

John Jones Surgical Society NEWSLETTER

Alumni News of the NewYork-Presbyterian Hospital/Columbia Department of Surgery



The “Penelope Project” A Review of Progress

Michael R. Treat MD

Introduction

Alan Kay, an American computer scientist and visionary has been often quoted for saying "The best way to predict the future is to invent it".

We would like to add to that, "The best way to invent the future is to build it."

The purpose of this article is to describe the amazing progress that we have had in building the future. The "Penelope Project" had its inception four years ago. The Penelope Project is about designing and building a new type of surgical robot, one that functions autonomously and intelligently, aided by a sense of vision and voice recognition. Current surgical robots, such as the "da Vinci" (Intuitive Surgical, Inc.) robot used in cardiac, urologic and other minimally invasive surgical procedures, function as direct extensions of the surgeon's physical and visual abilities. The Penelope type of robot is different- it functions as a co-worker acting in concert with the operating room staff.

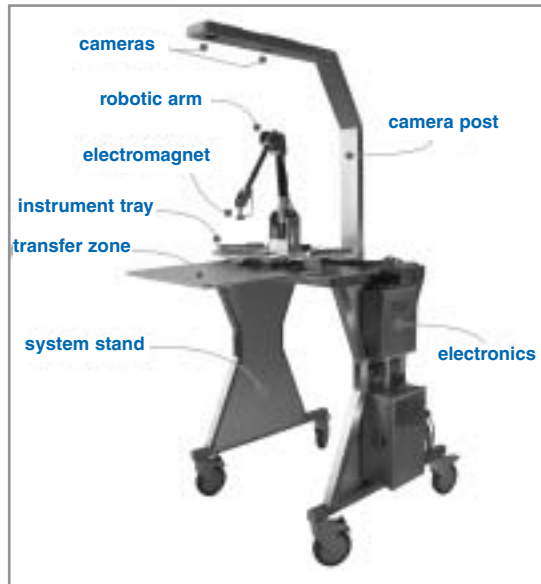
The project was the brainchild of Michael R. Treat MD, [1981 graduate of the surgical residency program] who assembled a brilliant team of computer programmers and engineers to build a series of increasingly capable prototypes, leading up to the clinical-grade machine which performed in its first surgical case on June 16, 2005 at the Allen Pavilion.

This machine is part of the transformation of the operating room. It represents the closer union of information processing technology with the day-to-day activities of people on the "sharp end of the stick", the surgeons and operating room staff who work together to help our patients.

Supporters of this project over the past four years have included: The Telemedicine and Advanced Technology Research Center of the United States Army (TATRC), The National Institutes of Health, The National Science Foundation, The Defense Advanced Research Projects Agency (DARPA), The NewYork-Presbyterian Hospital, The Department of Surgery of Columbia University

Clinical Grade Robot

The development of the machine has culminated so far in what we call the "clinical grade robot", which is a machine that is capable of performing in the operating room.



(ABOVE) Penelope 3.0 Alpha

Basic Functions of the Penelope Surgical Instrument Server

The Penelope™ Surgical Instrument Server (SIS) is the world's first autonomous, machine-vision guided, robotic surgical assistant. "She" is a co-worker or helper for the operating room staff. Penelope uses voice recognition to respond to the surgeon's verbal request for any of the variety of instruments required during a surgical procedure. Drawing from an assortment of instruments that she manages on an instrument tray, Penelope hands the instrument to the surgeon with a robotic arm. Using a visual capability, the robot then locates any instrument that the surgeon has finished using and returns it to the instrument tray. She can also count and document instruments and other items used in the surgical operation.

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Newsletter Information

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at bottom right of website.**

Second Annual

John Jones Surgical Society Day

at

NewYork-Presbyterian Hospital/Columbia

May 6-7, 2005

David W. Kinne, M.D.

