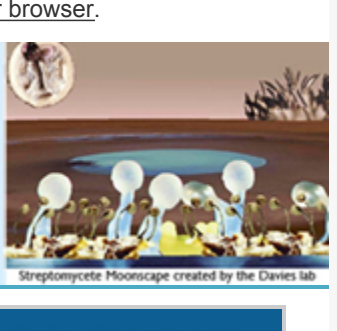
THROUGH THE PETRI DISH

Department of Microbiology & Immunology newsletter

May 2011



Streptomycete Moonscape created by the Davies lab

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THANK YOU

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If your e-mail address has changed, please email kbanguis@mail.ubc.ca to let us know!

HAVE YOU RSVP'D YET?

Tea & Tour for our alumni

Monday, May 30th, 2011
3:00 pm – 5:30 pm
Life Sciences Centre, West Atrium
2350 Health Sciences Mall
RSVP via email to kbanguis@mail.ubc.ca

WELL DONE AND WELL DESERVED!

- ***Lindsay Eltis*** for receiving a UBC Killam Research Prize in recognition of outstanding research and scholarly contributions.
- ***Curtis A. Suttle*** as the recipient of the 2010 A.G. Huntsman Award honouring his significant influence on the course of marine scientific thought.
- ***Bob Hancock*** for a 2010 Killam Award for Excellence in Mentoring recognizing his ability to create effective working relationships and constructive interactions with numerous graduate students over many years.
- ***Lindsay Eltis*** and ***Bill Mohn*** together with co-applicants ***Steven Hallam*** and other UBC and SFU researchers for the award of a $7.9M Genome Canada Applied Research Project grant for their project entitled: "*Harnessing microbial diversity for sustainable use of forest biomass resources*".
- ***Nita Shah***, graduate student in the Fernandez lab, as the recipient of the John Richard Turner Award that supports genetic research by students in Microbiology and Immunology.

……and the recipients of Faculty of Science Achievement Awards

- ***Ninan Abraham*** for outstanding research and taking on major leadership roles in and for the department.
- ***Jody Wright***, Ph.D. student in the Hallam lab, for her exceptional efforts in science education as an instructor, coordinator and course designer for workshops offered by the Advanced Molecular Biology Laboratories to grade 9 students and their science teachers. Jody was also the recipient of a University Graduate Teaching Assistant award last year.

CONGRATULATIONS!

MESSAGE FROM THE DEPARTMENT HEAD

by Dr. Mike Gold

It's hard to believe that a year has gone by since we published our first Microbiology and Immunology newsletter. Time seems to be accelerating, so it is important to periodically stop and take pleasure in all that we've achieved over the last year. Our students, faculty, staff, and alumni continue to succeed and receive recognition for their great accomplishments, many of which are highlighted in this issue of the newsletter.

Each year brings interesting new transitions and challenges. As you'll read about, a huge upcoming transition for our department will be the retirements of Drs. George Spiegelman and Hung-Sia Teh. It's hard to imagine the department without them. They have been mentors to all of us, as well as inspiring instructors for thousands (or maybe tens of thousands) of students. Also, to me, they look the same as they did 20 years ago when I first met them. Contrast that to my then and now pictures above. Hung-Sia and George will go on to pursue their many other interests, but I hope that we continue to see them often at department events. They are on the invitation list for my retirement party.

For faculty members, the greatest pleasure is seeing our former students graduate and become successful. This year we've had a number of graduate students complete outstanding PhD's and go on to very high profile post-doctoral positions. I now follow their successes on Facebook. Several of my former PhD graduate students are now faculty members at other Canadian universities and I've had fun sending them nerdy lab-warming gifts like sets of fluorescently colored test tube racks. I'm also thinking of enrolling them in the "book of the month" club where each month I send them one of their old lab notebooks, in an effort to clean up my lab. Mentoring your trainees is a life-long commitment and something our department takes great pride in. This year Dr. Bob Hancock was awarded the UBC Killam Prize for Mentoring, his nomination being supported by enthusiastic letters from a number of his former students and post-docs.

Our undergraduates continue to excel and impress us with their abilities and their desire to make the world a better place. I attended the spring graduation banquet last year for the first time and was very taken by the wonderful people we've all had the privilege of teaching and interacting with. I was nervous about having to give a speech to this very talented group of young people. Scientists usually don't give "speeches". We give "talks" about data. So I tried thinking about who was the wisest person I had known and any advice they had ever given me. Probably the wisest person I ever met was my grandmother, who always wanted to change the world for the better. So translating her advice, my speech to the graduating students went something like this:

Success is something we all have to define for ourselves but for my grandmother it meant that you are using your abilities to make a positive contribution to the world and to society. In my grandmother's language, it meant that you had become a "Mensch". The literal meaning of mensch is "a person" but it implies much more than that. It's a great compliment to say: "Now there goes a real mensch". How can you measure mensch-ness? As an undergraduate I was a physics major, so I like to describe things using graphs. On a mensch-ness graph, one axis would be the Albert Einstein/Yo-Yo Ma axis. It's how smart and accomplished you become in the things you do. The other axis is the humanitarian axis, the Terry Fox axis or the Rick Hansen axis. To be a mensch, you have to score highly on both axes. No matter how high you score on the Einstein axis, if you haven't moved off that axis into the humanitarian dimension, you weren't much of a mensch. At the same time, you need skills in order to make an impact in the Terry Fox dimension. All of our graduates have done extremely well on the Einstein/knowledge/ skills axis. And from my interactions with both our undergraduate and graduate students, I know that they have helped their classmates, friends, community, and those less fortunate through their many activities. My greatest pride as Department Head is that the people coming out of our department are mensches. The challenge for all of us is not to rest on our laurels and be a one hit wonder. You wouldn't want my grandmother to say, "Well, they used to be a mensch, but now eh..."

I'm taking suggestions for this year's graduation banquet speech.

Mike

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IS THERE LIFE AFTER IMMUNOLOGY FOR HUNG SIA-TEH?

by Dr. Hung Sia-Teh

Professor Hung-Sia Teh has worn many hats in our department and at UBC at large. Among them principal investigator on many research projects, Acting Director of the Biomedical Research Centre, and Acting Head, Department of Microbiology and Immunology. But, does he know how to retire?

On July 1, 2011 I will have been with the Department of Microbiology and Immunology at UBC for 34 years! During these 34 years I have been very fortunate to be given the task of teaching the subject I love: immunology. I find great joy in teaching this subject because it is relevant to our daily health and a fabulous subject from the developmental biology point of view. It is only in the recent past that we finally figured out how the immune system tailors its defense against specific pathogens. Of course there are miscues and when they happen, undesirable consequences are the result. Furthermore, our immune system can also cause autoimmune diseases, graft rejection, asthma and allergies. It is exciting to explain these concepts to my students. Over the past 34 years I must have instructed over 15,000 students. It is my hope that these students have learned a subject that will be useful for the rest of their lives. It will be a big bonus for me if a few of these students actually proceeded to do research in immunology.

It may be of interest to ask how I became an immunologist. I came from a very humble background in a small town in Malaysia called Teluk Anson. I didn't have any particular talent except to do well in my studies, which earned me a Canadian International Development Agency (CIDA or Colombo Plan) scholarship to the U. of Alberta in Edmonton in 1965. Following my graduation with a B.Sc. with distinction in Agriculture in 1969 I returned to Malaysia with the intention of serving in the Ministry of Agriculture. However, for unknown reasons, the Ministry refused me a job. Having been relieved of my contractual requirements I returned to the U. of Alberta in 1971 on a Medical Research Council Studentship to do my PhD in the Biochemistry Department. My first research supervisor, Christopher Smith, was a renowned nucleic acid chemist. During the first four months I learned how to sequence transfer RNA in his lab. I got my first good results after 5 months, obtaining sequences of partial digests that enabled me to complete the sequence of lysyl transfer RNA from yeast. Unfortunately, I could not share this nice result with Chris Smith since over the weekend that I made this progress he was killed in a climbing accident in Mt. Edith Cavell in February 1972. Consequently, after five months of graduate studies I was without a research supervisor. With the approval of the Department Head I operated Chris's lab with the help of a technician, got the project finished towards the end of 1972 and published the findings in the Journal of Biological Chemistry (JBC 1973 248: 4475-85). After completion of this project I decided to do something different. I wanted to switch to a more biological system and the only faculty member interested in immunology in the Biochemistry Department at that time was Vern Paetkau. Being a biochemist, Vern suggested that I work on determining whether immune responses can be regulated by cyclic AMP. I learned the immunological techniques from a post-doctoral fellow, Kwok-Choy Lee. Kwok-Choy was a fellow Malaysian and a very good friend and teacher. I was able to get some good results in the next year and got this work published in Nature (Nature 1974, 250: 505-507). This was how I got into immunology. After getting my PhD in 1975 I did two years of post-doctoral training with Rick Miller and Bob Phillips at the Ontario Cancer Institute in Toronto and joined the Department of Microbiology as an assistant professor in 1977.

One of the many colorful lakes in Jiuzhaigou National Park in Northern Sichuan, China.

