a flurry of rebuttals, and I was able to contribute what I thought was a rather good counter to his chapter in the March, 1997 issue of the Boston Review, which also carried articles from a number of other evolutionists. By this time the Internet was becoming a medium for unreasoned discussion, and, because I have not kept pace with this fashion, I heard only indirectly that Behe devoted a good deal of web-spinning to disparaging my rebuttal. This led a number of other biologists to take up the cudgels on my behalf, and I must confess it brought more attention to my blood clotting work than it had ever gotten.

Meanwhile, massive DNA sequencing efforts called “genome projects” have been undertaken, laying bare the molecular blueprints of hundreds of creatures. As a result, it has become possible to determine what genes an organism may have, or doesn’t have, without ever seeing the actual critter. One result is that it’s now possible to find out whether all vertebrate animals have the complete set of genes for blood clotting that people do simply by scanning their genomes with a suitable set of computer programs. Given this resource, in 2003, Yong Jiang, a postdoctoral colleague, and I used a computer to explore the recently completed genome sequences of the puffer fish and the sea squirt. It turned out that the sea squirt, which is an early diverging protochordate, doesn’t have any of the genes that encode the main framework of clotting, but it does have the constituent modules that are needed to construct such a system. The puffer fish had most of the full genes. Significantly, however, a few were missing, as I had long ago predicted, including one that was prominent on a list of those deemed indispensable in Behe’s 1996 book. Whether Behe ever read that article or not, I don’t know, but in his new book there is hardly a mention of blood clotting, and none regarding its evolution. I am not referred to, which is all right with me.

Dawkins used too broad a brush in describing Behe as a “poster boy” of creationists. Behe is not in the least a “young earth creationist” of the Jerry Falwell type. For example, in his new book he admits that Darwin was correct in stating that all living organisms are related and that “descent with modification” does occur. Where he draws the line – the “edge” mentioned in the title – is in refusing to accept natural selection as the invisible hand that brings about major changes. His new arguments are mostly based on the issues of rates of mutation and amounts of time. Behe acknowledges that microorganisms can adapt to new environments and become drug-resistant, for example, but that is quite a different matter, he contends, from inventing new species and new cellular machinery. He flatly states that random mutations simply cannot account for the complexity we observe in the living world. Only non-random mutations are in accord with his arithmetic, and he attributes those non-random events to an Intelligent Designer.

The matter of time and mutation rate is something that population geneticists and evolutionists have been contending with for most of the last century, beginning with the insightful studies of Ronald A. Fisher in England. Fisher was trained in the physical sciences, but in the 1920s he turned his mathematical and statistical training to resolving apparent differences between Darwinian natural selection and Mendel’s observations on mutations in plants. His carefully considered equations took into account matters like population size and generation times and fitness and other parameters. Even so, reconciling time and change in all instances has not been a trivial matter in biology, and some perplexing issues remain.

In his review, Dawkins, instead of presenting a more accurate rendering of the arithmetic of time and change, resorts instead to the tactic of citing authority, naming a battery of prestigious geneticists, including Fisher, whose conclusions all differ from Behe’s. He challenges Behe to submit a scientific paper with his numbers to a peer-reviewed journal.

Otherwise, Dawkins’ best counter to Behe’s arguments draws on a chapter in The Origin of Species about animal husbandry. He points out the great diversity of size and temperament in dogs, all of whom we know today are descended from a single species of wolf, as shown by

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**Emeriti Website**

The UCSD Emeriti Association maintains a website:

http://emeriti.ucsd.edu

Clicking the NEWS, PROGRAMS & MEETINGS button will allow you to view past issues of this newsletter. The website also provides the constitution and by-laws, lists of members, and minutes of meetings.
DNA analysis. Dawkins’ tone, however, is needlessly mocking. He could have made the same argument in a gentler way more likely to convince an impartial lay audience of the weakness in Behe’s position.

He also missed a great chance to catch Behe out, but instead came away with some egg on his own face. Here is what happened. In Darwin’s Black Box, Behe had taken up the bacterial flagellar apparatus as another example of “irreducible complexity.” This amazing machine is a whip-like organ that allows many bacteria to propel themselves through liquid media. In some bacteria it is composed of as many as 50 different proteins, all fitting together to form an articulating device complete with a rotor and shaft for spinning in two directions. Taking up Behe’s challenge that this could never have evolved, Kenneth R. Miller, a well known Brown University biologist, offered a hypothetical explanation of how it all might have occurred. In his review Dawkins extols this scenario, writing that it “beautifully showed how the bacterial flagellar motor could evolve . . .”

