Cathay May 2015

www.cathayradio.org

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Mission: The Cathay Amateur Radio Club is basically an active social club of Ham Radio Operators and their spouses. We support local community requests for HAM emergency communications. Several of us are trained in CPR/ First Aid and are involved with community disaster preparedness.

Monday Night Net Time: 9 PM Local Time/PST, Frequencies: 146.67MHz -600KHz PL85.4 and 442.70 +5MHz PL 173.8. The repeaters are linked only during the CARC Monday night net.

Update: Link to repeater 442.70 is currently not active until further notice.

The CARC Monday night net is the best way to find out the latest club news.

All check-ins are welcome.

Message from the President: George Chong, *W6BUR*

Hello CARC Members and Friends;

I know that all of you must be breathing a collective sigh of relief to having survived another tax season. So unwind and go out and having some fun!

FYI, I will not be able to host this year's CARC HAM Field Day.

Perhaps another CARC member would like to host the CARC HAM Field Day for this year. Just shoot me an email if you are interested.

Public Service Announcements Intro

Of special interest to our CARC members is follows:

- Cancer Society Relay Fund Raiser - CARC member, Skip Weiss - KG6SCE is requesting volunteers for communications support during an upcoming Cancer Society Relay Fund Raiser.

I like to thank all the CARC members who responded to Skip's request for volunteers at the last year's Daly City Relay Fund Raiser event.

For additional information on the fore-mention events, please read the "Public Service Announcement" section of this newsletter.

Featured Tech Article Intro

When you recharge your rechargeable electric tooth brush in the charging stand, you are using the properties of a "near-field electromagnetic wave" that results in inductive charging.

The "near field" only works over very short distances so up to now we been unable to recharge electrical devices that have been implanted in the human body such as a cardiac pacemaker. Cardiac pacemakers have an average lifespan of 7 years before requiring a replacement battery power source.

This month's article is about Assistant Stanford Professor Ada Poon and her developing a tiny medical invention that transmits "near-field electromagnetic wave" over additional distance as if it were like a "far-field wave".

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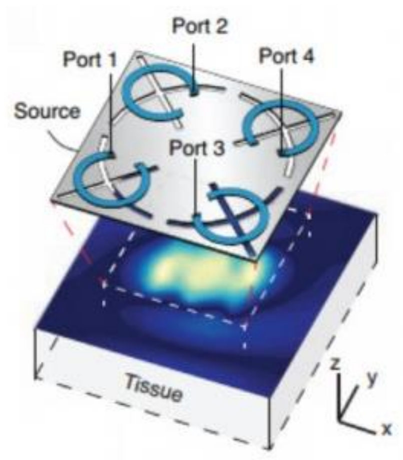

Mid-field power transfer, using a special antenna

This newly configured electromagnetic wave acts like a "mid-field" (a new term coined by her), a sweet spot between the near-field and the far-field.

Up to now nobody knew a "mid-field" existed. This discovery will result all the technical books to be rewritten.

The implication is that this "mid-field" will allow wireless transfer of energy to power tiny devices deep within the human body without any harmful effects.

This new technology will open up a whole new suite of medical devices to deliver drugs, pain management, recharging of heart pacemakers, and so forth.

We now have the privilege of reading about something that is just starting and will eventually become a big deal.

For more technical information on the electromagnetic "mid field" wave:
http://web.stanford.edu/group/poongroup/cgi-bin/wordpress/wp-content/uploads/2013/05/Phys.%20Rev.%20Lett.%202013%20Kim.pdf

The technical article is broken up into 4 parts because they were extracted from various public sources and will have some repeated information along with the additional information.

However, it is well worth reading the entire 4 parts on such an outstanding individual and her discovery that has many exciting medical science applications.

CARC Final Wrap-up News

Chat sub s'em to all you CARC members! - George W6BUR.

