

Assessment of the PIMS IGTC in Mathematical Biology

Purpose

The purpose of this document is to provide an assessment of the PIMS IGTC in Mathematical Biology. This was proposed at the PIMS IGTC Steering Committee in Fall 2010, and was also requested by PIMS in January 2011 in the context of funding decisions and planning for the future of the IGTC.

The assessment was created and assembled by Maryna Yaskina (IGTC Educational Coordinator) in consultation with Mark Lewis (IGTC Program Director). It is based on statistics taken from IGTC applications, and on questionnaires answered IGTC students, previous IGTC students and IGTC faculty. To respect privacy, the results have been made anonymous when reported in this document.

Scientific Context of the IGTC

Although the life sciences and mathematics have historically been separate, the application of mathematical and statistical methods to solving scientific problems in the life sciences and systems biology is now experiencing dramatic success.

To meet the need to train new researchers in this area, the Pacific Institute for the Mathematical Sciences (PIMS) established the first International Graduate Training Centre (IGTC) in 2007 in the area of Mathematical Biology.

PIMS' stated long-term goals include developing several International Graduate Training Centres; the first of these Centres focuses on the area of Mathematical Biology. PIMS stated vision in funding International Graduate Training Centres is to "Seize the scientific leadership on the world stage and to launch a strategic training program in emerging areas in mathematics." This is to be achieved through training a generation of researchers in the application of new mathematics to present-day global problems and, in the words of PIMS, the IGTCs are to be "Premier international programs of their kind."

IGTC Goals

The goal of each IGTC is to turn PIMS universities into international hubs for graduate studies in emerging and strategic areas of mathematics. Each Centre is to be supported by, and operate closely with, strong research groups so that students and researchers from around the world who want to learn and explore new mathematics will come to the IGTC. It is expected that at the end of five years, a successful IGTC will have become a worldwide centre of research, learning and training in its area. For the PIMS IGTC in Mathematical Biology, this five-year window ends in fall 2012.

IGTC Report

An extensive report on the IGTC was developed in June 2009. In this report, the vision, administrative structure, successes and challenges faced by the IGTC are given. We refer this reader to the report for further background information on the IGTC.

IGTC Applications

The number of applicants is increasing every year allowing us to raise the quality of students who obtain IGTC fellowship.

Academic year	Number of applications	Number of fellowships	Success rate
2007-08	10	6	0.6
2008-09	18	6	0.33
2009-10	24	7	0.3
2010-11	30	9	0.3

Based on informal feedback from the IGTC Evaluation Committee, the current level of excellence of IGTC students compares favourably to those of NSERC scholarship applicants.

Survey

In order to assess the success of the IGTC programme in mathematical biology, a survey was administered to IGTC students (current and students, who completed the programme) and faculty members, who supervise(d) IGTC students. This survey was sent out in January 2011.

Eight questions were asked of the students:

1. Dates when you were IGTC fellow or enrolled in the IGTC.
2. Start date of your degree program, and degree obtained and finish date if you have now completed the program.
3. Did you receive any additional fellowship funding? Your answer will help us determine how effective the IGTC was at leveraging additional funds. If yes, please specify dates and amount.
4. Were you a Canadian citizen/permanent resident when you were IGTC fellow?
- 5 Your current institution and your position there.

6. How did IGTC programme affect your career? Give specifics if possible.
7. Please list publications associated with your IGTC research. Include theses, papers arising from them, and other papers that are now submitted or published that you worked on when you were an IGTC student:
8. How did the IGTC help you work towards your goals? Be specific? Which parts of the program worked best for you? Which could be improved?
9. Please add any comments about the IGT or about how it impacted you.

Responses from students

The survey that was given to students and 27 responses were received. They are presented in the Appendix A, however detailed answers to questions 3, 4 and 7 are not included for privacy reasons. However, summaries of the answers to questions 3, 4 and 7, as well as the other questions, are given below. For the complete alphabetical list of papers please see the Appendix C.

Out of the 27 responded students, 17 are either Canadian citizens or permanent residents (answers to question 4).

Additional Funding

From the question 3, the additional funding students had received can be categorized as following:

Source of funding	Amount
Federal and government funding	\$438,200
Provincial funding	\$180,500
Universities	\$71,700
Total	\$690,400

Impact on Career

The question 6 in the survey asked how IGTC programme affected your career. Many students noted that the financial support provided by the fellowship allowed them to concentrate on the research. The majority mentioned a positive impact on their career development by building personal connections, improving professional skills, and developing more broad view on the field they are working in.

Some feedback from students:

“The IGTC programme has been an amazing program that has had a significant impact on my career. I am at a smaller campus, UBC Okanagan, and therefore there is not access to many professors in the field of mathematical biology. Thus, the opportunities that I have had from the IGTC programme have shaped my PhD education.”

“Financial support helped to concentrate on my research. Also, summer courses and IGTC summit really helped to broaden my interests and gave an opportunity to interact with people in the field.”

“It introduced me new areas of interesting ways to apply mathematics to biology. Mainly from attending the weekly seminars and also attending the summit. This adds to my breadth of knowledge as a PhD student that I would otherwise not have picked up.”

“My decision to enroll for grad studies at the U of A was influenced by the fact that the U of A is part of PIMS and hence participates in the IGTC programme. I had read about the IGTC programme and I realized that it would provide me with great opportunities for learning and networking. So far, in fact, it has given me an opportunity to attend the grad summit where I met colleagues from other universities and during which I learnt a lot about math bio.”

Altogether, the responses from students are the following:

How IGTC programme affected your career	Number of responses
Provided financial support to be able to do more research	11
Provided educational component	8
Helped with career development	18
Assisted multidisciplinary research	4

Papers published

From the start of the programme IGTC students published many papers in various journals (originally question 7, see Appendix C for the full list). Some papers appeared in the top three journals in the world: *Science*, *Nature* and *Proceedings of the National Academy of Sciences of the USA*. Many papers were published in top tier scientific journals such as *Biophysical Journal*, *American Naturalist*, *PLoS One* and *Ecology*, and in top tier mathematical biology journals such as *Bulletin of Mathematical Biology* and *Journal of Mathematical Biology*.

Overall, the papers were published in the following areas:

Areas	Number of papers
Biophysics	5
Biology	10
Medicine	4
Applied Mathematics	4
Mathematical Biology	3

Physics	4
Bioinformatics	4
Science	3

In addition, there are 7 Master Theses, one Master report, and 3 PhD Theses.

Helping students achieve goals

Question 8 asked students how the IGTC helped them work towards their goals and which parts of the program worked best for them. The majority students noted that the programme helped them to make personal connections through participation in the student exchange, summer courses and annual summits. Many students mentioned that received extra feedback about their own research helped them a lot. In addition, educational component of the IGTC programme is valuable for a lot of students.

