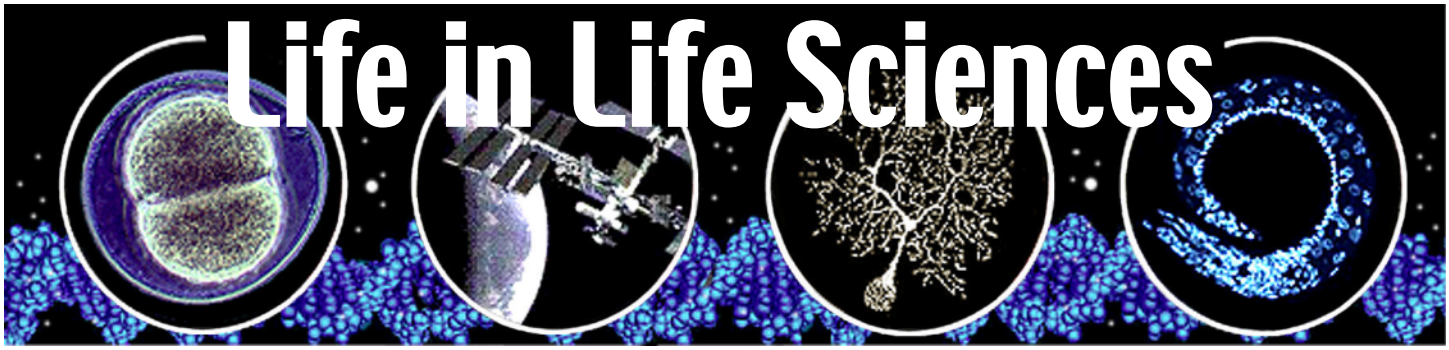

A JOINT PUBLICATION OF THE LIFE SCIENCES DIVISION AND SSBRP April 2001

Government Support Services Understanding Our Role

by Marvin "Chris" Christensen
ETSC program manager, Lockheed Martin

As many of you know, our program has experienced a rapid recruitment of talent in the last several months. It occurred to me that many of our new folks are not only unfamiliar with NASA programs, but also with the roles and responsibilities of the government support services element (us guys).

In general, NASA programs are promoted, sold, and funded at NASA Headquarters, although under Dan Goldin's leadership, some Level 1 program offices have moved to field centers. Once funded, programs move to the operating field centers such as Ames, Glenn, Goddard, Langley, Kennedy, Johnson, Marshall and JPL (a non-government enterprise operated by Cal Tech). Additional roles are implemented at Stennis, Wallops and Dryden. Each center has a charter that focuses its contribution to the overall NASA mission. *(contin. on page 2)*

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We Have a Name

Life in Life Sciences: that's what we're calling this gazette of selected news from in and around NASA's Life Sciences Division and SSBRP. Our thanks for this delightful and emminently appropriate moniker go to the silver-tongued Sid Sun, the division's assistant chief.

Sun's entry was one of a dozen or so creative names submitted to the contest that was held last Fall to name the newsletter. Your illustrious editor had intended to award a prize to the winner, but failed to confirm the rules and regulations regarding gifts of this nature and, as a result, all we'll be able to offer Sid is our heart-felt thanks and appreciation.

Not only do we have a new name, but starting with this issue, we have a new, electronic format, too. We're hoping to reach more people sooner by distributing the news electronically, not to mention to save a few trees.

In this issue, there's news from our outreach coordinators, info about *Drosophila* ground studies, and a look at what's up with nanotechnology in the division. If you have news or if there's something you'd like to see covered in an upcoming issue, please let us know. Forward your suggestions to cmarshall@mail.arc.nasa.gov.

Enjoy!

Cynthia Marshall Schuman

Government Support Services *(from page 1)*

Once distributed within the proper NASA organizational elements, program responsibility is assigned to the appropriate civil servants.

The government has numerous ways in which it can achieve its objectives. In some instances, the efforts will be conducted in-house, solely by civil servants. For large developmental projects, NASA will generally contract out all or part of the program. The trend towards performance-based contracting puts program responsibilities more squarely upon the contractor, with NASA managers monitoring technical and cost milestones to assure the government gets what it's paying for.