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Public Service Announcements

HAM CRAM / HAM Licensing

For upcoming HAM Licensing locations please refer to:
http://www.arrl.org/find-an-amateur-radio-license-exam-session

Auxiliary Communications Service (ACS)

The Auxiliary Communications Service (ACS) was organized by the San Francisco Office of Emergency Services (OES) following the 1989 Loma Prieta Earthquake to support the communications needs of the City and County of San Francisco when responding to emergencies and special events.

The Auxiliary Communications Service holds General Meetings on the third Tuesday of each month at the San Francisco Emergency Operations Center, 1011 Turk Street (between Gough Street and Laguna Street), from 1900 hours to 2100 hours local time. All interested persons are welcome to attend.

The ACS Net begins at 1930 hours (7:30 p.m.) local time each Thursday evening, on the WA6GG repeater at 442.050 MHz, positive offset, tone 127.3 Hz. The purpose of this net is to practice Net Control skills, practice checking in with deployment status in a formal net, and to share information regarding upcoming ACS events. Guests are welcome to check in. ACS Members should perform Net Control duty on a regular basis. On the second Thursday of each month, the net will be conducted on the output frequency of the WA6GG repeater, 442.050 MHz no offset, tone 127.3 Hz, simplex.

For more information, please attend an ACS meeting or check in on a net, or call 415-558-2717.

Upcoming meetings: Tuesday 7pm, May 19, 2015
Tuesday 7pm, June 16, 2015

Gilbert Gin (KJ6HKD)

Free Disaster Preparedness Classes In Oakland:
http://www.oaklandnet.com/fire/core/index2.html

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CORE is a free training program for individuals, neighborhood groups and community-based organizations in Oakland. The underlying premise is that a major disaster will overwhelm first responders, leaving many citizens on their own for the first 72 hours or longer after the emergency.

If you have questions about the recertification process, you may contact the CORE Coordinator at 510-238-6351 or core@oaklandnet.com.

Free Disaster Preparedness Classes In San Francisco – NERT Taught by San Francisco Fire Department

RSVP to sffdnert@sfgov.org or call 415-970-2024 to register.
Visit www.sfgov.org/sffdnert to learn more about the training, other locations, and register on line. Upcoming Special NERT Events.

May

2nd: Intro to NERT Communications Team (NCT) 101-103, 8:30 a.m. - 3:30 p.m., SFFD DOT*

13th: NERT Communications 201: Emergency Size-up & Messaging 6:30pm-9:30pm, SFFD DOT*

16th: Firefighters assistance. This drill involves lifting and carrying 2hr. drill, location & time TBD.

18th: NERT Communications 301: Hands-on buttons & knobs & antennas, 6:30pm-9:30pm, SFFD DOT*

19th: NERT Communications 401: Hands on message passing and Scribing, 6:30pm-9:30pm, SFFD DOT*

20th: NERT Communications 501: NET Control for NERT staging area, 6:30pm-9:30pm, SFFD DOT* Prerequisites: NCT 101-401

27th: NERT Coordinators and Leaders Meeting. 6:30pm-8:30pm, SFFD DOT*

30th: Disaster Mental Health (NEW! pilot training)

*** SFFD DOT is the Division of Training @ 19th Street/Folsom. (enter through yard on 19th and park along back wall) Division of Training classroom is in the 1-story building directly next to the Fire Station on the corner**.

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San Francisco Police Department: Auxiliary Law Enforcement Response Team (ALERT)

The Auxiliary Law Enforcement Response Team (ALERT) is a citizen disaster preparedness program designed. The ALERT program is for volunteers 16 years of age or older, who live, work, or attend high school in San Francisco.

Graduates of the San Francisco Police Activities League (P.A.L) Law Enforcement Cadet Academy are also eligible to join.

ALERT volunteers will first complete the Fire Department's Neighborhood Emergency Response Team (NERT) (www.sfgov.org/sfnert) training and then graduate into an 8 hour Police Department course specifically designed for ALERT team members.

ALERT members will work closely with full-time and/or Reserve Police Officers in the event they are deployed after a disaster. The Basic ALERT volunteer will have no law enforcement powers other than those available to all citizens.

