The Beam Line

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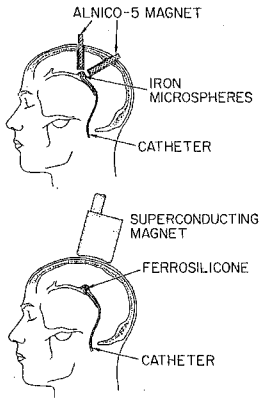
SLAC—Built Superconducting Magnet used in "Knifeless" Surgery

SLAC's Low Temperature Materials Group, headed by Dr. Steve St. Lorant, in collaboration with Dr. R.W. Rand of the UCLA Medical School, has designed and built a superconducting magnet system which has been used successfully in at least three surgical procedures at the UCLA Medical Center.

The magnet has been used to help destroy malignant and non-malignant tumors and promises to be useful in the treatment of brain aneurysms. In the former case, the magnet serves to allow a suspension of iron and silicone (ferrosilicone) to become rubbery (vulcanize) and choke off the blood supply to tumors with independent blood supplies, thus causing them to necrose or atrophy. In the case of brain aneurysms (a weakening of vascular cell walls which can lead to often-fatal cerebral hemorrhage), the hardened ferrosilicone, held in place during vulcanization by the superconducting magnet, forms a permanent plug to strengthen the cell walls and prevent hemorrhage.

A bit of the history of the collaboration should serve to make the technique and its applications more understandable.

A number of years ago, SLAC's Werner Schulz, himself an expert in microsurgical techniques, introduced Dr. Rand to Dr. H. Brechna, then head of SLAC's Magnetic Research Group. After some correspondence, Dr. Brechna agreed to design and construct a magnet to modify the then-existing technique of dealing with brain aneurysms.



Old and new techniques for treating brain aneurysms. Above, iron microspheres thrombose tissue while held in place by magnets inserted surgically. Below, ferrosilicone is held in place by the SLAC-built superconducting magnet.

The older technique, illustrated by the drawing, was to drill three-eighths-inch holes in the patient's skull in the vicinity of the weakened vessel, insert Alnico-5 permanent magnets into the holes and then inject, via catheter, a colloidal suspension of iron microspheres into the vessel. The magnet held the spheres near the weakened vessel walls. The iron would "thrombose" the tissue, that is, produce a local blood clot which would plug the weakened wall permanently. The magnets would then be removed.

There are two main disadvantages to this technique. First, who wants to have holes drilled in his/her head? Secondly, the patient must be kept absolutely still for 36 to 72 hours after the surgery, in intensive care, while the thrombosing action occurs; a painful and expensive period.

The external superconducting magnet would solve the first problem, but not the second. The magnet would have to be superconducting, since this would allow stronger fields with a smaller magnet and at lower cost.

So, Dr. Brechna contracted with Dr. Rand via the University and the AEC and drew up some specifications for the magnet. Dr. St. Lorant took over on Dr. Brechna's departure.

Steve St. Lorant (left) and Ed Tillman at UCLA prior to an operation. The six-inch-diameter magnet is facing us in this picture; its liquid helium supply is directly behind Tillman.

The second problem mentioned above, the 36-72 hours of intensive care, was solved by Dr. Rand when a plastic surgeon with whom he was acquainted suggested replacing the colloidal suspension with vulcanizable silicone mixed with the iron microspheres. This ferrosilicone vulcanizes in a mere 20 minutes, and is very similar to the RTV (room temperature vulcanizing) silicone in use at SLAC.