The meeting began on a festive note, with a cocktail party and dinner which was very well attended at the Terrace in the Sky in Butler Hall, 400 West 119th Street, on Friday, May 6, 2005. After dinner, Sherman Bull, MD, presented Conquering Everest which he did successfully with a team including his son, Brad, in 2001. In three prior attempts, he reached the south summit (100 meters below the peak) twice, only to be turned back by bad weather or injury. In his 1998 attempt, he fell 600 feet, breaking multiple bones and suffering DVT during his recovery, which took a year.

Illustrated with slides, he showed many frozen bodies. Interestingly, most deaths occur on the way down - perhaps climbers are not as careful as on ascent, and may be euphoric at their success. The physiologic demands are significant - the body requires 6000 calories per day, which is impossible - weight loss is unavoidable. Many foods freeze and chewing is hard work. Sherman found that M & M's were a good foodstuff. During the question and answer session, possible applications of this foolproof weight loss program at sea level were explored, to no avail.

Saturday morning, after breakfast in the Faculty Club, Drs. Kenneth Forde and Eric Rose offered welcoming remarks. The members were taken on tours, led by residents, of the laboratories on P & S 17, the transplant clinic and the new Children's Hospital of New York. Then, wet clinics were offered in the Milstein Operating Rooms: Dr. Memhet Oz performing AVR/GABG and Dr. James McKinsey an Angiogram and Peripheral Atherectomy.

After lunch in the Faculty Club, Dr. Eric Rose presented the Department of Surgery: A Five Year Perspective, which outlined the accomplishments and expanded new programs of the Department. Then the afternoon ended with scientific presentations given by many faculty members, moderated by Dr. Henry Spotnitz. These highlighted recent developments and future directions in many surgical fields. Following a question and answer session, the meeting was adjourned.



Whipple Surgical Society of P&S

Brent Y. Kimball P&S Class of 2007

This year the number of categorical surgical



Allen O. Whipple

applicants skyrocketed! In 2005 only four P&S students applied to general surgery residencies, in 2006 that number jumped to 21. The efforts of the Whipple Surgical Society coupled with commitment and support from the Department of Surgery has ignited new interest in surgery

among P&S students. More and more students are requesting, and at times even demanding exposure to surgery early in their medical education. The General Surgery Residency Program Director, Dr. Mark A. Hardy commented that "growth in surgery applicants this year is astounding, especially when compared to the dwindling interest in the recent past."

When a student witnesses first hand the role of a surgeon, application of cutting edge technology, and the doctor patient relationship forged through surgical intervention, a seed of idealism is planted. The Whipple Society of P&S has attempted to fuel the fire of surgery optimism by creating new programs for students to explore their budding curiosity towards surgery. The kidney and liver organ procurement program led by Dr. Benjamin Samstein continues to receive strong interest with approximately 40 students attending harvests during the last year. Because of this demand we have recently extended the program to include heart and lung procurement and transplantation as well. Chris Reverte a second year student who has led numerous students on organ harvests commented that "the hands-on experience quickly reminds students why they are in medical school. It is refreshing to step out of the classroom and into the OR to catch a glimpse of what the future may hold." We have also organized workshops for first and second year students to learn the most basic of all surgical skills, suturing. During the spring of '06 second year students will receive for the first time, hands-on laparoscopy instruction from Dr. Warren D. Widmann, Associate Program Director of the Surgical Residency Program. In coordination with Doris Leddy, Chair of the Surgical Education Committee, we now have a new program called "Spend a day with a Surgeon." Faculty from every specialty have opened their offices and OR's to students interested to experience, "a day in the life." This program is now available for students interested in a particular surgical specialty.

This year the number of general surgery applicants was split 50/50 between men and women. Through

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Where are They Now?

