

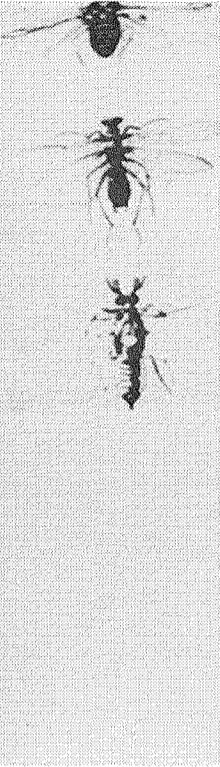
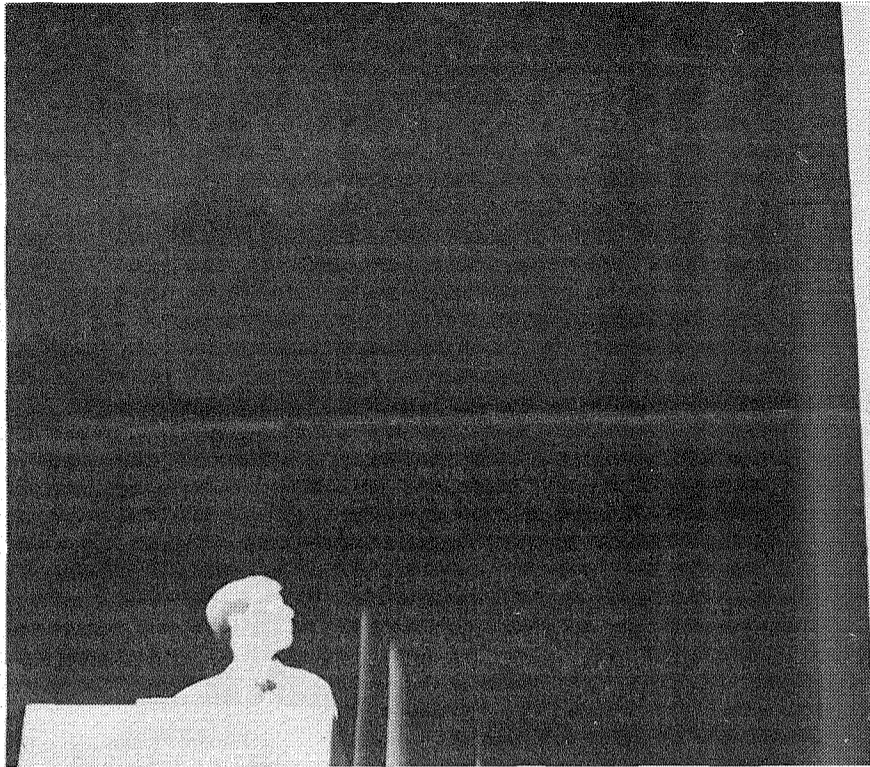


The California Tech

VOLUME CVI, NUMBER 6

PASADENA, CALIFORNIA

NOVEMBER 1, 2004



Dr. Michael Dickinson explains some structural characteristics of different types of flies. Dickinson is the Zarem Professor of Bioengineering and gave a Watson lecture on his research last Wednesday.

ME72 Modernization Underway This Term

By ZHIYUN GUAN

Recent changes to one of Caltech's most popular and publicized courses have sparked discussion and controversy within the community. The class, Mechanical Engineering 72, provides students a hands-on and competitive experience in design and robotics and fulfills part of the ME or E&AS lab requirement.

In previous years, students formed teams to build a device and solve an assigned problem, such as moving a cage assembly across a table or attaching magnetic items to a wall. At the end of the course, students participated in a much-anticipated competition at Beckman Auditorium. This year, however, the familiar format of ME72 has changed to meet the

new demands of the field.

Updating the course to cover more recent technological developments, current instructor Joel Burdick explained, is the ultimate goal for ME72. According to Burdick, a modern mechanical engineer comes into frequent contact with computing, sensing and advanced motor technology, aspects that were not extensively covered by the class's previous format. "We want to bring [ME]72 into the 21st century, actually the 20th century," he explained. "It's still kind of stuck in the 19th century at the moment."

The projects for the course this year involve the use of newer technologies. Students may choose from a DARPA chal-

Continued on Page 8, Column 1

Dickinson Researches Insect Flight Abilities

By DAVID CHEN

"Why are insects so successful and the dominant form of life on the planet?" Michael Dickinson, Esther M. and Abe M. Zarem Professor of Bioengineering, asked the audience.

He explained, "A possible reason is that insects were the first organisms to take active flight." After emphasizing the importance of insects in the terrestrial ecosystems, Professor Dickinson introduced his current research on how flies can fly.

The movement of flies is characterized by a gracefulness and extreme agility. For example, the involuntary take-offs—such as when someone is attempting to swat a fly—are over in less than one fortieth of a second. Thus, our ability to study the flight systems of such small insects had been hampered for

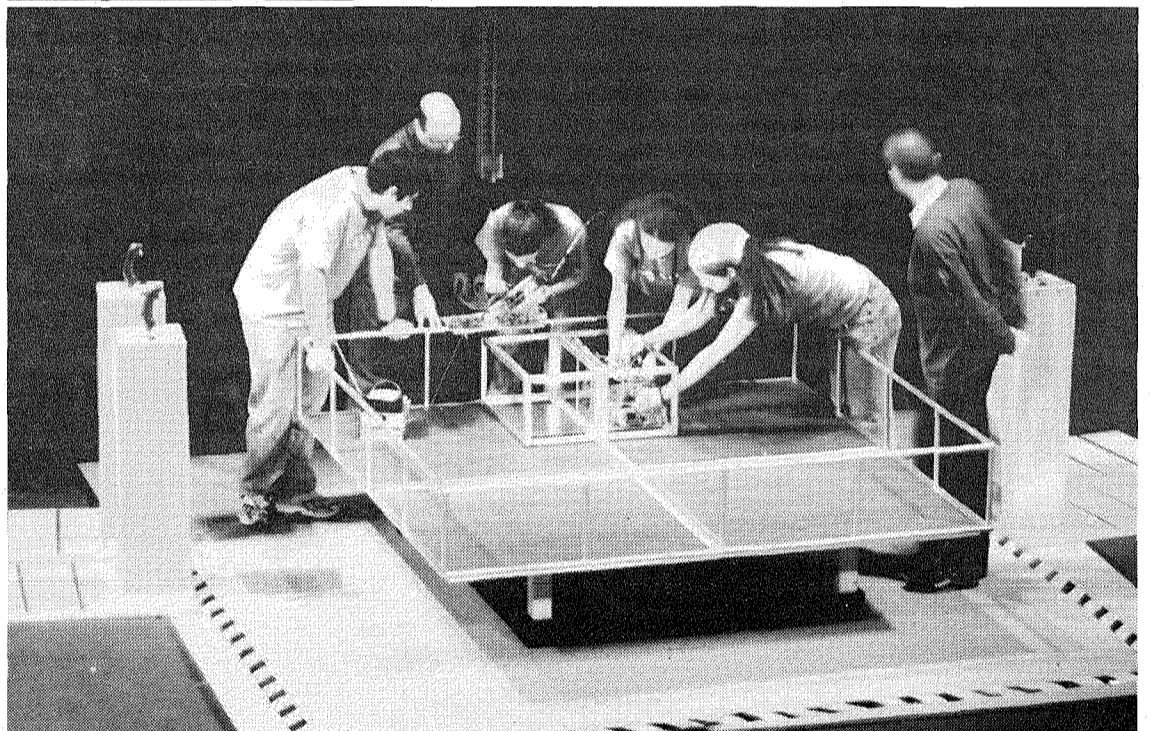
quite some time.

The previous way to study nervous systems of insects was to rip it out and put the nervous system in a Petri dish. Professor Dickinson, however, explained that this method of study precluded the understanding of how the parts work together.

The current systems-level integrative approach is to observe how the central nervous system affects musculoskeletal system, which influences the external environment and how the sensor systems send input back to the nervous system.

Professor Dickinson actually began this research into fly motion at the University of California, Berkeley. While Dickinson noted that "this is a strange place for a zoologist," his fascinating work actually involves much of

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Students prepare their robots during last year's ME72 competition. Due to changes that the course is undergoing, there won't be a competition this year, but students and professors hope it will return.

Collaborative Study of American Voting Offers Election Day Tips

By ROBERT TINDOL

PASADENA, Calif.--Voting experts from the California Institute of Technology and MIT say that American voters can take seven crucial steps to ensure that their votes are counted in the November 2 presidential election. The researchers have come up with the seven steps after studying U.S. elections for four years.

By following the steps, voters will help prevent the problems that arose in the 2000 presidential election, when as many as three million votes were lost due to voter registration mix-ups, two million additional votes perhaps were lost due to faulty voting equipment and confusing ballots and another one million were likely lost as the result of polling-place problems.

The announcement is made as part of the ongoing Caltech-MIT Voting Technology Project, which was initiated in December 2000 by Caltech president David Baltimore and then-MIT president Charles Vest following the election fiasco the previous

month. The group, composed of both political scientists and engineers, is charged with the tasks of evaluating the current state of reliability and uniformity of U.S. voting systems, establishing uniform attributes and quantitative guidelines for performance and reliability of voting systems and proposing specific uniform guidelines and requirements for reliable voting systems.

The seven steps are as follows:

1. Make sure you are registered. If you have an Internet connection, try Googling a couple of key terms like "voter registration" and the name of your county to see if your local election office is on-line. If you don't have the Internet or if nothing comes up on the search, call your local election office to make sure you are registered, that you are on your precinct's list of registered voters and whether you need to bring a form of identification with you in order to vote. If you have any doubt, you should call as soon as possible. The telephone number for your local election office is available from directory assis-

tance.

