

CALIFORNIA TECH

California Institute of Technology

Volume LIV

Pasadena, California, Thursday, October 16, 1952

No. 3

Freshmen endure soul washing

Peasants, Peons, and other forms of lowly Frosh come into their own in diverse initiation rites

Peons, Frosh, and other low lives have been baptized and received into the folds of the student houses with the blessings of all upperclassmen. Despite the 5 dollar and up fine rule for water fights inside the houses we have had to wade and swim our way through the alleys to assemble this story, with threatened and real detours into the showers.

Blacker bows

Blacker got after the Frosh last Thursday, issuing distinctive red ties which immediately made the wearers of same the most sought-after-men on campus. Earl "Slavedriver" Jacobs claims that this toughens them against attempted murder by strangulation.

Time to retire

As usual Dabney came out with something new. We are still attempting to locate the hosiery shop where these cute hats came from. One clever peon, an engincer, no doubt, was seen carrying his candle about with a shield so that he could move faster but it was of no avail against the superior upper-classmen. At press time the Darb Frosh are wearing pajamas to classes and meals but it is not required that they wear them to bed.

Eggs away!

Hearing the roll of drums from Dabney on Monday evening we hurried over clutching balloons bursting at the seams and water pails in full anticipation of the fray, only to find everyone standing in a big circle. The object of all this attention was a prostrate frosh, stripped to the waist, lying on old issues of the *California Tech* nonchalantly smoking a cigarette while from above the bombardier straightened his plumb bob and dropped the eggs—three perfect misses. Such an exhibition of mercy was too much. We left.

Rowdy Peasants

Ricketts made their peasants look presentable with new genuine straw sombreros, which for some unknown reason, like everything else in the house, began to pop up in other dining rooms.

6 am serenade

Fleming got into the act noisily again this year at 6:00 am Monday morning when they make the rounds of the other houses with much enthusiasm. Someone without a sense of humor had shut off the water in Blacker and Ricketts, much to the disgust of Building & Grounds and to the delight of Fleming. Foresighted frosh in Blacker and Ricketts were not entirely unprepared as they had stashed away precious liquid to use in the advent of Fleming Frosh.

Wetter water?

There were the customary water battles with the losers being dragged off to the showers by the victors. We narrowly escaped being one of the losers in

Campus Calendar

FRIDAY, OCTOBER 17
EARTHQUAKE demonstration lecture, Dr. Buwalda in 201B
SATURDAY, OCTOBER 18
FOOTBALL vs. Arizona State at Flagstaff
SUNDAY, OCTOBER 19
SCRIPPS Barbecue and Bike Race

Selective service college tests in December and April

Apply now if you haven't taken exam
Deadline: November 1; see draft board

Applications for this year's Selective Service College Qualification Tests are now available at all local draft boards. The tests will be given on December 4, 1952, and on April 23, 1953 at several places in this area including Caltech. The results of this test will be reported to your Selective Service local board for use in considering your deferment as a student.

Apply at once

Eligible students (principally those who have not yet taken this test) who intend to take this test on either date should apply at once to the most convenient local board for an application and a bulletin of information. (The nearest board the envelope provided. (Caltech Raymond in Pasadena.) Following instructions in the bulletin, you should fill out your application and mail it immediately in the envelope provided. (Caltech is Station No. 111.)

November 1 deadline

Applications for the December 4 test must be postmarked no later than midnight, November 1, 1952. According to Educational Testing Service, which prepares and administers the College Qualification Test for the Selective Service System, if you are planning to take the test, it will be greatly to your advantage to file your application at once, regardless of which date you select.

Eligibility requirements

To be eligible to apply to take this test, you must 1) intend to request deferment as a student; 2) be satisfactorily enrolled as a full time student, and 3) not previously have taken the Selective Service College Qualification Test. It is recommended that anyone who expects deferment as a student and who has not previously taken this test take it this year.

190,000 deferred students

Approximately 413,000 students have already taken the test, of which about 190,000 are currently deferred. The present criteria for deferment as an undergraduate

(Continued on Page 3)

Pendulum—last chance

All those undergraduate and graduate students who are interested in contributing literary, art or photographic work of a serious form (for example, short stories, poetry, character sketches, etc.) to the next issue of *Pendulum*, slated for publication early in December, 1952, should contact and/or leave their contributions by next Monday in the house mail box of one of the following men: Walt Lee, Blacker House; Leon Vick-

(Continued on Page 5)

Interview Schedule

WED., October 22 and Thursday, October 23—Shell Development Co. and Shell Oil Company—Research Laboratory. Dr. J. W. Givens and Dr. W. A. Bailey to interview Ph/DCh, ChE candidates, interested in petroleum research. Mr. J. A. Edgar to interview Ph/ME, EE, CE candidates interested in automotive research on fuels and lubricants. Please sign for appointments in Placement Office, 120 Throop Hall.

Attention, Frosh

Freshman section leaders should be elected tomorrow in all Frosh sections. Each leader is requested to report his name to Miss Pond in Dean Strong's office immediately after his election.

SAE features exhibits, talks

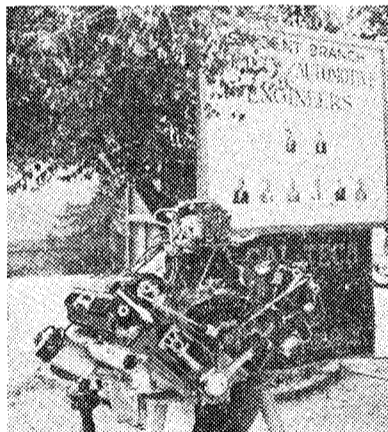
SAE at the California Institute of Technology began the fall term with an automotive exhibit and membership drive. Exhibited were two late model cutaway engines, a jet engine and the duPont road test car. The General Motors Le Sabre was exhibited under the sponsorship of SAE October 2.

Fall schedule

The program for the fall term is as follows:

October 16—Dinner meeting with Southern California section.

