Barton group develops theory on DNA repair

KIMM FESENMAIER
Science Writer

Our genetic information is under constant attack—not only from outside sources such as UV radiation and environmental toxins, but also from oxidative stress, the production of highly reactive forms of oxygen, within our bodies. Luckily, repair proteins are typically hard at work, locating and fixing damaged DNA. Over the past decade, Caltech chemist Jacqueline Barton has been exploring a model that describes how repair proteins might work together in this scavenging mission to efficiently home in on lesions or mismatches within the DNA.

Essentially, the model suggests that two DNA-bound repair proteins can use DNA like a wire to shuttle electrons between themselves—a process called charge transport. When one protein receives an electron from the other, its affinity for the DNA to which it clings decreases, causing the protein to fall off that strand. If instead, a lesion—a structural defect in the DNA—prevents that electron from being transferred between the proteins, both members of the pair remain bound to the DNA and begin inching toward the problem area. “They’re from different DNA-repair proteins,” says Pam Sontz, lead author on the study and a graduate student at Caltech. In a previous study, the Barton lab had conducted similar experiments with Endonuclease III (EndoIII), a repair protein that removes a mismatched pair of nucleotides, which are the individual chemical units that make up DNA. Then they used microscopy to visualize and count the number of proteins that bound themselves to the different types of DNA.

They found that only the proteins that were able to send and receive electrons through the DNA repositioned themselves in the vicinity of the mismatched nucleotides. “We believe that the redistribution comes from two proteins using charge transport to communicate with one another, and falling off of the strands that don’t have a lesion and attaching to the strands that do,” says Pam Sontz.

In the new study, the researchers investigated XPD, a protein involved in both DNA repair and replication. First, the scientists attached very short strands of DNA to a gold electrode, added the XPD, and used the electrode to measure the protein’s electrical potential, or its ability to send or receive electrons. Separately, the chemists made a solution of the protein along with both regularly matched strands of DNA and longer strands that included a mismatched pair of nucleotides, which are the individual chemical units that make up DNA. Then they used microscopy to visualize and count the number of proteins that bound themselves to the different types of DNA. 

Two repair proteins, XPD and EndoIII, are shown at the top of the image, bound to DNA and using DNA-mediated charge transport to locate genetic damage. "It's really difficult for the cell to build these clusters," Mui says. "So there is a thought that they must play a significant role in something else, which could be this mechanism to locate lesions within the DNA." 

News briefs from around the globe

Helping readers burst out of the Caltech bubble

Need to know

< 100 words about the world this week – topics sorted from good to bad by Sam Barnett – links to full stories available at barnett.caltech.edu/news

- Strong employment data
- Federal Reserve efforts
- Case against Swiss bank
- Egyptian investigation
- Floods in Australia
- Escalation in Syria
- Rise in malaria deaths

43 people killed by Syrian forces – China, Russia veto U.N. resolution
4000 ordered to evacuate – 300 buildings have been flooded
19 Americans face criminal trials regarding nonprofit financing
243,000 new jobs last month – DJIA stocks highest since May 2008
29% annual inflation target – predicts 2012 GDP rise of 2.2% to 2.7%
$1.2 billion allegedly hidden from the IRS with the bank's help
2012 elections

NEWS
The link between IQ and social group

OPINION
A response to Schef’s open letter

FEATURE
Warren Brown nominated as Prof of the Month

SPORTS
Caltech fencers qualify for NCAA Western Regionals

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Food with Mannion!

Do you like eating food? How about free food at nice restaurants? Ever want to tell the world exactly what you think of said food? The Tech will be beginning a new column to chronicle the foodie experiences of new writers every other week... The Catch: They’ll be going head-to-head with Tom Mannion who will be reviewing the same restaurant. If you have ever thought you were more of a gourmand than our resident master chef, now’s your chance to prove it!

Email us for a spot on the list at tech@caltech.edu

ASCIT Minutes

1/29/2012

Officer’s present: Chris Hallacy, Margaret Chiu, Laura Conwill, Diego Caporale, Mario Zubia, Michelle Tang, Laura Santos

Guests: Kathy Garcia

President’s Report

1. PFW: Probably won’t do midnight donuts again because the mob scares pre-frosh. Thinking of new ideas for the carnival.
2. Big I: May bring it back next year if there’s enough interest.
4. Athletics: Betsy Mitchell will be meeting with the athletics faculty board. Wondering what the Student Athletic Advising Committee (SAAC) is doing.