"Only good guys make it to the Great Wall"
- Mao Zedong

It is reasonable to ask why I choose to retire from a subject that I love. First, 34 years at UBC is long enough and second, I want to make room for new talent. But is there life after immunology for me? My colleagues often ask me what are my plans after I retire. To me the nicest thing about retirement is that you don't need a plan. I will have more time for my grandchildren, tennis, golf and skiing. My wife (Soo Jeet) and I like to travel and we will definitely travel more in the next few years. Being of Chinese decent, I am very interested in the Chinese language, history and culture. I plan to improve my skills in reading and writing Chinese and tour more extensively in China. While I was working I often squeezed in as much fun things as possible during the weekends. Retirement to me will be a never-ending weekend. I am definitely looking forward to it.

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NOT GOING TO THE LAB?

by George Spiegelman

I have often told the story (so some of you may have heard it) that I have worked every year of my life since I was 14. And I never had a job outside a lab. That's I suppose not strictly true since much of my "job" at UBC has been teaching and administration. However, I approached both teaching and administration as "experiments" (why not try this?).

So here goes, a life outside the lab. True? Well not really. It's just more expanding the thing I call the lab from inside the walls where there are chemicals, centrifuges and biological questions to places where there are other tools and questions.

So what is next? The reason I focused much of my energy on teaching is that very early in my time here at UBC I met some terrifically smart, really nice undergraduates. It became very obvious to me that "my job" here was to do what I could to help these people gain the abilities to deal with the world they will enter after UBC.

This world is not necessarily such a nice place. There are extraordinary challenges of the injustice in almost all countries and the increasingly difficult stresses that humans are applying to the global ecosystems. It's very likely that the key things students need to know are not covered by the lactose operon paradigm of gene regulation. My wife and I decided that she would work in the community and I would work within the university trying to promote understanding of, and ways to meet, these challenges. So I spent quite a fair chunk of time developing alternative education paths for undergraduate students.

So I'll be shifting energies to these same issues outside the university. I suspect the details might look different- my wife and I are thinking of some grand schemes. But the motivation will remain. And the occasional picnic will be a bonus!

As for what changes are needed, for me it's nicely summed up by a quote attributed to Chief Seattle who was reported to have asked some European settlers "*When are you people going to start acting like you are intending to stay?*"

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MISA

by Calvin Wong

Calvin Wong is President of MISA, graduating this May and thinking about doing a Masters in Management.

Let me introduce MISA: The Microbiology & Immunology Student Association.
In order to find out more about my own club, I went digging through the AMS archives and found an original copy of our club constitution, which to my tremendous amusement, was written on a typewriter! It turns out our club was founded in 1985, and our name wasn't always such a mouthful, simply the Microbiology Club.

The number of students in the program has steadily grown over the years, and so has the club. Starting with four executives in 1985, we've now grown to a team of over a dozen executives and nearly two hundred members. The goals of the early days were simple: promote interest in microbiology, and provide students with opportunities to interact academically and socially. The scope and number of our activities has increased over the years, but the basics remain.

We usually host a handful of social events throughout the year, such as hockey nights at the Abdul Ladha Science Student Centre, and whatever else students suggest. MISA used to be the kind of club that held regular bake sales to support weekend ski trips and beer gardens, a lot of them at that. There aren't as many beer gardens these days, but we do equally exciting things, like hosting a computer gaming tournament this year.

The Starcraft II Tournament: It was a huge success, and we're already planning on running it again, hopefully as a charitable event. This may look like serious work to you, but actually, it's fun!

On the academic end of the spectrum, our greatest success story from the past three years has been info sessions we call the Undergraduate Research Nights. Grad students and faculty members are invited to speak to undergrads about their current research. Students not only hear about the latest advances happening right in their backyard, but also glean valuable insight into how they themselves can get started early. Eventually, we want to be able to invite alumni to speak at our events as well. After all, who better to inspire and potentially mentor our students?

New this year, the MISA exec team offers advising to students on a variety of matters such as a good combination of electives to take. Then of course, there are some activities that we've been at for the better part of twenty-six years: info sessions to guide students applying to our program, producing our ever popular course review packages for midterms and finals, and offering peer tutoring for Biol 112 (I hear that course is harder now, not that I did well back when it was "easier").

And to balance life, we add some volunteer or charity work to our social and academic activities. This can mean working hand in hand with the department to organize events such as World AIDS Day or World TB Day which you've no doubt read about in last year's issue. Another fine example was this year's welcome back barbeque in September, when Pakistan was reeling from recent monsoon floods. In hopes of contributing what we could, we gave students the option of making a donation when they came by to pick up their hotdogs. No pressure, no recommended donation amount, and we actually ended up raising over $300 that day! We'd like to thank all who came out for their generosity and support.