Eric Liu, MD, Resident, Department of Surgery



Alfred Jaretzki III

Dr. Alfred Jaretzki III started his surgical residency at Presbyterian Hospital in 1944. After an interruption for military service, he completed his chief residency in 1954 and followed up with specialty training in chest surgery at both Presbyterian and Lenox Hill hospitals. As a resident, he did research with Drs. Voorhees and Blakemore and co-authored the Vinyon-N report of 1952. He continued his association with Columbia University,

initially on the staff of the Mary Imogene Bassett Hospital in Cooperstown, NY and thereafter at Presbyterian Hospitals in New York City. As a leader in the field of surgical therapy for myasthenia gravis, he has multiple publications on thymectomy, led the Myasthenia Gravis Task Force that published Recommendations for Clinical Research, and is a co-investigator on an NIH grant (awarded at age 85). With Drs. Herter and Forde, he recently co-authored, *A Proud Heritage: An Informal History of Surgery at Columbia*.

What major choices did you make to shape your career?

I have always felt that one of the attributes of being in the field of medicine, is that it is like being in school one's entire life. One is constantly searching for "truths" and constantly learning. Furthermore, I believe the Columbia Department of Surgery from the days of Whipple, Humphreys, Reemtsma and now Rose, has always been and remains an exciting place to work. In spite of the many changes and difficulties that now exist, if I had to select a career today I would still pick surgery.

My own goals were to have considerable patient contact and deal in some fashion with the health and physiology of the entire patient. I never wanted to become too specialized. However, the field of surgery has changed significantly in recent years perhaps making my choices and career somewhat obsolete. There have been many impressive advances that both require and have benefited from specialization. My only concern is that one's focus may become so limited that there will be in effect a return to the days of the barber surgeons that existed prior to John Jones.

What are your recommendations for a young academic surgeon, focus on one disease/procedure and be extremely good at a few operations, or continue to be broad and more general?

I do not know what is most "marketable" these days. I hope, however, that the young surgeon will select a field that will remain of compelling interest to him/her for many years, regardless of its hype. I think it is a mistake to reach too early for the "brass ring" (do they still have "brass rings" on carousel rides?); I have seen disasters from such "brass ring" choices.

I continue to believe that a young academic surgeon should first get comprehensive training in general surgery. A broad base makes a better specialist and in any case one cannot predict the direction medicine will take, which could make a limited chosen specialty obsolete. If at some

point working in a specialty is compelling, do so. However, at the beginning, I do not think one should select or limit oneself to an operative procedure or disease. Although it's more glamorous to become exceedingly proficient in one area, I suggest that this should not be an early choice. To subspecialize too early I believe is too limiting, prevents the necessary subsequent "growth" that is always necessary, and may even prove boring over the years.

Subspecialization may and probably will occur later, both in an unanticipated fashion and for unanticipated reasons. Having grown up in the Humphreys' era I liked being a generalist, which initially included general, vascular, and thoracic surgery. However, as time went on, my personal needs were more satisfied with a specialty and I therefore first stopped vascular surgery and later stopped general surgery. However, having done a considerable amount of abdominal surgery, thyroid surgery, and vascular surgery including aortic resections (I performed the first aortic resections performed at both the Lenox Hill and the Bassett Hospitals), I believe I was better prepared for my chest surgical career.

Subspecialization for me came even later. I was a general thoracic surgeon for the last 30 years of my career. Although my involvement in thymectomy for myasthenia gravis has been very rewarding and has given me an international reputation, it came toward the end of my career. Furthermore, although I had the full support of my Chairman and good friend Keith Reemtsma, my entrance into the field of myasthenia gravis was actually the result of many other factors, including my general surgical experience.

Of course, the direct answer to your question is that each young surgeon must make decisions that satisfy his/her own medical and personal needs and the present Attendings are in a much better position than I to give specific advice.

Since payment for private practice is decreasing, do you think there's more opportunity for the academic center to attract young talent?