October 23—"The Automotive Industry." Talk by Mr. James



Cutaway engine is SAE drive exhibit.

Crawford, retired VP of General Motors and 1945 president of SAE.

October 30—"Fundamentals of Engine Knock." Film by Ethyl Corporation.

November 6—"Boeing Gasoline Turbine Engine." Film and speaker from Boeing.

November 20—"Fuels and Lubricants." Talk by Mr. Stroebe, manager El Segundo Lab of Caltech.

December 4—"Sports Car Design." Talk by Roger Barlow.

Membership rising

SAE has 80 members now and expects 100 before long. Membership is still open and students of all classes and options may join. The fee is \$3.00 which pays also for the SAE monthly publication. One may enroll by contacting the following chairmen:

Bob Gillingham, Dabney; Rolf Hastrup, Blacker; Ed Stoeffel, Off Campus; George Moore, Fleming; Phil Birkeland, Ricketts, and Craig Marks, Graduates.

Glee club

Anyone interested in joining the newly re-organized Caltech glee club is invited to sign up on the sheet in lower Throop.

Y sponsors forum series

The Caltech Y, through the Graduate Luncheon Club, is sponsoring a series of luncheon forums concerned with issues of the coming election.

Today Milton Mayer, who for years was associated with the University of Chicago Round Table and during the past year was visiting professor of social research, Frankfurt University, Germany, will speak on the topic "Europe and the U.S. Elections." Next week, on Wednesday, October 29, Ray Wasser, the pastor of the First Congregational Church in Pasadena, will speak on "Principles and Compromise in Politics." Mr. Wasser is well suited for his talk for he has had a very intimate and active association with political leaders.

Undergrads invited

Although these luncheon forums are primarily for graduate students, faculty and staff, the speaker will not begin until 12:30 so undergraduates can come into the Athenaeum after lunch to hear the talk and question period. During the question period the speaker must answer definite questions and take a definite stand. This procedure helps to keep the platitudes to a minimum.

Mock election

Because Gallup was so very wrong four years ago, the YMCA is wondering whether it can't do better. Therefore in the very near future, the Y will conduct a mock election to see how Caltech rates the candidates.

Houses get dietician

This year, for the first time, the student houses have a dietician to plan their meals. Mrs. G. R. Sorrenti, who came to Caltech in July, is insuring balanced and nutritious meals.

The houses

She was born in Winnipeg, Manitoba, Canada, where she lived until she came to California. She received her BSc in home economics at the University of Manitoba and did graduate work at the University of Toronto in Ontario. Her favorite college subjects other than home ec. were psychology and economics and her favorite sports are tennis and swimming. She enjoys playing the piano, Puccini being her favorite composer.

Her office is located in the basement of the student houses.

Synchrotron sets world speed record

Record electron and X-ray energies, as well as a speed never before attained by man-accelerated matter, have been reached in the synchrotron under construction here at Tech for the past two years.

Operating at 460 m.e.v.

The machine, to be used in penetrating the mysteries of the atomic nucleus, has accelerated electrons to energies of 460 million electron volts in preliminary operation, Professor Robert F. Bacher reported. Dr. Bacher is director of the eight-man Caltech team cooperating on construction of the synchrotron under contract with A.E.C.

Speed gains weight

At this energy level the electrons were more than 900 times heavier than electrons at rest, in accordance with relativity and were traveling only one-tenth of a mile per second (or 60-millionths of one per cent) slower than light.

Powerful X rays made

When a 1/8th inch thick lead plate was put in the path of the electron beam for test purposes, 460 million volt X-rays were created, the most powerful ever produced by man.

Goal—1000 m.e.v.

Next stages of work on the synchrotron will involve raising its output somewhat above 500 million volts and using it for research. Later, its output is to be increased to around one billion volts. Two other high energy electron machines are under construction—a linear accelerator at Stanford University and a non-ferromagnetic synchrotron at the General Electric Co., Schenectady.

Previous highs

The previous high in electron energies was between 325 and 340 million volts produced by synchrotrons at the University of California at Berkeley, Cornell University and Massachusetts Institute of Technology, and the University of Illinois betatron.

Simple theory

In brief, the synchrotron operates as follows: An electron gun shoots bursts of about 100 billion electrons into the instrument at each pulse. The electrons travel clockwise around a roughly circular path, held there by a powerful magnetic field. Each time around, their energy is kicked slightly higher in a radio frequency cavity, until the desired peak is reached.

Research on nuclei

For research, the electron beam will be used to bombard plates of platinum, tungsten or

(Continued on Page 3)

It isn't so easy...

At the beginning of this term we went through what all of us consider an ordeal, registration. We had to fill out 14 or 15 cards and write our names about twice as many times. The programs that we filled out, we copied from pink preregistration cards which we filled out from blackline master copies last term (except for the freshmen). Unless we are taking extra units we had our programs handed to us almost on a silver platter, so that the whole process of making up a schedule took only 20 minutes.

Not so "easy" elsewhere

At many other schools, as a few of us know, the situation is quite different. Students must fill out a program without conflicts by consulting the catalog and the professors' schedules. Then when the whole schedule is arranged, it is found that there is a conflict or that one or more classes are filled up, and the schedule must, at least in part, be made over.

Who does it?

We have the Registrar's office to thank for relieving us of this headache. This spring they placed about 600 undergraduate students in 47 sections, arranged close to 100 classes for those sections, and arranged to have instructors and rooms for all those classes. They had to be sure that they did not have one section in two places at once, one professor in two places at once or one room occupied by two classes at the same time. While they were doing this they were also investigating several hundred prospective freshmen, wondering what the Selective Service System was going to do next and arranging for the graduate students' programs.

The **California Tech**, then, pays tribute to Dean L. W. Jones and the office he directs.