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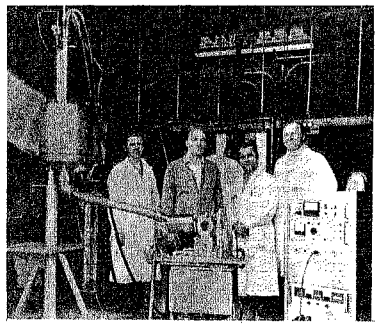
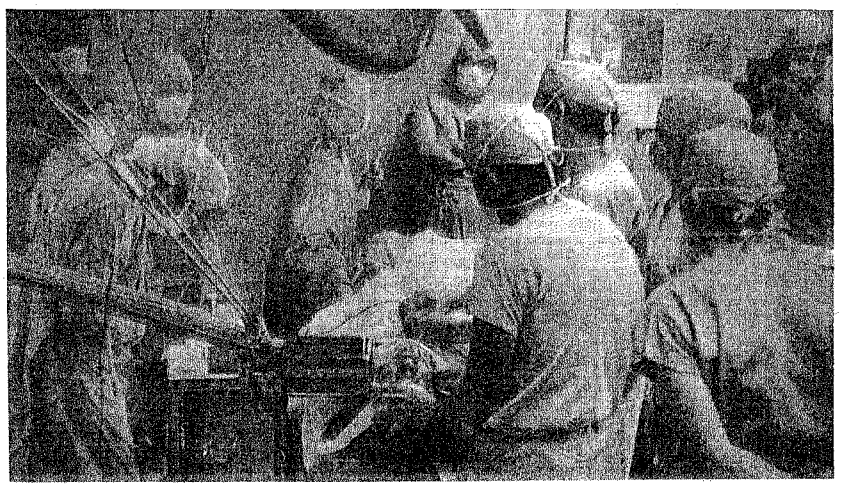


Part of the LTMR Group and the superconducting magnet system. From left to right, Walter Kapica, Ed Tillman, Ed Gruenfeld, and Armin Wolff. The magnet is directly above Tillman's right hand; its helium storage tank is at the left.



The picture was taken during the first clinical trial of the magnet-silicone technique for a malignant tumor of the tongue. The superconducting magnet can be seen next to the patient's left cheek.

"Time Dilation" Sequence Filmed Here

Encyclopaedia Britannica filming crew in the Klystron Gallery. From the left, Paul Deason, John Millerburg, Joan Churchill, and Kent Smith. Ms. Churchill is squatting on a wheel chair, a standard filming prop, prior to being wheeled down the gallery for a special effects shot.

The topic of time dilation in Einstein's special theory of relativity brought a four-person filming crew from Encyclopedia Britannica Films to SLAC on Thursday, May 17.

The crew, headed by director Kent Smith, included Joan Churchill (camerawoman), John Millerburg (Joan's assistant), and Paul Deason (sound).

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"Rules for Moonlighters"

Hanging on by your financial claws? Or are you thinking of getting a second job outside SLAC (or maybe have one already)?

Whatever the case, whenever you decide to take on that second job, think back in your photographic memory to the time when you signed all those papers after you were hired here at SLAC. Remember the clause which says " -- report to the Director all consultant or other comparable employment prior to entering into such employment?" That clause is still in effect.

The following is a memo from Dr. Panofsky issued to all SLAC employees (in June 1967) stating SLAC's policy concerning the appearance of conflict of interests.

"1. The activities of the Stanford Linear Accelerator Center are presently being conducted under the terms of two contracts with the Atomic Energy Commission, the terms of which include certain policies concerning employee outside activities which might give the appearance of a conflict of interest. Stanford requires that SLAC employees:

A. neither give gratuities to Commission employees nor accept gratuities from individuals or organizations with which SLAC is, or intends to do business,

B. not use information which is acquired in connection with their employment by SLAC for their own personal gain or for any other improper use,

C. not accept employment outside of their official hours of duty (or while on vacation) which will interfere with their work for SLAC or appear to create a conflict of interest,

D. not participate in, or influence decisions of SLAC where there is a personal interest of the employee involved. As used herein the term "personal interest" includes having an an employment relationship or a significant financial interest in (i) an organization with which SLAC may do business, or (ii) a competitor of such an organization. Questions concerning this policy should be referred to the Staff Counsel.

E. report to the Director all consultant or other comparable employment prior to entering into such employment, (emphasis added) and

F. agree that they will not perform consultant work for another Commission cost-type contractor or for any organization in the atomic energy field except with the Director's approval.

"2. In order to insure adherence to the policies mentioned above it is necessary that each employee report all consulting or other comparable employment to SLAC. Further, each employee must sign an agreement stating that he will not accept consulting or other comparable employment with (1) another AEC cost-type contractor, or (2) any organization in the atomic energy field without the prior approval of the Director or his designee. Where there appears to be a conflict with the above policies the employee may be asked to refuse the offer. For the purpose of this policy, the phrase "comparable employment" shall be interpreted as any employment in which the individual's duties include professional advice and/or services requiring a special knowledge or experience.

"3. If any employee has a question concerning this statement of policy or interpretation thereof, the matter should be brought to the attention of the Staff Counsel for information and, if necessary, to the Director or his designee for decision. Unless an individual employee reports that he has an outside activity or interest which may be inconsistent with the above policy, it shall be assumed that he is complying with the policy as stated.