SFPD ALERT Training

The next ALERT training classes have been scheduled for Saturday, June 25, 2015. The classes will be held at the San Francisco Police Academy, in the parking lot bungalow, from 8am-5pm (one hour lunch break).

IMPORTANT- All participants must complete the background interview process in order to be eligible to attend the ALERT training class.

Eligible ALERT participants may register for a training class by contacting the ALERT Program Coordinator, Mark Hernandez, at sfpdalert@sfgov.org, or by telephone at 415-401-4615.

SFPD ALERT Training Drill

All active/trained ALERT members are asked to join us for our next training drill, scheduled for **TBD.** The drill will be held in the Police Academy (350 Amber Drive) parking lot from 9am-12pm. Details will be emailed to active ALERT members, prior to the date of the exercise. Participation is not required, but strongly encouraged.

For more information on the San Francisco Police Department ALERT Program, email us at sfpdalert@sfgov.org, or call Sergeant Mark Hernandez (SFPD, Ret.), SFPD ALERT Program Coordinator, at (415) 401-4615.

For additional information on the web please refer to:
http://sf-police.org/index.aspx?page=4019

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HAM Volunteer Request From CARC Member Skip Weiss, KG6SCE

Event: Relay for Life / Daly City - A 24 Hour Cancer Society Relay Fund Raiser

Time: Starting at 10:00 am Sat June 6, 2015 and ending at 10:00 am Sun June 7, 2015

Location: Westmoor High School Sport Stadium
131 Westmoor Ave, Daly City, CA 94015
Entrance at corner of Del Prado Dr. & Mariposa Ave

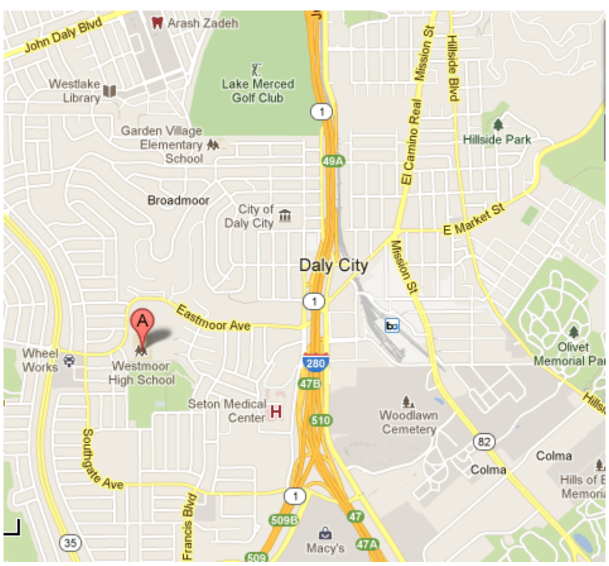
Additional Information:
http://main.acsevents.org/site/TR?sid=128433&type=fr_informational&pg=informational&fr_id=56642

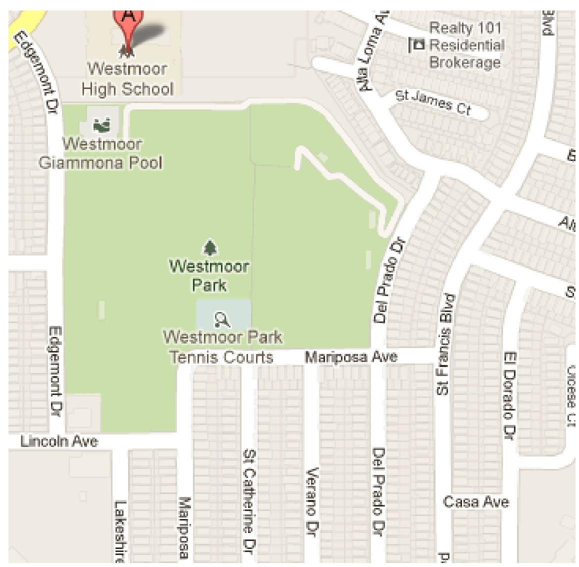
HAM volunteers are needed to help with directing cars, public safety and HAM radio communications support.