Special newspaper meeting Monday

The news gathering and writing and copy reading departments of the **California Tech** may be changed in the near future so that the work of putting the paper together each week will be split more evenly among the staff members. All the present members of the **Tech** staff, former members who are still interested in the quality of the newspaper, and all other students who are interested in any phase of journalistic activity are requested to come to a special meeting to discuss the proposed changes and to present ideas. The meeting will be held at 11 am next Monday, October 20 in room 206 Dabney.

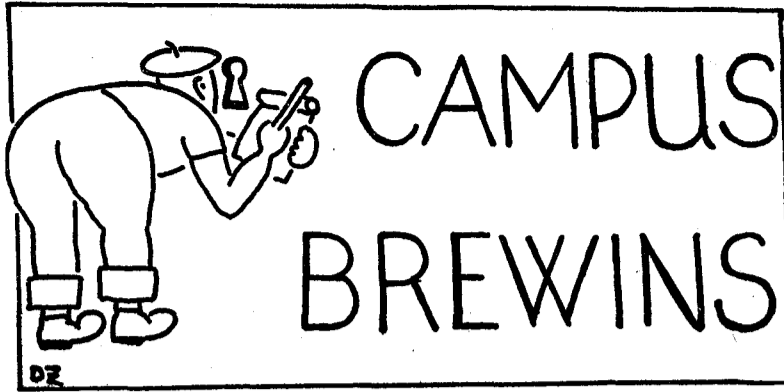
At present there is no feature editor or copy chief. Anyone who thinks that he can handle either job should be there.

HOUSE SOCIAL NEWS

Ricketts

This year the Ricketts Social team of Tyson and Marinkovitch in collaborating with the Fleming Social Committee, got off with a flying start. The result of this was the incident on the Northside of the houses last Saturday night.

This incident completely absorbed the houses involved (plus everyone else that was around), thoroughly divested the institutions of Westridge, South Pasadena, and Mayfield of their queens for the night, and was complete with everything from enjoyable and respectable refreshments to a rather lurid display of grass skirts.



... pump required to operate promiscuously in either direction (i.e. reversible) is . . .

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The following conversation took place in Dabney Hall after the Pomona game, as Bill Gardner approached a female form in the obscurity: "Hello, are you stag?" "No, I'm Mary." Pause. "Oh, well, may I have this dance?" "I'd love to, but my husband will be back in a minute."

Ah, Pomona

The Sailing Club sojourned Pomona-way last Saturday night—got quite corrupted. From what we hear, the affair was a dance with a Hawaiian theme in **everything**: the decorations were islandish and didn't get underfoot, yet were effective; the band was of a variety amazing—played Hawaiian music that actually moved; the entertainment started out with the traditional Hawaiian dance done by performers, but ended up with an amateur's version of the Hula that literally petrified (whenever anyone who saw it is asked about it they assume this state, with a dreamy, vacant expression conveying all that they will communicate about the thing), and nobody will talk about the Punch. Everyone agrees that the dress of the occasion was what made dancing most difficult—it definitely wasn't cumbersome—quite distractingly the other way around—made it unworthwhile to watch where one was going. All in all, sounds like we missed something—judging from the sensation Peyton aroused by invading Little Tony's replete with

typical costume, there are no doubts. —Ah, Well—

Much as the beak loathes the Waiters' Union, it must admit that the first improvement in many years has taken place. This is the importation of Scripps women as occasional extra waiters. Seconds of coffee have increased by a factor of five on the two nights the Flemingites were so blessed.

Landlubber

Naval vet Pitton has laid claim to the title of World's Worst Sailor. After losing the bail can and letting the boat drift on the rocks, he pleaded inexperience and begged buddy George Moore to pilot the boat to the dock. George managed to run over another boat's anchor chain during the process.

Boy chemist

Larry Starr, curious about the inflammability of benzine, boiled some over an open flame in Turkey lab, creating a miniature version of Dante's Inferno. Lunan stood by with the extinguisher. Prof. Lucas later informed Starr that benzine was inflammable.

Backsliding

The Blacker House church suffered a crippling blow this past week. Pope Les Earnest, apparently unmindful of his duties and responsibilities as head of the true church, committed the supreme heresy of attending services elsewhere in Pasadena. In addition, it is rumored that the Pope's foul deed came as a result of the persuasive glances of a woman. Murmurs of reform are being heard.

California Tech

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Caltech band

Will all potential band instrument players please talk to Tom Taussig in Dabney House. The new Caltech band will shortly be outfitted in school colors and parade at football games. New members are urgently needed.

Stained Stefanides spent a harrowing evening last Saturday warding off the amorous attacks of the sweet young things from the Fleming exchange. In a private interview with the Beak, the Baby Faced Killer attributed his popularity to clean living and to the experience he picked up in Juarez over the summer.

Gone to pot

After briefly returning to the fold and winning the coveted Alley Achievement Award, Rolf Hastrup has again wandered into the clutches of a predatory female. Rolf is now faced with the problem of how to get his house pin back so he can give it away again.

(Continued on Page 3)

Everything on campus has gone stark, raving

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Harmony course now given for credit

The Humanity Division offers a non-credit course in harmony and music theory, to which all students, both graduate and undergraduate, are welcome. It is taught by William Kline, the conductor of the Caltech student orchestra, who also teaches music at the East Los Angeles Junior College. Work is on an individual basis, so students of any degree of musical proficiency can be accommodated. The group meets in Dabney Lounge on Tuesday afternoons at four o'clock.

SELECTIVE SERVICE

(Continued from Page 1) ate student are either a satisfactory score (70) on the SS College Qualification Test or specified rank in class (upper half of male freshman class, upper two thirds of male sophomore class, or upper three fourths of male junior class.) However, local boards are widely divergent in their application of these standards to educational deferment, and it must be remembered that educational deferment, his board once a person has received an is not obligated to redefer him.

Occupational deferments
Of those who graduated from college last spring and are now working, only six percent have been deferred because of occupation. However, according to the Office of Education, three fourths of this deferred group majored in science or engineering.