"Time Dilation"

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Time dilation, the relativistic effect whereby clocks in different frames of reference don't appear to move at the same rate, is easily illustrated at SLAC. This is the example used in the film: an experimenter wishes to study the interactions between 15 GeV pi mesons and protons using SLAC's 82-inch bubble chamber. The pi mesons, which have a "lifetime" of only 26 billionths of a second, are expected to travel about 400 feet from the target where they are produced in the switchyard into the chamber. But it would appear that this would be impossible, since using the formula distance = speed times time, using the speed of light for the speed of the meson (a good approximation), and 26 billionths of a second for the time, the distance would only be 27 feet, a far cry from 400.

The problem is we're using the wrong value for time in the formula. Although the pi meson "thinks" it lives 26 billionths of a second, we, being in a different reference frame see the pi meson's internal clock as running slower, in fact 107 times slower for a 15 GeV pion. Thus the mean distance a 15 GeV pi meson will travel before decaying (if unimpeded) is more like 2700 feet.

The crew did some shooting in the 82-inch chamber building, at another point in the Research Yard, and in the Klystron Gallery.

Jim Ferrie of the Bubble Chamber Operations Group acted as technical consultant for the shots of the chamber and PIO's Steve Kociol coordinated the visit and did some on-camera speaking.

When the movie is released late this summer, showings will be held at SLAC.

Job Openings at SLAC

Physical Science and Engineering Technician II
Under general supervision performs work in electronics such as install, terminate and check-out multiconductor and coaxial cable; fabricate, assemble, and wire electronic chassis, panels and distribution frames. Day shift. $730-$932. No. 6117.

Mathematician
Scientific oriented programmer to work with physicists, engineers and other programmers in designing, writing and maintaining an operating system; applicant must be familiar with the following systems: PDP-11 IBM 1800, System 7, 360/91, 370/168; proficiency in machine and assembly language, and competence in FORTRAN. Day shift. Salary - open. No. 5902.

Physical Science and Engineering Technician I
Assist in assembly of ultra-high-vacuum components, pumps, valves, gauges, pumping devices; testing of UHV components; assist in preparing ultra-high-vacuum chambers for pumpdown and bakeout and installation into the SPEAR ring; provide leak-detection service and maintenance of machines associated with aforementioned equipment. Salary - $630-$804. No. 7756.

PS&E Technician II
Under general supervision, perform work in electronics such as: mechanical fabrication, assembly and wiring of electronics chassis; trimming, drilling and loading of printed circuit boards; printed circuit board layout; assembling coaxial and multi-conductor cables and installation of interconnecting wiring on the Accelerator. Day shift. Salary - $730-$932.

Storekeeper I
Applicant will make physical inventory of all government property, using prepared forms, recording property identification number, will make specialized searches for individual missing property items. Participate in physical inventory actions involving General Stores, Metal Stores, Accelerator Spares, etc. Perform other routine activities in office administration. Must be able to perform above duties with minimum supervision. Day shift. Salary - $544-$696. No. 7248.

In addition to the above positions available at SLAC, a complete listing of open positions on the Stanford campus and the Stanford Hospital are posted outside of the Employee Relations Office, Room 238, A&E Building, and in the Employee's Canteen in the Research Yard.

Contact the Employee Relations Office (phone extension 2355) if you are interested in any of these positions.

"Knifeless" Surgery

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Meanwhile, it occurred to Dr. Rand that the superconducting magnet-ferrosilicone technique might be useful in treating those tumors (either cancerous or not) which are fed by an independent blood supply (or blood supplies). As mentioned above, the vulcanized ferrosilicone cuts off the blood supply to the tumor, causing it to necrose.

Dr. St. Lorant and his "cold power" group (Steven Curtiss, Joel Fritsche, Ed Gruenfeld, Walter Kapica, Ed Tillman, and Armin Wolff) surmounted a number of technical difficulties in building the device and making it work.

The first clinical trial occurred at UCLA in August, 1972. A man who was dying of lung cancer also had a malignant tumor of the tongue and lower mouth. Since the tumor made talking and eating quite difficult, the patient agreed to try the superconducting magnet-ferrosilicone technique. It worked beautifully. Dr. St. Lorant, who was present during the operation, said that within one-half hour after the ferro-silicone had solidified, the tumorous part of the tongue began to atrophy. Four days after the procedure, most of what was left of the tumor was snipped off. Three weeks after this, the remainder just fell off. The man lived for seven months after the initial operation, with no evidence of local recurrence; meanwhile he was able to eat and was much more comfortable in general.