Top left: *Taking orders for one of five fantastic flavors of hotdogs.*
Top right: *Iron Chef Taiwanese Kevin Tsai working the grill.*

Just for the record, ours are "Japanese-style hot dogs" and not "Japa Dogs", because that would be trademark infringement... And yes, there are clear differences between the two. Mainly, ours are better :) . If you've ever had a Japa Dog before, be sure to come by next time MISA has a hotdog sale. I'm sure you'll agree :)

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USING A BACTERIUM TO PREVENT A VIRAL INFECTION

by Sassan Sangsari

Sassan is a 4th year Integrated Sciences student who has been working on the HIV Microbicide Project in the Horwitz Lab since the summer of 2010. His interests in HIV/AIDS span beyond research and drug development, as this particular virus is linked to many social justice issues.

Microbiologists are combining forces

With laboratories in the Life Sciences Centre being side by side, departmental collaborations are strongly encouraged and easily implemented. Microbiology Dr. Marc Horwitz, a Virologist, is getting the crucial element to combat sexual transmission of HIV delivered by his colleague John Smit, a Bacteriologist from the floor below.

While HIV/AIDS constitutes one of the major public health concerns of our time, lots of research grants are enticing researchers to come up with creative strategies to reduce global infection rates. The virus can primarily be transmitted both sexually and by blood contact. As for sexual transmission, condoms are known to effectively prevent HIV infections. The catch of course is that people don't like to use condoms. And here is where microbicides come into play.

An HIV microbicide is a gel or crème that can be applied topically prior to sexual intercourse in order to reduce the chance that the virus can be transmitted. As such, it offers several benefits over condoms. For starters, there is no "rubber in the way of full pleasure". Quite to the contrary, it could even serve as a lubricant. Second, if the microbicidal ingredient can be packaged into a colourless and odourless gel it becomes barely noticeable by the sex partner and one could thereby avoid any issues along the lines of "So you don't trust me to not have HIV?!". Currently no microbicides have made it to the market, though the list of candidates in the pipeline is long.

The main host cells of HIV are Helper T cells and Macrophages, both of which display the crucial receptor CD4 and either co-receptor CXCR4 or CCR5 that HIV binds to with its viral membrane proteins gp120 and gp41. To prevent HIV from infecting a host cell, one needs to prevent these key players from mingling with each other. For this, the bacterium Caulobacter crescentus has been hired to do the job.

After playing with C. crescentus, a harmless gram-negative bacterium found in soil and water, for the past three decades, Dr. Smit found a way to make the bug produce and display any protein he wants on its surface. So by displaying MIP-1alpha (the natural ligand of CCR5) on C. crescentus recombinants for example, an agent is introduced that blocks a critical host cell co-receptor from being accessible to the virus. Similarly, expressing the peptide Fuzeon (an antiretroviral drug that binds gp41) confines virions like a mosquito light trap. By developing multiple recombinant bacteria that interfere with the infection process in several ways, it becomes highly improbable for a mutant to evade the microbicide effect.

The team, consisting of faculty research associate Dr. John Nomellini, lab technician Iryna Shanina and undergraduate students Evan Ailon, Lara Robertson and Sassan Sangsari, are currently trying out different proteins displayed on C. crescentus in the hopes of increasing the potency of the blocking effect in vitro. Once an optimized cocktail is determined that works on a representative sample of HIV strains, the project will hopefully test the microbicide on non-human primates trials.

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FINDING INSPIRATION IN AFRICA

by Rebecca Gordon

Rebecca Gordon is a fourth-year student in Department of Microbiology and Immunology. After graduation this April she is pursuing a Master of International Public Health.

I went to Africa last summer thinking HIV/AIDS was a medical and scientific challenge; posed to us by Mother Nature and waiting for the adequate advances in technology and bright minds to save the day. This view was one of the factors that had driven me to study microbiology and immunology at UBC. I returned from Africa with a new perspective, new goals and a new direction for the next chapter of my life as I graduate from UBC this April.

Two students of Obambo Primary School showing off their pictures and poems about HIV which earned them stickers and a new pen.

GIVE (Global Initiative for Village Empowerment) is an organization run by a group of volunteers made up of UBC students and alumni working in the Kanyawagi region of Western Kenya combatting the HIV/AIDS pandemic through projects in nutrition, business, health and education. I was selected to travel to Kenya as part of the HIV/AIDS Education team in December 2009. To briefly sum up the projects: theHIV/AIDS Education team has succeeded in creating an HIV/AIDS curriculum for grades six to eight and implementing it as an examinable subject in seventeen schools of the Ojola School Zone. GIVE also funds the summer examination period, hosts a celebratory Education Day and runs the HIV/AIDS Awareness Football Cup for the students of the Ojola Zone.

The Kanyawagi region, which includes theOjola School Zonewhere our education projects are focused, is a community deeply affected by the HIV/AIDS pandemic. The "Headteacher's" office walls' show class summaries similar to what we see in Canadian schools with information on grade, teacher name, classroom and number of students. The difference in the Ojola Zone is the additional rows for the number of half-orphans, number of orphans and number of "high-risk" students. The number of primary school students with one or no surviving parents is staggering. This is one of many indicators of the catastrophic effect HIV is having on the community.