2. Get a sample ballot from your local elections office, if one hasn't been mailed to you and read it carefully. If you have received a sample ballot in the mail, this is a good time to make sure that your name and address are correct and that you know the location of your polling place. For additional information on the elections in your area, you can also go online at <http://www.vote.caltech.edu> or http://web.mit.edu/gsc/www/initiatives/election_US/.

3. Bring your sample ballot to help you in the voting booth. Your sample ballot contains a wealth of information and also provides a convenient way to keep up with your registration information as well as your choices on local initiatives that are complicated or require some study. You can mark your choices in your sample ballot and use it for reference when you cast your ballot.

4. Try to vote between 10 a.m. and 4 p.m., or allow extra time for long lines. The times before work, during the lunch hour and

Continued on Page 2, Column 4



Carolyn Porco of the Space Science Institute answers a question during her lecture about the Cassini Probe.



Courtesy of vote.caltech.edu

This LA county early voting site utilized the new touch screen devices that will be used in California for this election.

Voter Survey Reveals Information About Electronic Voting Devices

By MARK WHEELER

While the November 2 election will determine who will occupy the White House for the next four years, it may also make another determination as well: namely, whether Americans will embrace the use of electronic voting devices.

Suffering through the Florida recount debacle in the 2000 presidential election may have raised America's consciousness as to the methods they use to cast votes. Since then, there have been lots of claims made by advocates about how comfortable people are with electronic voting, while opponents have argued just the opposite, that the confidence of all voters is now shaken by the thought of using electronic voting systems. Who's right, who's wrong?

Neither, says R. Michael Alvarez, a professor of political science at the California Institute of Technology and codirector of the Caltech/MIT Voting Technology Project. "In fact, there appears to be a lot of indecision on the part of voters about the use of electronic voting devices," he says. Alvarez and Thad Hall, assistant professor of Political Science at the University of Utah and a collaborator with the Voting Project, just completed a study on American registered voters' attitudes about electronic voting devices.

"Roughly one-third of the registered voters in our sample stated they had no opinion about any of the arguments for or against the use of electronic voting machines," notes Hall. "This might represent uncertainty about electronic voting machines, a lack of familiarity with them, or some ambivalence about their use."

That leads Alvarez to believe that public opinion is at a critical moment regarding their use. This November, voters in 42 states will use new voting systems, such as touch screen ballots and optical scan machines. As a result, says Alvarez, "The performance of these voting systems on November 2 will play a critical role in determining how

American voters feel about using electronic voting technologies in the future." If things run smoothly with few glitches, electronic balloting will probably be here to stay. If there is another glitch-filled election, the controversy will go on.

The telephone survey, funded by the University of Utah's College of Social and Behavioral Science and Political Science Department, was conducted by International Communications Research between August 25 and

29. It interviewed a nationwide sample of 829 male and female registered voters. (The margin of error for the poll was plus or minus 3.4 percentage points.) While roughly one-third of voters in the sample expressed no opinion, a plurality of 38 percent of voters said they are most comfortable with using electronic voting machines to cast their vote, while 30 percent were most comfortable using optical scanning devices.

Not surprisingly, the survey shows a sizeable generation

Voting Tips to Ensure Your Vote is Counted

Continued from Page 1, Column 5

after work are especially busy, so if you can avoid voting at these times, you should try to do so. If you cannot vote on November 2, you should examine your sample ballot or ask at the local election office if you can take advantage of "early voting" opportunities where you live.

5. Know your rights and ask for help if you need it. You can obtain information beforehand from your local election office or the web sites <http://www.vote.caltech.edu> or http://web.mit.edu/gsc/www/initiatives/election_US/, but don't be afraid to ask the officials at the polling site if you need help.

6. You have a right to vote if you are registered in your precinct, even if your name does not appear on the list of registered voters in your precinct. Rules vary across the nation, so ask the poll workers in your precinct what you can do if your name does not appear on the list of registered voters. Casting a vote when your name mistakenly

does not appear on the list is often called "provisional" or "fail-safe" voting. In some parts of the country, if you cast a provisional ballot in the wrong precinct, your votes may not get counted, so be certain you vote in the precinct you are registered in.

7. Stop and double-check that your ballot reflects how you want to vote before you turn in your ballot. Common problems include unintentionally voting for more than one candidate for an office, accidentally not voting for a candidate or a measure, forgetting to vote both the front and back of a two-sided ballot, accidentally turning over an extra page in a multi-page ballot, accidentally voting for the wrong candidate, making a mistake in the "write-in" section and accidentally entering both the vote for a candidate and entering his or her name in the write-in section. If you make a mistake, ask a poll worker for a new ballot.

gap in attitudes about electronic voting. More than half of Generation Y registered voters, those between age 18 and 28 and a generation that grew up with computers and video games, expressed comfort with their use. But only a third of those 59 and older were comfortable with the newer electronic voting technology.

A plurality of registered voters in the sample—43 percent—also agreed with the statement that electronic voting equipment is prone to unintentional glitches, while 38 percent agreed that electronic voting increases the potential for fraud.

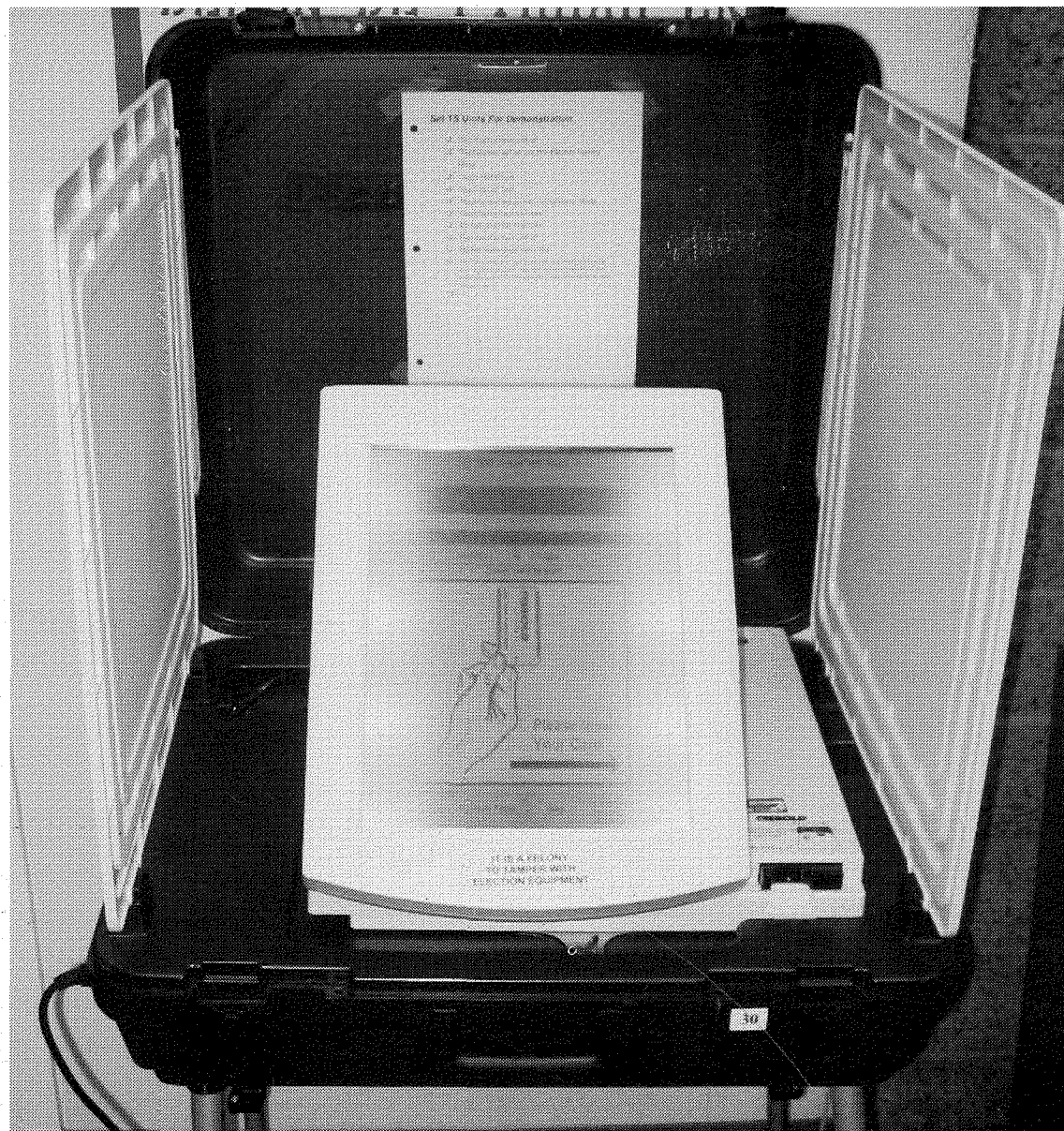
Other questions broke responses down by race and political affiliation (see <http://vote.caltech.edu/Reports/fall04survey.pdf>

for complete results), but the scientists believe opinions will be strongly set by the November election. "The tenor of the debate over voting technology has been very argumentative over the past two years," says Hall, "but electronic voting hasn't been all bad."

On the one hand, he says, there have been many cases of anomalies in the implementation of electronic voting systems that have resulted in votes being lost or problems at polling places. At the same time, there have been cases of electronic voting enfranchising voters, giving certain voters—such as people with disabilities—the chance to cast a secret ballot for the first time, or lowering the number of uncounted ballots.

"Much of this debate has played out among media and political elites," says Alvarez, "and our goal was to determine how the public views these issues at this point in time, in particular the tradeoffs between possible increases in accuracy relative to potential increases in either glitches or outright election fraud.

"Overall, I'd say the electorate does seem inclined to favor some form of electronic voting, but it's weak. So it will be interesting to see how the November elections shapes this ongoing argument."



Courtesy of vote.caltech.edu

The new touch screen stations are manufactured by Diebold and here is what the modern election booth looks like. No levers, switches, punch cards, chads or curtains to deal with.