This is a complicated issue that is influenced by many events that have occurred since my retirement; accordingly, I am not really qualified to answer it. Although to me academia is far more interesting, at this time there appears to be a tremendous squeeze on academic physicians. They are now required to be involved in patient care, resident teaching, close resident supervision, research, and the need to support themselves, all with the addition of a marked increase in overhead. This places extensive pressures on the academic surgeon that I didn't face and I think would actually hurt the recruitment and maintenance of an academic status. Accordingly, as I believe is emphasized by Dr. Rose, there has become a great need for an increase in financial support for both junior and senior faculty through various means including charitable grants.

I hope these comments from the 20th century will prove somewhat helpful, or at least interesting, to the aspiring surgeon in the 21st century. ■

**SAVE
THE
DATES**

*Third Annual
John Jones Surgical Society Day
New York-Presbyterian/Columbia Campus
Friday, May 19, 2006*

**2006 ACS Reception
October 10, 2006 - Chicago, IL**

*For more information & reservations contact Trisha
at 212.305.2735 or Email: tjh2104@columbia.edu*

American College of Surgeons Clinical Congress - San Francisco 2005

John Jones Surgical Society (Columbia Presbyterian)

Kenneth A. Forde, MD

On Tuesday October 18th 2005, members of the John Jones Surgical Society held a lively reunion at the Annual Clinical Congress of the American College of Surgeons in San Francisco. The reception was held in the Westin St. Francis with 87 in attendance. It was gratifying to see recent graduates sharing their experiences with faculty, some of whom were past teachers. It also provided a wonderful opportunity for alumni to catch up with the Chairman, Dr. Rose and meet some alumni with whom we had lost contact. The combination of delicious food and animated conversation made for another successful alumni event.

Mark your calendars, next year's reception will be held in Chicago, Tuesday, October 10th. See you there.



(ABOVE) Dr. Kenneth Forde, President of the JJSS and Dr. Eric Rose Chairman, Department of Surgery



(ABOVE) Dr. John Connolly and his wife Ginny with Dr. James Chandler (right)



(ABOVE) Department of Surgery faculty member Dr. Daniel Davis (center) with former graduates of the program Drs. Sherman Bull (left) and Arthur Lee Jr. (right)



(LEFT) Department of Surgery faculty member Dr. Tracey Arnell (right) meets with from left, Drs. Teresa Kim (Senior Resident), Aku Ude (recent graduate), Patricia Sylla (Chief Resident) and James Lee (recent graduate)

Meeting old friends at the John Jones Surgical Society Reception at the 91st American College of Surgeons Clinical Congress, at the Westin St. Francis, San Francisco, Monday October 18th.



(ABOVE) Dr. Kenneth Forde (right) seen here with alumnus Dr. Karen Horvath, her husband Fred and their daughter Kathryn



Dr. Sheldon Levin with his wife Dolores



Dr. Roger Cohen



(ABOVE) From left, Dr. Michael Hirsh, Dr. Robert Szarnicki and his wife Mary

(BELOW) JJSS Alumni Dr. Marilyn Butler (left) and Dr. Steven Libutti with his wife Mary



(LEFT) From left, Dr. Donald Syracuse and his wife Dolores and Dr. Henry Spotnitz

Continued from "The Penelope Project" page 1



One of the things that makes this robot so different from other surgical robots is that the overall behavior of Penelope is controlled by its software "cognitive architecture". This is artificial intelligence software that enables the robot to respond in a clinically appropriate manner to the changing environment within the OR. The cognitive architecture also gives the robot the ability to recognize errors both human and robotic, and then respond with corrective action. A request to delivery an instrument will generate assertions commanding the motor system to do the appropriate things (such as pick up the instrument), but will also cause the firing of a rule that will set up a goal stack for that delivery action. If the sensors (i.e. the vision system) report to the cognitive architecture that the instrument is unexpectedly no longer in the gripper, this will trigger the firing of rule which essentially states "If the instrument is no longer in the gripper when it should be in the gripper, then go and look for it." This type of goal seeking means that the robot will be quite relentless in trying to carry out intended actions.