My primary role involving interaction with the students in Kenya was teaching life-skills workshops to supplement material taught by teachers.Misconceptions, ignorance and myths make prevention and education initiatives challenging but extremely important. The most difficult days were always when we set out, with our very helpful employee and fellow educator Maurice, to teach the "Condom Use" workshop. The use of condoms is still extremely controversial in the region but is a required portion of our education program. Condoms are tools not only for protection against HIV infection but also for other sexually transmitted infections and early pregnancy, all of which pose a considerable risk to the students of this region.

Learning how to handle a soccerball, or at least run around in the general vicinity of a soccer ball, creates a great environment for gaining trust, teaching and learning from children.Our weekly soccer tournaments were a useful venue for teaching condom demonstrations to the students. Although there are twelve steps to correctly putting on a condom, which I'm sure not all of you knew, the first step in this demonstration was distracting the little kids to avoid any inappropriate viewing of the erect prosthetic penis. This is where I, running and a soccer ball, came in handy. Soccer tournaments also gave us a chance to talk to the students outside of the classroom environment and quiz them on their knowledge. Correct answers to questions won them new school uniform shirts, which were a big deal! These weekend talks where I could share my passion about the biology of HIV and help students solve health and some relationship problems were the highlight of my time in Kenya. I eventually adjusted to situations such as havinga serious conversation with a thirteen-year-old boy about the risks of his sexual relationship with his new, HIV positive girlfriend.

Me teaching a lesson on the HIV lifecycle and the four stages of an HIV infection.

This summer I am very proud that GIVE will be piloting a novel project in the Ojola Zone pioneered by myself and Martina Feldman (my peer in the MBIM program). It has been widely recognized in the public health community that the HIV/AIDS pandemic is undergoing a significant shift in Sub-Saharan Africa towards females. This project will couple an after school girls club program lead by female teachers with the distribution of sanitary napkins. The goals of this project areto increase female students' school attendance and provide confidence building life-skills to decrease risk-behaviour.

It is very easy to get caught up in studying and forget about the big picture, particularly as an undergraduate student in an intense program in the Faculty of Science at UBC. Higher education and research are driven by the big picture ideas. There is a big world out there filled with the big issues that should be inspiring us to continue our studies. My place of inspiration happens to be Africa but a source for inspiration or a glimpse of the big picture does not have to be so far from home. There are many amazing opportunities with organizations here in Vancouver that are always thankful to have enthusiastic individuals with a background in microbiology.

Martina and I with students on Education Day.

Me talking to a group of female students at a Saturday soccer game about how HIV infects cells.

If you would like more information about GIVE or would like to donate time or funds to any of our projects please do not hesitate to contact Rebecca at rebeccagordon3@hotmail.com or check out their website at www.givesociety.org

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BEHIND THE SCENES - JASON GRIGG DECODES IRON SCAVENGING

by Dr. Sigrid Auweter

Dr. Sigrid Auweter is a post-doc in Dr. Brett Finlay's lab and generally curious about research.

Jason Grigg, graduate student (now actually a post-doc) in Dr. Michael Murphy's lab, wants to understand how pathogenic bacteria overcome one of the toughest challenges inside the host: extremely low concentrations of free iron, an essential nutrient for all cells. While at UBC, Jason has solved crystal structures of several iron uptake systems in Staphylococcus aureus, which has laid the foundation for a mechanistic understanding of iron acquisition by Gram-positive bacteria. Despite his success, Jason has not forgotten how he worked for years without measurable results. And he vividly remembers the time when things finally reshaped in his favor.

It was the week before Christmas in 2005, and Jason was one of the last students left on campus. With his plane home to Ontario departing early the next morning, Jason decided to spend the night in the lab, frantically setting up crystal trays. He was desperate for some good science news. His 4th year thesis work at the University of Western Ontario was not much of a success and after not getting any results in his first six months at UBC, he was now working on his second project in Michael's lab. All the hard work made him pass out on the couch, dreaming of a first paper, and he missed his plane to Toronto. But, a few hundred dollars poorer after rescheduling a flight just before Christmas, things finally turned around for quiet, determined Jason. An email arrived and an excited Mike Murphy presented Jason with the best Christmas present crystallography has to offer: a picture of a big, beautiful, reddish crystal, grown on one of the plates Jason had set up that night.