Please contact Skip Weiss, KG6SC via email for further details and assignments.

- Email address: "Skip Weiss" calgrizzly@earthlink.net
- Subject Line: Relay for Life/HELP

Skip (KG6SCE) and his VFW are supporting this worthwhile event. Map of Westmoor High School Location is shown below (entrance located at the intersection of Mariposa Avenue & Del Prado Drive):





The Relay Event is:

- Organized, overnight community fundraising walk
- Teams of people camp out around a track
- Food, games and activities provide entertainment and build camaraderie
- Family friendly environment for the entire community

The scheduled activities are:

Opening Ceremony: 10:00 am Saturday, June 6, 2015

The Opening Ceremony brings everyone together for a high-energy event kickoff to celebrate the lives of those who have battled cancer, to inspire hope by sharing recent accomplishments and progress, and to remind everyone that while we are winning this battle, fighting cancer is a year-round priority.

Survivors & Caregivers Lap: 10:30am Saturday, June 6, 2015

During the Survivors & Caregivers Lap, upbeat music plays as all cancer survivors and caregivers at the event take the first lap around the track cheered on by the other participants who line the track, celebrating their victory over cancer and their fight to end cancer!

Luminaria Ceremony: 9:00pm Saturday, June 6, 2015

The Luminaria Ceremony is a time to remember people we have lost to cancer, to support people who currently have cancer, and to honor people who have fought cancer in the past. The power of this ceremony lies in providing an opportunity for people to work through grief and find hope.

Fight Back: 9:30am (Sunday, June 7, 2015)

The Fight Back Ceremony symbolizes the emotional commitment we each make to the fight against cancer. The action we take represents what we are willing to do for ourselves, for our loved ones, and for our community to fight cancer year-round and to commit to saving lives.

Closing Ceremony: 10:00am (Sunday, June 7, 2015)

The Closing Ceremony is a time to remember the lives of those lost and to

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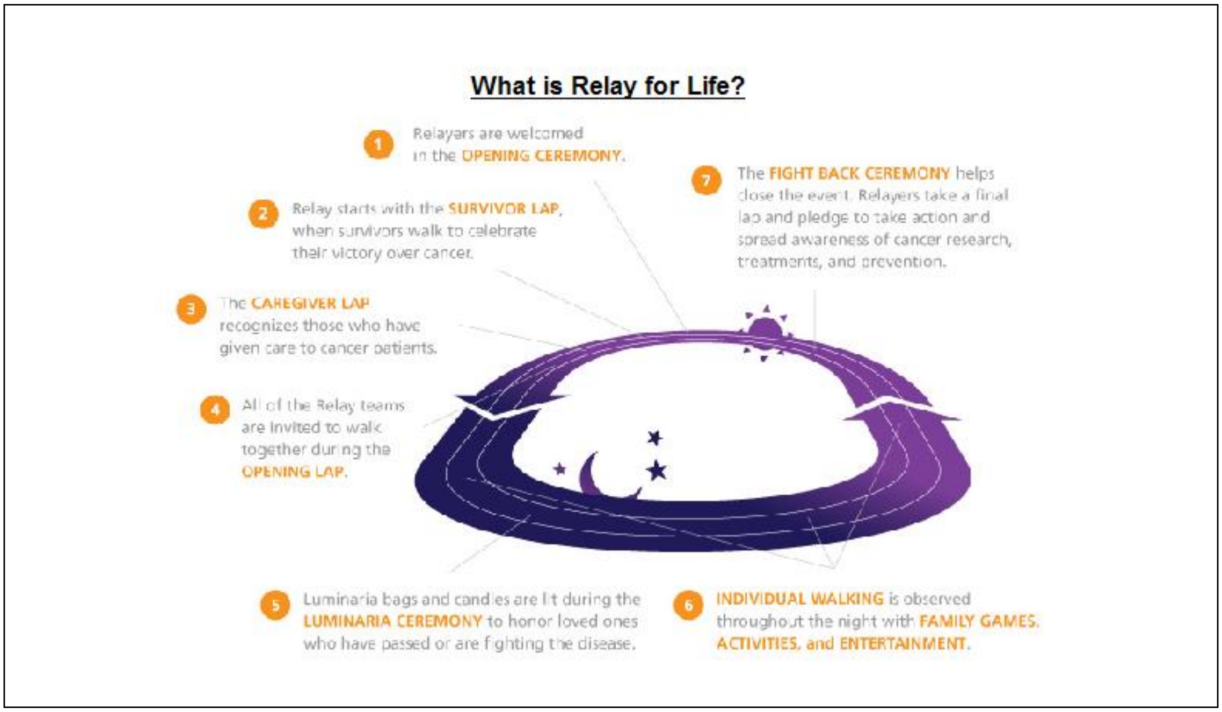
Celebrate that each of us has committed, through our participation in a Relay event, to fight back against this disease over the next year.