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CAMPUS BREWINS

Bah!
Old man Wilkes, too tired to get any of his own, chaperoned John Goetten's girl to the football game last weekend while the latter was tussling on the Rose Bowl turf. Seeing the gleam in Wilkes' eye, however, Big John hurriedly engaged Kill-Joy Jacobs to go along and keep things honest. Further details are shrouded in secrecy.

Finis
And then there is the story of Mrs. Hale who called Dabney House on the phone and was answered by a Blacker freshman. The eager lad, finding the supply of shower heads exhausted, was probably preparing to remove the phone.

Three can live . . .
The proverbial candle is having both ends singed, again, by one Darb who sent two billet doux by fast carrier to two different Scripps gals in two different halls. Seems he has too much talent for one gal at a time. Two Schmippies may be too much for Dick to handle, but at least we know that he can handle himself.

As cheaply
Tiger Mandl wears that frus-
(Continued on Page 4)

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THE SPACE BEAVER

By WALT LEE

Asf
The December issue of Astounding, on sale Wednesday, November 19, will have as a lead story a yarn by Raymond F. Jones. The issue will also contain an article explaining the theory that a positron is merely an electron going backward in time.

News notes
Isaac Asimov's Gnome Press novel **I, Robot** will appear in a dollar edition this year by Grosset and Dunlap.

Actor's son William Powell Jr. is writing the screen story for **Space Island**, upcoming space-opera from Universal.

Heinlein's film, **Destination Moon** is now available for home showing on 16mm machines.

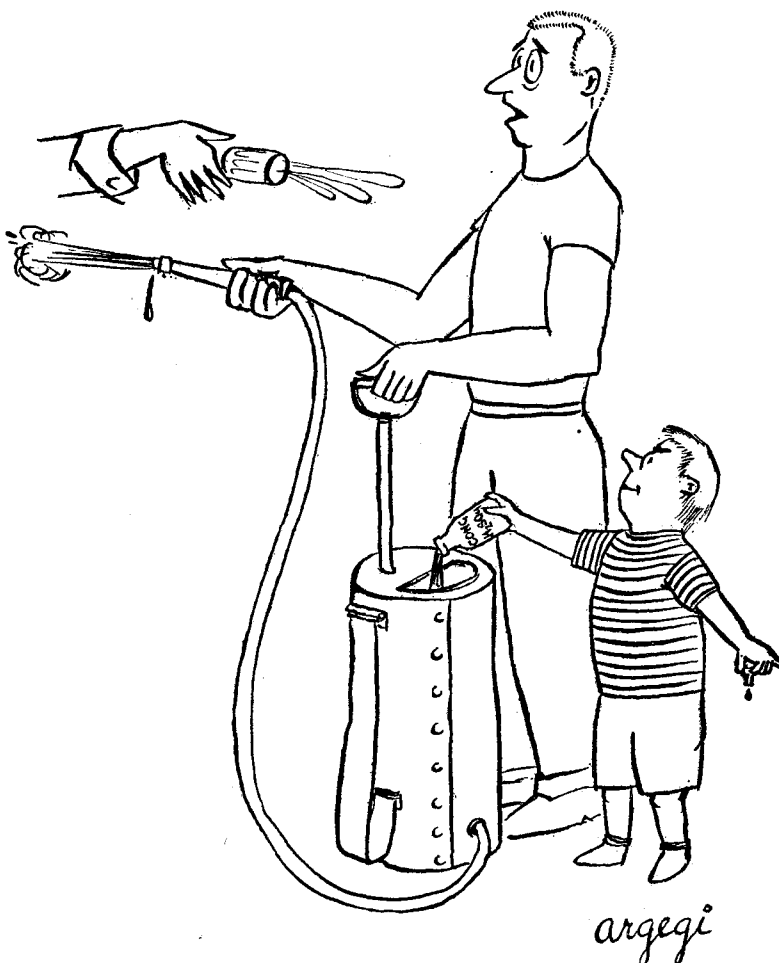
Walter M. Miller Jr., L. Sprague de Camp (CIT alumnus), Poul Anderson, Sam Merwin Jr., and Frank Robinson, have been commissioned by **Shasta** to do original novels, most of which will see print in three or four months.

Also scheduled for fall publication is a fantasy magazine "like the old Unknown." This from Lester del Rey, editor of **Space Science Fiction**.

MOVIES
Willy Ley and Chesley Bonestell's king sized space primer, **The Conquest of Space**, has been purchased by **Paramount** and turned over to George Pal for production. **Paramount** has also bought **Turmoil** from Lester del Rey.

Columbia started work on the **Atom Outpost** June 3.

The Twonky by Lewis Padgett is essentially ready for release. Arch Obler filmed it in 17 days—edited for 3 months. It was originally scheduled as part of a three story movie, but it eventually stole the whole show.



SYNCHROTRON

(Continued from Page 1)

other heavy metals and thus produce X-rays. These X-rays, in turn, will be used to bombard various materials for experiments on atomic nuclei, the "cores" of atoms where most of their weight and energy are concentrated. The research will be aimed at a better understanding of the structure of these cores and the tremendous forces that keep their constituent protons and neutrons locked together.

These are some of the greatest unknowns in physics today.

Find cosmic rays?
In particular, Dr. Bacher said
(Continued on Page 4)

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CAMPUS BREWINS

(Continued from Page 3)

trated look since Saturday night, but when he offered to display his query, he lowered his sights on Jay Kimmel's ginch. Things went well during the last dance, when he offered to display his summer muscles, she covered her shocked look by retreating hastily with Jay.

Too tall

Leney and Glasel would each have given their left eye-ball for a pair of Adler elevator hooves. Hugh could, at least, look into his girl's eyes, but the only gal short enough for Glasel was already being entertained, in no small manner, by Schulze.