In the government support services arena (for example, Lockheed Martin Technology Services), contractual responsibilities run the gamut from pure performance-based to level-of-effort support. Our program is somewhat of a hybrid, with our focus directed to supporting our NASA leads in meeting their program responsibilities. In this role, it's essential to remember that NASA is our customer. We always owe them our best technical input and advice, but the buck stops with them and they must make the final judgements as to program direction and decisions.

If some of their judgements seem contrary to what we perceive to be appropriate program implementation, we need to remember that in many instances they are reacting to internal NASA information that helps shape the decision.

Experienced NASA managers recognize the true relationships between Headquarters, field centers, civil servants, and contractors. These managers don't just talk about teamwork, they recognize the synergy that is essential to program success and are skilled in creating the environment that encourages the best from the team.

I believe that we are fortunate in that Ames personnel have a long-term history of close contractor working relationships and that this results in everyone's commitment and dedication to program success. With ownership comes pride in product. As we progress through the political and programmatic peaks and valleys of our program it's essential that we all remember this.

Small is Beautiful: Nanotechnology Comes to SLR

What It Is : If you're not familiar with the term, "nanotechnology," just think small. Very small. Very very small. Nanotechnology is the study of things on the scale of 10^{-9} meters and below. Loftus is involved in nanotechnology at Ames by means of an Integrated Product Team (IPT). For the uninitiated, an IPT is pretty much what it sounds like: a cross-directorate, interdisciplinary team that comes together to create a product. The IPT on which Loftus works is headed by Meyya Meyyappan of Code AS and is funded in part by the National Cancer Institute's Unconventional Innovations Program. Some 35 researchers center-wide are part of this IPT.

"I'm not a 'space' person by any stretch of the imagination," David Loftus confides.

Still, Gravitational Research Branch Chief Emily Holton has declared the Stanford hematologist, "perfect" for SLR.

Loftus does have an interest in cytoskeleton research, something he shares with a number of other SLR members. But the true lure that brought this youthful-looking M.D./Ph.D. to NASA is nanotechnology.

David Loftus, M.D./Ph.D.

Nanotechnology? If nanotechnology research in the Life Sciences Division sounds off-base—or at least, not alive—think again. This up and coming field is one that NASA is betting the farm on. Writing in the NASA publication, *Spinoff 2000*, NASA's administrator, Daniel S. Goldin articulated that, "There are three core technologies that will be essential to NASA's future success: biotechnology, nanotechnology, and information technology."

And, in fact, the project on which Loftus acts as medical director, has very real applications in the life sciences. "What the project is all about is to develop a type of biosensor catheter for detecting molecular signatures of cancer," Loftus explains.

A cancer molecular signature is, in very general terms, a specific marker for a certain type of cancer. For example, clinicians look for the presence of prostate-specific antigen (PSA) in the bloodstream as a marker for prostate cancer. Molecular signatures can also be things such as cell-surface proteins. A third type of molecular signature—changes in the DNA of cancer cells—is the type of molecular signature *(contin. on page 3)*

Nanotechnology Comes to SLR *(from page 2)*

that Loftus and his colleagues want to be able to detect.

Although DNA-based signatures have only been identified for certain types of cancers, "so far, these are the most specific cancer markers available," Loftus says. Unfortunately, they're also the most difficult to measure.

The tool that Loftus and his colleagues envision for identifying the DNA sequences would be a catheter about the size of a slender hypodermic needle. This catheter would be inserted into the part of the body where malignancy is suspected.

Located on the "business end" of the catheter, as Loftus calls it, will be a multi-part biosensor. This biosensor is expected to contain a silicon chip onto which a carbon nanotube has been synthesized.