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Featured Tech Article:

Part 1: Professor Ada Poon:

http://web.stanford.edu/group/poongroup/cgi-bin/wordpress/people/

Ada was born and raised in Hong Kong. She received her B.Eng degree from the EEE department at the University of Hong Kong and her Ph.D. degree from the EECS department at the University of California at Berkeley in 2004.

Her dissertation attempted to connect information theory with electromagnetic theory so as to better understand the fundamental limit of wireless channels. Upon graduation, she spent one year at Intel as a senior research scientist building reconfigurable baseband processors for flexible radios.

Afterwards, she joined her advisor's startup company, SiBeam Inc., architecting Gigabit wireless transceivers leveraging 60 GHz CMOS and MIMO antenna systems.

After two years in industries, she returned to academic and joined the faculty of the ECE department at the University of Illinois, Urbana-Champaign. Since then, she has changed her research direction from wireless communications to integrated biomedical systems.

In 2008, she moved back to California and joined the faculty of the Department of Electrical Engineering at Stanford University. She is a Terman Fellow at Stanford University. She received the Okawa Foundation Research Grant in 2010 and NSF CAREER Award in 2013.

E-mail: adapoon AT stanford DOT edu

Part 2: Wireless Recharging

http://news.stanford.edu/news/2014/may/electronic-wireless-transfer-051914.html

Stanford Report, May 19, 2014

Stanford engineer invents safe way to transfer energy to medical chips in the body

A wireless system developed by Assistant Professor Ada Poon uses the same power as a cell phone to safely transmit energy to chips the size of a grain of rice. The technology paves the way for new "electroceutical" devices to treat illness or alleviate pain.

BY TOM ABATE

A Stanford electrical engineer has invented a way to wirelessly transfer power deep inside the body, and then use this power to run tiny electronic medical gadgets such as pacemakers, nerve stimulators or new sensors and devices yet to be developed.

The discoveries reported May 19 in the *Proceedings of the National Academy of Sciences* culminate years of efforts by Ada Poon, assistant professor of electrical engineering, to eliminate the bulky batteries and clumsy recharging systems that prevent medical devices from being more widely used.

The technology could provide a path toward a new type of medicine that allows physicians to treat diseases with electronics rather than drugs.

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"We need to make these devices as small as possible to more easily implant them deep in the body and create new ways to treat illness and alleviate pain," said Poon.

Poon's team built an electronic device smaller than a grain of rice that acts as a pacemaker. It can be powered or recharged wirelessly by holding a power source about the size of a credit card above the device, outside the body.

New generation of sensors

The central discovery is an engineering breakthrough that creates a new type of wireless power transfer – using roughly the same power as a cell phone – that can safely penetrate deep inside the body. As Poon writes, an independent laboratory that tests cell phones found that her system fell well below the danger exposure levels for human safety.

Her lab has tested this wireless charging system in a pig and used it to power a tiny pacemaker in a rabbit. She is currently preparing the system for testing in humans. Should such tests be approved and prove successful, it would still take several years to satisfy the safety and efficacy requirements for using this wireless charging system in commercial medical devices.