From the feedback:

“IGTC funding and workshops were of great assistance to my research and to writing my master's thesis. In particular, these enabled me to pursue research and to communicate and share ideas with others in the same field, or in related fields of mathematical biology.”

“The summer school really help me broaden my view and make some academic friends from all over the world; Some feedback from the ‘ Phd student visit’ to other university really help my research direction. “

“The IGTC has opened up many opportunities for me to attend courses, conferences, and the IGTC summit. Without the IGTC I would not have met my current supervisors and not known of the work that they do – I have no idea where I’d be! I really enjoy the courses that are put on by the IGTC, they are very useful topics.”

“The annual summits were excellent opportunities to discuss general and preliminary ideas with other students and faculty. The exchange I did (and talk I presented during the exchange) was great for allowing in-depth discussion of my research with other students and faculty. This led to some improvement of my thesis methods, as well as some new ideas.”

Overall, the question can be summarized as following:

How did the IGTC help you work towards your goals? Which parts of the program worked best for you?	Number of responses
Creates stimulating environment	3
Helps to make personal connections	12
I had more feedback about my own research	9
Provided financial support allowing more time for the research	5
Created network	5
Provided educational component	10
Helps to improve skills by making presentations	1

Responses from faculty

Seven questions were asked of the faculty:

1. By our records you have (had) following students who receive (d) either IGTC fellowship or enrollment in the programme. Please add names if there are more.
2. If students have graduated, please indicate their current whereabouts and position there.
3. Please list publications associated with your students IGTC research. Include theses, papers arising from them, and other papers that are now submitted or published that you worked on when you were an IGTC student.
4. How did IGTC advertizing and outreach help you to attract students to the graduate programme in your university?
5. How did IGTC advertizing and outreach help you to recruit students?
6. What impact an educational component had on students?
 - a. Summer courses?
 - b. Seminars/courses?
 - c. Summits?
 - d. Student exchanges?
7. Please add any comments about the IGT or about how it impacted your students.

From the faculty members that either currently supervising an IGTC student or supervised one in previous years, we received 10 responses (see Appendix B). However, detailed answers to questions 1, 2 and 3 are not included for privacy reasons.

Most of the students continue to work on their degree after the completion of the IGTC programme. However there are student who received academic positions: one is a Newton Fellow in Pathology at Oxford University, UK; another is an Assistant professor at St Francis Xavier University, NS; one works for Alberta Environment; another is Science Teaching and Learning Fellow, postdoctoral researcher at UBC.

Attracting and recruiting students

Questions 4 and 5 assessed the effectiveness of the IGTC programme in attracting and recruiting students. Some have noted that it is hard to tell as they already had the students before they started IGTC programme. However those, who experienced recruiting new students, noted that the programme is helpful for attracting students to PIMS universities.

From the feedback:

“We get many students who apply to our department and refer to the PIMS IGTC scholarship. I would say we have about four or five more than usual.”

“The IGTC programme was instrumental in attracting (student name) to UVic to work with me and (faculty member). He is a first-rate student, and it is of tremendous value to us to have attractive programmes like this to bring in students of his caliber.”

Overall, the responses were the following:

IGTC helped to attract and recruit students	6
IGTC did not helped to attract and recruit students	3
IGTC helped to retain students	1

Educational component

Question 6 asked about the impact of an educational component on students. Everyone agreed that summer courses and annual summits are extremely beneficial to students. A few noted that summer courses are especially valuable for students from small universities who otherwise do not have an access to the variety of courses in mathematical biology. Many faculty members commented that the current UofA video course as a great idea as it enables students to take a course in mathematical biology during the regular semester without any traveling.

IGTC students in the second year (in the PhD programme only) are asked to complete a student exchange to visit a PIMS university for approximately one week for collaboration

and communication with other research groups and to present his/her research. To date, five students have completed an exchange and we received very positive comments from them.

The answers from faculty about the educational component of the IGTC can be summarized as following:

Summer courses

Very helpful	9
N/A	1

Seminars/courses

Very useful	5
N/A	5

Summits

Very helpful, especially for building the network and career development for students	9
N/A	1

Student exchanges (for PhD students only)

Received a positive feedback from their students	3
Sometimes not so efficient if there is no one else in the similar area	1
N/A	6

From the feedback:

“The educational influence was enormous: without IGTC, my student will not be able to get relevant training at all. She has had so far the benefit of 2 courses: one course in Victoria last summer and now with Prof. Lewis. This has significantly enhanced her training and vision.”

“Very important as the students have had a chance to hear lectures from leading researchers and to work with a group of excellent students”

“ Both my own and other students seemed to gain a lot from IGTC summer courses”

“Summer courses are the most important source for the mathematical biology courses that my students take. They offer a wide variety of topics that UVic alone cannot offer.”

“The current UA video course is ideal and enables these students and others_ to take a course not otherwise available at UVic.”

“Several of our students (including (student name)) are taking a Mathematical Ecology course with (faculty name) this term (Jan-Apr 2011) in an interactive online format. Again it is a very significant enhancement of their graduate education to get intensive

exposure to additional areas of Mathematical Biology with experts in the field, beyond the specialties they are already exposed to through local faculty here at UVic. This programme allows students to get the breadth of expertise represented by faculty across the PIMS universities, not just at one of them.”

“The summits are an excellent opportunity for students to present their work and learn professional skills. I highly recommend all the summits to my students.”

“ These are a key component of this program and add enormously to their training, especially giving talks and presenting posters.”

Comments

Question 7 in the survey was for comments. Everyone acknowledges the IGTC programme for making a huge impact on training and career of their students.

From the survey:

“ IGTC has become an invaluable part of the training we can offer in mathematical biology. It brings together faculty and students from across the region and highlights the excellent research and training at every institution”

“The program has a large impact on the students here at UVic, which has a relatively small math biology program. It enables the students to have an enriched program, to make excellent connections and to enhance their research interests. The program is just up and running, and is beginning to reach its full potential.”

“IGTC is great – it supports students and it forms a sense of community between the participating schools. This will have a great effect on their careers.”

Overall, faculty acknowledges IGTC programme for

Providing financial support	2
Helping with recruitment and retaining students	1
Providing educational component	3
Building network and helping with career development	3

Summary

Overall the IGTC appears to be well on the road to meeting the ambitious stated goal to " become a worldwide centre of research, learning and training in its area." There is a great deal of enthusiasm for the program from students and faculty alike. Overall, the responses to surveys are very positive, although some also make suggestions as to how we can improve. The impact of the IGTC can be felt in two areas: (i) recruitment/advertising/profile of mathematical biology at PIMS institutions and (ii) education/career development/skills enhancement for mathematical biology at PIMS

institutions. In the first area, impact appears to be higher in smaller institutions and/or for junior faculty. In the second area, impact appears to be felt across the board. The aspect we can improve in the most is to help facilitate interactions with students who are in the program, but have less institutional support available for math biology, or have supervisors that are not as familiar with the field.