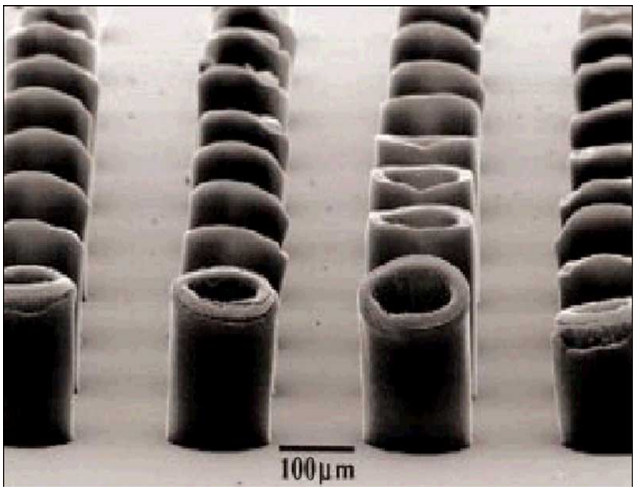
A carbon nanotube, briefly, is an extremely small (one-fiftieth the diameter of a strand of hair), electrically conductive structure. The nanotube will play a couple of important roles in the sensor. For one, it will relay signals to the silicon chip, which in turn will forward them to a computer.

In addition to relaying signals, the nanotube will also be the receptacle for a fragment of DNA that is complementary to the target DNA sequence and thus, will bind to the target.

"The idea is to sense only certain genetic sequences and to reject all others," Loftus notes. In other words, the clinician needs to know what he or she is looking for.

> "There are three core technologies that will be essential to NASA's future success: biotechnology, nanotechnology, and information technology."
>
> *-Daniel S. Goldin, NASA Administrator*

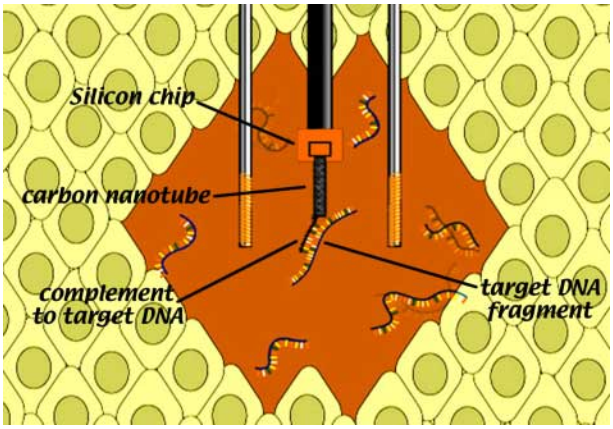
"It's not a probe designed for a physician or some other clinician to go on a fishing expedition, stabbing the patient thousands of times looking for molecular signatures; it's much more of a directed approach," Loftus says.



Carbon nanotubes

And unlike current diagnostic tools, Loftus' design will be minimally invasive and provide immediate results.

"[Current] techniques all require that a specimen be removed from the body before it can be analyzed; you have to have a biopsy," he observes.



Biosensor

"And turn-around is two to three weeks, as compared to the biosensor catheter, which is designed to make a measurement *in situ*, therefore giving an instantaneous diagnosis. We actually do the analysis while the catheter is in the body and we don't remove anything as we would in a biopsy situation," he explains.

Unfortunately, clinical availability of the biosensor catheter is still a long way off. Loftus estimates that it will be in development for at least another decade.

But that doesn't stop the team from imagining myriad uses for the finished product.

Some of the applications other than cancer detection would include identifying infectious disease agents. A catheter-based biosensor of the type that Loftus foresees could be targeted against a specific microbial signature in some absessed area of the body. Loftus also anticipates that sensor technology might also be used outside the bounds of the catheter format to detect microbial pathogens in the air or in lakes or streams or in the food industry.

But is there a space application? Loftus' impression is that, "NASA is extraordinarily interested in biosensors of all kinds, and so they're very supportive of any research having to do with biosensors, even though it may not have a direct application to the space-based missions that NASA is more or less primarily interested in."

The Power of Touch in Sensory Development

Who doesn't like to be hugged or to have their back scratched? There's just no denying the primordial pleasure of being in the moment, coddled, cooed over, and cared for.

Now, a researcher in the Gravitational Research Branch is postulating that touch isn't just nice, it plays a vital role in the early development.

April Ronca, Ph.D.

Labor contractions promote postnatal adaptation

April Ronca, a principal investigator in Code SLR, has observed in studies of pregnant rats that exposure to zero-gravity (0-g) increases the number of contractions during the birthing process when the rats were returned to Earth (1-g).

"We saw a doubling of labor contractions," Ronca says.

After exposure to 0-g, the muscles that cause contractions are weakened and as a result, move the fetuses far less distance than would normally occur. Because a mother rat (called a dam) can give birth to a dozen or more offspring, the process can get lengthy.