Poon believes this discovery will spawn a new generation of programmable microimplants – sensors to monitor vital functions deep inside the body; electrostimulators to change neural signals in the brain; and drug delivery systems to apply medicines directly to affected areas.

Drug therapy alternatives

William Newsome, director of the Stanford Neurosciences Institute, said Poon's work created the potential to develop "electroceutical" treatments as alternatives to drug therapies.

Photo by Austin Yee

A battery less electrostimulator next to medicinal pills for size comparison.

The new powering method allows the device to be wirelessly powered deep inside the body.

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Newsome, who was not involved in Poon's experiments but is familiar with her work, said such treatments could be more effective than drugs for some disorders because electroceutical approaches would use implantable devices to directly modulate activity in specific brain circuits. Drugs, by comparison, act globally throughout the brain.

"To make electroceuticals practical, devices must be miniaturized, and ways must be found to power them wirelessly, deep in the brain, many centimeters from the surface," said Newsome, the Harman Family Provostial Professor and professor of neurobiology at Stanford.

He added, "The Poon lab has solved a significant piece of the puzzle for safely powering implantable microdevices, paving the way for new innovation in this field."

How it works

The article describes the work of Poon's interdisciplinary research team that included John Ho and Alexander Yeh, electrical engineering graduate students in Poon's lab; Yuji Tanabe, a visiting scholar; and Ramin Beygui, associate professor of cardiothoracic surgery at Stanford University Medical Center.

The crux of the discovery involves a new way to control electromagnetic waves inside the body.

Electromagnetic waves pervade the universe. We use them every day when we broadcast signals from giant radio towers, cook in microwave ovens or use an electric toothbrush that recharges wirelessly in a special cradle next to the bathroom sink.

Before Poon's discovery, there was a clear divide between the two main types of electromagnetic waves in everyday use, called far-field and near-field waves.

Far-field waves, like those broadcast from radio towers, can travel over long distances. But when they encounter biological tissue, they either reflect off the body harmlessly or get absorbed by the skin as heat. Either way, far-field electromagnetic waves have been ignored as a potential wireless power source for medical devices.

Near-field waves can be safely used in wireless power systems. Some current medical devices like hearing implants use near-field technology. But their limitation is implied by the name: They can transfer power only over short distances, limiting their usefulness deep inside the body.

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What Poon did was to blend the safety of near-field waves with the reach of far-field waves. She accomplished this by taking advantage of a simple fact – waves travel differently when they come into contact with different materials such as air, water or biological tissue.

For instance, when you put your ear on a railroad track, you can hear the vibration of the wheels long before the train itself because sound waves travel faster and further through metal than they do through air.

With this principle in mind, Poon designed a power source that generated a special type of near-field wave. When this special wave moved from air to skin, it changed its characteristics in a way that enabled it to propagate – just like the sound waves through the train track.

She called this new method mid-field wireless transfer.

In the experiment, Poon used her mid-field transfer system to send power directly to tiny medical implants. But it is possible to build tiny batteries into microimplants, and then recharge these batteries wirelessly using the mid-field system. This is not possible with today's technologies.

Co-author Ho noted, "With this method, we can safely transmit power to tiny implants in organs like the heart or brain, well beyond the range of current near-field systems."

Tom Abate is the associate director of communications for Stanford School of Engineering.

Media Contact

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Clifton B. Parker, Stanford News Service: (650) 725-0224, cbparker@stanford.edu

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Featured Tech Article:

Part 3: The Discovery of Mid-Fields

Tiny, implantable medical device can propel itself through bloodstream

http://engineering.stanford.edu/news/implantable-wirelessly-powered-self-propelled-medical-device

For fifty years, scientists had searched for the secret to making tiny implantable devices that could travel through the bloodstream. Engineers at Stanford have demonstrated a wirelessly powered device that can do just that.

By Andrew Myers

Someday, your doctor may turn to you and say, “Take two surgeons and call me in the morning.” If that day arrives, you may just have Ada Poon to thank.