The California Tech

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Don't Waste Your Vote!

By SIMON QUE

Political analysts like to cite Ralph Nader's candidacy as a reason for Al Gore's defeat in the 2000 presidential election. Many of Ralph Nader's votes came from voters who would otherwise have cast their ballots for Gore, enough to swing across the margin of victory to hand several states to George W. Bush. This election year, Ralph Nader is running again, but many voters are deeply suspicious of his candidacy due to the "spoiler" effect. "A vote for Nader is a vote for Bush," they say. If enough people voted for Nader instead of John Kerry, then Bush would win. Nader doesn't stand a chance of winning; voting for him would be throwing away a vote. And so many liberals justify voting for Kerry; even though they'd prefer Nader, a Kerry victory would be far better than a Bush victory. Many conservatives do the same with voting for Bush.

This is the "strategic voting" that is often studied in political science as a method that produces more favorable outcomes than voting by principle. And while it does work to produce better outcomes, it only makes sense on a collective level, when one thinks in terms of the segments of the electorate who would vote for each candidate.

But when individual voters use it to justify voting for a "winnable" candidate rather than their ideological favorite, they follow the reasoning of strategic voting into an area where it no longer makes sense. Unless the electorate is extremely small, perhaps a few hundred or few thousand, the chances that one voter's vote will swing the election are next to none. In a state with millions of voters, it is hopeless to expect that one's vote will be the tie-breaking vote. One statistician has even calculated that it is more likely that the voter will be killed in an accident on his way to the polling place than actually impact the outcome.

Another way in which this reasoning fails is in a regionalized system like the Electoral College, where the winner in each state gains all of that state's electoral votes. Yet I know of many people from California who refuse to even consider voting for a third-party candidate solely on the grounds that the candidate can't win, that it would be a wasted vote. But California is a heavily Democratic state; Bush doesn't stand a chance of winning the popular vote here. In the past three presidential elections, the Democratic candidate won in California by well over a million votes. It would make virtually no difference in the outcome whether a few people in California vote for a major candidate or a minor candidate.

How about in a battleground state, where the margin of victory is slim? Even if the two major candidates are tied before the last person's vote, that vote will not swing the result between the two candidates. Instead, it will swing it between one major candidate and a tie. Sure, voting for the winnable candidate would in theory secure his victory, but would the other side accept such a slim margin of victory? Remember what happened in Florida in 2000? There was a recount. If that

happened in a key state this year, someone on the losing side would probably agitate for a recount as well, and won't be satisfied until there is a more significant difference in the popular vote. Thus, even when the margin of victory is small enough, one person's vote probably won't be sufficient to finalize the vote.

A potential objection some might raise would be that if everyone reasoned this way, then it would be impossible to cooperate and pull a strategic voting victory. But again, this reasoning applies only to large groups of voters, not to individuals. The choices that an individual voter makes on his ballot are not somehow linked to the others' choices. If I were part of a large group that agreed to vote strategically for one winnable candidate on Election Day, but decide to "defect" to a third-party candidate after I pick up my pen to mark my ballot, it would in no way impact how everyone else in

"In a state with millions of voters, it is hopeless to expect that one's vote will be the tie-breaking vote."

the group votes. And even if everyone else in the group defects to other candidates when casting their votes, my voting in accordance with our agreement would do nothing to influence them back.

So strategic voting and winnability are poor criteria on which to base individuals' voting decisions. The obvious alternative, then, is good old principle-based voting. If you actually support a major candidate to a significant degree and don't have to hold your nose while voting for him, then by all means vote for him. But if you're dissatisfied with both the Democratic and Republican candidates, then vote for a third-party candidate that you like instead. Your vote will count a thousand times more toward increasing the third party's vote count of tens of thousands than toward increasing a major candidate's pool of tens of millions. A drop in a bucket is more significant than a drop in an ocean, even if it's just a drop. This will send a message of protest to the major parties and a message of encouragement to the third party, especially in states where one candidate barely beats another. The big parties may then be more likely to borrow ideas from the third party in the future. And when your friends come to you and ask you about your vote, you then have a chance to tell them about an otherwise unknown candidate and the ideas he represents.

Of course, it is possible to do all of this outside of the election, but political organizing and campaigning takes time, money, and effort. On the other hand, the election is a way that has already been arranged for you to publicly express your views. It may also be the only time when the major parties and many individuals will show interest in your views.

Don't be fooled when people tell you to vote strategically and to not waste your vote on a third-party candidate. In reality, it is a wasted vote if you choose a major candidate that you don't like. It will make no difference in the outcome, it will not change the course of the major party in the future, and it will not let your true opinions be heard. So on Election Day, keep in mind what you're actually looking for in a candidate, not whether everyone else will vote for him.

Fencing's Harvard Places 3rd at UCI

By MIKE RUPP

October 25, 2004
Caltech Athletics
Weekly Roundup

Athlete of the Week: Men's Water Polo's Tom Jurczak

The 6-0 Sophomore from Davidsonville, Maryland was Caltech's best player this week in two close losses to SCIAC opponents Cal Lutheran and Pomona-Pitzer. Against Cal Lutheran, Jurczak had four goals, four steals, two errors drawn and an assist.

Against Pomona-Pitzer, Jurczak had three goals, three steals and one assist.

Jurczak, along with Sophomore Daniel Oliver and Seniors Jason Lee and Logan Linderman, have formed the core of the team's offense this season.

Jurczak will try to break the team out of its slump this Wednesday at home against La Verne. The match is set for 4:00 PM.

Sophomore Rebecca Streit continues to lead Women's Volleyball

Sophomore Outside Hitter Rebecca Streit continued to lead the Caltech Women's Volleyball team this past week. Caltech won against West Coast Baptist College in four games before losing three straight matches to La Sierra University and then to SCIAC opponents Claremont Mudd-Scripps and Cal Lutheran.

Streit lead the team in kills, kill percentage, and service aces over the course of the week, and was third on the team in digs. She lead the team in points in each match, and was especially effective with a 21 kill and three ace performance against La Sierra.

Senior Outside Hitter Kristen Zortman was second on the team in kills and kill percentage, and led the team with an outstanding eight blocks for the week.

Sophomore Outside Hitter Elisabeth Streit was third in kills, tied her sister for the team lead in aces, and led the team with 55 digs in 14 games. Senior Middle Blocker Delia Davies was fourth in kills, and second in blocks with four.

The team's record now stands at 7-14, coming into their final two weeks of the season. The team's next match is this Tuesday at Occidental College. Their final home match of the season is this Friday night at 7:30 PM against Pomona-Pitzer.

Fencing: Harvard places third at UCI Invitational

Sophomore Katherine Harvard placed third in Women's Epee at the 2004 UC Irvine Fencing Invitational. Harvard, coming of a stellar Freshman season that saw her become the first Women's Fencer in school history to qualify for the NCAA Championships, was Caltech's top finisher in a field that included both NCAA and club teams from all over the western region.

The team's next match will be their sole home meet of the season, November 6th at 10:00 a.m. in a club match.

Men's Soccer loses to Whittier; Claremont M-S

The Men's Soccer team took two more hard losses this past week, losing to Whittier College, 4-1 and then to Claremont Mudd-Scripps, 9-0.

Against Whittier, Senior Defender Chris Habliston scored late in the first half to cut the deficit to 2-1, but Caltech was unable to capitalize, and Whittier scored two more goals in the second half. Freshman Goalkeeper Elliot Pallett had seven saves.

Against Claremont Mudd-



courtesy of donut.caltech.edu

Tom Jurczak is this week's Athlete of the Week for his huge contributions to the Men's Water Polo team.

Scripps, one of the top teams in the country, Caltech struggled throughout, finally losing 9-0. Pallett, once again playing the full 90 minutes in goal, had ten saves for Caltech.

The team's next match is this Wednesday at home against the University of Redlands. Match time is 4:00 p.m.

Men's Water Polo falls to Cal Lutheran and Pomona-Pitzer

Sophomore Tom Jurczak was named Caltech Athlete of the Week after leading Caltech in two close losses to Cal Lutheran and Pomona-Pitzer.

Against Cal Lutheran, the team lost 14-10, despite three goals by Senior Logan Linderman and two more by Sophomore Daniel Oliver. Oliver also had two assists in that match.

Against Pomona-Pitzer, Oliver scored two more goals and had two more assists, but Caltech fell short again, losing 10-6.

The team's next match will be at home this Wednesday against La Verne University. The match begins at 4:00 p.m.



Looking for an Opportunity to Make a Difference?

CIA's Directorate of Intelligence is seeking candidates for Analyst Positions.

Representatives from CIA's analytical arm, the Directorate of Intelligence, will be interviewing for analyst positions in Los Angeles during the week of January 17th. Analysts work on the forefront of protecting national security, quickly assessing how rapidly changing international developments will impact US interests at home and abroad. They use information from classified and unclassified sources from around the world to develop and provide the reliable intelligence that is essential for US policymakers to make informed decisions. The DI is hiring for the following positions:

- Analytic Methodologist
- Collection Analyst
- Counterintelligence Threat Analyst
- Counterterrorism Analyst
- Economic, Political, Leadership and Military Analysts
- Science, Technology and Weapons Analyst
- Medical Analyst
- Psychological/Psychiatric Analyst
- Crime and Counternarcotics Analyst

Candidates must have at least a bachelor's degree with a minimum GPA of 3.0. Language skills, previous foreign area residence or travel, and relevant work experience are pluses. Candidates must successfully complete a medical examination, polygraph interview, and an extensive background investigation. All positions require US citizenship and relocation to the Washington, DC area.

The CIA is America's premier intelligence agency, and we are committed to building and maintaining a work force as diverse as the nation we serve.

For additional information, and to apply online, please visit www.cia.gov. Successful applicants who have submitted their resume by **November 12th** will be contacted to attend an information session and arrange a local area interview.