But more importantly, weaker contractions may negatively affect the development of some behaviors and processes that require external stimulation. "There is a whole body of literature suggesting that labor contractions promote postnatal adaptation," she explains.

"What we've been able to show so far is that contractions are the number-one important feature of the birth process in terms of promoting the release of stress hormones, which appear to underlie the neonate's ability to adapt to life outside of the womb. The onset of respiration at birth and the neonate's ability to find a nipple and suckle are dependent upon labor contractions. Neonatal rats begin to suckle at two hours after birth with about a 90 percent rate of nipple attachment if they are exposed to similated uterine contractions, whereas, if they are not exposed to contractions, that level is about 25 percent. So it's a big difference, a very big difference," she notes.

Ronca's work may be particularly useful in improving the care of premature infants. "It may not be advisable for premature infants to undergo labor, but there may need to be other kinds of sensory augmentation," she explains. Several hospital-based research programs have begun to test these ideas in human infants.

Vestibular development depends on gravity

Development after birth is only one part of the whole story of sensory development. The vestibular system, which directs the sense of balance, develops well before other senses such as sight and sound.

While not much is known about how the vestibular system develops, Ronca did find that it appears to rely on the pull of gravity to mature properly. In post-flight videotapes taken of rat pups that underwent their prenatal development during Space Shuttle missions in 1994 and 1995, she observed that when pups were placed on their backs, they righted themselves less frequently and less completely than their Earth-bound controls.

Knowing more about the vestibular system can be of particular benefit to the elderly, who are prone to dizziness and falling. Falls are the top cause of accidents in people over the age of 65.

"One of the areas that I am particularly interested in is how the vestibular system forms, begins to operate, and maintains its function across the lifespan. Studies of early sensory development provide insights into changes that occur during development and also during aging, when our sensory acuity is reduced. After all, we get reading glasses as our eyes decline. We get a hearing aid as our ears decline. What we're finding out now about the developing vestibular system will contribute to our understanding of how the system is put together, how it relies on gravity, and how it interacts with other sensory systems. Only by understanding these things can we hope to remedy age-related degradation in our sense of balance through prosthetics or aids," Ronca says.

Who We Are

Joellen Jarvi
Assistant Project Manager, Space Station
Biological Research Project (SSBRP)

***Late breaking news**: Beginning in mid-May, Jarvi will be working at Headquarters. The position will be in Code U, the Office of Biological and Physical Research, where she'll be acting as a Liaison for Fundamental Biology.*

HOME: *Cupertino*

BIRTH PLACE: *Medford, Oregon*

JOB HIGHLIGHTS: *Responsible for managing the administrative side of SSBRP, including project planning, budgets, schedules, export control, ISO, and day-to-day internal operations.*

FAVORITE HOBBIES: *Bicycling and hiking. Jarvi has commuted to work by bicycle daily since 1979.*

LAST MOVIE SEEN: *I did see one recently; the excellent Chinese movie, "Crouching Tiger, Hidden Dragon."*

FAVORITE VACATION SPOT: *"Anywhere I can ride my bicycle." In 1998, she toured the Czech Republic, Germany, and Australia. Last year, she rode the Lewis and Clark Trail from Montana to the Pacific Ocean.*

LAST BOOK READ: *"Tis" by Frank McCourt and "Tuesdays with Morrie" by Mitch Albom.*

LIKES BEST ABOUT HER WORK: *Helping to see that a task gets accomplished. "I truly enjoy knowing personally, and working with, the people in this large SSBRP organization."*

Fun Facts about Fruit Flies

Drosophila melanogaster, the lowly fruit fly, holds tremendous value to space researchers. It's small and inexpensive; it can quickly produce multiple generations; and it has numerous genetic markers, including eye color and hair type. (Who'd have thunk it?)

Sharmila Bhattacharya, Ph.D., a Lockheed Martin scientist supporting the Life Sciences Division, makes her career from studying organisms like *Drosophila* using advanced tools in molecular biology and genetics.

At the moment, Bhattacharya is involved in ground-testing the Insect Habitat, hardware developed by the Canadian Space Agency to house *Drosophila*—and later, other insects—aboard the International Space Station.