Yesterday, at the International Solid-State Circuits Conference (ISSCC) before an audience of her peers, electrical engineer Poon demonstrated a tiny, wirelessly powered, self-propelled medical device capable of controlled motion through a fluid—blood more specifically. The era of swallow-the-surgeon medical care may no longer be the stuff of science fiction.

Someday, your doctor may turn to you and say, "Take two surgeons and call me in the morning." If that day arrives, you may just have Ada Poon to thank.

Poon is an assistant professor at the Stanford School of Engineering. She is developing a new class of medical devices that can be implanted or injected into the human body and powered wirelessly using electromagnetic radio waves. No batteries to wear out. No cables to provide power.

"Such devices could revolutionize medical technology," said Poon. "Applications include everything from diagnostics to minimally invasive surgeries."

Certain of these new devices, like heart probes, chemical and pressure sensors, cochlear implants, pacemakers, and drug pumps, would be stationary within the body. Others, like Poon's most recent creations, could travel through the bloodstream to deliver drugs, perform analyses, and perhaps even zap blood clots or removing plaque from sclerotic arteries.

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Challenged by power

The idea of implantable medical devices is not new, but most of today's implements are challenged by power, namely the size of their batteries, which are large, heavy and must be replaced periodically. Fully half the volume of most of these devices is consumed by battery.

"While we have gotten very good at shrinking electronic and mechanical components of implants, energy storage has lagged in the move to miniaturize," said co-author Teresa Meng, a professor of electrical engineering and of computer science at Stanford. "This hinders us in where we can place implants within the body, but also creates the risk of corrosion or broken wires, not to mention replacing aging batteries."

Poon's devices are different. They consist of a radio transmitter outside the body sending signals to an independent device inside the body that picks up the signal with an antenna of coiled wire. The transmitter and the antenna are magnetically coupled such that any change in current flow in the transmitter produces a voltage in the coiled wire -- or, more accurately, it induces a voltage. The power is transferred wirelessly. The electricity runs electronics on the device and propels it through the bloodstream, if so desired.

Upending convention

It sounds easy, but it is not. Poon had to first upend some long-held assumptions about the delivery of wireless power inside the human body.

For fifty years, scientists have been working on wireless electromagnetic powering of implantable devices, but they ran up against mathematics. According to the models, high-frequency radio waves dissipate quickly in human tissue, fading exponentially the deeper they go.

Low-frequency signals, on the other hand, penetrate well, but require antennae a few centimeters in diameter to generate enough power for the device, far too large to fit through all but the biggest arteries. In essence, because the math said it could not be done, the engineers never tried.

Then a curious thing happened. Poon started to look more closely at the models. She realized that scientists were approaching the problem incorrectly. In their models, they assumed that human muscle, fat and bone were generally good conductors of electricity, and therefore governed by a specific subset of the mathematical principles known as Maxwell's equations -- the "quasi-static approximation" to be exact.
Poon took a different tack, choosing instead to model tissue as a dielectric -- a type of *insulator.* As it turns out human tissue is a poor conductor of electricity. But, radio waves

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can still move through them. In a dielectric, the signal is conveyed as waves of shifting polarization of atoms within cells. Even better, Poon also discovered that human tissue is a "low-loss" dielectric -- that is to say little of the signal gets lost along the way.

She recalculated and made a surprising find: Using new equations she learned high-frequency radio waves \ travel much farther in human tissue than originally thought.

Revelation

"When we extended things to higher frequencies using a simple model of tissue we realized that the optimal frequency for wireless powering is actually around one gigahertz," said Poon, "about 100 times higher than previously thought."

More significantly, however, her revelation meant that antennae inside the body could be 100 times smaller and yet deliver the same power.

Note the tiny device on top of a penny

Poon was not so much in search of a new technology; she was in search of a new math. The antenna on the device Poon demonstrated at the conference yesterday is just two millimeters square; small enough to travel through the bloodstream.