Officer’s Reports

1. ARC (Margaret)
   a. Option requirements: Option heads are meeting with Melanie Hunt to discuss changes they might make to their major requirements in response to a change in core.
   b. Course feedback: working on Omsbuds, trying to get qualitative input by midterms.
   c. Option fair: Working on getting professors and students to hold booths.
   d. Prof of the month: Warren Brown (humanities) is the January prof of the month.
   e. SFL: Will be

2. IHC (LC)
   a. New Fleming President: Is now Alan Menezes.
   b. Admissions: Trying to get more house information available to people who are admitted, both about the housing system and housing personalities.
   c. Bechtel Committee: student appointments are being made, up in the air right now.
   d. Alcohol Cabinets: Are officially going to be made for each of the houses, though no deadlines for building have been set yet.

3. Director of Operations (Diego)
   a. Paintballs in SAC 15: has started moving them to a better location. They are now on rolling chairs.

4. Treasurer (Mario)
   a. Club funding: If clubs run out of money before the end of this year, they can come to ASCIT with proposals for more.

5. Social Representative (Michelle)
   a. Ice event: Went well! Though music stopped early because of too many noise complaints.
   b. Pong marathon?: Thinking about doing a massive water pong and ping pong tournament

6. Secretary (Laura)
   a. Big T Editor: New editors in chief are Nikita Sinha and Melissa Xu.
   b. SFC committees: Scheduling meetings with them.

The California Tech

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Letters and submissions are welcome; e-mail submissions to tech@caltech.edu as plain-text attachments, including the author’s name, by Friday of the week before publication. The Tech does accept anonymous contributions under directed circumstances. All contributions are subject to editing and abridgment for any reason. All written work remains property of its author.

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Caltech scientists find status within group affects IQ

KIMM FESENMAIER Science Writer

Our cognitive abilities and decision-making skills are dramatically hindered in social settings where we feel that we are being ranked or assigned a status level, such as classrooms and work environments, according to new findings from a team of researchers from Caltech and four other institutions that studied rhesus monkeys in the face of long-held ideas about intelligence and cognition that regard IQ as a stable, predictive measure of mental horsepower.

“You may joke about how committee meetings make you feel brain-dead, but our findings suggest that they may make you act brain-dead as well,” says Read Montague, director of the Human Neuroimaging Laboratory and Computational Psychiatry Unit at the Virginia Tech Carilion Research Institute and corresponding author on the paper.

To investigate the impact of social context on IQ, the researchers divided a pool of 70 subjects into groups of five and gave each individual a computer-based IQ test. After each question, an on-screen ranking showed the subjects how well they were performing relative to others in their group and how well one other person in the group was faring. All the subjects had previously taken a paper-and-pencil IQ test, and were matched with the rest of the group so that they would each be expected to perform similarly on an IQ test.

“What we found was that sensitivity to the social feedback of the rankings profoundly altered some people’s ability to express their cognitive capacity,” Quart says. “So we get this really quite dramatic downward spiraling of one group purely because of their sensitivity to this social feedback.” Since so much of our learning—from the classroom to the workplace—is socially situated, this study suggests that individual differences in social sensitivity may play an important role in shaping human intelligence over time.

During the computer-based test, about a third of the subjects underwent brain scans, using functional Magnetic Resonance Imaging (fMRI). This type of imaging allows scientists to track increases in oxygenated blood flow, indicating heightened activity, in the brain. At the start of the test, researchers observed increased activity in all the participants important to people,” Quart says. “When they saw their rank go up, that was a reward.” The idea for the new study came, in part, from a study published in 1999 in which researchers from Emory University examined social rank—a strong and extremely motivating signal the things that we're learning more and more in social neuroscience is the role of our social contexts and the social adaptation of the brain.” Understanding the role social context plays and its differential impact on the brain may ultimately help educators and others to...
**Caltech Couture: Weather wear**

**ALEX LÄNGERFIELD**

Columnist

Here's something to consider: It's now February, the Houses just finished their annual ski trips, and 80-degree weather has been a pretty normal phenomenon lately. What's going on? We're in California! California is truly a state of contrasts. In one day you can go skiing in Squaw Valley in record snow conditions (home of the 1960 Winter Olympics), pass Donner Lake on the I-80 (where the Donner Party partially committed to cannibalism when it got trapped in over six feet of snow for the winter), then drive through the desert Great Central Valley and finally enjoy the afternoon basking in the setting West-coast sun, sipping a Napa Valley wine, savoring a Ghirardelli chocolate dessert, and admiring the blooming roses.