In addition to testing the hardware, she's also exposing the fruit flies to conditions of hypergravity, using the one- and eight-foot diameter centrifuges and the vibration table.

"Centrifugation is a way of creating a gravity gradient. What we do is we spin [the fruit flies] and expose them to twice or five times or ten times normal gravity, then try to ask questions such as how their development is affected, how their behavior is affected, and whether their life span is affected.

We've seen some interesting results," she comments, adding that she won't be ready to share those results for several months, when preliminary studies will have been completed.

Bhattacharya and her colleagues did share, however, a number of interesting tidbits about *Drosophila*:

o Fruit flies can sense gravity. "The adults are negatively gravitaxic, so they normally stream upwards, away from gravity," Bhattacharya explains.

o Adult flies can live as long as two or three months, if the temperature and humidity are right. (Their life cycle, from the time an egg is laid until it emerges as an adult, is about 10 days.)

o The fruit fly's genome was fully sequenced just last year.

o Its genome contains 13,601 genes. By contrast, the human genome has approximately 30,000 genes.

o More than a third of the *Drosophila* genes have no known counterparts in other organisms. (See "Confessions of an Ex-Fly Pusher," in The Scientist, 5/1/00, p. 11)

o Carbon dioxide can be used to anesthetize fruit flies. "As long as you keep them perfused with CO_2, they'll stay asleep. The minute you remove the CO_2, they will wake up and be none the worse for it," Bhattacharya says.

o *Drosophila melanogaster* is the insect that hovers near over-ripe fruit in warm climates. They're much smaller than the common house fly that we see in our homes and offices.

o The mechanisms by which the nervous system works in a fruit fly is, "pretty darned similar" to that of human beings, Bhattacharya says.

o The most common eye color for *Drosophila* is red.

Outreach Reps Participate in the Community

Lockheed Martin staffers Victoria Callor and Emanuel Barros have been getting the word out to local schools about the International Space Station. In February and March, the pair donned space suits and visited Slater School in Mountain View and Bellhaven School in east Menlo Park.

(left to right) Emanuel Barros, Kayla Barros, Victoria Callor and Mr. Yamarone

At Slater, they were the guests of Mr. Yamorone's fourth graders, including Barros' daughter, Kayla. The class of 28 saw the video, "Meet Me at the Station," competed for prizes by answering questions about the video, tasted astronaut ice cream, and observed an experiment that Barros demonstrated. "I wanted it to be as interactive as possible," Callor said.

The Bellhaven visit was in coordination with Stanford University's chapter of the Rotary Club, which is sponsoring an after-school program for 15 gifted but at-risk seventh and eighth graders. Callor estimates that of the 900 students in grades kindergarden to eighth grade at Bellhaven, some 65 percent will not graduate from high school.

Speaking to school groups is a great way to get involved in the community. Young people need role models and teachers welcome the opportunity to jazz up their lesson plans.

If you'd like to speak on behalf of the Life Sciences Division, give Callor a call. "We have things you can give out, posters, and little prizes you can give students; it really helps. And I can accompany speakers or not, whatever their preference is," she says. Callor can be reached at extension 4-0499.

NASA Speakers at The Tech

(And Discount Admission, too!)

Jeff Smith, the deputy director of the Center for Bioinformatics will be speaking at The Tech Museum of Innovation on Saturday, July 14 at 2 p.m. in the Center for Learning. Smith will talk about bioinformatic experiments currently being conducted on the International Space Station.

To inspire all of us to get out and support Smith, The Tech is offering a $2 dollar discount* on gallery admission that day to all NASA Ames Research Center employees and up to 3 guests.

To be eligible to receive the discounted tickets, the employee must be present and show his or her badge at the admission counter. The discount can also be applied to the purchase of a Combination ticket, providing access to both the museum galleries and 1 film shown in the IMAX Dome Theater!

Another speaker from the Life Sciences Division will be speaking at The Tech on Saturday, August 11. The same discount will apply then. Stay tuned for more details.

**Not valid for advance telephone, on-line purchases, or group reservations. Not valid with any other discounts or promotions. IMAX subject to availability*

Judges needed

In May, more than 1200 students from nearly 50 countries will be in San Jose to compete in the Intel International Science & Engineering Fair. Twelve hundred judges will be needed on May 8 and 9 in San Jose. If you can help, please contact Roy Okuda at okuda@sjsu.org or call (408) 924-2525. For more information, visit www.intelisef2001.org.