Another feature of the software is the "prediction engine". This is software construct that creates a database about a surgeon's individual preferences. The prediction engine uses statistical techniques to anticipate the surgeon's requests for instruments. The system has the ability to build upon its ongoing experience to continually learn and improve.

The machine-vision system is the other unique feature of this robot. The machine-vision capability of the robot automatically identifies and counts surgical instruments

Machine-vision has become a standard technique for industrial process control. In addition to identifying and counting, machine-vision is also used to inspect for minute physical flaws. We are the first to apply it in the operating room. Machine-vision is the only solution to the problem of counting all of the items used in a typical surgery. In addition to instruments, very small items such as surgical sutures and small orthopedic screws can be identified and counted. Work is being done to develop methods that enable machine-vision to be applied to surgical sponges.

(ABOVE) Penelope responds to a verbal request for an instrument, delivers that instrument to the surgeon, and retrieves the instrument when the surgeon is finished with it.

Evolution of Penelope

The robot was conceived and built from the ground up, entirely through the efforts of the talented team of Robotic Surgical Tech, Inc. Beginning with a cardboard mock-up, the work progressed steadily and more refined and complete versions of the machine were built. This work involved writing original computer software for the machine-vision, artificial intelligence and motion-control systems of the robot, and designing and building all of the mechanical components including the robotic arm itself.

This machine was meant to embody all of the features that would be necessary to perform in the surgical operating room. The basic concepts of having a mechanical arm and an overhead machine-vision camera were retained from previous versions, but the overall physical layout was completely new. The layout was carefully designed to handle the number of instruments needed to support a general surgical case, and included special instrument trays which could be detached for sterilization. It also featured a "vertical back tray", which was intended to hold additional instruments. This machine performed in a mock-operation in an operating room at the Milstein Hospital, as part of the John Jones Surgical Society Day, in May 2004.

Letter to the Editor:

re: Nathan Lane, MD

It was my good fortune as a second year medical student and later as a surgical resident to have spent quality time in the Department of Surgical Pathology and some of it under Dr. Nathan Lane's tutelage. I was also lucky as an Attending Surgeon to benefit from his wise consultation and advice until his retirement. Dr. Marboe's tribute to Dr. Nathan Lane in the Spring 2005 issue of the Newsletter prompted me to share a recollection of my own. Nat had a wonderful, even mischievous sense of humor.

He and I (from my endoscopic and colorectal surgical practice) reviewed many slides in consultation concerning colonic polyps removed and thought, by less experienced pathologists, to be malignant with major surgical resection recommended. To Dr. Lane, it was clear that the pedestrian pathologist, seeing adenomatous glands with some atypia in the substance of the polyp, assumed invasive cancer was present but, on closer inspection, it was his interpretation that the surface portion of the polyp had broken off and had become entrapped in the head and stalk of the polyp, a clue being the inflammatory reaction around a nest of atypical but not frankly malignant cells. He would say "we cannot just write back and label this a benign polyp. Let's call it pseudocarcinomatous entrapment with siderogenous desmoplasia. They will then be impressed with our consultation". And so we did!

Kenneth A. Forde, M.D.

Department of Surgery ■

Continued from "The Whipple Society" page 2

activities like the recent Women in Surgery conference we have added confidence, strength, and gender equality in this medical specialty. Second year student Beth Hochman commented that, "It is great to know that there are many extremely successful and very happy women in surgery here at Columbia, and that there is nothing holding me back from pursuing my own career in surgery."