The amount of research that the IGTC has generated is truly impressive. Fifty papers are listed as products from the IGTC, with papers in *Science*, *Nature*, *Proceedings of the National Academy of Sciences* and other top journals. Although it is too early to have a large sample size, students that have graduated from the program have gone on to do well, occupying posts as faculty members or as postdocs in prestigious institutions such as Oxford.

Appendix A

IGTC Survey 2011 to students

Please send your replies to Maryna Yaskina (igtcmathbio@math.ualberta.ca) by Friday, January 21. Thank you.

1. Dates when you were IGTC fellow or enrolled in the IGTC:

1. From Fall 2010 to present
 2. Jan. 2010 – Present
 3. Fellow: 01 Sep 2009 – 31 Aug 2010; Enrolled: 01 Sep 2010 – 31 Aug 2011
 4. September 2010 to present.
 5. September 2008-August 2010
 6. 2007, Sept-2009, Aug
 7. Sept. 1st, 2009-Aug. 31st, 2009 enrolled; starting Sept. 1st, 2010 – IGTC fellow
 8. 2008-2009 (enrolled)
 9. September 2010
 10. (Sep 2010 – Aug 2011)
 11. May 2010, enrolled
 12. September 2010 - present
 13. Sept/09-present
 14. Academic year 2010/2011
 15. Jan 2007 – Jan 2009
 16. September 2007 – September 2009
 17. September 2009 – now, fellow.
 18. 2009-2011
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14. Start date – Sep 8 2010
 15. Jan 2007, MSc Applied Math, Oct 2010
 16. Start: September 2003, Finish: December 2009, degree obtained: PhD
 17. September 2009, MSc in Applied Math, not done yet.
 18. I started my Ph.D. in July 2008, and I expect to finish it in 2012.
 19. Sept. 1 2009 -
 20. September 2009 – my degree is still in progress
 21. Started on September, 2010. Seeking for a Masters Degree.
 22. MSc: Start- September 2006 Finish-October 2008 PhD Start-September 2008
 23. 2006
 24. September 1, 2009 - started MSc in Applied Math, not yet completed
 25. September 2010
 26. 5th Sep 2007
 27. Sept 2009. M.Sc not yet completed.
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5. Your current institution and your position there:

1. I am a graduate student/research assistant at Simon Fraser University.
 2. University of Victoria, Graduate Student (master's)
 3. University of Alberta, PhD student
 4. University of Alberta, Masters student
 5. University of British Columbia, Okanagan, PhD student
 6. University of Alberta, PhD candidate
 7. University of Calgary, PhD student
 8. UVic - graduate student
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9. PhD student, Dept. Computing Science, University of Alberta
 10. Simon Fraser University, Lab for Computational Biology, MSc Student
 11. UBC-Okanagan , grad student
 12. UVic – Mathematics Graduate Student
 13. UBC, MSc student
 14. University of Alberta – Grad student (Master’s)
 15. Data Technologist, Alberta Environment, Alberta Government
 16. Institution: UBC, Position: Science Teaching and Learning Fellow, postdoctoral researcher
 17. UBC, MSc student.
 18. University of Calgary, Ph.D. student
 19. University of Alberta – Graduate Student – Master’s Program - Oncology
 20. University of Alberta, PhD Student
 21. The University of British Columbia, student.
 22. University of Alberta, Teaching Assistant
 23. University of Alberta, graduate student
 24. University of Alberta, MSc student
 25. University of Alberta and PhD candidate in Applied Mathematics
 26. PhD student, Dept. of Biological Sciences, University of Alberta, Canada
 27. M.Sc student in Mathematics at the University of British Columbia.
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6. How did IGTC programme affect your career? Give specifics if possible.

1. It helps a lot for me. If I didn't receive the fellowship, it would take from me a lot of time to do teaching assistant rather than my research. The program helps me improve academic connections to more mathematicians who are interested in Mathematical Biology. Now I could see the possibility that I might get jobs latter not only from Computer Science departments but also Mathematics departments.
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2. Provided funding that enabled me to pursue research in mathematical neuroscience. In particular, supplied sufficient funding so that a greater proportion of time could be devoted to research than would otherwise be possible.
3. The IGTC sponsored a summer course that I took at Bamfield in 2009 (Models in Ecology) which was a helpful start into my PhD research area.

The yearly summits gave me opportunity to get to know fellow students in Math Biology and to learn about what is going on in this field at other Universities. I think this is helpful in achieving experience with meeting with other researchers, talking about mine and other people's research.

I haven't done my exchange to another University yet, but I think this will be similarly useful in experiencing what it's like to be a researcher, to get to know other people in the area and to get feedback on my own work.

4. The IGTC encouraged me to pursue multidisciplinary studies in math and biology, when I otherwise would have ended up in pure biology. I believe that a strong background in math has led me to very interesting projects and will open a lot of doors when I am looking for work in the future.
 5. The IGTC programme has been an amazing program that has had a significant impact on my career. I am at a smaller campus, UBC Okanagan, and therefore there is not access to many professors in the field of mathematical biology. Thus, the opportunities that I have had from the IGTC programme have shaped my PhD education. The IGTC has given me opportunity to present both poster and oral presentations and get valuable feedback on my research. Not only that, but it has given me countless opportunities to connect with other students, post-docs, and professors and learn about their current research programs. Additionally, I have taken three courses that have been sponsored by PIMS IGTC which have greatly increased my knowledge and allowed me to enhance my mathematical skills and given me the opportunity to learn from world-class researchers. Furthermore, these courses have given me the opportunity to connect with even a greater variety of students as these courses had students from different regions of the world. Funding provided by the IGTC helped with my living costs and travel so that I can focus exclusively on my research during my studies and didn't need to work additional TA positions to support myself. The IGTC official visit to the University of Alberta helped to shape my research project and gave me important advice for my thesis project. It was an excellent trip and gave me an opportunity to present my work in a mathematical biology seminar. The contacts made in this program have also led to speaking engagements in other seminars at PIMS universities, which are excellent opportunities that I would not have otherwise had. Therefore, this program has been very influential and has provided amazing collaboration and training that would not have been otherwise possible.
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6. It gives me more to focus on my research and nice communication chances on each IGTC summit.
 7. Financial support helped to concentrate on my research. Also, summer courses and IGTC summit really helped to broaden my interests and gave an opportunity to interact with people in the field.
 8. Positively - networking opportunities; mentors; relevant and useful courses and workshops
 9. It introduced me new areas of interesting ways to apply mathematics to biology. Mainly from attending the weekly seminars and also attending the summit. This adds to my breadth of knowledge as a PhD student that I would otherwise not have picked up.
 10. IGTC programme allowed me to continue my Computational Biology research with financial security in the second year of my MSc studies, and broaden my knowledge of other research areas within Mathematical Biology.
 11. The summer courses are great for meeting people and learning special topics.
 12. N/A
 13. Met students from other PIMS schools at the IGTC summit. The workshop on writing grant applications was helpful in putting together my application for NSERC.
 14. My decision to enroll for grad studies at the U of A was influenced by the fact that the U of A is part of PIMS and hence participates in the IGTC programme. I had read about the IGTC programme and I realized that it would provide me with great opportunities for learning and networking. So far, in fact, it has given me an opportunity to attend the grad summit where I met colleagues from other universities and during which I learnt a lot about math bio.
 15. Provided good opportunities to develop professional skills (poster presentations, skills seminars, chance to practice networking with others)
 16. So far, it has had great effects. I'm not sure I would have finished my degree (PhD) without the IGTC funding that allowed me to concentrate on my thesis work. It was also a great benefit to exchange ideas with IGTC faculty and fellow students, as this helped develop several key ideas for my thesis.
 17. Funding helped me focus on my studies, allowed networking with other students. I am sure the connections I've made will come in very useful in my career.
 18. The funding offered by the IGTC offered me the possibility of designing my experiments at a greater scale by hiring more assistants, and gave me more time to
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work on my project since I didn't need to supplement my funding with additional teaching duties.