She has developed two types of self-propelled devices. One drives electrical current directly through the fluid to create a directional force that pushes the device forward. This type of device is capable of moving at just over half-a-centimeter per second. The second type switches current back-and-forth in a wire loop to produce swishing motion similar to the motion a kayaker makes to paddle upstream.

"There is considerable room for improvement and much work remains before these devices are ready for medical applications," said Poon. "But for the first time in decades the possibility seems closer than ever."

Stanford doctoral candidates Daniel Pivonka and Anatoly Yakovlev contributed to this research.

Ada Poon's research was made possible by the support of C2S2 Focus Center, Olympus Corporation, and Taiwan Semiconductor Manufacturing Company.

Featured Tech Article:

Part 4 – Pain Management Application.

Stanford Report, October 7, 2014

Miniature wireless device being developed by Stanford Bio-X team creates better way of studying chronic pain

http://news.stanford.edu/news/2014/october/poon-pain-biox-10-07-14.html

A team of Stanford Bio-X scientists and engineers is creating a small wireless device that will improve studies of chronic pain. The scientists hope to use what they learn to develop better therapies for the condition, which costs the economy $600 billion a year.

BY AMY ADAMS

Ada Poon, a Stanford assistant professor of electrical engineering, is a master at building miniscule wireless devices that function in the body and can be powered remotely. Now, she and collaborators in bioengineering and anesthesia want to leverage this technology to develop a way of studying – and eventually developing treatments for – pain.

Chronic pain costs the economy $600 billion a year and the two most common treatments have significant drawbacks: narcotics are addictive and surgery is costly and carries considerable risks.

"Many people simply can't find a medication or technique to control their pain, despite all the approaches available," said David Clark, a professor of anesthesiology and pain management who treats patients with chronic pain in his medical practice. "Most people don't even achieve 50 percent pain control."

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The collaboration builds on work by Scott Delp, professor of bioengineering and mechanical engineering, and his students Kate Montgomery, who is a Bio-X fellow, and Shrivats Iyer. They developed a way of using light to control the activity of neurons that transmit pain, taking advantage of a technique called optogenetics. One color of light stopped the nerve from firing and prevented pain. Another color caused the nerve to fire.

To be clear, the work involved genetically engineering nerves in mice to be responsive to light, and is therefore not something that can currently be done in humans. But the work did point to a new way of studying how the sensation of pain is transmitted to and from the brain and, potentially, developing or testing better therapies.

Despite promise as a new model for studying pain, the initial approach had limitations. Since the light came through a cumbersome fiber optic cable, the mice couldn't move freely or use exercise wheels. It wasn't a natural environment and so any insights might not be relevant to humans.

"Right now, the only way to study pain is an indirect method," Poon said. And that indirect method has so for not been successful in generating new therapies.

"We've had failure after failure to translate drugs that were successful in animals to humans," Clark said. "This puts a premium on understanding how we should be studying pain."

Coupling a wireless technology to optogenetics eliminates the wire and allows a mouse to move freely, use an exercise wheel and socialize. Clark said this combination will allow researchers to design experiments that more closely mirror a patient's experience.

For example, Clark said that when he sees patients they don't necessarily complain only about the pain. They complain about not wanting to see friends, not being able to go to work, or not being able to do activities they enjoy.

"What we will be able to look at is a more natural measure of pain relief," Poon said. They could assess whether a treatment allows mice to return to normal activities by tallying time spent on an exercise wheel or socializing.

This collaboration is one of 22 projects recently funded by the Stanford Bio-X Seed grants, which Carla Shatz, the director of Bio-X, calls the "glue" that brings interdisciplinary teams together. This project is typical, with an electrical engineer, a

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bioengineer and an anesthesiologist, all of whom are Bio-X affiliates, working together to solve a biomedical problem. Bio-X has so far brought together more than 600 interconnected faculty members from across campus.

"When you combine people with different skills you will come up with something with truly high impact," Clark said.

Media Contact

Amy Adams, Stanford News Service: (650) 796-3695, amyadams@stanford.edu,

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