Does paradise actually exist? I'd say yes. I came back to Pasadena from winter break and my first reaction was to go to the beach, or at the very least, the pool. Now here's a problem. Before leaving for break, I packed away my summer clothes and put out my winter clothes. Now I'm pulling out summer pieces one by one as the weather doesn't seem to break much.

I admit that I love the sunshine, but I still feel funny wearing shorts and getting deep tan lines in February. We're not in Australia, where it is actually summer, and we have even had a couple of rainy days. I spotted a few Christmas trees still standing West-coast sun, sipping hot chocolate? Is it fair for us to don our systems, we should pull out our winter clothes now while it's still the season. On the conventional side, it's more appropriate to mimic the season. However, the season here is a Southern Californian winter which might as well call for bathing suits! It's convenient to dress according to the weather. However, this means that we would barely ever wear cozy sweaters and earmuffs, but those are just too much fun to wear!

So, if we must get it out of our systems, we should pull out the winter clothes when it's formally winter unless we want to have a Christmas in July. I guess having suntan lotion (alright, or sunscreen) and a fuzzy scarf with you is just another proof that you are in blessed California!

**In response to Isaac Shuff's open letter**

**TRAVIS SCHOLTEN**

Contributing Writer

I am writing this letter in response to Isaac's letter last week regarding hazing. In it Isaac makes a great effort at explaining and contrasting how rites of initiation from earlier in Caltech's history were far worse than those performed today, by any "reasonable" definition of worse.

To bolster his claims, Isaac found a photo of a young man with a blanket of sorts over his head and a belt around his neck in the style of a leash.

This was supposed to be characteristic of the kind of behavior any reasonable person would find deplorable. I laughed when I saw that photo. I say that in complete sincerity. Does that mean I am not a reasonable person? As I find something oddly amusing about that situation, should my viewpoint be dismissed as "not reasonable"?

I bring this up because any rule or policy which is only enforced when a "victim" feels victimized by a "perpetrator" creates the unwinnable situation when the subjective interpretation of the "perpetrator" must necessarily be subjugated to the interpretation of the "victim".

What's more, it also follows that any person who does not agree with the victim must themselves be as guilty - at least in spirit - as the perpetrator. (Recall the outpouring of anger at men who refused to condemn DSK.)

How many of you remember the Duke lacrosse players? For all intents and purposes, the "perpetrator" has no defense. How can one argue with a "victim"'s claims that they have been hazed/harassed/etc.? The simple answer: there is no argument. The dangerous conclusion: under such rules, a concept of justice cannot exist.

Like Isaac, I too am leery of a hazing policy which defines hazing in the eyes of the beholder. Our Honor Code works because we know violations of the Honor Code represent serious transgressions of proper behavior in the Caltech community.

The new hazing policycheapens the value of the Honor Code by suggesting that in addition, there are petty transgressions which, by their "offensive" nature, must be dealt with as seriously as other violations.

In other words, just because I laughed at that photo, does that mean I am actually as deplorable as you may want me to be?

---

**“Love Sucks” a cappella concert comes to Caltech**

Romantic entanglements got you down? Well look no further! We have the solution for you!

With Valentine's Day fast approaching, it is once again time for the annual “Love Sucks” a cappella concert hosted by Caltech’s Fluid Dynamics and Out of Context. Every year collegelegiate a cappella groups from all over this chunk of the state gather to show off their talents and collectively lament at how unfortunate it is to be in love. Got a romantic chip on your shoulder? Then come to the concert!