19. The IGTC programme has allowed me to communicate readily with other mathematicians in my area of cellular biophysics. This has the potential to create beneficial interdisciplinary partnerships as I undergo experiments to test biophysical aspects of cellular processes. The annual summit was helpful at networking and discovering other mathematicians in my area of work.
20. The IGTC program allowed me to have funding for my first two years of the program to allow me to learn course material without a heavy TA load, meet people in my related field, meet other students from other universities, learn about new research being conducted, and improve my public speaking skills. All of these experiences and opportunities have helped my career in terms of being successful in my program and networking.
21. To be honest, I thought it was going to be of more significance to me, but I'm realizing now that, outside from the fact that I don't have to spend time working as a TA, it hasn't made much difference.

I thought there will be more seminars, workshops and other opportunities, but so far I have only attended one event. That event was the annual summit, which was good, but not that impacting.

Last term I attempted to join a "distance" course, offered at U Leth, which was announced to me through the IGTC. I ended up quitting because there was no support from UBC or the IGTC to facilitate the situation. I had to bring my own computer and "attend" the course from my desk. Maybe this term, with the new course that is being offered, it will be better.

22. Made connections with other students and faculty through annual IGTC summit meetings.
 23. Annual summits and partner institution visit very helpful place to develop communication skills and to network - I'm sure this will help my career.
 24. The scholarship allowed me to devote more time to my research and to connect with other students working in Mathematical Biology.
 25. At the last IGTC summit in Naramata, BC, which was also the first I attended, I was exposed to latest research works of some IGTC fellows. So, I know I am not a stranger in the mathbio research community and I have got some work to do so that I can also have a presentation come next summit.
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26. The feedback I got in IGTC workshops on my posters was very constructive and useful.

The Mathbiology seminar series at University of Alberta sponsored by IGTC was a great exposure for me to different areas of research in Mathbiology and provided great insights into my own research.

27. I am not working yet, but the program has allowed me to spend more time doing research than grading or tutoring while in school.

8. How did the IGTC help you work towards your goals? Be specific? Which parts of the program worked best for you? Which could be improved?

1. With the support from IGTC, I have more chances to talk to more researchers from Mathematics and Statistics department. So I think there should be more submits per year rather than one right now. It is great if the program can be extended to include east coast institutions like University of Toronto and McGill University. I wish there will be more summer schools per year or more Mathematical Biology courses offered (there should be at least one per semester).

2. IGTC funding and workshops were of great assistance to my research and to writing my master's thesis. In particular, these enabled me to pursue research and to communicate and share ideas with others in the same field, or in related fields of mathematical biology.

3. Being part of the IGTC makes me ambitious to do good work. This happens because of two things: First, when I have to present my work at IGTC events, I have to think about what I do and why, and why it is important. Second, seeing what other IGTC students do, encourages me to also do really good work.

4. The IGTC helped me in several ways. Most obviously, I received a fellowship from the IGTC that relieved me of any financial stress and allowed me to focus on my studies, rather than having to fund my education through additional part-time work (i.e., teaching assistantships). The IGTC also provided a supportive and enthusiastic network of other graduate students interested in mathematical biology. The annual IGTC summit exposed me to a broad range of research and gave me the opportunity to interact with people using similar tools to answer very different questions. The relationships I have made with fellow IGTC students will last for many years to come.

5. The IGTC have significantly helped me in my goals to become a professor. The program had annual summits which enhanced my presentation skills and has given me numerous contacts in the field of mathematical biology, which will be useful in collaboration and in securing a post-doctoral position. Additionally, the other research I was exposed to during these summits has given me new ideas for my own research. The

summer schools allowed me to develop a breadth of knowledge in math biology and learn from and connect with world-class researchers. The official visit shaped my research project and gave great advice for my research project. The funding aspect allowed me to focus exclusively on my research. Overall, I am extremely happy with the PIMS IGTC in mathematical biology and I can not think of a manner in which it can be improved. I think they have done an excellent job in providing opportunities, funding, and training.

6. The summer school really help me broaden my view and make some academic friends from all over the world; Some feedback from the ‘ Phd student visit’ to other university really help my research direction.

I heard about reducing IGTC fellowship each year, I think it is a better idea that we have one year of full fellowship without TA rather than two years of half fellowship with TA. We could set the IGTC as a research scholarship, so the eligible students will be limited to the second year of master student and above third year of PhD student or even PhD student passing the candidacy.

I don’t think IGTC summit every year is necessary. In stead, we could have it every other year, or we could even cut the budget more by just setting several travelling award to research related conferences if applicants give a talk.

7. It helped me financially so I don’t have to teach that much and can concentrate on research more. It provided an opportunity to take a summer course in the area I wasn’t familiar with. The summit gave an opportunity to communicate with people and share the ideas. I can’t think of anything that needs improvement.

8. It allowed me to concentrate very specifically on my interests in mathematical biology while attending a school which does not have a large applied math department. The networking, as well as the education in mathematical biology (e.g. guest speakers, credit courses, computer lab components of workshops and courses) and career preparation (e.g. dynamic speaking workshop at one of the summits) were the best parts for me. One area that could be improved is the communication regarding upcoming events, as well as expectations about program completion. When my first application for fellowship was not successful, I was enrolled in the program. When my application for fellowship the next year was not successful, I was not enrolled automatically, but I was not informed of this. The resulting confusion about whether or not I had eventually completed the program was very frustrating.