Unhappily for Dawkins’ criticism, Behe had already countered this hypothesis in the book under review, noting scornfully that it had appeared in a “trade book” rather than in the serious scientific literature. He went on to point out that in the ten years since his first book had been published, not one scientific article had appeared in a refereed journal that offered any explanation for how the bacterial flagellar motor could have evolved. This comment makes Dawkins’ taunt that Behe should write for a refereed journal ring hollow and even makes one wonder how carefully Dawkins read the book.

Ironically, however, in April of this year, just a month or two before the book’s appearance, but well before Dawkins’ review, an article appeared in the prestigious Proceedings of the National Academy of Sciences written by two biologists at the University of Arizona, Renyi Liu and Howard Ochman, that elegantly and convincingly demonstrates how the bacterial flagellar apparatus did evolve. They were able to do this by examining the full genomic sequences of 249 bacteria, 41 of which were found to have sets of varying numbers of genes for the flagellum-machinery. They then carefully reconstructed and compared the various proteins involved. What emerged was a grand view of the history of a long string of gene duplications. If Dawkins had been aware of this article, he could have truly demolished Behe’s claims, but he missed the opportunity for a knockout punch.

Although Behe uses sarcasm and ridicule at every opportunity in his books, the science community should stay on a higher plane. Name-calling will not win the day. The harsh personal comments employed by Dawkins are likely to be counter-productive in winning converts. If there is a goal for these public debates and discussions, it has to center on fighting for the middle ground. The evolutionist base is secure; it is that vast sector of the American populace that doesn’t accept evolution that needs to be better informed about biology.

I don’t mean to be too hard on Dawkins. He and I certainly agree on every aspect of the biology in question. The only issue that divides us is one of tactics in how to change the views of others. Along those lines, numerous books have appeared in the past decade that reveal the absurdity of the arguments employed by Intelligent Design proponents and Creationists. Several of them are intended for the educated non-biologist. Of all those I’ve seen, the one I would most recommend is The Tower of Babel: The Evidence Against the New Creationism by Robert T. Pennock – great reading for intellectually curious emeriti!

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**An Aussie Song to a Sullivan Tune**

A swagman who camped 'neath a coolibah tree
Singing 'tilda, Matilda, Matilda,
Was watching his billy-can boil for his tea
Singing 'tilda, Matilda, Matilda.
But he hadn’t been settling there very long
When a jumbuck came by, interrupting his song,
Just as he was supposing that nothing was wrong
In his 'tilda, Matilda, Matilda.

The jumbuck had come from the back of beyond
Singing 'tilda, Matilda, Matilda,
To take a wee drink at that billabong pond
Singing 'tilda, Matilda, Matilda.
The swagman ensured it would never go back,
So he shoved it head-first in his tuckerbag sack,
To be cooked, and to eat when he needed a snack,
In his 'tilda, Matilda, Matilda.

Two troopers on thoroughbreds, passing that time
Singing 'tilda, Matilda, Matilda,
Had just the good fortune to witness the crime
Singing 'tilda, Matilda, Matilda.
But the swagman declined to submit to arrest,
So he jumped in the water, although fully dressed,
And the bubbles came up – but then, you know the rest
Of his 'tilda, Matilda, Matilda.

This ditty should end, though I can’t be sure how,
Singing 'tilda, Matilda, Matilda,
But I’ve come to the end – I shall sing it you now
Singing 'tilda, Matilda, Matilda.
There’s no longer a sign on that desolate ground
Where the jumbuck was bagged and the swagman had drowned.
You can still hear his song, as an echoing sound
Of his 'tilda, Matilda, Matilda.

— Ralph Lewin


1776 And All That: History and the American Psyche

By Sandy Lakoff
Professor Emeritus of Political Science

During the visit of Queen Elizabeth II earlier this year, the columnist David Brooks remarked that whereas Britons are constantly reminded of their storied past by the glitter of monarchy, we Americans, lacking a living link to our past, are more disdainful of history. (He might have added that, having committed an act of lèse majesté in 1776 by rejecting royal rule, we must now make do with Burger Kings and Dairy Queens.)