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THE WORK OF A NATION.
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Caltech UnBubbled Part III: The War in Iraq Intelligent Debate on the Issues at Stake in National Politics

Advocay for Immediate Withdrawal from Iraq

By SIMON QUE

On the morning of June 28, 2004, I read the surprising news that the "hand over of power" from the U.S. administration to the interim Iraqi government was complete, two days ahead of schedule. Iraq, said the news sources, became a sovereign state that day.

However, the United States still plays a major role in Iraq, most prominently through the presence of 140,000 troops stationed there. The supposed goal of U.S. involvement there is to help to facilitate and overlook the reconstruction of Iraq until it can sustain itself. U.S. troops would help train the armed forces of Iraq and to contain the violence and prevent it from growing worse. There would be popular elections soon, and troops must be in place to prevent terrorists from subverting them. In the long run, the hope is that a free and democratic Iraq would become a stable state in the Middle East and contribute greatly to combating terrorism.

But unfortunately, the efforts of the U.S. are futile toward achieving these goals.

In order for a country and its people to become free, it must first have gained sovereignty. National sovereignty means that the people of Iraq are the ones who shape their country and decide the course that it takes. It means that they and their rulers do not answer to foreign powers. And it means they take full responsibility for providing for their national defense.

And when 140,000 foreign soldiers are stationed in a country, it cannot become truly sovereign. When Iraq allows a foreign power to dominate it with military forces, it loses its sovereignty - in fact, if not in name. Consider what would happen if the Iraqis voted in favor of measures that reduced freedom, aided the terrorists, or demanded that U.S. troops leave. An ABC News poll in March 2004 indicated that 36% of Iraqis wanted coalition forces out as soon as the Iraq government was in place. Another 33% wanted them out in six months or less. Would the U.S. administration allow disagreeable choices by the Iraqi people and respect Iraqi sovereignty? Would it let Iraqis choose true independence rather than face the restrictions imposed on them by the presence of the U.S. military? Regardless of how they choose, Iraqis will have a hard time enforcing their own vote when the administration still holds true military power in Iraq. Indeed, the administration has already confiscated firearms from Iraqis citizens. When the U.S. still holds this sort of veto power over the Iraqis, regardless of whether it chooses to exercise that power, Iraq is not a free country but a puppet state. That it holds popular elections would be meaningless. Simply calling it sovereign does not make it so.

But sovereignty itself will not automatically bring freedom in Iraq. Freedom is something that the Iraqi people must discover and take up for themselves. And they may not necessarily be ready to do that. As an example, consider the rampant violence and terrorism in parts of Iraq. One justification for U.S. presence there is that terrorists may attempt to scare the Iraqis before an election in order to influence its outcome. In a speech before the United Nations General Assembly last month, President George W. Bush said, "As we've seen in other countries, one of the main terrorist goals is to undermine, disrupt and influence election outcomes." But if Iraqis truly believed in freedom and self-rule and were ready for it, they would not be easily shaken by terrorism. They would take steps to defend against terrorism and to fight back, on their own accord. On the other hand, if they were not ready for it, keeping a large military force there is a poor substitute, simply because it does nothing to change the attitudes of the Iraqi people toward freedom and self-rule.

And even holding popular elections does not guarantee freedom if the Iraqi people would not embrace it on their own. They could very well vote in favor of leaders and measures that decreased freedom. In the same speech, President Bush said that "people everywhere are capable of freedom and worthy of freedom." This is a grave misstatement. Without a proper appreciation of liberty, there is nothing to prevent Iraqis in the future from voting to support terrorists, theocrats, and dictators for promises of stability and security, just as Germans viewed Adolf Hitler as a savior from their economic woes when they supported his rise to power in the 1930's. Even in the United States today, many people accept or tolerate a federal government with police-state powers for protection against the threat of terrorism.

Real Iraqi freedom is something that Iraqis would be willing to defend on their own and not surrender to foreign powers or terrorist threats. It is also something that they must come to discover on their own, and not by the policing efforts of any foreign military force. If they were really ready for freedom, they would seize it without the help of foreign troops. There would be hundreds of thousands of brave Iraqis who would voluntarily serve as soldiers to defend their own country. On the contrary, a foreign security force gives them the opposite of freedom. With this greater security comes less freedom, as the foreign power would want to exercise its role in providing security and cracking down on terrorism. We've already seen the abuses of power by the U.S. military that have taken place in the Abu Gharib prison facility.

During the Vietnam War, a political cartoon depicted the situation in Vietnam as a South Vietnamese soldier propped up by an American rifle, shrugging as if he did not have a clue as to what he was doing. That is what the situation in Iraq would be like if the Iraqis are not ready for their own freedom. If that is the case, then the U.S.'s efforts are futile. Iraqis would not learn to keep their freedom on their own accord if the U.S. did it for them, and American military presence would serve as a crutch, not as a real solution. It would not help to bring about real, permanent change for the better and also would pose a risk to freedom in the future.

Whether or not the Iraqi people are ready for freedom, the current U.S. policy of involvement in Iraq until it becomes stable does no good for them in the big picture. The result would be either loss of sovereignty and freedom with no real progress toward a truly free Iraq. In that case, the most obvious path of U.S. foreign policy would be to pull American troops out of Iraq now without looking back.

But neither President George W. Bush nor Senator John F. Kerry has suggested this plan of an immediate exit, though some third party candidates such as the Green Party's David Cobb and the Libertarian Party's Michael Badnarik have. Bush wants to continue the current course of American involvement while Kerry wants an international peacekeeping force. Although Kerry's plan does not actually require the U.S. to continue direct involvement in Iraq, it will be the U.S. that takes part in arranging the hand over of peacekeeping to the United Nations and will continue to provide financial support for the U.N. But this is still indirect U.S. involvement in what is a hopeless venture that cannot be fixed with more firepower. Both candidates support having non-Iraqi forces in Iraq, but regardless of which countries send security forces to Iraq, Iraq will not be sovereign and thus will not have freedom. It is time to bring the troops home and to let the Iraqis decide their fate through their own actions.

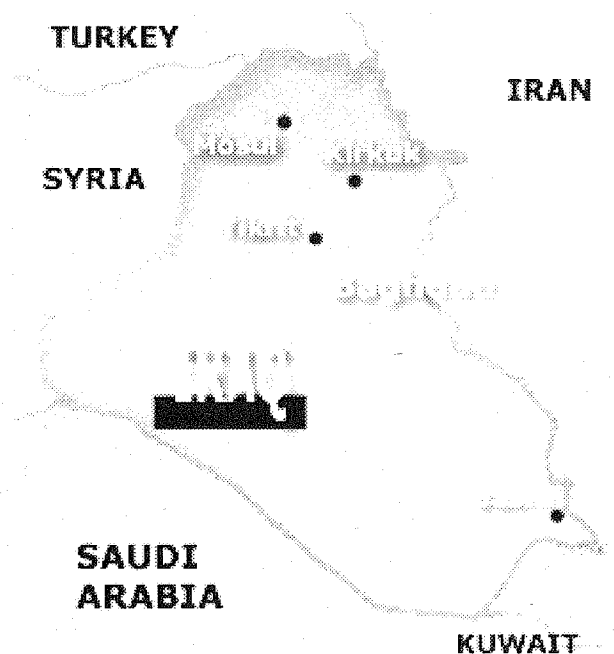
Dear Caltech Community Members,

It is not surprising that the topic which rouses such passions even among Techers is war - particularly war in Iraq. Please read these differing home-grown opinions on this issue. And, if so inspired to follow up, a good place to start might be: <http://www.npr.org/politics/issues2004/>

Today, the Caltech UnBubbled Project brings you the last spread before the November elections. And in doing so, we'd like to join the chorus of voices to encourage you to vote. With any luck, the awareness and analysis we've tried to encourage will serve to better inform that choice.

And when that duty is done, there will most certainly be a contested aftermath to closely watch. Why ogle over the headlines of this most partisan and bitter celebrity death match? Because, buried between the blow by blow coverage and arcane legal briefs will be the pulse of our democratic system. If we are to even to hope of enjoying its permeating benefits, we must not neglect the duty to monitor and maintain its health.

"To see what is in front of one's nose needs a constant struggle." -- George Orwell
~ The Caltech UnBubbled Editors



The Brilliance of an Iraq Invasion

By SLOANE WIKTOROWICZ

I am anti-war. But the war I'm against is that declared on September 11, 2001: the war on America. We didn't start it, our government's foreign policy didn't cause it, and 2,992 men, women, and children¹ certainly did nothing to deserve massacre. This is the most atrocious of wars, a total war where civilians are targeted. Some perspective: the last time America was so brutally attacked, it took four years, 92,000 American troops killed², the firebombing of cities, and the only nuclear weapons ever used in combat to bring it to a close. Ladies and gentlemen, we are now in the middle of the War on Terror, World War III.

In order to win the War on Terror, we must eliminate the terrorist diarchs and stop their recruitment. Since the terrorists' advantage is stealth, the traditional hunt-and-kill strategy is an engagement on their terms. The ideal military campaign will force the terrorists out in the open, en masse, where they can be dealt with by the most highly trained force in human history. An invasion of Iraq causes the terrorists to throw all they've got at our military instead of at our cities, because they can't afford to "lose" a Middle Eastern country.

People will turn to terrorism when they have nothing to lose and when terrorism appears to be effective. Thus, cutting off terrorist recruitment requires those people to be offered a better life, and it also requires terrorism to be discredited. If Iraqis are allowed to govern themselves freely, terrorist sympathizers in neighboring countries will see that it's possible to do something productive with their lives. If terrorism is a force that can only harm America when her back is turned, and if terrorism can't even "win back" territory in the Middle East, then it will be seen as utterly useless.

