The Wonders of Saliva

Why do animals lick their wounds? It is a long-time fascination with that question and others like it, which revolve around the diverse qualities and characteristics of saliva, that continues to drive the research activities of Dr. Daniel Malamud, Professor of Biochemistry.

Regarding the major research projects currently underway in his laboratory, Dr. Malamud notes that "they may sound unrelated, but they have a similar theme – examining what is so special about this fluid we call saliva." One of the key projects now under investigation involves the characterization of a salivary protein that inactivates HIV, while another is examining the presence of vascular endothelial growth factor (VEGF) in saliva and its role in wound healing.

Dr. Malamud's work on the former project began nearly 12 years ago as a follow-up to findings from the National Institute of Dental Research (NIDR), which reported that HIV-1 loses its infectivity when incubated with saliva.

"These findings were interesting from several standpoints," recalls Dr. Malamud. "Number one, it could explain why it is extremely difficult to transmit HIV orally. Secondly, if there is a natural molecule that blocks HIV infectivity, it could be very exciting from a therapeutic standpoint. So, I decided to pursue it."

At the time, he had no experience with virology, but easily found collaborators within the University of Pennsylvania who did and has since completed three sabbaticals in virus laboratories. Approximately five years ago, Dr. Malamud built his own HIV lab in the Levy Building. His present collaborators on this project include Ms. Cheryl Davis and Drs. Wei Wu and William Abrams from the SDM and Drs. Drew Weissman and Irwin Chaiken from the University of Pennsylvania School of Medicine. Dr. Malamud's research efforts have confirmed that the NIDR's original findings were correct – the infectivity of HIV is inhibited when incubated with saliva. More specifically, they have identified two glycoproteins with anti-HIV activity – salivary agglutinin (SAG) and mucin.

"Probably a dozen labs around the world are working on this and each of them has identified different molecules," notes Dr. Malamud. "At first, that was disconcerting. But when we thought about it, it was not surprising that there might be a series of salivary molecules with the same activity, similar to the series of antibacterial activities in saliva and tears."

Dr. Malamud and his collaborators are presently focusing on SAG – a very large glycoprotein that is about half protein and half carbohydrate. SAG has been shown to inhibit HIV infection by binding to gp120, the primary receptor on HIV, and stripping it from the virus, thus rendering the HIV virus defective and lacking in what it needs to bind to its cellular receptor. The ultimate goal is to be able to a develop an SAG-based drug that would block HIV infection, but the full SAG molecule is too big to do so, and therefore, Dr. Malamud is focusing on finding the specific region of the molecule that binds to gp120.

"We are currently dissecting the molecule to identify the smallest part that works in blocking HIV infection," he explains. While the unpredictable nature of scientific investigation makes it impossible to predict how long this stage of research will be underway, Dr. Malamud notes that they have received an SAG molecular clone from another laboratory, which is speeding their work.

"It turns out that another group of investigators identified the SAG protein about two years ago in the lung. They have cloned the gene and were kind enough to give it to us," he adds. "Since we will no longer have to collect saliva but rather express the protein in the lab, that will speed things up a great deal."

Another ongoing project was born approximately five years ago when Dr. Norton Taichman, Professor Emeritus of Pathology, was on sabbatical in England studying vascular endothelial growth factor (VEGF). VEGF, produced by many types of cells, functions as a major regulator of the development of blood vessels and is known to help in the progression of neoplastic, inflammatory, and wound healing processes. Dr. Taichman was struck with the idea that VEGF may relate to Dr. Malamud's research into saliva and why animals lick their wounds. He contacted Dr. Malamud for a saliva sample, and sure enough, it tested positive for more VEGF, with more activity than Dr. Taichman had seen in any other tissue or body fluid. *(continued on page 6)*

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"It was very exciting, and when he came back from his sabbatical, we started collaborating," recalls Dr. Malamud. "We were the first to document that VEGF is a component of normal human saliva, and we've confirmed that enormous amounts of VEGF are produced and secreted into the oral cavity of both humans and mice." Their current collaborators on this project include Dr. Carolyn Gibson, Associate Professor of Histology/Embryology, and Dr. Timothy Crumbleholm, a pediatric surgeon at Children's Hospital of Philadelphia.

"We don't yet know the role of VEGF in saliva, but we believe it may contribute to why the mouth heals so quickly and doesn't scar," says Dr. Malamud. "We also think it may be part of a defense system that maintains mucosal homeostasis." Working with a mouse model, they have found that by supplying VEGF to a wound, as if the animal were licking it, the tissue heals faster.