9. At the moment, the program is somewhat in conflict with my main goals at the moment, which is to write my candidacy. The conflict is that I now have to split time between courses/work/writing. However, this issue will obviously resolve itself by the end of the term at the latest so it is not a serious conflict.

10. During IGTC summit, it was quite interesting to learn about the state-of-the-art research projects in Mathematical Biology; however I felt that there was a large gap between the research profiles of computational biologists and biomathematicians that

attended the summit. In this direction, maybe there can be some additional material introduced to the summit content as to what each field can learn from the other and/or which research directions can be reached through the collaborative effort of researchers from both fields.

11. I met (faculty name) at the summer course and he answered a research questions that I have been struggling with.

12. The IGTC has opened up many opportunities for me to attend courses, conferences, and the IGTC summit. Without the IGTC I would not have met my current supervisors and not known of the work that they do – I have no idea where I'd be! I really enjoy the courses that are put on by the IGTC, they are very useful topics. The only improvement I would suggest is to (if possible) get the students together more frequently – I think the times when we all get together is what really makes the IGTC special.

Now that I've written my answer to question 9, actually – I think if there was some way to get more undergraduates involved in the IGTC, that was was an incredibly valuable experience for me when helping decide what I wanted to do after my bachelor's.

13. I haven't yet had many interactions with the IGTC. The conference would have provided me with more opportunities if it were held later in the academic year, simply because I didn't have much research underway after two months of my masters. The workshop with Dr. Schreiber was excellent value for the amount of time he spent with us. His lecture and the workshop he ran complemented each other nicely - I went away with ideas for modeling within evolutionary ecology and a new tool (namely, R) to use in that endeavor.

14. The grad summit was helpful in learning about what my colleagues are doing at their respective universities and as mentioned above, it was also a good networking opportunity.

15. Great opportunities to meet other mathematical biologists at various stages of my career. The summits were great.

16. -The funding helped me concentrate on my research.

-The annual summits were excellent opportunities to discuss general and preliminary ideas with other students and faculty. The exchange I did (and talk I presented during the exchange) was great for allowing in-depth discussion of my research with other students and faculty. This led to some improvement of my thesis methods, as well as some new ideas.

17. Provided a support network. Felt connected to other schools, other research; summit gave me a chance to see what other research groups were working on, which has given me ideas for a PhD. The program was fantastic. The one thing I would have liked would

be more information; maybe a monthly newsletter with research progress from all PIMS groups?

18. While I chose other options than the courses and summer school proposed, I really appreciated what have been offered. Summer courses of 1 or 2 weeks offered by the IGTC can be particularly convenient as they make it easier to pool together students from various universities. An increase in their frequency could be a great improvement. I also greatly appreciated the possibility of e-participation to some courses, such as the mathematical ecology course proposed by (faculty name) in 2011. These have the potential to provide IGTC students with an access to a much larger range of options than those offered by their own university and choose the most useful/relevant courses to their area of specialization. I think PIMS universities should more systematically propose this options.

I greatly appreciated the IGTC summit. The professional development components were very well designed and exchanges with professors and students enriching.

I still haven't participated in the student exchange programme, but I am looking forward to it.

19. My goal is to develop a comprehensive model of how cellular processes are so well coordinated, and to accurately describe the information and communication pathways within cells. This requires both innovative experiments to test the theoretical models my group has developed over the past decade which are now only experimentally being made possible (and recent results around the world are giving encouraging signs as to the basis of our theories). Thus, there is great potential for our models of intracellular communication to be refined by understanding the role of the cytoskeleton in the transfer of these signals. This will require development of current mathematical models of cellular communication. Collaboration with mathematicians familiar with biology is a necessity to develop the theory to go with the experiment results in development. My goal is also to keep my mathematical abilities refined as I begin biological experiments in the Department of Oncology and interactions with other mathematicians is helpful.

The summit worked well to meet other people in my area. The summit's organization was outstanding.

20. IGTC helped me achieve success in my program in terms of coursework, and allowed me to realize the potential of mathematical modeling in a related field such as Epidemiology. Without this scholarship, I do not see myself being as successful as I am now because I have made a community of friends during the summits that I can see myself collaborating in the future. I enjoyed all aspects of the program including the Summits. The week-long mentorship aspect is a really neat component that will allow me to learn from other people related to my research area of interest.

21. I attended last year summer school, and I think that helped me to become familiar with the world of MathBio research. However, when I attended that summer school, I wasn't part of IGTC yet.

22. Met other faculty and students interested in the same type of research as myself whom have helped give insight into potential research directions.

23. IGTC helped me become a more well-rounded scientist, by emphasizing the importance of aspects of science other than the science itself (like communication of the science). Summit was helpful, but always felt rushed. More communication with other IGTC members would have been helpful - perhaps a mailing list, or a more interactive website to learn about what IGTC student are doing.

24. Attending the workshop in Naramata was a great experience allowing me to see what other students do in Mathematical Biology. The weekly MathBio seminar hosted here at the U of A is a great opportunity to learn about mathbio research as well.

25. As mentioned in 6 above, I am working hard so that I can also present my research work at the next IGTC summit.

26. I had the opportunity to contact researchers in my field of studies and exchange idea with them.

27. The IGTC allowed me to spend much more time on research, allowing me to develop a deeper understanding of current Min protein oscillation models and construct new approaches to understanding the Min system.

9. Please add any comments about the IGT or about how it impacted you.

1. Thanks for supporting me

2. The IGTC, along with providing funding and organizing regular meetings, creates a community for students and professors in mathematical biology which is vital to research and advancement in the field, and to those working in the field.

3. In spite of getting another scholarship even more worth than the IGTC fellowship, the fellowship offer helped me deciding to do my PhD at the UofA. The other scholarship I only got after having already made the decision to come to the UofA.

At the UofA, the IGTC fellowship is particularly good for international students, because many other funding options are not available for international students.

4. Mostly I appreciate the IGTC as a forum that brings together students and other researchers who share a common interest in combining the fields of mathematics and biology in their work. Without the IGTC, I would not have met many mathbio students

from other western universities. This sort of networking is a key part of scientific research.

5. I am extremely happy that this program was in place during my graduate studies as it has given me numerous opportunities and training that would not have been otherwise possible.

6. I am grateful that I was once awarded this scholarship.

7. I am happy to be a part of IGTC. Not only does it provide financial support and opportunities for collaboration, but also it creates a net of researches working in the same branch of science and sharing an interest in Math Biology.

8. -----

9. -----

10. -----

11. -----

12. As said above – without the IGTC I would not have had the opportunity to meet so many great professors (and their students) from different universities that work in subjects that interest me. That information was crucial to helping me to decide where I apply to grad studies.