Brooks is surely right. When we say “That’s history,” we mean to dismiss whatever is “old hat,” “horse and buggy,” “yesterday’s news,” or, in the current teenage usage, no longer “cool.” We may wax nostalgic about the country’s pioneering origins, admire the practical wisdom of the founding fathers, and even reenact Civil War skirmishes, but as an art critic once observed, the tradition that is most venerated in American culture is the “tradition of the new.” The dollar bill proudly proclaims that ours is the “tradition of the new.”

We readily acknowledge and apologize for such sins of the more distant past as Indian removal, slavery, nativism, and patriarchalism, but feel no need to pay reparations for the wrongs committed by previous generations. None of that happened on our watch! Instead, we focus on the need to move on by trying to realize ideals previously honored in the breach. Campaigning in New Hampshire, Hillary Clinton quoted Dr. Martin Luther King, Jr. as saying that “we are guided by the fierce urging of now.”

But ignorance is not necessarily bliss when it keeps us from becoming aware of who we are and why and how we have come to hold the beliefs that unite us as a people. The fact is that American political thinking has been profoundly shaped by three strands of historic influence. These can be summed up as the legacies of Britain, the Roman Republic, and ancient Athens. More specifically, these influences are British individualism, Roman pluralism, and Athenian communalism.

Together they make up the compound form of autonomy or self-government that is the essence of modern democracy. In this respect at least, history is by no means bunk. Indeed, only by understanding this triple inheritance can we appreciate how our democracy today benefits from their dialectical interplay and, conversely, how it suffers when any one of them is exaggerated at the expense of the others. The synthesis of these historical influences helps keep our democracy supple, resilient, and stable, and makes it, despite its flaws, a model worthy of being emulated.

I had difficulty deciding what sort of doctor I wanted to be. As students we had to apply for internship by fourth year. I was fascinated with the brain and behavior and was considering psychiatry. Between the third and fourth year, to support myself, I worked as a nurses’ aide in the private psychiatric hospital at McGill. One of my female patients liked me very much and I was assigned to her much of the time. She had enrolled in McGill in Physical Education, after her father refused to let her study medicine, but had developed mental problems. In due course, she was pronounced cured, and her family was coming to pick her up the next day. At 10:00 p.m. the nurses always went down to get a cup of coffee before going home, and I stayed at the desk to cover the phone or call bells. The patient’s call lit up a light at the desk so I went to her room. I put the key in the outside light switch prior to putting it in the door. She shouted through the viewing window; “You don’t have to turn the light on, you don’t have to open the door much, but I have something for you. I have a little present for you – you have been so nice – but I can’t push it under the door as it crumples up. If you’ll just open the door a crack, I can slide it out.” That sounded all right since she was being discharged, so I opened the door. The next thing I knew there was a rope around my neck made out of the bed sheet, and I was flying through the air! I tried to put my hand up to pull the sheet from my neck but she was far stronger than I, and pulling harder. The only thing I could do was kick the floor. I kicked and kicked! Fortunately, the dining room, where the nurses had their coffee, was right below me. They heard the noise, raced upstairs and rescued me before I became unconscious. The next day, I had many bruises and petechiae. Needless to add, the patient’s call lit up a light at the desk so terribly sick with high fevers, superimposed infections, or bleeding, and usually all died in less than three months. Death was a daily occurrence. Fortunately, the Chief of Hematology was compassionate and fought for a change. He also was bright, handsome, and married (unfortunately) to a very attractive, wealthy woman. I was quite jealous, for I adored him. I gave a lot of care to his patients.

In my second year of residency I had to decide on a career in either General Pediatrics or a subspecialty. While rotating through the ER I was located next to the Hematology Lab and wandered in frequently, chatting with the technicians and looking at blood and bone marrow slides. One day the Chief told me he was going to an international hematology conference and asked whether, since I was so at ease in the lab, I would keep an eye
Hematology was renowned and a fantasy to fill in for them. The professor of a sick child, and would call me and beg to find themselves tied up in the office with members, scheduled to lecture, would rise at that time were so minimal. Faculty there had to have private practices on the side to support themselves because salaries at that time were so minimal. At Harvard I found that I loved to teach. All the clinical pediatric faculty there had to have private practices on the side to support themselves because salaries at that time were so minimal. Faculty members, scheduled to lecture, would find themselves tied up in the office with a sick child, and would call me and beg to fill in for them. The professor of hematology was renowned and a fantastic teacher. I would see all of his patients with him, when he talked with parents of terminally ill children, to tell them of the prognosis. Under his guidance I learned to nurture each child, and support and console the parents. He would teach me at the microscope most evenings and I emulated him to the best of my ability.