Banged up

The Sunday beach outing provided many memorable incidents for the men of Dabney. When

froshes King and Pixton arrived with the firewood they found that the party had resorted to bottled warmth to escape the fate of a freezing death. After exploring the dubious comforts of rocky caves and sandy waists the couples journeyed their aching backs homeward. The sad note sounded when Billings and Arneson returned to Tech with their gomobiles crudely modified by holiday traffic. Schulze had his date quaking in fear when he was stopped by the local Gestapo on suspicion of driving a stolen car, and being under age—with-out shoes, yet.

FROSH ENDURE

(Continued from Page 1)

the fracas.

In Blacker the get-wet-faster theme went to the ultimate when the pledgemasters had the peons running in and out of the Monday evening meal with buckets of water in order to fill up a large trash can so one of the

frosh could jump off from a plank into it.

— or consequences

To the unlucky frosh who lost their distinctive apparel went "humorous" assignments ranging from persuading PCC girls to eat at the student houses to measuring the cubic capacity of the razor blade disposal boxes in the house medicine cabinets, and woe to the Frosh who did not complete his assignment!

Into the fold

Within the houses initiation has served to unite the frosh within the house, and made them known to all the upper classmen. Through the brawls, animosities have undoubtedly developed between individuals, but we hope this will pass in consideration of the heat of the moment.

SYNCHROTRON

(Continued from Page 3)

we will try to find out what particles are created when nuclei are bombarded with very high energy X-rays. These may include a number of particles produced by cosmic radiation, which streams into earth from space. Which particles the synchrotron will be able to produce, beyond the relatively pi meson, is completely an open question, he added.

One interesting research project will be an attempt to determine what physicists call the photo-meson cross-section for hydrogen—or the probability of meson production from hydrogen by energetic X-rays. The nucleus of ordinary hydrogen is known to consist of just one proton, which has long been considered a fundamental particle in nature. But mesons weighing about one-tenth as much as a proton can be produced by bombarding such nuclei, and a further study at higher energy promises to be illuminating in understanding the proton and its structure, Dr. Bacher said. The photo-meson cross-section for deuterons, or double-weight hydrogen nuclei, will also be studied.

500 m.e.v. for year

The synchrotron will operate at the 500-million volt level for

perhaps a year or two while major efforts are put into physical experiments at this stage. At the same time they will be conducting tests to determine what changes will be needed in their pioneering instrument to take it beyond 500 million volts toward their ultimate goal of one billion volts.

The machine is built in the shape of a race track whose outside diameter is 36 feet. The 140-ton electromagnet which keeps the high speed electrons in their orbit as they are accelerated to ever higher speeds is divided into four quadrants. Each quadrant contains 18 roughly rectangular segments weighing almost two tons apiece surrounding a one-by-three foot vacuum chamber.

The quadrants are separated by five-foot straight sections. In three of these are attachments for pumping system that maintains an almost perfect vacuum in the chamber through which the electrons travel. In the fourth straight section is a radio frequency cavity.

Electrons are shot into the synchrotron by an external electron gun driven by a high voltage pulse transformer. They pass through an accelerating tube immersed in oil and are injected into the vacuum chamber (at one of the pump sections) with an energy of about one million volts. Their velocity then is roughly 175,000 miles a second, or about 94 per cent that of light.

The electrons move clockwise around the synchrotron. Each time they reach the radio frequency cavity they get a 250-volt boost in energy. In one-fourth of a second they will have traveled some 46,000 miles—almost twice around the earth—to reach an energy of one-half billion volts.

Flywheel turns up!

At these speeds a powerful magnetic field which increases as their speed increases must be used to keep the electrons from flying out of their orbit. Power for the electromagnet which does this job is supplied by a 7,500 kilowatt motor-generator. As each burst of electrons is shot into the synchrotron the magnetic field is produced by a current which rises steadily from zero to 3,000 amperes in one-quarter second, then decays again to zero as the current flows back through mercury arc rectifiers. These convert electrical energy to mechanical energy

(Continued on Page 6)

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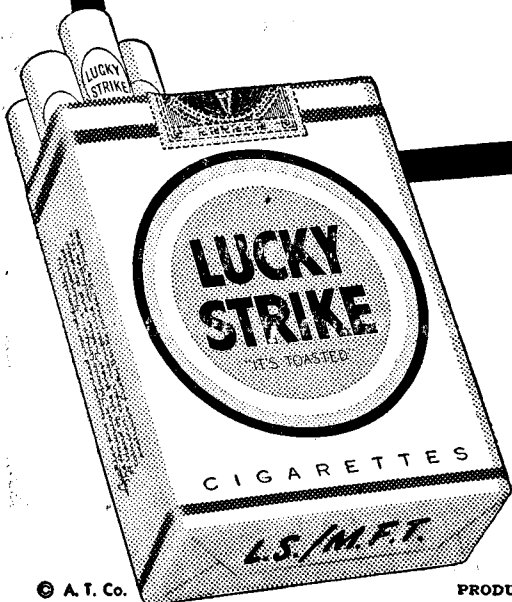
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Athlete of the week

By NICK

Pat Fazio

To run a T-formation football team, a good ball-handling quarterback is a necessity. Filling the bill for the Beavers this year is Pat Fazio, two-year veteran and a letter winner last year.

Mighty mite

Fazio is the smallest man on the team at 140 pounds, 5 feet 6 inches, the oldest at a ripe 24, and probably the fastest. Pat has spent his time well, though; he's married, has a baby, and served some time for Uncle Sam.

Key man

Coach LaBrucherie's biggest problem in switching over to a T this year was finding a quarterback who could handle the ball well, pass, and run. He came up with Pat, who's done a pretty good job for a newcomer to the difficult T.

Glue-fingered

Handling the ball on every offensive play except punts, the quarterback has to be sure-handed, fast moving player, or he's doomed. Pat filled the bill on the fast-moving part; he's been a dash man on the track team. And he proved to be an able ball-handler, while his passing is improving steadily. Filling Babe Karasawa's shoes is no easy task, but Pat's working on it.