13. More workshops - even led by students who have learned useful techniques in their research field would be a good use of time at the summit.

14. -----

15. -----

16. The only thing I haven't said so far is that the IGTC membership and events allowed me to be a part of the larger Mathematical Biology community, which I found difficult otherwise (since my supervisor was new to this field). This was important to me both for the opportunities for feedback and collaboration, but also for professional development and personal happiness.

17. It certainly influenced my decision to attend UBC instead of an eastern school, and I'm very glad I came here.

18. Using my participation to the IGTC programme as a "visiting car" somewhat helped me in my networking activity, as it often triggered a surge of interest of professors I've been talking to.

19. While the majority of members of the IGTC are in areas distinct from cellular biophysics, there are some members directly involved in cellular biophysics, and these interactions have been very welcome. It is my hope that in the future there will be more biophysicists created by programs such as this, as people with strong expertise in physics, math, and biology are needed to tackle the finer mysteries of life which are now more accessible than ever.

20. The IGTC program is an amazing program because it has allowed me the opportunity to learn more about mathematical modeling in a supportive learning environment. I think the yearly summits, summer schools, and seminars are all components that have impacted my outlook and success in this field. I feel that without such program I would not have been as successful in achieving my goals, which was to learn how to integrate mathematical modeling in Epidemiology. I think this program has been well thought out and I have made many friends during the summits that I can see myself working with in the future. This kind of networking has great impacts to one's academic career. Thank you IGTC!!!

21. I hope that in the time that's left, before I finish my masters, the IGTC will impact me more.

22. -----

23. I think it is a positive thing for the math bio community. However, I think it is important to keep it open so that ALL students in relevant fields at participating institutions are invited to attend these events so that the IGTC can avoid being an exclusive club. Not sure if non-members were invited this past year...

24. -----

25. -----

26. -----

27. The IGTC program encourages novel research by allowing an individual to allocate more time and thought toward his or her research.

Appendix B

IGTC Survey 2011 to faculty

Please send your replies to Maryna Yaskina (igtcmathbio@math.ualberta.ca) by Friday, January 21. Thank you.

4.. How did IGTC advertizing and outreach help you to attract students to the graduate programme in your university?

1. To be honest, I don't think it did. All of the students above were already at the UofA or intending to come to the UofA.

2. It didn't attract any new students but it certainly helped retain them. As can be seen by the publication list these students are very active and have great publications. Any university would be more than willing to recruit them to their grad program.

3. Was very good for attracting (students name). This year (2010) we saw a big uptick in the number of very good students applying here, many of which applied for IGTC (although relatively few showed up in the end)

4. I am not sure what the differences between the 2 questions are, and so far I have not enjoyed any influence of IGTC on the recruitment process.

5. See #5 below

6. The IGTC Summer school helped me to attract a terrific postdoc, William Holmes to UBC. It also helped to get (students name) funded as an incoming student. I did not try to recruit other students via IGTC funding afterwards as I felt that I had already benefited from IGTC funding (for (students name) and (students name)) and others deserved a chance. However, there were a number of excellent students recruited by my colleagues and they have certainly helped to raise the overall level of energy, accomplishments, and enthusiasm in the Math-Bio extended group at UBC. Overall this has been a very good influence.

7. We get many students who apply to our department and refer to the PIMS IGTC scholarship. I would say we have about four or five more than usual.

8. (students name) was interest in working with (faculty members name) and me was the result of various IGTC activities.

9. The IGTC programme was instrumental in attracting (students name) to UVic to work with me and (faculty members name). He is a first-rate student, and it is of tremendous value to us to have attractive programmes like this to bring in students of his caliber.

10. The ones that got the IGTC fellowships considered this an “added incentive” to come work with me. The majority did not get fellowships or didn’t have substantial fellowships as they had other additional funding, or were enrolled rather than being fellows. These students told me they were attracted to the fact that we had an organized mathbio program via the IGTC.

5. How did IGTC advertizing and outreach help you to recruit students?

1. It is difficult to tell. I typically hear from students first, and then I point them in the direction of the IGTC. I have not come across a situation where a student has heard about the IGTC and then starts looking for a university/supervisor.

2. It really didn't. Rather it works as follows: I tell some people who apply to work with me to apply also to the IGTC program. If they get funding from IGTC it becomes easier for me to actually recruit them.

3. (students name) was keen to come here and participate in the program.

4. See #4 above

5. (students name) was attracted by attending an IGTC summit at UBC where he was finishing his undergrad degree. (students name) was attracted by a summit and by knowing about the program when he was an undergrad at UBC Okanagan. Both students were attracted by the possibility of funding that would enable them to spend more time on research.

6. See above.

7. My students were already here before IGTC started

8. N/A

9. See #4 above.

10. It increased awareness globally as to the mathbio activity.

6. What impact an educational component had on students?

a. Summer courses? _____

1. Very positive!

2. N/A

3. I would like to especially comment on the practical fitting course offered at SFU in 2009. The students that attended that course really learned some valuable things (esp. (students name), it had a big impact on her MSc. Thesis work.)

4. However, the educational influence was enormous: without IGTC, my student will not be able to get relevant training at all. She has had so far the benefit of 2 courses: one course in Victoria last summer and now with (faculty members name). This has significantly enhanced her training and vision.

5. Very important as the students have had a chance to hear lectures from leading researchers and to work with a group of excellent students

6. Both my own and other students seemed to gain a lot from IGTC summer courses. (students name) took my course as well as a course at SFU as did others ((list of students names) etc). It would be great to have some webcast courses to help cut down travel costs.

7. very useful

8. Summer courses are the most important source for the mathematical biology courses that my students take. They offer a wide variety of topics that UVic alone cannot offer.

9. The IGTC summer course we offered at UVic in 2010 provided our students, and all those who attended, a fantastic opportunity to meet and interact with and learn from some of the top people working in both infectious disease networks and neuronal network modeling in the world. These are areas of great practical import in regards to health policy and medical interventions, as well as being at the forefront of fruitful areas of mathematical research. Without the IGTC programme, these students would not have had the opportunity to learn this material in such a stimulating and concentrated context. It would be difficult to overestimate the value of such opportunities for motivated graduate students.

10. Quite a number took summer courses, eg, the course I held at Bamfield.

b. Seminars/courses? _____

1. I do not know what these are.

2. N/A

3. N/A

4. N/A

5. The current UA video course is ideal and enables these students and others to take a course not otherwise available at UVic.