Indeed, the Middle Eastern public image of terrorism is further reduced by an invasion of Iraq. While we chase bin Laden from cave to cave, he is seen as a freedom fighter, an outlaw, and a martyr. When this is the image of a terrorist, he will gain sympathy. However, even though the search for bin Laden progresses at the same rate, the Iraq invasion has trumped the terrorists' outlaw image. They are now seen as those who behead individuals and detonate a few car bombs, but who have failed to take control of Iraq.

Saddam may have had nothing to do with 9/11, but he was still a legitimate target to be overthrown. UN Resolution 1441 admits as much. The real goal in Iraq, however, wasn't to simply destroy Saddam's military. The goal was to defeat it so quickly that terrorist reinforcements would become the frontline fighters. The terrorist who can complement a conventional force by lurking in the shadows is a grave danger, like the Viet Cong supporting the NVA, but the terrorist who is forced to bear arms in the light is grossly outmatched. What's more, he can't abandon his sinking ship, because he would then be banished, as a coward, from his home.

Iraqis are beginning to step up to take control of their own country, but they are understandably wary. Bush, Sr. promised them aid to overthrow Saddam after the Gulf War, but this aid never came. The Shiite and Kurdish uprisings were then massacred with tanks and helicopters that Bush, Sr. had allowed Saddam to retain. Clinton promised aid for a second coup, but that aid was again denied when the coup began³. Thus the Iraqi people found themselves betrayed, and their oppression under Saddam continued.

This sort of oppression is painfully familiar to Eastern European countries, but more comforting to them is the memory of the United States brushing aside the Soviet Iron Curtain. It is therefore no coincidence that Poland, Ukraine, Romania, Bulgaria, Hungary, Georgia, Azer-

baijan, Latvia, the Czech Republic, Lithuania, Slovakia, Albania, Estonia, Kazakhstan, Macedonia, and Moldova not only strongly support our invasion of Iraq, but they also have troops on the ground in Iraq. Even though we also enjoy the troops and support of England, Italy, the Netherlands, South Korea, Japan, Denmark, El Salvador, Australia, Iraq itself, and others⁴, some claim we have a weak coalition. This is invariably because four countries are conspicuously absent.

France was owed billions of dollars from weapons purchases by Saddam⁵, and that debt would be nullified were Saddam ousted. Indeed, the 3rd Infantry Division claims to have found French Roland-3 surface-to-air missile launchers in Iraq last year⁶, and it is unclear whether these launchers were supplied before or after Iraq sanctions were applied⁷. The purpose of these missiles is to shoot down military aircraft, and Saddam had frequently shot at our planes patrolling the no-fly zone since the end of the Gulf War. Thus it is reasonable to be suspicious of France's intentions. Additionally, when two French journalists were kidnapped in Iraq last August, Islamic Jihad and Hamas argued for their release⁸. These terror groups condemn kidnapping of French citizens, yet they have no compunctions about blowing up Israeli children. What, then, is France doing behind the scenes to garner their support?

Russia was also owed billions by Saddam, and its companies have received vouchers from Saddam, through the UN Oil for Food Program, worth more than \$19 billion⁹. French companies received more than \$4 billion, and China has taken in almost \$3 billion. By comparison, the US has received just under \$500 million. This income would stop, just as weapons debt would disappear, once Saddam's regime were ended. Incidentally, one of the past employees of the company hired to oversee the Program, Cotecna, was none other than the son of UN Secretary-General Kofi Annan¹⁰. This is the same Kofi Annan who called the Iraq invasion "illegal."

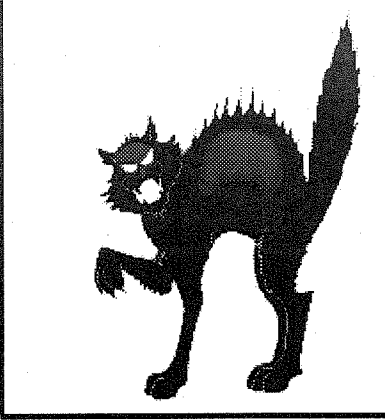
When North Korea threatened to use nuclear weapons on the US, China was unwilling to enter into direct negotiations, citing that it was best resolved by talks between North Korea and the US¹¹. China thus abdicated its responsibility, as a major power, to condemn North Korea's actions, and this forced the US to confront North Korea on its own. Regardless of its reasoning, China's initial attitude of isolation towards North Korea makes its strong opposition to the invasion of Iraq questionable. After all, how could China have been quiet about North Korea, its own neighbor, yet adamant about Iraq?

The Allied firebombing campaign of World War II was designed to destroy the German will to fight. Coupling this with the German losses incurred during World War I, Germany's post-World War II political climate prevented it from taking part in combat not essential to Germany's defense¹². It's therefore not surprising that Germany is now pacifist. While it's reasonable that Germany should be opposed to our Iraq invasion, I don't find it particularly concerning. After all, the countries Germany invaded 65 years ago support our invasion today.

Contrary to the personal opinions of news anchors, we are winning the War on Terror, and we are winning both the Iraq and Afghanistan theaters. Certainly, we are pushing some who were undecided towards fighting us. But we are also making many more converts who are helping us fight. The Iraq theater wasn't won with the toppling of Saddam's statues; rather, that's when the real conflict began. Our invasion of Iraq forces the terrorists to stream across Iraq's borders to fight our troops, and we are eliminating the terrorists rapidly. If we hadn't invaded

Goodluck Charms for Midterm Week

By HAMILTONY FALK



Here it comes, that weekend every year where you walk a little on edge, never knowing when something scary is just going to jump out of the bushes at you. You'll just be striding along, minding your own business and WHAM, a math midterm! (Anyone who thought I was talking about Halloween, don't feel bad. I thought so too, at first.)

However, midterms weekend doesn't need to be scary, or even painful. Here are a few easy steps to make sure your midterms don't give you more stress or discomfort than necessary. First, find a quiet, well lighted area with a large desk area and no one to come by and distract you. Second, make sure you have a comfortable chair, maybe some snacks to keep you going, and are happy being in the place you are for the duration. Then make sure you have any necessary materials, like paper, books, calculator and the exam itself. Now you only have one step left before you can happily sit down and take your midterm. Just go to a computer, go to the Harvard website and download a transfer application, fill it out and send it in. There, now you can take your midterm in a relaxed manner, knowing that you have a ticket out of this horrible place. Now I realize that this isn't an option available to everyone, so I've gone ahead and thought of some other stress free ways to do exams. You can also drop out and lead a life of crime.

Unfortunately some people seem to think that finishing their education here is more important than being happy, and I'd feel really guilty¹ if I let those people get by without some suggestions. The best thing you can do is make sure you're lucky. While this is usually a natural talent, there are many ways to boost your luck. If you've ever walked by the statue of Millikan between Sloan and Bridge, and you're the type that looks at statues' noses when you walk by, you know that Sir Milli's nose is nice and shiny, compared to the rest of his rather faded face. This is because his nose is made out of a magic rock that fell from the moon. Therefore, if you rub it, you get good luck, and will do better on your exam. One person I made up who rubbed it got a 110 on their Phys 2a midterm after

rubbing it. Another student found a twenty dollar bill in the pocket of his or her jacket.

Other lucky things you can do is find a cat that isn't black and cross its path as many times as possible. See, when a black cat steals luck from someone who's crossed it's path, it deposits that luck into the general "paths of cats crossed" account, and you get some of it back when you cross a non-black cat's path. A lucky hat or pair of underwear (yours or anyone who isn't careful enough about locking their door) will help, as will rabbit's feet, four leafed clovers, sparkly stones, rabbit's hands, a "lucky" Dominican midget², prayer³ and slipping cash under my door. You can also do jumping jacks. That doesn't actually help your luck, but it keeps you in better shape, and is known to fight heart disease. If you're not interested in doing well with luck, or you want that extra bonus to make sure your grade will allow you to pass, you can also take advantage of the fact that most tests are curved. Find out who else is also taking the exam and hang around out side their room making loud noises and maybe slip a little something into their food so they can't concentrate on the exam. Throw some water balloons though their window, because no one wants to turn in a wet exam. You could also try pulling the fire alarm⁴ or actually lighting other students on fire. Remember: If you do something illegal, I'll point out that only an idiot would follow my advice. If you're really desperate, you can also place a trashcan with a sign proclaiming it to be the midterm turn in box in front of the real receptacle. If you're the only one to turn a test in, they have to give you at least a B. I guess technically you could also study, but that really isn't my department.

1 Not really, I just can't write a column that's only one paragraph telling you to drop out.

2 If you don't understand this reference, talk to Pedro Martinez.

3 To your TA. As far as I know the Gods of all the major religions have forsaken Caltech.

4 Actually, don't bother. No one pays attention to them anyway.

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ASCIT Minutes: DevTeam, Interhouse, Student Faculty Conference Committees, Avery Ath Team

ASCIT Minutes
October 18, 2004

Present: Ann Bendfeldt, Ryan Farmer, Meng-meng Fu, Kelly Lin, Galen Loram, Kim Popen-dorf, Claire Walton, Corinna Zy-gourakis

Absent: Shaun Lee

Guests: Ivan La Frinere-Sandoval, Dan O'Hanlon, Boris Chen, Kevin Trotter, Keris Allrich, James Yoon, Binghai Lin

Call to Order, 12:05 PM

New/Open Positions:

1. Know a lot about comput-ers? The Donut Devteam is look- ing for new members to help run and maintain the donut website. Devteam members are ASCIT employees and receive a salary. If you'd like to find out more about the job, or if you are in-terested in interviewing for the position, email galen@caltech.edu, binghai@caltech.edu, or shaun@caltech.edu.

Money Requests:

2. Keris Allrich and June Wicks ask to take Prof. Tirrell out to lunch at the Ath. Vote: 5-0-0.
3. Eric Cady, of Lloyd House, requests \$100 multihouse funding for laser tag event with Fleming. Vote: 5-0-0 (approved).
4. Kevin Trotter, of Fleming House, requests \$100 multihouse funding for laser tag event with Lloyd. Vote: 5-0-0 (approved).
5. Dan O'Hanlon, of Dabney House, requests additional money for the annual pumpkin drop on October 31.