"We are putting together a grant now to look at the process of VEGF production and its role in wound healing," adds Dr. Malamud. "We have a system to selectively knock out the VEGF gene in the salivary gland or to correct it through gene therapy with a vector that contains VEGF, and we are going to look at how that impacts wound healing."

As for its future applications, Dr. Malamud notes that in the simplest sense VEGF could potentially be used in the formulation of protective bandages to help promote healing. More significantly, it could possibly play a role in the treatment of diabetics, who are prone to a whole series of infections as well as poor healing of wounds. Diabetic mice have been shown to have lower levels of VEGF in their saliva.

"There is a lot more work to be done," he adds. "We need to know how you control the healing of a wound and clearly VEFG isn't the whole story. There are probably a dozen other factors involved, including epidermal growth factor and nerve growth factor. Interestingly, however, they are all found in saliva." ■

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New Practice Management Technology Introduced in School Clinics

New computer technology is now supporting operations in all SDM clinics, and providing the foundation for a future of paperless charting and digital radiographs.

Since July, frontline clinic staff have been using the Dentrix Enterprise system for patient registration, billing, and insurance functions. Dentrix is one of the most widely used practice management software programs within the dental profession, and SDM was the first site to undertake a major roll-out of the Enterprise version, developed to manage multiple clinical settings. The Enterprise system has been in use throughout the School's Dental Care Network since November 2000.

"The clinic staff is heroic in making this system work," says Dan Shapiro, Director of Information Services. "We are encountering technical challenges. The complexity of our organization poses problems for the software that haven't been encountered elsewhere, so the vendor is constantly trying to accommodate our needs. But what is really making it work is the frontline staff at the School who interact with the system on a day-to-day basis."

Mr. Shapiro notes that the staff training to transition to the Dentrix system went smoothly and applauds the staff for their flexibility in making the switch. Presently, the frontline clinic staff members are the only ones who directly use the Dentrix system, though long-term plans call for using this system to support digital radiography and paperless charts.

"The vision is that everything will eventually be electronic, and what we *(continued on page 3)*

PENNSmiles: Expanding SDM Community Outreach Ventures

The School of Dental Medicine is building upon its community outreach initiatives and will be taking mobile oral health care to those neighborhoods that need it most, thanks to a recent grant from the Health Resources Services Administration (HRSA).

The HRSA funds were awarded in support of the School's Minority Outreach Oral Health Initiative, also being called PENNSmiles. The program will provide oral health education, screening, and referral services to minority children in West Philadelphia and will eventually provide treatment as well through a fully equipped dental van.

"Maintaining a strong community presence is part of the Dental School's mission, and we are very pleased to be able to expand our efforts in this way," says Dean Raymond Fonseca. "It is very important for us not only to provide access to care to those children who otherwise would not be able to get it, but also to strengthen our ongoing relationship with the Philadelphia School District."

SDM has been working with the School District for the past five years as part of a program coordinated by the University's Center for Community Partnerships, which identified oral health care as a pressing need in West Philadelphia. SDM faculty and students have been visiting targeted schools to provide oral health education, screening, and referral services to children in the classroom, and PENNSmiles will build upon these efforts.
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Hygiene Students Become Integral Part of PCUs

Building upon its model for integrative clinical instruction, SDM incorporated Harcum College dental hygiene students into the School's Primary Care Units (PCUs) last fall, and this year is working with the College to further strengthen the program.

"The feedback from students and faculty alike has been very positive. This program supports us in our goal of emulating the private practice setting in our teaching clinics," notes Dr. Philip Giarraputo, Director of the Primary Care Unit program. "We are continuing to refine the integration by working with Harcum to adapt their students' clinical schedule to ours, so they will be at the School for a continuous period of time. This will strengthen the continuity of care for the patients as well as the working relationships within the PCUs."

Approximately 25 dental hygiene students are assigned to one of the 12 PCUs for three days a week. As an integral part of the PCU, they work with the SDM students and the PCU Director as they would if part of a private practice. The hygiene students continue to be supervised and evaluated by Harcum faculty and also rotate through the School's specialty clinics.