Gehle goes over for TD

Footballers display power and fight

**Lose to Pomona, 19-14
Flagstaff next for eager Beavers**

Caltech's Beavers showed a lot of spirit and drive in their second game of the season against Pomona last Saturday night at the Rose Bowl. Although dealt their second loss of the season the Beavers gave Pomona's Sagehens all they could take, ending the game much stronger than the Sagehens in this, their first contest of the season. The score, 19-14, indicates the closeness of the game which was not settled until the gun had been fired.

The Sagehen's offense was confined to two long passes which set up scores, and a long run from scrimmage for a touchdown. Tech scored on a long pass at the end of the first half, and closed the scoring with a long drive in the fourth quarter. Numerous other times the Beavers clicked in mid-field, but stalled when they approached the Pomona goal, once being stopped on the 1-yard line.

Statistics

The Beavers showed again that they were the superior team in everything but the final score, as for the second straight week they outdowned and outgained their opponents. The final count in first downs was 15-10, while the yardage gained both by passing and running was in Tech's favor by large amounts. Pomona scored first in the first quarter of the game, after receiving a Tech fumble on the 48. A 21-yard pass set up the touchdown, as Schmidt of Pomona went over from the 1-yard line. Wedel of Pomona sent the Sagehens out in front 12-0 with a 63-yard dash off tackle soon after the Beavers had been stopped on the Pomona 18. The Beavers scored just before the half ended as Eric Ward was sent into the game and completed a 37-yard pass to Neil Stefanides, who incidentally played another outstanding offensive and defensive game.

Pomona scores

Pomona shot ahead, 19-7, soon after the second half began, culminating an 86-yard drive, which was helped by a 15-yard roughing the kicker penalty, with Bob Bury plunging over for what proved to be the winning touchdown.

Gehle scores

Tech monopolized the rest of the game, barely missing a touchdown on the Hens' 2-yard line after a 60-yard drive. The Beavers finally hit pay dirt, however, recovering a fumble on the Pomona 32 and driving for a touchdown with Ed Gehle finally scoring on a two-yard plunge on fourth down. Gehle converted after this one as he did the previous one to make it 19-14. The Sagehens stalled the last two minutes and the Beavers couldn't get the ball again before the gun sounded.

Flagstaff next

The Beavers showed again that they have potentially a very good football team, and when they start making some breaks they will win some games. This weekend they journey to Flagstaff to take on Arizona State, a team Tech defeated last year by 28-14. Flagstaff ran up a large

score in trouncing LaVerne last week, and indications are that the Beavers will face a much improved team over that of last year.

Up to strength

The Beavers are ripe for a win, though, and Arizona State may be in for a battle this Saturday night. Pat Fazio and Jack Walker, who played very well against Pomona despite the fact that both had the flu will be in shape for the game, as will Hugh Taylor, who missed last week's game because of illness.

Starters: Henderson, Muelberger, McDonald, Pilant, Menetray, Tallman, Stefanides, Fazio, Walker, Johnson Gehle.

Statistics

	Pomona	Caltech
First Downs	10	15
Running	5	10
Passing	2	2
Penalties	3	3
Yards Gained Rush	144	185
Yards lost	35	19
Net Gain Rushing	109	166
Yards Gained Pass.	72	70
Total net yards gain	181	181
Passes Attempted	3	17
Passes completed	2	5
Average length		
punts	38	44
Fumbles lost	4	2

Frosh spark Tech practice

Indications of a great Frosh harrier team were shown last Friday. The first two Techmen to finish in a practice meet with Pasadena Nazarene were Frosh, both of whom won high school letters in the sport. Yet another Yearling took a fifth. The relatively poor showing of the varsity may be accounted for by the fact that three key men could not be there that day.

Interhouse Friday

The first Interhouse meet of 1½ miles will be held tomorrow. Right now it looks like Dabney is the class with Blacker close behind. The Darbs sport two good Frosh plus a few old but game upperclassmen. Blacker is led by Van Walkley, while Ricketts counters with Parker and Birkland.

Oxy next

The varsity took a severe blow with the apparent loss of letterman Ames, however Van Walkley and Marshall are improving rapidly and should fill the gap. The first conference meet comes October 31 when Tech takes on the ever-powerful Oxy on their home course.

PENDULUM

(Continued from Page 1)

man, Dabney House; Mike Boughton, Fleming House; George Johnston, Ricketts House. For off campus and Throop Club please address Pendulum, Box V, Lower Throop. The deadline for contributions for the December issue is Monday, October 20.

Coming attractions

- Thursday: **I. H. Baseball**, Fleming vs. Throop. Dabney vs. Blacker.
- Friday: **I. H. Cross Country**, 1½ miles.
- Saturday, **Varsity Football**, at Flagstaff. **Frosh Football**, Oxy, here 2:00. (Let's get out & cheer)
- Tuesday, **J. H. Cross Country**, 2 miles
- I. H. Baseball**, Ricketts vs. Fleming, Blacker vs. Throop.

Special Notice: Only 8 more weeks till the athletic banquet. Save now, buy later. Buy on the easy installment plan. Save 25¢ per week. No down payment required!

Pigskin Prognostications

GAME	Mr. Musselman	Boris Taylor	John Wall	George Patraw
UCLA Stanford	Stanford 6	UCLA 7	UCLA 11	UCLA 18
Purdue Notre Dame	Notre Dame 1	Purdue 3	Purdue 14	Purdue 9
SC Oregon St.	SC 13	SC 6	SC 20	SC 28
Ohio St. Wash. St.	Ohio State 14	Ohio State 12	Ohio State 14	Ohio State 15

Over the wall

By John Wall

The running was great, the passing was great, and the tackling was great; but the score was awful. That sums up the Pomona-Tech game last week.