This year's lineup includes a total of eight different groups from as far away as UCSD, and as close by as Cal-State Northridge. Awesome groups like Awakening, whose former members include Sara Bareilles, and the rival all-female groups from USC and UCLA are all making an appearance to show off their triads and trills. If you like music, here’s one concert you won't want to miss.

The concert will be held in Dabney Hall at 3:30 pm Sunday, February 12. Admission is free to all and all are welcome. Come support your fellow students and see some great talent from all over SoCal!
**Prof of the Month: Professor Warren Brown**

Brown shies away from using secondary reading, and does not assign textbooks because "they tend to give prepackaged interpretations".

"I exclusively give primary sources texts from the period and I give background lectures to provide a framework for the students to make the most of the opportunities given to them."

He urges, "Take the humanities classes seriously... You are an citizen of a world that does not understand what you do all the time. That will often try to manipulate what you do for political or economic ends... I can't think of a better way to teach students [than to use past sources] to see what people have done to understand the organization of things they are going to meet out in the world."

There will be a reception recognizing Professor Brown in early March, along with the release of the Monthly of the Month for February.

**Be on the lookout for announcements, and spend time learning these amazing individuals.**
Yann Tiersen’s Skyline is fitting sequel to Dust Lane

CLEMENT LACROUTE
Staff Writer

Disclaimer: I am a French citizen reviewing a French artist, please do not take anything that is written below as neutral ground. This is a highly biased article, targeted at making you buy albums and concert tickets that will help France get its triple A back. Now on with the music.

Skyline is in that sense a true masterpiece. It is beautiful on its own, but in a form that is closer to Tiersen’s previous works, but in a form that is closer to rock. In addition to Tiersen’s usual repertoire of strings and pianos, he adds electric guitars and synthesizers and includes plenty of collaborators such as Syd Matters and Matt Elliott.

Dust Lane is also more ambitious work, with tracks running up to 8 minutes, developing into complex pieces that go beyond mere songs—the amazing piece “Till the End” by itself justifies the album’s purchase. Dust Lane also contains elements that reflect a rupture in Tiersen’s life, following his mother death. Pieces are imprinted with a rather dark tone (see the tune “dark stuff”), even though hope is not absent.

It is also the first record where Tiersen’s talent once again. If you were to listen to only one of the pair, then it has to be this one. Still, Skyline is a great answer to some of the questions that Dust Lane asks, which ties these two CDs to some of the questions that Dust Lane raises, which ties these two CDs to one another. You’ll probably end up loving them both.

If by any chance this review convinced you that these albums are worth listening to, you should also know that it’s even better to see them performed live. And you are in luck, since Yann Tiersen will be in Los Angeles at the Music Box on May 12, 2012. Skyline will be released in America on April 17, 2012.
Caltech fencers qualify for post-season championship and a chance at NCAA finals

Mackenzie Day
Contributing Writer

Caltech’s Fencing Team brought their foils, epees, and sabers to bear in the tournament hosted at Northwestern University on February 4th and 5th. Two solid days of competition saw the team through successive victories throughout the day, and culminated in seven fencers qualifying for the NCAA regional championships. In these championships, slated to be held in March at Stanford University, the fencers have the chance to continue on to NCAA Finals.

Beyond seven regional qualifiers, the tournament was host to several other exciting turns of events. Of the seven qualifying fencers, four of them are among the team’s freshmen. Harrison Miller and Ingrid Fiedler, who joined the team only this January, managed to pull out enough wins to qualify in their first ever NCAA tournament. John Christian, a freshmen epee fencer, qualified in his weapon, and then went on to win the team bouts in a completely different style of swordplay. Christian brought in several saber wins for the team, adding to the earlier men’s saber victory against University of Detroit Mercy. Beyond their foil fencer, Katie qualified in her primary weapon, but in epee as well.

By far the most impressive of the freshmen qualifiers is women’s foil fencer Katherine Fisher. A long time foil fencer, Katie qualified in foil with six wins. She then switched weapons to help the women’s epee team defeat Cleveland State University, University of Detroit Mercy, and Lawrence University. By the end of the day, Katie had qualified for the post-season championships not only in foil, her primary weapon, but in epee as well.