Back in Vancouver, Jason used the crystals to solve the structure of the NEAT domain, a haem binding protein domain, which is part of an iron uptake system that allows S. aureus to scavenge this cherished metal from the host (1). This iron import system contributes significantly to S. aureus virulence and the NEAT domain contains some of the most important antigenic epitopes present in vaccines against the opportunistic bacterium. Jason's findings have provided a molecular understanding of how haem is moved into Gram-positive bacteria, have impacted vaccine development, and have been cited over 30 times since being published in the fall of 2006. Since then, Jason has gone on to also solve the 3D structures of SirA, HtsA, and IsdE, receptor components of three other bacterial iron uptake systems (2-4).

Besides his work in the lab, Jason plays volleyball and loves exploring the city. He plans to stay in academic science, as he enjoys the creativity and freedom that come with the profession. Jason is currently applying for post-doctoral positions in the USA.

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IN THE FERNANDEZ LAB

by Dr. Rachel Fernandez

The Fernandez lab studies *Bordetella pertussis*, the bacterium that causes "whooping cough". There are effective vaccines for pertussis, but every year, about 20 million people in the world – mostly children– suffer from pertussis and almost 300,000 of them die. *B. pertussis* is an exclusively human pathogen with no environmental reservoir. Neither natural infection nor vaccinations provide life-long immunity. Adults and adolescents whose immunity has waned are the source of the infection. We are working to understand the reasons for this and to develop the next generation of pertussis vaccines.

The research in our lab has two themes: bacterial cell biology and bacterial pathogenesis.

The bacterial cell biology program looks at how proteins, specifically virulence factors, cross the Gram-negative outer membrane. We focus on a class of proteins called autotransporters, which are key virulence factors in Gram-negative bacteria; our research addresses periplasmic trafficking of *B. pertussis* autotransporters and the folded state of the proteins prior to, during, and after translocation across the outer membrane. We have discovered that *B. pertussis* can subtly modify the lipid A part of its lipooligosaccharide (LOS) and we are further investigating how the bacterium does that.

Bordettella pertussis growing on Bordet-Gengou media.

The bacterial pathogenesis program addresses immune evasion and immune modulation tactics used by *B. pertussis*. *B. pertussis* uses several mechanisms to evade our immune defenses. One key defense is the complement system, which plays an important role in marshalling both innate and adaptive immune responses. A pathogen's ability to control complement activation shapes the host's integrated immune response to it. Our lab investigates how *B. pertussis* evades the complement system. We have discovered that autotransporter proteins play a significant role in this process.

Toll-like receptors (TLRs) are a critical component of innate immune responses. They engage bacterial structures such as LPS and DNA and trigger the production of cytokines and other molecules involved in generating adaptive immunity. We have discovered that *B. pertussis* has the capacity to modulate immune responses by adding a glucosamine molecule to each phosphate group on its lipid A. This process is controlled by the Bordetella Bvg virulence regulon. The presence or absence of the glucosamine decoration dramatically changes how the host responds to *B. pertussis* with respect to the induction of pro-inflammatory cytokines. These cytokines are important for generating adaptive immunity, although too high an induction leads to high fevers and possibly other deleterious effects. It turns out that only human TLR4 receptor complexes can discriminate between lipid A that is or is not modified with glucosamine; mice are blind to this change. We are investigating the mechanism underlying this finding. We are examining the significance of this modification with respect to pathogenesis and working to understand the host's ability to mount long-lasting immune responses. Our work has implications for improving pertussis vaccines, especially the killed whole-cell pertussis vaccine still being used in low and middle-income countries.