6. We run a number of graduate courses that IGTC students are taking, as well as a seminar and work in progress series.

7. very useful

8. No experience.

9. Several of our students (including (students name)) are taking a Mathematical Ecology course with (faculty name) this term (Jan-Apr 2011) in an interactive online format. Again it is a very significant enhancement of their graduate education to get intensive exposure to additional areas of Mathematical Biology with experts in the field, beyond the specialties they are already exposed to through local faculty here at UVic. This programme allows students to get the breadth of expertise represented by faculty across the PIMS universities, not just at one of them.

10. My students all go to the mathbio seminar which is held weekly at Alberta. Also many of them have attended mathbio courses at Alberta.

c. Summits? _____

1. Positive – if only to get to know other students in mathematical biology and become integrated in the mathematical biology community. I'd like to think that they learned something from the professional development components as well.

2. Summits are good because it helps them get to know other students of similar interest in the region.

3. The summits are an excellent opportunity for students to present their work and learn professional skills. I highly recommend all the summits to my students.

4. N/A

5. These are a key component of this program and add enormously to their training, especially giving talks and presenting posters.

6. These have also been very exciting and great for the students. It has been hard for me to get to some of them during the middle of teaching terms. I helped to organize the first one.

7. very useful

8. This is a great opportunity for students and faculty members to interact, know, comment on and get help and inspiration from each other's research. It also makes the IGTC program a vivid and integrated community.

9. My impression is that these help to build a community of researchers and students across the PIMS universities much like what develops naturally at each individual university. Again the broader range of contacts can be of great benefit as these students' careers develop.

10. All of them in the program have gone to each summit available, whenever possible. They have made very positive comments about the benefits of the summit.

d. Student exchanges? _____

1. I do not have experience with these.

2. N/A

3. Especially valuable for those students who are at the smaller institutions, however, (students name) really enjoyed going to UA, where he got some valuable feedback, and we had a great visit from (students name) last year.

4. N/A

5. N/A

6. We had a visit by (students name) to U Alberta that was very helpful. (students name) was there at the same time.

7. sometimes not so efficient, in particular if there is no one else in a similar area as the candidate.

8. No experience.

9. N/A

10. (students name) and (students name) did these. Both were positive about the experience.

7. Please add any comments about the IGT or about how it impacted your students.

1. N/A

2. IGTC helps me recruit and retain some top notch students who are typically not eligible for CIHR or MSFHR funding because they are (a) too mathematical - even though they publish in top biological journals or (b) are foreign. Just in the past year the three students I have supported by the IGTC program jointly published 8 journal papers in highly prestigious venues such as Nature and Science so clearly the program is working!

- 3.** IGTC has become an invaluable part of the training we can offer in mathematical biology. It brings together faculty and students from across the region and highlights the excellent research and training at every institution.
 - 4.** I also highly appreciate the financial support which allowed my student to have teaching relief.
 - 5.** The program has a large impact on the students here at UVic, which has a relatively small math biology program. It enables the students to have an enriched program, to make excellent connections and to enhance their research interests. The program is just up and running, and is beginning to reach its full potential.
 - 6.** IGTC helped to find students doing great research, so that they did not have to be diverted to TA duties etc. it also helped with networking, professional development, and overall research excellence.
 - 7.** IGTC is great – it supports students and it forms a sense of community between the participating schools. This will have a great effect on their careers.
 - 8.** In general, my students have a wider choice of courses, a very supportive and vivid community, a widened view of the whole mathematical biology field, and opportunities to closely work with other researchers. I believe that IGTC provided indispensable experiences for my students.
 - 9.** N/A
 - 10.** I think that students have really appreciated the chance to network and to interact via a larger math biology community provided by the IGTC.
-

Appendix C

Publications associated with the IGTC programme.

1. *Aleksic M, *Dushek O, Zhang H, Shenderov E, Chen JL, Cerundolo V, Coombs D, van der Merwe PA (2010) *Dependence of T cell antigen recognition on TCR/pMHC confinement time. Immunity* 32: 163-174. *Equal contribution.
2. (MSc thesis): Ashander, J. *Parasite exchange, wild salmon, and farms* (UAlberta) 2010.
3. Ashander, J., Krkošek, M., Lewis, M.A. *Aquaculture-induced changes to dynamics of migratory hosts and specialist parasite: A case study of pink salmon and sea lice* (accepted pending minor revisions to **Theoretical Ecology**).
4. Cherkasov A, Hsing M, Zoraghi R, Foster LJ, See RH, Stoyanov N, Jiang J, Kaur S, Lian T, Jackson L, Gong H, Swayze R, Amandoron E, Hormozdiari F, *Dao P*, Sahinalp C, Santos-Filho O, Axerio-Cilies P, Byler K, McMaster WR, Brunham RC, Finlay BB, Reiner NE. *Mapping the Protein Interaction Network in Methicillin-Resistant Staphylococcus aureus. J Proteome Res.* 2010 Dec 17. [Epub ahead of print]PMID: 21166474 <<http://www.ncbi.nlm.nih.gov/pubmed/21166474>>
5. D. Coombs, R. Das and J. Morrison. *Membrane domain detection and characterization with fluorescence microscopy and mathematical modelling.* (Book Chapter). Will shortly appear in: “**Cellular Domains**”, I.R. Nabi (Ed.), Wiley Interscience, 2011.
6. D. Coombs, O. Dushek and P. A. van der Merwe, *A review of mathematical models for T cell receptor triggering and antigen discrimination* (Book Chapter). To shortly appear in: **Current Mathematical Models in T Cell and B Cell Biology**, C. Molina-Paris (Ed.) (Springer, 2011).
7. Phuong Dao, Kendrick Wang, Colin Collins, Martin Ester, Anna Lapuk, S. Cenk Sahinalp, *Optimal Discriminative Subnetwork Markers Predict Responses To Chemotherapies*, Submitted to 19th Annual International Conference on Intelligent Systems for Molecular Biology (ISMB'2011).
8. 1000 Genomes Project Consortium (including *Hajiresouliha I*), Durbin RM, Abecasis GR, Altshuler DL, Auton A, Brooks LD, Durbin RM, Gibbs RA, Hurles ME, McVean GA. *A map of human genome variation from population-scale sequencing. Nature.* 2010 Oct 28;467(7319):1061-73.PMID: 20981092 <<http://www.ncbi.nlm.nih.gov/pubmed/20981092>>