Suggestions for Budget Sur- plus:

6. Ivan La Frinere-Sandoval asks for approximately \$500 to buy fitness equipment, such as dumbbells, for his new fitness club that already has several members.
7. James Yoon asks for funding to buy more video games for his new gaming club which already has 60 to 70 members.
8. Boris Chen asks for funding to start a music library with CDs (classical, jazz, etc.) and sheet music. Galen suggests that Boris also talk to the music department and the MHF.

Other Business:

9. Kim Popen-dorf reports that most of the services currently lo- cated in the SAC basement-such as the chamber music practice rooms, photography dark room, etc. will be relocated to other lo- cations during the South House Renovations. As of now, there are no plans to relocate the ASCIT screening room for the duration of the renovations.
10. Kim also stresses the im- portance of continuing to take good care of our houses, particu- larly in the time before the reno- vations, in order to show that we do respect our houses.
11. Claire Walton thanks the Meat Club for agreeing to pur- chase food and grill at the BBQ for the Varsity soccer game against Whittier on Wednesday, October 20.
12. Binghai Lin reports that the devteam is procuring fresh- men pictures and new graduate student information for the donut directory.
13. Meng-meng Fu discusses the feasibility of an online system for anonymous comments to pro- fessors about their classes.
14. This term's club checks are out! You should email Kelly Lin (kyl427@caltech.edu) with

your name, club name, and mail- box code in order to receive your club's check.

Meeting adjourned 12:45 PM.

October 26, 2004

Present: Ann Bendfeldt, Ryan Farmer, Kelly Lin, Galen Loram, Kim Popen-dorf, Claire Walton, Corinna Zy-gourakis

Absent: Shaun Lee, Meng- meng Fu

Guests: Peter Foley, Alice Lin, Ann Lu, Scott Medling, Dan O'Hanlon, Ann Rajala, Emma Schmidgall

Call to Order, 12:12 PM

New/Open Positions:

1. Know a lot about comput-ers? The Donut Devteam is look- ing for new members to help run and maintain the donut website. Devteam members are ASCIT employees and receive a salary. If you'd like to find out more about the job, or if you are in-terested in interviewing for the position, email galen@caltech.edu, binghai@caltech.edu, or shaun@caltech.edu.

Money Requests:

2. Dan O'Hanlon, of Dabney House, requests \$150 for the an- nual Dabney Pumpkin Drop from the roof of Millikan Library at midnight on Halloween. Vote: 6-0-0 (approved).
3. Senior class co-president Al- ice Lin requests \$200 to fund the senior class outing to Jake's Bil- liards in Old Pasadena. Vote: 5-0-0 (approved).

Club Money Requests:

4. Peter Foley, from the Caltech Sailing Club, requests \$100 for boat registration. Vote: 5-0-0 (ap- proved).
5. Ann Lu, from the Caltech Dance Troupe, requests \$300 to fund a dance instructor and out- ings to see dance performances. The BoD approves \$50 for the dance instructor (Vote: 6-0-0), and encourages Ann to speak to Cathy Jurca about funds for cul- tural outings.
6. Scott Medling, from the Caltech Christian Fellowship, re- quests \$200 to fund CCF "alpha- dinners", which provide a way for non-Christians and new Chris- tians to learn more about Christ. Vote: 5-0-0 (approved).

7. Dan O'Hanlon, from the Caltech Magic Card the Gather- ing Club, requests \$200 to fund club member participation in a downtown tournament, The BoD asks Dan to return when he has an exact count of the number of participants.

8. Ann Rajala announces that Out of Context (OOC) has qual- ified for the semifinals of a nation- al a cappella competition in Ber- keley, CA. Congratulations! She requests \$250 to pay for competi- tion registration. Vote: 6-0-0 (ap- proved).

9. Emma Schmidgall, from Caltech Hillel, requests \$100 for club events, including weekly Shabbat dinners and an upcom- ing Hannukah dinner. Vote: 6-0-0 (approved).

Other Business:

10. Kim Popen-dorf reports that the South House renovations planning committee has come up with a better site layout for the modular units that includes mini- courtyards.
11. Once again, Kim stresses

the importance of continuing to take good care of our houses, particularly in the time before the renovations. She reports that the IHC is considering the estab- lishment of a Damage Commit- tee with a Damage Representa- tive from each house in order to evaluate all reported damage in- cidents and determine whether they should be classified as normal wear and tear, accidental damage, or willful damage. Such a com- mittee represents a form of pro- active student self-governance that reflects the students' desire to keep our houses neat.

12. Kim mentions that Avery resident Max Zavodny is spear- heading an effort to establish an Avery House Ath team that would compete with the seven houses in interhouse athletics.

13. Claire Walton discusses the possibility of funding an In- terhouse Party this upcoming January. Kim will talk to the IHC about this idea to see if there is enough support for a seven-house party.

14. This term's club checks are out! You should email Kelly Lin at kyl427@caltech.edu with your name, club name, and mail- box code in order to receive your club's check.

15. Congratulations to the fol- lowing members of the Student- Faculty Committees! Thanks to everyone who interviewed. Note that the chair of each committee is indicated with an asterisk.

Paul Nagami, Ziqing Zhao, Tim Barnes, David McKinney, Ran- som Poythress

Chem/ChemE: Mayra Sheik, Raman Shah*, Lydia Ng, Chris- tine Chang, John Sadowski

EE/CS: Will Coulter, Hao Ye, Michelle Wyatt, Jacob Burnim*, Arjun Bansal

ESE/CNS/CE/Mat Sci/BE: Meghan Crowley*, Rachel Maire, Helena Wang, Kayte Fischer*, Martin Peek

GPS: Tina Dwyer, Lizz Fel- nagle, Kate Magary, Belle Philibosian*, Susan McDonald

Ma/ACM: James Berglund*, Yuliya Gorfina, Nick Hutzler

MechE/Aero: Kevin Monaja- ti*, Jason Yosinski, Joanna Co- hen, Kayte Fischer

HSS: Lizz Felnagle, Csilla Felsen, Angelina Crans*, Fran- cesca Colonnese, Galen Loram

Honor Code: Ann Bendfeldt, JD Salazar, Matt Krogstad, Nick Wall*, Galen Loram, Vera Pavel

Workload/Student Morale/SF interactions: Galen Loram, Ryan Witt, Nick Ma*, Kate Magary, Rocky Velez

Physics, Astro, Aph: Janet Sheung, Joe Wasem, Jaelyn Hom- nick*, Vivian U, Adam Azarchs

Core Curriculum: Rahul Deb*, Meghan Crowley, Rocky Velez, Andy Green, Grant Chang- Chien, Lea Hildebrandt

Meeting adjourned 1:00 PM.

Respectfully submitted,
Corinna Zygourakis

Biology: Vincent Auyeung*,



TACIT to hold auditions for Shakespeare's *Measure for Mea- sure*. TACIT (Theater Arts at Caltech) will hold auditions for the second play of its 2004-2005 season, *Measure for Measure* by William Shakespeare, during the second week of November. All members of the Caltech Commu- nity are invited to audition.

The auditions will be held in Ramo Auditorium on Wed., Nov. 10, at 7:30 p.m. and on Sat., Nov. 13 at 1:30 p.m. No special preparation (such as monologues) is required, but reading the play in advance and finding inter- esting roles does help. The play will be performed during second term on three consecutive weekends begin- ning Feb. 18, 2005.

As it becomes available, related in- formation will appear at <http://tacit.caltech.edu/>.

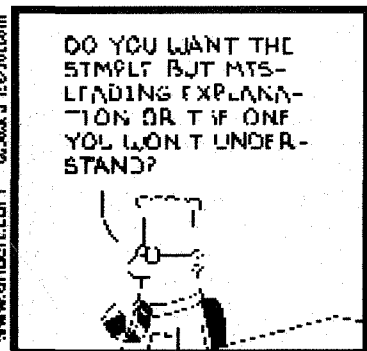
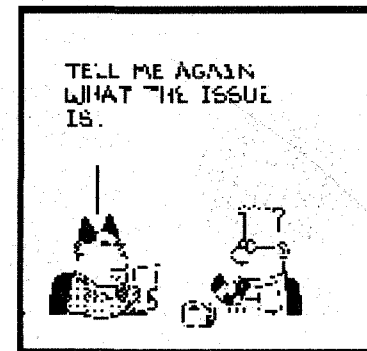
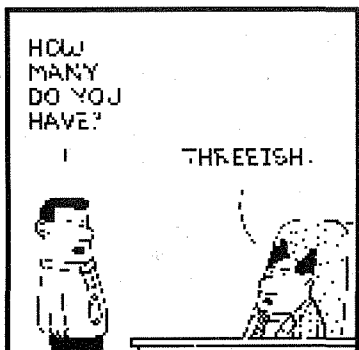
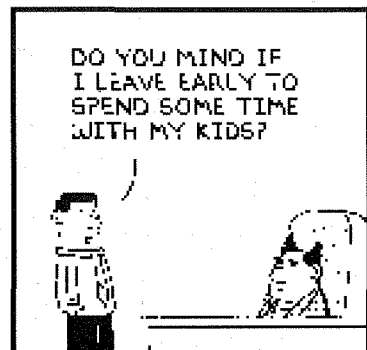
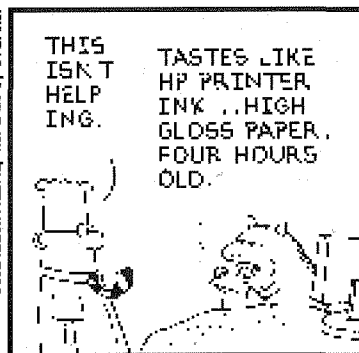
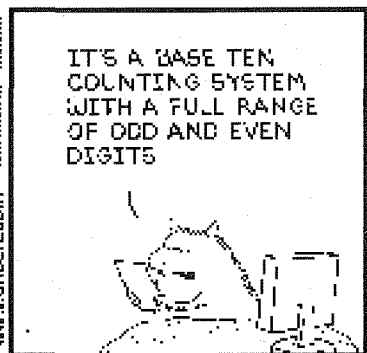
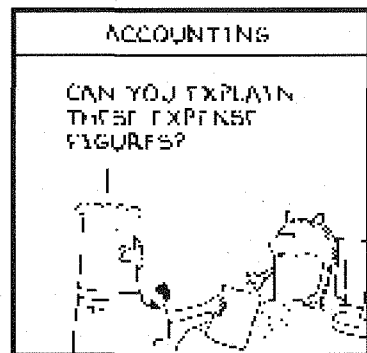
November at the Women's Center. November 2--Election Day! Did you know that in the 2000 presidential election:

- * 105 million women were of vot- ing age (97 million men)?
 - * 69% of eligible women were reg- istered to vote (62% of men)?
 - * Only 56% of eligible women voted (53% of men)?
- Don't forget to VOTE!