With an unbelievable amount of support from the Department of Surgery we hope to carve a pathway for these activities to eventually be built into our academic curriculum. Dr. Eric Rose, Chief of Surgery, reminded us that Columbia College of Physicians and 'Surgeons' is the only medical school with "Surgery" built into its name. With this in mind, the Whipple Surgical Society of P&S is committed to foster the surge of interest in surgery, and to continue the P&S tradition of creating tomorrow's leaders in surgery. ■

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Research Committee Report 2005

Henry M. Spotnitz, MD

The fourteenth Annual Surgery Resident's Research Competition was held in Alumni Auditorium May 26th, 2005. There were eleven, seven minute, presentations and six, one minute/poster presentations. Fourteen members of the Research Committee and Leadership group scored the presentations. There was a large turnout of residents, faculty, and students. Dr. Henry M. Spotnitz thanked all who participated. The prizewinning papers were:

Prize Winners (Score) Research

1st

Allan W Tulloch, B.A. (2.046)
STRO-1 Positive Human Mesenchymal Stem Cells Delivered in a Fibrin Scaffold Enhance Myocardial Neovascularization and Cardiogenesis after Acute Ischemia.

2nd

Jae-O Bae, M.D. (2.154)
Upregulating PIGF and Follistatin Suppresses Activin Signaling and Rescues Neuroblastoma Angiogenesis During VEGF Blockade.

3rd

Joey C. Papa, M.D. (2.158)
Vascular Recovery During Sustained Anti-Angiogenesis is Mediated By Microenvironmental Sequestration of VEGF.

4th

Avraham Belizon M.D. (2.267)
Surgical Trauma Induces Proteolysis Of Insulin Like Growth Factor Binding Protein -3 (IGFBP-3) In Transgenic Mice, and is Associated with a Rapid Increase in Serum Levels of Matrix Metaloproteinase-9 (MMP-9).

START-UP GRANTS

The Research Committee awarded 20 Start-up Grants to 16 Residents working with Attendings. Grants ranged from \$1,000.00 - \$5,900.00 with a total of more than \$100,000 awarded. We thank all participants for their hard work and creative ideas. We hope to learn the results of these investigations during the Residents' Research Competition May 25th, 2006.

BLAKERMORE PRIZE AND AWARDS - MAY 2005

Blakermore Prize and Awards were awarded to the following residents: Prize (\$1,000) for best 5 year body of research: David Rabkin, M.D. Award 1 (\$250, 1 year of research): Patricia Sylla, M.D. Award 2 (\$250, 1 year of research): James Lee, M.D. Award 3 (\$250, 1 year of research): Olakunle Oluwole, M.D.

Thanks to all of our developing surgical scientists.

Henry M. Spotnitz, MD
Vice-Chair, Research and Information Systems
Director, Cardiovascular Surgery Research Laboratory

Contributions to the Resident Research Fund

should be payable to **Columbia University,
Department of Surgery** with "Resident Research
Fund" written in the Memo

Mail to: Kenneth A. Forde, M.D.
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contact William J. Horan at 212-304-7203 or
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National Recognition

The National Museum of Health and Medicine is a branch of the Armed Forces Institute of Pathology and is located in Washington DC on the campus of the Walter Reed Army Medical Center. The Museum announced in May, 2005, the opening of its newest exhibition — "Penelope: The World's First Autonomous, Vision-guided, Intelligent, Robotic Surgical Instrument Server."

(LEFT) Exhibit of Penelope at the National Museum of Health and Medicine in Washington, DC.

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Scene from the operating room of the Allen Pavilion of NewYork-Presbyterian Hospital, June 16, 2005

Historical First Case

Penelope performed recently in her first real case in the operating room. That case was the removal of a small benign tumor (lipoma) from the forearm of a woman. The operation was performed by Spencer E. Amory MD, the Director of Surgery at the Allen Pavilion, and longtime supporter of this project. Allen Pavilion OR nurses were involved, including Circulating Nurse Doreen Taliaferro and Scrub Nurse Dilcea Burgos-McCallum. The robot handed instruments to Dr. Amory as requested and returned them when they were not being used anymore. This was a truly historic event, marking the first time an autonomous, machine-vision guided machine "scrubbed in" to a live surgical operation.

This article is respectfully dedicated to Dr. Kenneth A. Forde, without whose vision, support and love this work would never have been done.

[Dr. Michael Treat is Associate Professor of Clinical Surgery in our Department] ■