After three years in Boston, I was lured back to Duke as an Assistant Professor of Pediatrics and soon realized there was no one trained in Pediatric Hematology in the entire South. My office was flooded with referrals from pediatricians and hospitals struggling to provide services for oncology patients, mostly with leukemias. Children died quickly because there was little therapy. Children's Hematology quickly expanded to include Children's Oncology, creating a whole new set of problems without solutions.

The seven years I spent at Duke were stimulating and very busy, but in the spring of 1963, a call came from the Woman's Medical College in Philadelphia, the only medical college for women in the United States. Dr. Marian Fay, a biochemist who was President and Dean, asked if I would be interested in becoming Chair of the Pediatrics Department. I told her that she must have the wrong Doris Howell, but she assured me that I had been highly recommended by my two former Chiefs. I pulled myself together and replied that I did not believe in a medical college exclusively for women. “You are frank!” she replied. I had not meant to be so blunt and explained that since medicine was still a man's field, and women were not yet a part of it, a woman needed to study and learn in an environment where she worked with male doctors and male patients. She persisted, and after visiting the college I decided to go, thinking I might influence the faculty's point of view. By July, I was Professor of Pediatrics and the first full-time woman Chairperson of a Pediatric Department in the United States. Eventually, the Board of Directors voted to make the college co-educational and we admitted 20 males to join the 50 women students. The next Dean, however, did not support the change and therefore was not very enthusiastic about me. Requests from my department got short shrift and he finally suggested that I leave. I wouldn't give him the satisfaction so I stayed another two years to do battle, before accepting the post of Deputy Director of University Affairs at the Association of American Medical Colleges in Washington, D.C., a job that proved temporary because I was recruited to come to UCSD. Here, I was to have a chance to build from the ground up. 

A HOLIDAY CONCERT

The La Jolla Renaissance Singers, who will perform at a holiday party for emeriti and retirees on Wednesday, December 5, at 3:30, were originally known as the UCSD Madrigal Singers. The group was founded in 1964 by the late Charles David Keeling of SIO, in order to provide an outlet for fine amateur singers interested in the Renaissance and Baroque repertoire. Keeling was a world-renowned atmospheric scientist, but also an enthusiastic and accomplished pianist and singer. When he was sidelined by a back injury in the early 1970s, his place was taken by tenor Michael M. Mullin, a marine biologist at SIO, who led the group until his untimely death in 2001. Mullin was succeeded by bass William Propp, Bookheim Professor of History and Judaic Studies and also an accomplished pianist and bassoonist. Over the years, roughly two-thirds of the singers have been affiliated with UCSD – as students, alumni, faculty, staff, or spouses. The group currently consists of about 27 choristers, who appear in period costume and, in recent years, have added an instrumental component.

The December program is entitled “A Christmas Tour of the Habsburg Empire – Sacred Music from Europe and the New World.” Throughout the 16th and 17th centuries, Hapsburg monarchs ruled over the first World Empire, with holdings from the Netherlands to Romania and beyond Europe from the Caribbean to the Philippines. The sacred music of this trans-continental imperium is correspondingly diverse, ranging from High Renaissance polyphonic motets to European folk carols to New World compositions strongly influenced by Spanish, Native American, and African rhythms and harmonies.
By Sandy Lakoff

Street Smarts: At the University Heights Arts Festival in September, a pavement chalk cartoon by an artist who goes by the name of Koba depicted Mother Theresa and Osama bin Laden. It was captioned nicely: “Better to Doubt and Do Good than Believe and Do Evil.” . . . A permanent work of art by Julius Caesar, exhibited at the L Street Fine Art Gallery, featured a wise observation by Allison Wiese: “All bad precedents begin as justifiable measures.” . . . Bumper sthick: FERMEZ LA BUSH; THINK OUTSIDE THE FOX.

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Your head: use it and lose it. To show that scientists can sometimes be too smart for their own good, Herb York tells the story of the physicist who was third in line to be guillotined during the French Revolution. First came an archbishop. Amazingly, the blade stopped just short of his neck. “A miracle, a miracle!” the crowd shouted, and he was set free. Next came a bishop and again the blade stopped short. “A miracle, a miracle!” the crowd shouted, and he too was set free. Next came the physicist. As he was positioned on his back at the base of the guillotine, his neck where the malfunctioning blade was designed to fall, he looked up and said, “Aha . . . I see what’s wrong . . .”