In February, 1973, a brain aneurysm operation was performed. While the old technique of inserting magnets was used, ferrosilicone was used rather than iron microspheres. The patient went back to work on April 2.

On March 26 a woman with a tumor of the adrenal gland was operated on using the new technique. The woman had undergone two previous surgeries which were unsuccessful since the tumor surrounded the femoral artery, a major blood supply, and could not be completely removed. This tumor was fed by three blood supplies, so three ferrosilicone injections were employed along with the SLAC-built superconducting magnet. At last report, the patient was doing well, although it was not yet possible to ascertain if the tumor had been completely destroyed. An advantage of using the superconducting magnet here was that, unlike the previous operations, no blood loss resulted. This was very important since the patient had extremely high blood pressure.

The next day a 70-year-old woman, who declined conventional surgery for a type of brain tumor called a meningioma, was given the superconducting magnet-ferrosilicone treatment. Tests taken recently showed that the tumor's blood supply had been completely obliterated.

The magnet itself - a one-of-a-kind item - is about six inches in diameter, produces 10,000 gauss at its surface and can produce up to 2,000 gauss at a tissue depth of 10 centimeters. It is made of a niobium-tin compound and is cylindrical in shape.

When we asked Dr. St. Lorant what other uses he might envision for the magnet, he reeled off quite a list: removal of mastoid tumors (unsightly tumors which often appear behind the ear and are difficult to remove because of their copious blood supply); destruction of tumors of the kidney, thyroid, lung, and liver; and an improved, simplified way of doing splenectomies (spleen removals).

The system can, he said, be miniaturized, and this entire project illustrates the way in which the "hard" sciences can help the medical profession.

Layoff TASK FORCE Report No.4

The current figures for placement of SLAC employees since layoff notices were given are as follows:

There are 7 employees who have dropped out of the job market. Of those employed, 17 have been placed at SLAC, 5 at Stanford University, and 26 have taken positions elsewhere. Currently, only 18 SLAC people remain unemployed out of the original number of 73 employees given notices.

Medical Department CALL BACK

The SLAC Medical Department (ext. 2281) no longer has a secretary during the morning, so if you call and there's no answer (the only nurse on duty may be out of the office for a couple of minutes), please call back in a few minutes. In emergencies, call 2313.

STANFORD Alpine Chalet

From June 16 through July 26, Stanford faculty and staff members and their immediate families are invited to enjoy the recreational facilities and luxurious accommodations of the Stanford Alpine Chalet at Alpine Meadows at a 15% discount off all regular rates (daily, weekly, weekends). These special get-acquainted rates include lodging at the beautiful Swiss-style chalet -- 3 1/2 hours from the Bay Area and 10 minutes from Lake Tahoe -- and three excellent home-cooked meals a day. The Chalet is operated by the Stanford Alumni Association and has a capacity of 36: 10 luxury rooms with twin beds, private baths and balconies and 4 dormitory-style rooms with 4 twin beds and private baths. In the heart of spectacular high Sierra scenery replete with hiking trails, the Chalet boasts a new swimming pool and two professional tennis courts. Chalet guests may take advantage of excellent trout fishing in the Truckee River, or just float down it on a rubber raft. Back at the Chalet they can refine their ping-pong, badminton, or horseshoe techniques. For youngsters the Wilderness Experience program offered at Alpine Meadows has courses in backpacking, natural science, rock climbing, and mountaineering. Nearby stables provide horses for riding. Finally, there are the beaches and the night life of Lake Tahoe North Shore to enjoy. Stanford Alpine Chalet brochures are available at Bowman Alumni House. Call Peter Voll, extension 8-2026 for more information. For rates and reservations call Stanford Alpine Chalet at (916) 583-4625.

Letter to the Editor

Mack Dillard, SLAC Crafts Shop employee, recently won his grievance and will be reclassified from Maintenance I to Maintenance III with back pay to July 1971.

The Dillard decision is a landmark in Affirmative Action Programs and opens the way for further probing into a badly implemented policy.

It is also significant because it shows the difference between individual bargaining (Mack has been asking for more pay for 8 years) and collective action, as Mack's case was supported by a USE representative.

Glenda Jones
Library

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