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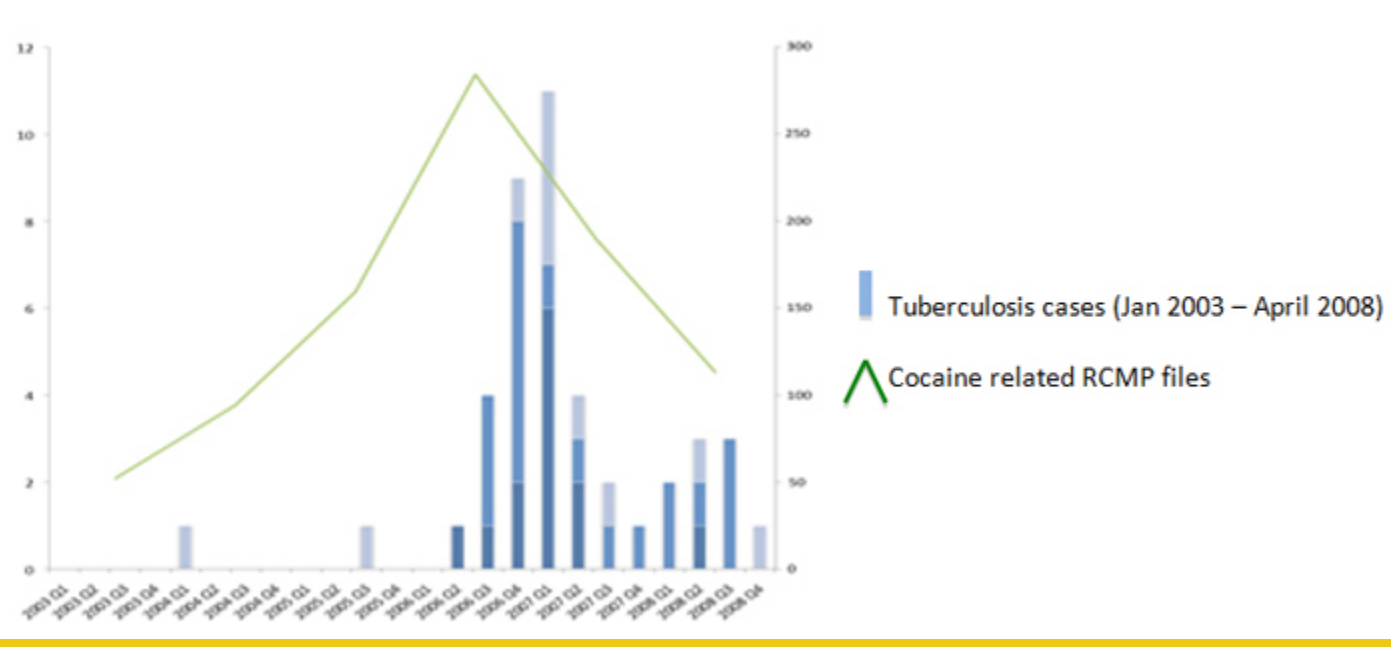
TB IN THE NEWS

by Dr. Jennifer Gardy

Self-described asscientist, nerd girl, person on TV, panda enthusiast….Dr. Jennifer Gardy leads BCCDC's Genome Research Laboratory and is an Adjunct Professor in M&I

On March 24th, for the second year in a row, the Centre for Tuberculosis Research organized a fantastic program to commemorate World TB Day, with short talks from local researchers and a keynote address, this year delivered by Pam Chedore, on the challenges and opportunities associated with improving TB lab capacity in the developing world. These events, held in the Life Sciences Centre at UBC and reaching out to the local community in the Downtown Eastside,reminded us all that TBremains a health issue of tremendous importance, not just in the developing world but also here in low-incidence countries like Canada. British Columbia has, on average, about 300 cases of TB a year, with many of these occurring in vulnerable populations, like the street-involved. Since 2006, BC has seen two large outbreaks of TB in marginalized populations – one lasting from 2006-2008 on Vancouver Island, and one that's been going on since 2008 in the Okanagan area.

The 2006-2008 outbreak was recently the subject of a groundbreaking study led by M&I Adjunct Professor Dr. Jennifer Gardy and Pathology & Laboratory Medicine Assistant Professor Dr. Patrick Tang, which also involved former M&I postdoc (and current SFU Professor) Dr. Fiona Brinkman and a host of other local TB researchers. Published in the February 24 issue of the *New England Journal of Medicine*, the study combined whole-genome sequencing of 36 *M. tuberculosis* isolates from the outbreak with social network analysis. By merging genomic, epidemiological, and clinical data, the researchers were able to reconstruct the outbreak, identifying its origins and stepwise spread throughout the community. Interestingly, the epidemic curve of the outbreak and cocaine-related RCMP files in the outbreak community suggests that the outbreak co-occured with a spike in cocaine prevalence in the community.



The study, which has been highlighted in prestigious scientific journals such as ScienceDaily, as well as local, national, and international newspapers, is one of the first examples of the emerging field of "genomic epidemiology", in which whole genome sequences are used as an epidemiological tool to follow the spread of a pathogen during an outbreak. This type of study only became possible recently, with the dramatic reduction of sequencing time and costs brought about by next-generation sequencing platforms, and is poised to yield amazing new insights into how infectious diseases behave within populations. By using genomics to reconstruct other outbreaks across a range of populations, we will be able to build a knowledgebase describing how different pathogens behave in different types of social networks – information that is critical to designing effective intervention and control strategies.

The BC Centre for Disease Control, where Drs. Gardy and Tang are both based, is already using the NEJM study's findings to guide how they investigate other outbreaks. One of the most striking results to come out of the paper was the fact that rather than a chain of transmission, in which Person A infects Person B who infects Person C and so on, this outbreak occurred in "bursts" of transmission, with Person A infecting many other people, most of who did not go on to spread the disease further. The superspreaders identified by the reconstruction were all socially well-connected, suggesting that in BCCDC's future outbreak investigations, it is most practical to try to identify, test, and treat the people who are most "popular" in their social network.