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Streets and Narrow: Contrary to the stereotype, my mother-in-law was quite lovable, but having come to America from her native Russia as a teenager, she did not have the firmest grasp of the nuances of the English language. That led to occasional confusion. Once, when we were driving along the New York side of the Verazano Narrows Bridge, she posed a question that had probably been on her mind awhile. “You’re a smart boy,” she asked, “so tell me why, in this day and age, when they can do so many wonderful things – make airplanes, even go to the moon – why, when they build a bridge, do they make it a narrow one?”

Should he have taken a cartouche instead? A thief in Paris planned to steal some paintings from the Louvre Museum. After careful planning, he got past security, stole the paintings, and made it safely to his van. However, he was captured only two blocks away when his van ran out of gas. When asked how he could mastermind such a crime and then make such an obvious error, he replied, “Monsieur, that is the reason I stole the paintings. I had no Monet to buy Degas to make the Van Gogh.” (See if you have De Gaulle to send this on to someone else. I sent it to you because I figured I had nothing Toulouse.) – Anonymous of the Internet. Of course the thief could have said; “Your Monet or your life!”

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Amen: Joe Gusfield recalls that when he was an undergraduate at the University of Chicago it used to be said that it was a place where Protestant professors taught Catholic theology to Jewish students. . . Which reminds me of the transfer student from Chicago who came to Brandeis and made a nuisance of himself in our dorm by telling us how much better the educational program was there. We asked him to prove it by showing us a term paper he had written. We read it and discovered it was full of spelling mistakes. When we called this to his attention he replied, “O.K., so I can’t spell, but ask me any of the Great Ideas!”

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What’s In a Name?: A Jewish restaurant south of the border is cleverly named “Tante Chane” – Yiddish for Tia Juana. . . Which reminds me that I was once inspired by Madame Tussaud’s waxworks, a mecca for tourists to London, to imagine a name for a bridal shop there: Madame’s Trouseau.

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Cat’s Meow. Nominee for best headline of the year, from the Times of London: “GAY PRIDE: Homosexuality in the Animal Kingdom”. . . The same paper notes that this year marks the fiftieth anniversary of the publication of Theodore Geisel’s classic children’s book, The Cat in the Hat. “Dr. Seuss,” as the Times notes, “revolutionized early learning on both sides of the Atlantic by effectively killing off Dick and Jane.” His 1,700 word story used only 220 different words, so as to meet a publisher’s requirement for a book with no more than that number of words.

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Dictionary Entries, Sort of (from Anonymous of the Internet)

Coffee (n.) a person who is coughed upon Flabbergasted (adj.) appalled over how much weight you have gained. Abdicade (v.) to give up all hope of ever having a flat stomach. Esplanade (v.) to attempt an explanation while drunk. Willy-nilly (adj.) impotent. Negligent (adj.) describes a condition in which you absentmindedly answer the door in your nightie. Lymph (v.) to walk with a lisp. Gargoyle (n.) an olive-flavored mouthwash. Flatulence (n.) the emergency vehicle that picks you up after you are run over by a steamroller. Balderdash (n.) a rapidly receding hairline. Testicle (n.) a humorous question on an exam. Oyster (n.) a person who sprinkles his conversation with Yiddish expressions. Circumvent (n.) the opening in the front of boxer shorts. Frisbeetarianism (n.) the belief that, when you die, your soul goes up on the roof and gets stuck there. Pokemon (n.) a Jamaican proctologist.

Yet Another Bio-Bib!
Prepare to be surveyed – this time by the UC council of emeriti associations. We’ll be asked to list scholarly, professional, university and public services performed from June 30, 2005 to July 1, 2007. Please respond because it helps remind the powers that be that we earn our COLAS and perks.

– Don Helinski, President
Chronicles
November 2007

Mark Your Calendar!

Wednesday, December 9
Atkinson Pavilion, 3:30 - 5:30 pm
La Jolla Renaissance Singers
“A Christmas Tour of the Habsburg Empire – Sacred Music from Europe and the New World”

Wednesday, January 9
Henry Powell
Professor of Pathology
“Madness and Maladies of Famous Composers”

Wednesday, February 13
Theodore Friedman
Professor of Pediatrics
“Gene Doping in Sports: Ethics of Genetically Modified Athletes”

— The Faculty Club, 3:30 - 5:30 pm —