The Beaver gridders showed great strength in their running attack with little Pat Fazio at the helm, and Walker, Johnson, and Gehle doing the bucking. The showing of Ed Gehle at full back was a pleasant surprise to me for although it was not record breaking, it looked tremendously improved over the Redlands game. If this trend continues, big Ed may yet fill the big

shoes of graduated great Hal Woody. Also a special award of merit goes to Big Ed for his fine extra-point work.

The heavy work as always fell to the line. Despite the loss of the "Terror of Tech" Hugh Taylor, the offensive line performed nobly in opening the holes for the backs.

The biggest lack was still a passing attack. Ward hit a few good ones, but his ball handling is still strictly small time.

* * *

For those who would get wet, there is news. The swimming pool is just over the pile of steel headed this way (we hope). We can hope to see the pit dug sometime this spring (sorry class of '53).

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Benioff will build linear strain seismograph for secular strains

To show deformations of one part in 100 million

A sensitive instrument designed to measure long-term strains in the earth's crust which produce earthquakes will soon be installed in a mountain tunnel by the Seismological Laboratory here at Tech. It is known as a secular linear strain seismograph.

100 feet of fused quartz

The new meter will consist of a 100-foot length of two-inch fused quartz tubing rigidly fastened to a pier sunk in the rock. It will be held up by a number of flexible supports. Mounted on another pier at the free end of the tube will be specially designed electronic apparatus to measure displacement of that end with respect to the pier.

This will be the first attempt anywhere at precise measurement of large-scale strain patterns of the earth's crust, said Dr. Beno Gutenberg, Director of the Laboratory.

Earthquake forecasting?

The installation will be experimental, to determine whether such slowly developed distortions can be measured in this way. If they can, the foundations of the science of seismology will be strengthened. And at some distant date—perhaps centuries hence—these measurements combined with much more of the same sort of intensive study as the laboratory has launched on the 1952 Kern County, California, quakes may bring seismologists within reach of one of their elusive goals: earthquake forecasting. This day, however, appears to be far in the future as man measures time. It is just barely visible on the remote horizon and it is the linear strain seismograph which brings it to view.

Grant from GSA

Dr. Hugo Benioff, Caltech professor of seismology, has been awarded a \$10,200 grant by the Geological Society of America for development and construction of the new instrument. He has already assembled a number of its component parts and expects to begin construction at the mountain site this fall.

With the sensitive fused quartz strain meter Dr. Benioff hopes to be able to observe strains of the order of one part in 100 million. This would correspond roughly to a one-1000th inch compression in two miles of rock—or a one inch squeeze between the U.S. east and west coasts.

For long-term strains

The meter will be installed in an abandoned tunnel in the San Gabriel Mountains near the Big Dalton Reservoir, about five miles northeast of Glendora, through the cooperation of the Los Angeles County Flood Control District. The tunnel was bored more than 100 feet into the granite mountainside to determine the nature of the rock structure to which the Big Dalton dam was to be attached.

The instrument will be used primarily to record and measure

secular (i.e., long-term) strains in the earth's crust. Such strains—unlike the short-duration ones created during earthquakes—may take years or centuries to develop.

Long gradual buildup

Secular strains, for instance, have been building up along the northern portion of the great San Andreas Fault since the 1906 San Francisco quake and along the southern portion since the Fort Tejon quake of 1857. (The latter produced damage for at least 100 miles to the northwest and southeast of the town of Gorman.) It is these strains, which have been accumulating for nearly 50 years on the northern San Andreas and for almost a century on its southern portion, that lead Caltech seismologists to expect the great rift to slip again some day in the indeterminate future.

Squeeze or stretch

Secular strains accumulate when the two faces of a fault, a dynamic fracture in the earth's crust, lock along the fault line. When enough strain energy is stored in the crustal rocks so that the resulting force breaks the obstruction, a vast, abrupt movement of rock masses occurs—in one direction on one side of the fault and in the opposite direction on the other.

So far no instruments have been set up elsewhere to measure secular strains. The Benioff linear strain meter is intended to provide precise information on the amount of squeezing or stretching over a wide area. Its location near Glendora will be about 25 miles from the San Andreas Fault.

Eventual network

Dr. Benioff hopes that if the tests are successful he eventually will be able to establish a network of such meters throughout central and southern California. Recordings from the network would make it possible to get an overall picture of the strain pattern and its development in the area.

Seismologists then may determine the source of the basic stresses causing earthquake-producing strains. They would still not be able to predict when or where an earthquake may occur, Dr. Benioff emphasized, although they would move a step closer to that distant possibility. When they have enough data to determine the amount of strain in a particular area and sufficient earthquake history to know at what strain level the fault slips, he said, it may be possible to estimate roughly when a quake can be expected. This, however, will require many decades of study, and perhaps centuries.

Earth tides

The new instrument also will be used to measure tidal strains of the earth produced by the gravitational attraction of the sun and moon. These bodies cause a slow hobbling or ground swell, just as they cause ocean tides. The period of the swell, like that of the tides, is about

twelve hours. In other words, the earth's crust is pulled slightly out of shape, reaches its maximum distortion and returns to its original position over a period of one-half day.

Geophysicists have been able to determine tidal movements of the solid crust—finding, for instance, that the earth pulsates about eight inches at the equator—but not tidal strains. These are the squeeze and stretch which produce such movements. Knowledge of the amount of tidal strain will give geologists a better idea of the structure and rigidity of the earth.

Long period waves

A third purpose of the linear strain meter is to measure and record long-period seismic waves beyond the range possible with existing instruments. Such waves are generated by large earthquakes. An early Benioff strain seismograph recorded long waves from the 1933 Japanese quake with a period of three to four minutes and later registered some with a seven minute period from the 1950 Assam quake. Longer period waves may exist but cannot be recorded with existing instruments.

Structure down 600 miles

Waves of these periods provide information about the nature of the faulting at the epicenter and may indicate the duration of the processes at the source as well as the extent of faulting. They also may reveal facts about the structure of the earth's mantle down to 600 miles or more below the surface.