"In practice, the hygienist is one of the dentist's most important colleagues," notes Dr. Giarraputo, "so it is important for both the dental and hygiene students to be learning to interact. Plus, it is a great advantage for us as clinicians to be able to examine patients when they come in for a cleaning or x-ray, just as it would be in a private practice – the continuity of care is much better this way." Prior to this integration, patients would visit the Paletz Clinic for dental hygiene services, making it much more difficult to coordinate their prophylactic care with the care they are receiving from SDM students.

This program is also making more effective use of the School's clinic resources, notes Dr. Ronald Sarg, Director of Quality Assurance and Infection Control. The Paletz Clinic, which previously had been dedicated solely to the Harcum dental hygiene students, now houses two PCUs. "It also enables us to more efficiently utilize internal resources, such as the support staff, who can now manage its support of the Harcum program as part of the PCUs," adds Dr. Sarg. "The integration also allows us to maintain better institutional identity among patients."

The Harcum students are giving the program changes high marks and are pleased to be part of the PCUs. Charlene Ziegler, Director of Clinic Support Services, reports that a survey conducted by the Harcum faculty revealed that the hygiene students felt they were an integral member of the dental team and could now treat patients in a more realistic setting, comparable to a private practice.

"This integration process eliminates fragmented clinical education, increases students' interpersonal skills, and enables them to learn the realities of practice management," adds Dr. Giarraputo. "It's a model that would be useful for other programs across the country to consider when looking for ways to improve the training of both dental medicine and dental hygiene students." ■

Clinic Faculty Orientation Adds December Session

A second orientation session for SDM clinical faculty will be held in December in a move to make this forum for information exchange a biannual program.

"By holding the orientation twice a year, we hope to reach faculty members who couldn't attend the first session held in the fall as well as any new hires," says Dr. Philip Giarraputo, Director of the School's Primary Care Unit program. "It will also enable us to update all the faculty on any new procedures or materials in a more timely manner."

Since first implementing the orientation in 1998, it has been held the week after Labor Day; the timing of that session will remain the same. As of press time, the dates for the new December orientation had not yet been confirmed.

The goal of the orientation is to review clinic procedures and operations and bring all the clinic faculty together to meet and answer questions as a group. "In their individual practices, everyone may do things differently, but when instructing in the clinic, we have set protocols for procedures based on the School's teaching modules," explains Dr. Giarraputo. "Some faculty will come to the orientation with questions on the procedure protocols, others want to know about the materials we are using or how the referral system works. We try to address the full range of issues about which they need and want to know." Dr. Giarraputo notes that the School is constantly assessing and incorporating the latest dental materials into the clinics, making information on their use a topic of particular interest at the orientation meetings.

Along with Dr. Giarraputo, presenters at the orientation sessions include Dr. Ronald Sarg, Director of Quality Assurance and Infection Control, who addresses clinic safety issues; Charlene Ziegler, Director of Clinic Support Services, who discusses the operational aspects of clinic management; and Denise Sanders-Powell, Supervisor of IMS, and Jacquelyn Taylor-Powell, Director of Patient Assignment, who explain their roles within clinic operations.

Though the orientation program is particularly important to new clinical faculty, all clinical faculty as well as department chairs and clinical directors are encouraged to the attend.

"Because the clinic faculty is at the School on such different and limited schedules, we see the orientation as an important opportunity to bring them together and introduce them to other faculty, especially from the specialty clinics," adds Dr. Giarraputo. ■

Hispanic Dental Association *(continued from page 1)*

have in place now lays the ground work for that," explains Mr. Shapiro. "However, to implement that, students will need to have chair-side access to the technology to reference patient records in real time."

Right now, paper charts continue to be used in all the clinics and students do not interact directly with the Dentrix system. However, a web interface, accessible to students and faculty, has been established to add the necessary academic elements that the Dentrix system does not provide. This interface (known as WebSPIN) is accessible through the "Inside SDM" section of the School's web site and is being used for such functions as tracking student point equivalents, ordering instruments, and listing students' patient assignments; it is replacing the SPIN system. "Most of the SPIN functions have been moved over to this new system. Our goal is to eliminate the SPIN system entirely as soon as possible," adds Mr. Shapiro.

Having piloted the Dentrix system in the School's Dental Care Network before introducing it to the clinics, Mr. Shapiro foresees that the School will follow this same model what it comes to expanding its use though digital radiography and electronic charting. "However, with the Dentrix system now in place throughout the School's clinics," he notes, "we have established the environment for using 21st century technology." ■

Staff Recognized For Job Well Done

In making the transition to new practice management technology, the dedicated work and cooperation of the SDM clinic staff cannot be overstated, notes Dan Shapiro, Director of Information Services, and on Friday, October 12, those involved with this project gathered to celebrate the staff's help in making it a success.