Upperclassmen Eugene Vinitsky, Stanford Schor, and Jonathan Schor all pulled similar stunts after qualifying in their primary weapons. These gentlemen changed from their primary weapon to a secondary to help their teammates battle against some of the most highly rated fencers in the country. These gentlemen showed the utmost skill and versatility in their ability to move between weapon events, and impressed the referees with how well they held their own.

One referee was particularly stunned when, after telling Stanford Schor that he had the wrong equipment to fence left-handed, Stan’s response was simply to flip the sword to his right (non-dominant) hand and complete the match this way. In a conversation after the bout, the referee admitted that he could not believe that Stan had never done this before.

All in all, Caltech held its own against some very fierce competition. Apart from the reputation and training of such division I schools as Northwestern and Princeton, in attendance at this tournament were several Olympic medalists. On the first day of the tournament, Caltech’s women’s saber team faced off against a two time Olympic bronze medalist. It was fun, and she was quite good.

To compensate for their lack of experience relative to the fierce competition, Caltech’s fencers defer to other methods at their disposal. Using their smarts, their speed, and even their sick dance moves our fencers showed the competition how to always be on their toes. In one epic bout, whirling wielder Emmett Goodman spun 360 degrees to avoid the point of his opponent’s foil. He then spun back and attempted to hit his opponent with a classy-looking around the back attack. Though this series of maneuvers is highly illegal, the referee was so amused with this fencer’s attempt to get the touch that he did not penalize him with a yellow card. Like the referee, we applauded Emmett’s ingenuity and fighting spirit.

Two days, countless bruises, and a few snapped blades later, the team returned to Caltech victorious. Every member of the team was victorious. Upperclassmen and freshmen alike were able to win in their matches in straight sets.

Caltech men’s tennis team loses season opener

Amol Kamat
Sports Editor

On Saturday afternoon, the Caltech men’s tennis team took on the Chapman University Panthers in their first match of the season, losing 9-0. Chapman, located in the city of Orange in the county of Orange (“the OC” if you will), will soon be joining the SCIAC, so the match promised to be competitive and entertaining. In reality, it was...not. Although, I once saw a bird play with a ping-pong ball and then miss and fall of his perch, which was pretty similar to this match and fairly entertaining, so there you go.

The match started with the Beavers looking poised and energized. Their cheer of “CALTECH!” certainly struck fear into the hearts of the Panthers, whose only response was to win all of the matches in straight sets. Indeed, the Beavers’ day went downhill after player introductions. All three doubles teams fell quickly. Caltech’s #1 doubles team (Devashish Joshi and Luka Mernic) were able to take 3 games from the visitors and #3 doubles (Chu Chin An and Amol Kamat) were able to take 1 game (and look damn good doing it), but they still failed to make a significant impact on the powerful Panthers players of the OC.

The Caltech Singles players also failed to impress, with all six Beavers losing in straight sets. In fact, only one player, John Chen, was able to win more than one game (he won two).

Highlights from the game included freshman Ryan Battersman making his NCAA debut and junior Amol Kamat looking great in singles. I mean, he didn’t actually play great tennis, but he’s just really, ridiculously good looking. Battersman played #6 singles and managed to stay out on the court longer than any other Beaver, despite losing 6-0, 6-0. That’s pretty impressive. You might say Chapman’s strategy against Ryan was: “We double bagel the Battersman.” With four years left to practice and learn, Battersman will certainly soon be the hero Caltech deserves, even if he isn’t the one they need right now. Yup, that’s right.

Caltech takes on Biola University this Friday at 3 pm. From what I understand, they will be getting all orange warm up suits, so you have that to look forward to. With all that orange, we’ll look like the OC, huh? Am I right? Yeah, I’m right.
Looking to make some extra cash? Beckman and Ramo Auditoriums are hiring Ticket Takers, Late Ushers, and Regular Ushers. Students get to choose when they want to work, no experience needed, no hard labor involved, and they can work 2 hr. shifts, 3 hr. shifts, or 4 hr. shifts at $15 per hour.

*Requirements are a good attitude and a welcoming smile.

Get paid to attend concerts, performances, lectures, films, and even parties!

Go to http://events.caltech.edu/index.html for more info on public events at Caltech.

To apply, email Adam Jacobo (ajacobo@caltech.edu) or call (626)395-5907.