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CURRICULA UPDATES FOCUS ON FIRST YEAR

by Dr.Joanne Fox

Dr. Joanne Fox has a cross-appointment as instructor in M&I and the Advanced Molecular Biology Laboratory (AMBL), the educational facilities of the Michael Smith Laboratories exploring creative ways to get people excited about Science. She seems to have many, many balls in the air. To see that colourful array, check her website at http://www.msl.ubc.ca/faculty/fox .

Seminar in Science (SCIE113). Offering a small-class experience and extensive faculty member interaction, SCIE113 aims to get students thinking about, "What is science?" and, "Where does science fit in my life?" These first year seminars explore science as a comprehensive way of knowing with curriculum that aims to strengthen critical thinking and communication skills. The Department of Microbiology and Immunology is actively involved in helping this new initiative grow at UBC. Drs. Joanne Fox and Steven Hallam taught two of the very first seminars offered in the 2010 academic year – the first year this course was offered. The 2011/2012 academic year will see this new course expand to offer ~400 first year students access to the program.

Dr. Fox poses with one section of SCIE113, the First Year Seminar in Science.

Throughout the term, all students from the small-group seminars come together for a "Science and Society" speaker series, resulting in an audience of several hundred first year undergraduate students. The goal for this speaker series is to help students place science in the broad context of their lives, the university environment and global society at large. In 2010, our series included talks from faculty and graduate students in the Department of Microbiology and Immunology. Dr. Brett Finlay – named by Canadian Living magazine as one of the 10 Canadian scientists "most likely to save your life" – talked about his passions for research and Jody Wright, a graduate student from the Department shared her story of the path to her Ph.D.

If you're interested in getting involved, we're actively recruiting young alumni to participate in our Science and Society speaker series. We're looking for engaging speakers to deliver a 30-35min talk that helps expand students' horizons so they think widely about their future and what they can do with a science degree.

To find out more about this new course, you can visit the Faculty of Science website and/or contact Dr. Joanne Fox, Director, First Year Seminars (SCIE113) at: joanne@msl.ubc.ca or check out http://www.science.ubc.ca/students/new/courses/113

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FROM THE FRONT LINES IN M&I

by Dr. Julian Davies

Dr. Julian Davies is Professor Emeritus at the University of British Columbia, Fellow of the Royal Society, and a former President of the American Society for Microbiology.

Click here to read more about Julian.

Nature Biotechnology 26, 727 (2008)

And, yes, Julian is still in his lab every day :)

Nature Biotechnology 26, 727 (2008) doi:10.1038/nbt0708-727
http://www.nature.com/nbt/journal/v26/n7/full/nbt0708-727.html

Microbiology, having begun in the late 19th century, is a relatively young science compared to Chemistry and Physics. However, in its short lifetime microbiology has become the most important of the life sciences; this is due to several factors:

- microbes are the most ancient of living organisms

- they are the most numerous and universal

- they define the survival limits of life (temperature, pressure, etc.)

- all living beings depend on microbes for their existence

Since we as humans, are contigent on microbial beings for almost everything we do ("bugs are us"), it is not surprising that we tend to treat them as equals (why not indeed?) and even endow them with human characteristics (anthropomorphism). This is no more evident than in publications about bacteria and other microbes. The common journals in the field are littered with statements that are adopted from our own life styles. Authors clearly regard bacteria in the way they would their pets or children; microbes have been given pseudo-human characteristics. Bacterial behaviour is frequently described in terms of a war metaphor (weapons, fighting, defence, competition, etc); we are led to believe that microbial communities in the environment are in a constant state of fighting to the death. As other examples of humanizing bacterial properties, here are a few statements taken from the current literature:

"making a choice to utilize a particular substrate"
"the decision to make a compound"
"bacteria as predators, prey, or even invaders"

But seriously, how* and why are all living beings so dependent on bacteria? For one thing they are the oldest living organisms and for another they possess an unimaginable number of metabolic functions that permit the synthesis and breakdown of almost any organic molecule. Recent studies have shown that microbes in the human gut (and elsewhere) respond to a variety of human hormones; this includes unlikely compounds such as insulin, adrenaline and others. Conversely, the bacterial communities (or microbiomes) produce chemicals that trigger certain events in neighboring human cells. A new field of investigation is developing, called microbial endocrinology, that attempts to elucidate the chemical signaling that is involved in inter- and intra-kingdom communication within complex structures. Humans consume plant products, what are the effects of phytohormones on chemical communication in the gut? There must be an enormous number of interactions going on down there!

To conclude this scientific ramble, how about a little consideration of ethics and philosophy? Since microbes are so important to all life, do they have any rights? Do you realize that when you bake a loaf of bread 100s of millions of yeast cells die? I suppose I should have said "murdered"!

* "How?" is not a biological question, it is something that one asks a priest; but you know what I mean.

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