Conference Update

Code SL and SSBRP will be represented at the following conferences during May, June, and July:

May 20 – 24:	American Society for Microbiology, Orlando, FL.
June 22 – 26:	Thirteenth International *C. elegans* meeting, Los Angeles, CA.
July 21 - 25:	Plant Biology 2001, Providence, RI.


C. elegans

ISO Update

o In February, Code S underwent an internal audit. Four Corrective Action Requests (CARs) were written — but only one was in the Life Sciences Division!

o Ames has a new ISO 9000 registrar, National Quality Assurance, Inc. (NQA). The next scheduled audit is April 25 - 27. Word has it that NQA will be interested in how we control nonconforming products (that is, SLP 53.ARC.0013, 13.1). Please review these System-Level Procedures (SLPs) and any other work instructions specific to your project or department in this regard.

o Welcome to Katherine Papadopoulos, who will be tracking SL Quality System action items, documents, and CARs as well as performing SL Document Control Administrator (DCA) duties.

Kudos to…

o Hats off to Steve Patterson, Debra Reiss-Bubenheim, Sharmila Bhattacharya, Vera Vizir, and Chiraq Vyas, who worked with BioServe Space Technologies to send up a fruit fly experiment on STS-106, which flew last September.

o Congratulations to the Life Sciences Data Archive, which received the top award from the Austin, TX chapter of the Society for Technical Communication. The LSDA won in the category of "online book."

Welcome!

We have been tremendously successful in hiring nearly 70 new staff members for the Life Sciences Division and SSBRP since November 2000.

NASA new hires

Almeida, Eduardo (SLR)
Aquilina, Rudy (SLO)
Girten, Bev (SLO)
Hines, Kim (SLE)
Lusby, Terry
(SLE Deputy Branch Chief)

Lockheed Martin new hires

Araujo, Christine
Aros, Rich
Autio, Gordon
Bob Barbes (SSBRP)
Barrett, Joyce
Bedard, Robert
Bischoff, Mary Beth
Blackford, Cameron
Brandt, Jennifer
Brown, Ted
Carr, Joseph
Contreras, Fautismo
Dali, Lisa
Davila, Theresa
DeCardi, Peter
Dodson, Karen
Dreher, Brian
Dwyer, Joseph
Estep, Amanda
Fahlen, Thomas
Fry, Frederick
Gray, Bruce
Gregory, Patricia
Hagen, Jeremy
Hamlet, Peter
Hernandez, Tino
Hill, Esther
Husain, Manzar
Jordon, Paul
Kanellakas, Alex
Kerwin-Peck, Deborah
Kovo, Yael
Kreider, George
Leese, Russ
Leskovsky, David
Lew, Katherine
Litwiller, Eric
Machado, Ann
Mahdavian, Sep
Mainusch, Harald
McDonald, Mary
McElroy, Andrew
McGann, Christine
Mersioch, Charles
Mian, Rahad
Mrdjen, Peter
Nguyen, Nicholas
O'Hara, Dee
Oxford, John
Panelo, Jack (Agapito)
Pearce, John
Phillips, Robert
Rask, John
Remiers, Jonn
Santiago, Delia
Saujume, Mary
Sisley, Mike
Sofla, Saced
Sullivan, Eugene
Sun, Gwo-Shing
Tillman, John
Tou, Janet
Walkowiak, Paul
Wang, Tony
Westbrook, Russell
Winfree, Seth
Yuan, Emma
Zargarian, Lida

"Chemistry is dead biology."

Who said it? Name that scientist and win a sweet treat. Send your answer to cmarshall@mail.arc.nasa.gov.

Congratulations to Pam Davoren and Duncan Atchison, who correctly guessed that Mal Cohen was the Ames researcher who helped to explain why Navy A7 Crusader aircraft were unexpectedly crashing into the sea.

J. Loken

C. Marshall

The life sciences division newsletter is issued occasionally. Writing and editing by Cynthia Marshall.
Layout design and graphics by Judy Loken. We welcome contributions; submit them to cmarshall@mail.arc.nasa.gov.