The new instrument will be a modification of existing ones at the Caltech Seismological Laboratory in Pasadena and at a Caltech auxiliary station on Palomar Mountain. These latter are designed to measure only shorter-term squeezing and stretching of the earth's crust observed during earthquakes and their aftershocks.

Away from disturbance

The tunnel site will remove the new strain from human disturbance. A person standing on the floor of the Laboratory squashes the granite bed below enough to record on the instrument there. Furthermore the secular linear strain instrument must be well protected from temperature change. The secular instrument to be built near Glendora will be made of fused quartz, a material which responds less to temperature variation than the steel used in earlier models at the Laboratory. Dr. Benioff chose the tunnel location because he hopes its temperature will vary less than one degree throughout the year.

No rest for seismologist

The Kern shock of July 21 launched Caltech seismologists on their greatest emergency hunt for earthquake data since the Seismological Laboratory was founded more than a quarter century ago. In an atmosphere of natural but almost constant interruptions from the press and public for days and weeks, theirs has been the most extensive bit of earthquake detective work in this country, if not in the world. This pursuit had long been planned, to take

effect in the event of a major quake. It was directed from the laboratory by Dr. Gutenberg.

Immediate start

A Seismological field party under Dr. Richter was on the road two hours and odd minutes after the first shock. It was but the first of many to go out from the Laboratory, and Dr. John P. Buzwalda and other geologists seeking surface evidence of the quake were enroute from Caltech not long after.

The geological teams covered hundreds of square miles in their search for earth cracks, crustal distortions and other manifestations of the great upheaval. The seismologists recorded aftershocks with portable equipment at half a dozen locations over a period of weeks. In addition, seismograms from a dozen Caltech auxiliary stations in Southern California augment the Pasadena and field records.

Epicenter near Wheeler Ridge

Preliminary conclusions from the concerted seismological-geological survey include:

(1) Epicenter of the initial shock was near Wheeler Ridge at the south end of the San Joaquin Valley and west of U.S. Highway 99, according to Dr. Gutenberg. Rock rupture started about ten miles below the surface. It traveled northeastward under the valley to pass east of Arvin along the White Wolf Fault (sometimes called the Bear Mountain Fault) on the west front of Bear Mountain, then past Bealville and Caliente. Epicenters of the various aftershocks were scattered through a 600-square mile area.

No simple fault scarp

(2) Hidden slippage of perhaps 10 to 15 feet on the rocky incline of the fault tore the earth in the obscure deeps of its crust. What happened there was not exactly what happened at the surface. Lurching of different huge masses of ground produced long zones of multiple surface cracks and long ridges such as the one east of Arvin that looks like a road embankment. Nowhere does there appear to be a clear simple fault trace like that of 1906 when the temblor broke the surface with a continuous offset of fences and roads.

(3) The new surface features are the latest contributions of invisible unrest which has been changing the face of the earth along the White Wolf Fault for perhaps the last million years. Altogether the crust has probably been offset vertically a total of some ten thousand feet, perhaps a few feet at a time, since the movement began. For the gray granite rock exposed at an elevation of 6,895 feet near the top of Bear Mountain forms the "basement" several thousand feet below the sediments on the floor of the San Joaquin Valley in this area.

SYNCHROTRON

(Continued from Page 4)

which is stored in a large motor-driven flywheel until the process is repeated—at the rate of about 70 times a minute.

When the radio frequency cavity is turned off at peak magnetic field the electrons leave their orbit and strike the target.

The electron synchrotron principle was first developed by Dr. E. M. McMillan, a Caltech alumnus, now of the University of California at Berkeley. The Caltech instrument is a modified version of the "race track" type first suggested by another Caltech alumnus, Dr. H. R. Crane of

Wise building

This earthquake taught the same old lesson that structures designed for quake resistance suffered little or no damage. Many weakly constructed brick and concrete-block fronts, walls or buildings fared badly. Properly designed structures built of sound materials stood unharmed, indicating that earthquake safety in California is simply a matter of building wisely.

17 separate stations

The Laboratory so far has had time only to skim the cream from its voluminous records of this earthquake. These include perhaps the world's most comprehensive, concentrated recording of aftershocks. For one 36-hour period the Laboratory bracketed the earthquake-active area of the Tehachapi and southern Sierra Nevada Mountains with a cordon of temporary seismographic stations to get sets of records from 17 separate locations (including the permanent auxiliary network). From them the seismologists will derive data on the structure of the earth's crust and the location of active faults in that area as well as the speed of seismic waves and the depth of earthquake origins.

More after-shocks

The question of how long after-shock activity will continue is frequently asked. For the answer, until the new linear strain seismograph and other developments put seismology on a more quantitative basis, scientists must look backward. They can judge only by past experience, now confirmed by Dr. Benioff's method of plotting a curve of after-shock strain relief.

Shocks down to magnitude 4 centering in the Arvin-Tehapi area are usually noticeable in the Los Angeles area. Shocks of this size may be expected to continue at the rate of one or two daily for several months. Minor shocks that can be felt only near their epicenters may continue for two or three years. A stronger than usual shock can be expected occasionally, and an after-shock of magnitude 6 may well occur within a year. But the intervals between such shocks will be longer and longer.

The damage caused by a shock, however, depends not only on the magnitude but also on the distance from the epicenter. The magnitude 6 quake which damaged Bakersfield on August 22 liberated only one-100th the energy of the major shock a month earlier. But because the center was only a few miles from town, Bakersfield was far more severely jolted.

There is now no reason to expect another shock on the same fault larger than the main shock. It is impossible to tell, however, whether or when there might be slippage on some other fault which will cause another major California quake.

the University of Michigan.

Material from U.C.

Construction of the machine was speeded up by the fact that Caltech secured the vacuum pumping system and iron for the magnet from the University of California. They had been used for a pilot model of the six-billion volt proton accelerator now under construction at Berkeley.

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