Reel Women Series

India: Holy Cow!
Date: Thursday, November 11, Time: 12-1pm; Location: Women's Center located in room 265 of the Center for Student Services.

Adventure Diva, Holly Morris, travels to India encountering women with a strong identity and heritage, including the first woman to reach the top of Mount Everest, a woman who risks her life to help women in a low- er caste, a sharp shooting policewom- an and that's just to start with! Free pizza and sodas. No RSVP needed. Cosponsored with ISP & OASIS.



Engineering Immunity Project To Aid the Body's Defense Systems

By D. WILLIAMS-HEDGES

PASADENA, Calif.--In response to the arduously slow progress in finding cures for AIDS and cancer, Caltech researchers are now investigating a promising new approach in the treatment of these diseases.

With a \$1.5 million matching grant from the Skirball Foundation in New York, Caltech biologists have established the Engineering Immunity project, designed to create a novel immunological approach to treating—and even some day preventing—HIV infection and some cancers like melanoma.

The immune system provides humans with a powerful defense against infectious diseases—but sometimes, it fails. Utilizing an innovative, integrated approach, the Engineering Immunity project will combine gene therapy, stem cell biology and immunotherapy to arm the immune system; this integrative methodology offers groundbreaking potential for treatment of these diseases and others for which the immune system currently fails to provide defense.

Caltech President David Baltimore, who won the Nobel Prize in 1975 for his work in virology and cancer research, stated, “The Engineering Immunity project advocates a new approach to therapy for AIDS and cancer with revolutionary implications for the treatment of these and many other diseases. It is an innovative research project that holds special significance for the future of biomedical sciences.”

In the fight against HIV, the virus that causes AIDS, T-cell immunity and T-cell-focused therapies and vaccines have been methods widely investigated and pursued. However, antibodies often pro-

vide the best protection against viruses and virtually all vaccines for other viral diseases are designed to elicit antibody-based immunity. Antibodies against HIV do appear during HIV infections, but heretofore, they had not been able to provide therapeutic advantage to most patients. Rare neutralizing antibodies have been identified, but have not proven valuable because a general way to elicit their production in all patients has not been found. Moreover, most of them are effective only at very high concentrations that are hard to maintain in a person by conventional means. Thus, early attempts to elicit antibody-based immunity against HIV have largely failed.

The Engineering Immunity integrated methodology involves utilizing retroviruses, which are natural carriers of genes. Retrovirus vectors will be produced that encode antibodies found to be effective against HIV. Utilizing retroviruses, the Baltimore Laboratory at Caltech, in collaboration

with Caltech structural biologist Pamela Bjorkman, will introduce specific genes into stem cells. These genes will encode specificity molecules on the immune cells, thereby arming the immune cells to kill selected agents or cells, i.e., the cells that are growing HIV or particular cancer cells.

The Engineering Immunity initiative will provide a new route to the production of antibodies with therapeutic and even protective, ability for a potential cure of AIDS, melanoma and other diseases ultimately.

The Skirball Foundation, an independent foundation created in 1950 by Jack H. Skirball, is dedicated primarily to medical research and care, educational and social needs of disadvantaged children and advancing the highest values of the Jewish heritage. Among the many institutions that the Foundation has supported are the Skirball Cultural Center, the Salk Institute, the Venice Family Clinic and the Jewish Childcare Association in New York City.



Dr. Hunt and students trek up a sand dune to unload their equipment and prepare for the ride down.

Sand Surfers Study Dune Sound Effects

By MARK WHEELER

PASADENA, Calif. - Sliding down a sand dune on your derriere might at first take seem a bit undignified for a professor from the California Institute of Technology. But for mechanical engineering professor Melany Hunt, it's all in the name of science.

Hunt wants to know why many desert sand dunes give off sound—and a loud, droning sound to boot—whenever the dune avalanches, or a strong wind blows, or a scientist slides down its side. While the phenomenon has been known about for centuries (Hunt has a book, *Tales of Travel*, circa 1923, that mentions Marco Polo knew about it), what causes the sound remains a mystery. Most believe the answer is friction—tiny grains of sand rubbing together. But that's only part of the story, Hunt believes, noting that the sound continues even after the movement has stopped. And further, the sound a sand dune makes in winter differs from the sound it makes in summer.

Intriguing questions, says Hunt and it ties into her research concerning the flow of particulates and granular materials, including the natural environment of both sand and debris flows. Which is why she has spent the last few summers investigating the phenomenon of sand dune sound as a mentor with Caltech's Summer Undergraduate Research Fellowships (SURF) program. (Every summer, the SURF program brings undergraduate students from various schools to Caltech to conduct independent research with faculty members.)

So several times each summer, Hunt, her research colleague, mechanical engineering professor Chris Brennen and her students make the long drive to the Eureka Dunes in Death Valley, California, or the Dumont Dunes nearby, or to the Kelso Dunes near Mojave, CA. Once there, they slog up to the dune's crest line, carting a radar unit, geophones (a type of microphone) and lots of water to combat the common 100-plus degree temperatures.

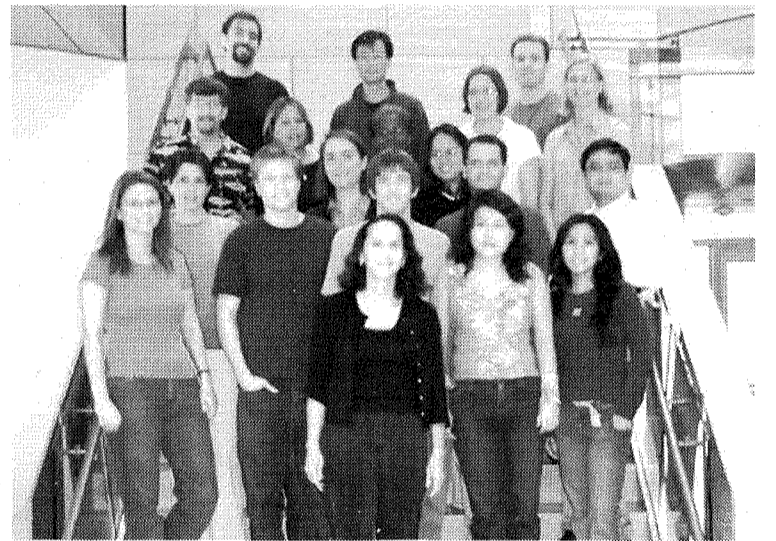
The equipment is being used to confirm Hunt's theory about the loud sound that's generated—she believes it's a resonance effect, much like a string being plucked on a musical instrument. Over a long period of time, whatever rain that falls in this desert environment percolates into the sand dune, eventually forming a band of moisture some two meters (3.3 feet) down. In time this sand hardens, says Hunt, forming a hard, cement-like crust. When the sand on the surface is disturbed, friction between sand grains creates a noise that reverberates, back and forth, between the dry sand on the surface and the wet sand below.

“That may be why smaller dunes don't make sound,” says Hunt, “because they haven't been around long enough to form that hard layer of sand.” The minimum needed is about two meters of thickness, she says. The loudest dunes are the tallest and the steepest, those with a maximum 30-degree angle of repose; that is, the steepest the dune's face can be without collapsing. It's also the reason she believes the sound varies by the season, which effects how much moisture is in the sand.

Hunt and her students dragged the radar to the top of the dune and used it to confirm the existence of the band of wet, hard sand down below. The geophone was used to record the noise as the students slid down the dune.

For a QuickTime movie, complete with sound, of students sliding down a dune, please see the website of Kathy Brantley, one of Hunt's former students, at <http://www.prettypixel.net/Dunes/index.html>.

Courtesy of me.caltech.edu



Courtesy of www.its.caltech.edu/~bjorker

The Bjorkman group will be introducing genes into stem cells to design immune cells to target specific bodily hazards.

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INFORMATIONAL SESSION: Wednesday, November 10, 2004, 3:30 PM, Brennen Conference Room
Refreshments

CAMPUS INTERVIEWS: Thursday, November 11, 2004



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Frozen Pumpkins Strike: Once again, dropping stuff off tall buildings is delivered to campus, Halloween style.



Election Day Tomorrow: Or today if the *Tech* comes out late again. Select your favorite candidate in what will undoubtedly result in a Kerry victory in California.



Grad Student Arsonist to stand trial: Physics graduate student William Cottrell is scheduled to go to trial on November 9 for burning SUVs in the name of saving the environment.

ME72 to be Extended

Continued from Page 1, Column 5

lenge, designing a device to study spinal-injured animals, or automating a test for patients with Parkinson's disease. Having four projects instead of two, Burdick said, provided "a broad spectrum of things, so people could choose something in their area of interest." Richard Murray, department chair of Engineering and Applied Science, agreed that changes were needed. "Curriculum revision is an essential part of keeping the ME program vital and exciting," Murray said.