All of the clinic staff members who are using the Dentrix Enterprise system and/or its web interface, WebSPIN, were invited to this "thank you" party held in the courtyard of the Evans Building.

"We wanted to recognize all the work the staff had done as we were changing systems," says Mr. Shapiro. The IMS, Clinic Management and Insurance departments jointly sponsored the event. ■

SDM Students Raise Relief Funds, Organize Blood Drive

In the aftermath of the September 11 terrorist attacks, SDM students came together to build support for the American Red Cross relief efforts, raising money for its Disaster Relief Fund and organizing a blood drive.

From September 17 through 28, members of SDM's American Student Dental Association (ASDA) spent their lunch hours collecting donations for the American Red Cross Disaster Relief Fund. The ASDA executive board set up the drive outside the School's Student Lounge and raised a total of $935.

"The funds will be used to help families of the victims of the New York City attacks," says ASDA Vice President Aaron Miller (D'04), who organized the drive. "We were very pleased with the turnout of support from the SDM community and thank everyone who donated."

Give Blood November 9

SDM students, staff, and faculty will have another opportunity to support the American Red Cross and the community at large through a November 9 blood drive, being sponsored in collaboration with the School's chapter of the Psi Omega dental fraternity.

"As a health care-oriented community, it is a responsibility, but also a privilege for SDM to host a blood drive, especially at this crucial time of need," says Maybelle Hwang (D'02), who organized the drive along with Ann Colter Hosch (D'04).

The drive will be held on Friday, November 9, from 9 a.m. through 2:30 p.m. in S-1 of the Evans Building. Eighty-five donors are needed to reach the drive's goal, and now through November 9, Psi Omega members will be set up outside the Student Lounge from noon to 2 p.m. to sign up donors. Ms. Hwang explains that on the day of the drive walk-in donors will be accepted only on a limited basis, so students, staff, and faculty should sign up in advance.

Students who participate, either as a donor or a volunteer during the day of the drive, will be awarded community service credit, and as an added incentive, Psi Omega will be raffling off prizes to participants at the conclusion of the drive. ■

PENNSmiles: Expanding SDM Community Outreach Ventures *(continued from page 1)*

"What we have found to date from our work with the School District underscores the vital need for the expanded resources that PENNSmiles will offer," notes Dr. Joan Gluch, Director of Community Health and principal investigator for PENNSmiles. "A pilot study of six schools in West Philadelphia revealed that 68% of the children screened showed evidence of dental decay and other oral health problems that required dental care – that is significantly higher than the national statistics of 29% of children with dental decay."

The PENNSmiles program involves three phases – Phase One, the education, screening, and referral programs in West Philadelphia schools; Phase Two, the dental van design, construction, and delivery; and Phase Three, the mobile oral health care program.

Phase One has already begun – student and faculty visits to schools started in September, and in October and November, six oral health education, screening and referral programs are scheduled for the Drew School, targeting kindergarten through eighth grade. During this time, eight oral health workshops and screenings are also scheduled for adults at four community schools in West Philadelphia. "The program also calls for parental education," says Dr. Gluch, "so we will be leading these dental health workshops during area night school programs."

Phase Two of PENNSmiles is also well underway, with Dr. Gluch reporting that the School is actively working on designing the dental van and selecting a vendor; delivery of the van is expected by the end of February 2002.

The PENNSmiles van will be approximately 40 feet long and will be custom designed with two fully equipped dental operatories. Other features will include two digital radiography units, a separate instrument preparation area, computer access, and a separate waiting area with a VCR/DVD player for educational use.

The van will be used to supplement the classroom education, screeningand referral activities starting in March 2002, and Phase Three – treatment within the dental van – is anticipated to begin in September 2002. However, Dr. Gluch stresses that even after the dental van is fully operational for treatment, oral health education, screening, and referrals within the classroom will continue to be a vital element of the PENNSmiles program.

"The mobile dental van will be an extension of the Dental School," notes Dr. Gluch. "Students and faculty will employ all the same policies and procedures as in any other School clinic. The PENNSmiles van will provide a valuable setting for expanding our students' clinical and community-based education, while providing much-needed care to children in the community." ■