Another major modification affects the competition that traditionally concludes the course. According to Burdick, human resources are strained in the department this year; former ME72 instructor Eric Antonsson, is on leave at JPL, while Murray, who had helped with the course, now has more responsibilities as department chair.

The competition format is financially demanding as well and the cost of the contest day itself was \$25,000 last year. "With the shortage of people in the department this year," Burdick said, "we weren't able to do that kind of fundraising." Due to these limitations, he explained, there will be no public contest this year.

The decision to alter ME72 and particularly to forgo the contest, has proven controversial among students. Aimee Eddins, an ME major currently enrolled in the class, voiced concern that the loss of publicity would hurt Caltech. During previous competitions held in Beckman, she recalled, "the whole [auditorium] was filled with people; a lot of companies came and a lot of people in the community were really interested. This year, that won't be filled." Curriculum changes were also a concern for Eddins. "If you just add the other components to 72," she said, "you neglect the mechanical aspect" integral to the course.

However, Eddins found updating the material for ME72 in some form necessary. "Having it the way it was, without either adding another class or modifying it somehow, wasn't necessarily providing enough education to

the mech engineers in what they would see once they go out into the real world," she said. The current format of the course, though, she added, could be further improved.

Bing Huo, a junior, said that ME72 was a strong motivating factor in his choice to major in mechanical engineering. In its original format, the course was "probably the best thing that [the department] had, the most publicized and one of the reasons that people respect the ME major," he said.

Although Huo had planned to take the class, the recent alterations have been disappointing. "I've known about the competition for two years and its one of the things that I looked forward to the most," Huo said. Without it, the course is not the same; "I don't think I'm going to take it," he concluded.

Addressing student concerns, Burdick said that he hoped to improve the course in the future. "What we'd like to do," he said, "is to offer a two-quarter course which would extend [ME]72 and still keep the strong mechanical design component" while introducing newer material. Burdick also noted "lots of feedback from students [saying] that they loved the contest atmosphere." The competition will probably be revived when resources are sufficient, he said.

Although there have been rumors on the possible cancellation of the course next year, Burdick said that this was not the department's intent. "Rather than thinking replacing 72, we're hoping to extend 72 and improve and augment it," he said. Murray also said that he had not heard of plans for discontinuing the course.

Student predictions on the fate of ME72 varied. Aimee Eddins anticipated a better future for the course. Could the updated ME72 be both useful and exciting for students? "It definitely is possible," she said. "I really hope that's how it turns out to be." Bing Huo was less optimistic; the positive changes would happen eventually, he said, "but not while I'm here."

Vision, Rotation Sensors Control Complicated Fly Flight Patterns

Continued from Page 1, Column 2

biology and engineering. To conduct much of the research, Dickinson and his group constructed and utilized many devices to help them study the flight of flies.

The high-speed cameras used today record data at 6000 frames per second, compared to most cameras that record at 30 frames per second. To use these cameras, Professor Dickinson and his group initially built a "fly-orama," a one-meter diameter cylinder for flies to fly in. They imaged the flies with infrared light, which the flies do not detect.

Flies tend to fly in straight lines with sharp, almost 90-degree turns that are called saccades. With just a few wing-strokes, the flies are able to complete such a sharp turn, quite an astonishing feat compared to most human-built aircraft, which require a large turning radius.

Professor Dickinson noted that "It looks like flies have an internal clock to make saccades at regular intervals," while showing a diagram tracking a fly's positions over time in the fly-orama. In fact, he noted that the diagram resembles a spirograph picture. However, changing the visual environment of the fly-orama would affect how often saccades were executed, indicating that visual input was important.

Flies have vastly different eyes than our eyes. Most notably, they have about 600 lenses per eye, although the common misconception that a fly sees 600 duplicate items is not true. The fly actually sees a single composite image that's quite blurry. Professor Dickinson compared the images viewed by the flies to a digital camera with 25 by 25 pixel resolution.

Two thirds of the nerve cells are used for image processing, highlighting the importance of visual input. Professor Dickinson emphasized that flies perform saccades away from expansions in the visual input. When an object appears to expand on the right side, the fly turns left and the opposite happens when an object expands from the left.

The group then constructed a "closed-loop" flight simulator which prevents flies from moving their heads. This guarantees that the cameras mounted on top of the fly's head record exactly what the flies can see. The motions of the left and right wings are recorded in real-time and the displayed images change according to these motions. Essentially, the flies "get to play a little video game."

They later noticed that flies tend to fixate on an object. For example, in the simulator, the flies would attempt to fly toward a stripe forever. They then studied this behavior with squares

that would spontaneously expand. As soon as the box grew larger, the buzzing coming from the wings would change to a higher frequency. When the expanding box was on the left or right side, the fly would turn to the opposite direction. When the expansion occurred directly ahead, however, the flies would put forward their "landing gears."

There are two primary groups of muscles. The power muscles are indirectly connected to the nervous system and they are asynchronous. In fact, these power muscles are further divided into downstroke muscles and upstroke muscles. As one of these groups expands, the other contracts, so both groups act in an oscillating pattern. Professor Dickinson noted that these represent the most powerful biological motors on the planet.

The steering muscles are directly controlled by the nervous system. Each firing of these muscles is finely controlled. In contrast, the power muscles are constantly activating in their rhythm, to keep the fly aloft.

The two ways to control direction are changing the frequency and the phases of the strokes. During the transition from the upstroke to downstroke, an impulse is sent from the nervous system. If the impulse is sent earlier than normal, the stroke amplitude is greater and the stroke comes closer to the fly's head.

Professor Dickinson also gave an overview of the aerodynamics that allows these remarkable insects to fly. Since these insects are so small and their wings are not rigid, the forces and motion on them can not be accurately measured. Instead, the group built a larger model, called Robofly.

Robofly contains four sensors per wing to measure the aerodynamic forces. Later, however, the group built a new version, which they labeled Bride of Robofly. The wingtip to wingtip measurement is 60 cm on this model.

The group accurately recorded a fly's motion and its wing sizes as it performed saccades and they were essentially able to replay these motions on Bride of Robofly. Using the sensors on this model, they realized that the upstroke (when the wings are moving backwards) actually generates more lift than the downstroke.

Professor Dickinson explained that there are three ways the flapping wings can generate forces. The first and most important technique is delayed stall, where the fly moves its wings forward at a very steep angle. Most aircraft we use would fall if the wings were built so steeply, but the flies are able to create a pow-

erful vortex that actually lifts the fly up.

The fly also creates some lift by rotating its wings during the recovery phase, when the top of the wing is on bottom and the wings are being pulled backwards. Finally, the flies can extract some energy from the wake created by the motion of the wings.

The group also built a magnetic tether that is loose enough to allow the fly to rotate. They observed that when the fly was permitted to rotate, the fly would stop rotating after 90 degrees. In contrast, when the fly's rotation was prevented, the fly would attempt to rotate for a longer period of time. This indicated that the fly could somehow detect when it should stop rotating.

Professor Dickinson explained that flies are insects, which all previously had four wings. In the fly's case, the hind wings evolved to become halteres, sensors that detect rotating motion. These halteres influence the phase changes that create a counter-force when it is time to stop the turning motion.

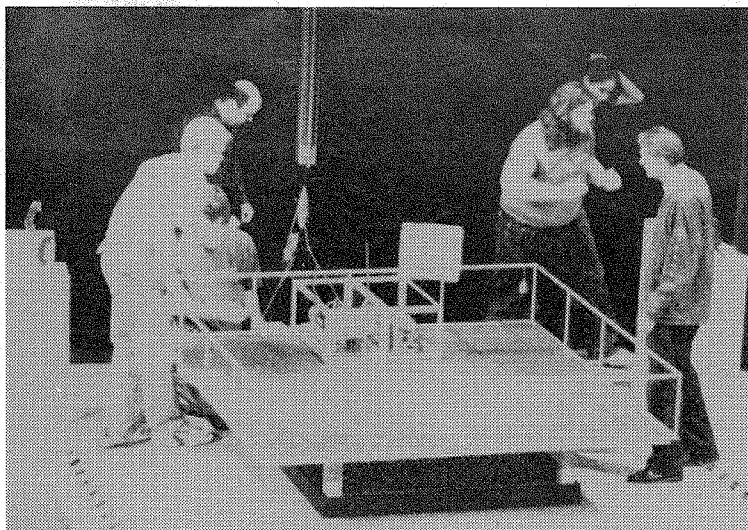
Professor Dickinson noted that it is not certain why halteres don't stop the rotations right away, but a current hypothesis is that visual input also feeds into control the halteres, which then are able to control the wings.

At this point, Professor Dickinson also paid homage to one of his heroes, Ed Lewis, who recently passed away and had previously won a Nobel prize for his work in fly genetics. Ed Lewis caused flies to mutate so that their halteres became wings again, definitively demonstrating the evolutionary hypothesis that the fly's hind wings have lost their movement purposes to become sensors today.

To conclude, Professor Dickinson thanked his many supporters, such as the NSF, DARPA, the Office of Naval Research, the MacArthur foundation and of course, Esther and Abe Zarem, who helped fund Professor Dickinson's current position.

Dickinson also noted his newborn child, on which he commented, "Perhaps I've found an entity I find more complicated than a fly." Of course, Dickinson concluded his presentation with a slide labeled, "Think before you swat!"

The presentation took place October 27, 2004 at Beckman Auditorium as part of the Watson Lecture Series. Readers interested in seeing more details regarding Professor Dickinson and his group's research can look at their website. The next presentation will be on November 10 by Professor Christof Koch, who will be discussing research regarding consciousness and the brain.



The California Tech Archives

Students prepare to face off in the final round of last year's ME72 competition.

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