9. (PhD theses): O.Dushek, *Mathematical modeling in cellular immunology: T cell activation and parameter estimation*, (UBC), 2008.
10. O. Dushek, M. Aleksic, R.J. Wheeler, H. Zhang, S.-P. Cordoba, Y.-C. Peng, J.-L. Chen, V. Cerundolo, T. Dong, D. Coombs and P. A. van der Merwe. *Antigen potency and efficacy reveal the mechanism of efficient T cell activation*. Submitted to **Science Signaling** (2010).
11. Dushek O, Das R, Coombs D (2009) *A role for rebinding in rapid and reliable T cell responses to antigen*. **PLoS Computational Biology** 5(11): e1000578.
12. *Dushek O, *Mueller S, Soubies S, Depoil D, Caramalho I, Coombs D, Valitutti S (2008) *Effects of intracellular calcium and actin cytoskeleton on TCR mobility measured by fluorescence recovery*. **PLoS One** 3(12): e3913. *Equal contribution.
13. Dushek O, Das R, Coombs D (2008) *Analysis of membrane-localized binding kinetics with FRAP*. **European Biophysics Journal** 37: 627-638.
14. Dushek O, Coombs D (2008) *Analysis of serial engagement and peptide-MHC transport in T cell receptor microclusters*. **Biophysical Journal** 94: 3447-3460.
15. Dushek O, Coombs D (2008) *Improving parameter estimation for cell surface FRAP data*. **Journal of Biochemical and Biophysical Methods** 70:1224-1231.
16. E Foxall, R Edwards, S Ibrahim, P van den Driessche, *A contraction argument for two-dimensional spiking neuron models*. Submitted to **SIAM J Applied Dynamical Systems**, November 2010.
17. J. Gong, M. dos Santos, C. Finlay, T. Hillen, *Are more complicated Tumor Control Probability Models Better?*, submitted to **Math. Medicine Biol.** 2010
18. J.Gong and T.Hillen, C. Field, M. Parliament, *Optimal cancer radiotherapy treatment schedules under cumulative radiation effect constraint*. In preparation
19. *Hajirasouliha I*, Hormozdiari F, Alkan C, Kidd JM, Birol I, Eichler EE, Sahinalp SC. *Detection and characterization of novel sequence insertions using paired-end next-generation sequencing*. **Bioinformatics**. 2010 May 15;26(10):1277-83. Epub 2010 Apr 12. PMID: 20385726
<<http://www.ncbi.nlm.nih.gov/pubmed/20385726>>
20. T. Hillen, G. de Vries, J. Gong, C. Finlay, *From cell population models to tumor control probability: including cell cycle effects*, **Acta Oncologica**, 7:121-142, 2010

21. Hormozdiari, F., Alkan, C., Ventura, M., Hajirasouliha, I., Malig, M., Hach, F., Yorukoglu, D., Dao, P., Bakhshi, M., Sahinalp, S.C., Eichler, E.E., *Alu Repeat Discovery and Characterization within Human Genomes*. Genome Research 2010 (Epub ahead of print) **PMID**: 21131385.
22. Hormozdiari F, *Hajirasouliha I*, *Dao P*, *Hach F*, *Yorukoglu D*, *Alkan C, Eichler EE, Sahinalp SC.
Next-generation VariationHunter: combinatorial algorithms for transposon insertion discovery. **Bioinformatics**. 2010 Jun 15;26(12):i350-7.PMID: 20529927 <<http://www.ncbi.nlm.nih.gov/pubmed/20529927>>
23. L. Korobenko and E. Braverman, *A logistic model with a carrying capacity driven diffusion*, **CAMQ** 17 (2009), 85-105
24. Korobenko, L.; Braverman, E. *On permanence and stability of a logistic model with harvesting and a carrying capacity dependent diffusion*, submitted
25. Y.-X. Li, R. Lukeman, L. Edelstein-Keshet *Minimal mechanisms for school formation in self-propelled particles*, **Physica D**, 237 (5), p 699-720 (2008)
26. (MSc thesis): J.Lindquist, *Pair formation and disease dynamics: modeling HIV and HCV among injection drug users in Victoria, BC* (MSc thesis and manuscript-in-progress) (UVic)
27. Lindquist, J., Ma, J., van den Driessche, P., Willbroodse, F., 2011, *Effective degree network disease models*, **Journal of Mathematical Biology**, 62(2), 142-164.
28. Lindquist, J., Ma, J., van den Driessche, P., Willbroodse, F., 2009, *Network evolution by different rewiring schemes*, **Physica D**, 238(4), 370-278.
29. (PhD thesis): R.Lukeman, *Modeling collective motion in animal groups: from mathematical analysis to field data*, (UBC), 2009.
30. R. Lukeman, Y.-X. Li, L. Edelstein-Keshet *Inferring individual rules from collective behavior*, **Proc. Nat. Acad. Sci. U. S. A**, 107 (28): 12576-12580
31. R. Lukeman, Y.-X. Li, L. Edelstein-Keshet *A conceptual model for milling in biological aggregates*, **Bull. Math. Bio.**, 71 (2), p 352 (2009)
32. (MSc thesis): Marleau, J.N., *Modelling early plant succession on Mount St. Helens*, (UAlberta), 2009
33. Marleau, J.N., Jin, Y., Bishop, J., Fagan, W.F., Lewis, M.A. (2010). *A Stoichiometric model of early plant primary succession on Mount St. Helens* (accepted to **American Naturalist**).

34. (MSc report): Mckenzie, H.W., *Population dynamics in streams*, (UAlberta) (2010)
35. Mckenzie, H.W., CL Jerde, D.R. Visscher, E.H. Merrill, and M.A. Lewis. *Inferring linear feature use in the presence of GPS measurement error*. **Environmental and Ecological Statistics**.
36. Mckenzie, H.W., M.A. Lewis, and E.H. Merrill. *First passage time analysis of animal movement and insights into the functional response*, [Bulletin of Mathematical Biology, 71\(1\): 107-129](#).
37. Mckenzie, H.W., H.W., Lewis, M.A., Jacobsen, J.T., Jin, Y. *R_0 analysis of a spatiotemporal model for a stream population* (in revision at **SIAM J. on Applied Dynamical Systems**).
38. Mckenzie, H.W., Merrill, E.H., Spiteri, R., and Lewis, M.A. *Linear features affect predator search time: implications for the functional response*. Submitted to **Ecology**.
39. (PhD Thesis): S. M. Merchant, *Spatiotemporal Patterns in Mathematical Models for Predator Invasions*, 2009.
40. S. M. Merchant and W. Nagata, *Wave train selection behind invasion fronts in reaction-diffusion predator-prey models*, 2010, **Physica D**, vol 239, pp. 1670-1680.
41. S. M. Merchant and W. Nagata, *Instabilities and spatiotemporal patterns behind predator invasions with nonlocal prey competition*, submitted, 2011.
42. J.S. Morrison, R.Das, C.W. Cairo, D.E. Golan and D. Coombs. *Deciphering multi-state lateral mobility in single particle trajectories with a hidden Markov model*. This was submitted and rejected in 2010, but we are now working on improving it and will submit it again.
43. (MSc thesis): J.S. Morrison. *Deciphering multi-state mobility within single particle trajectories of proteins on the plasma membrane*. UBC, 2010.
44. (MSc thesis): E.Prosk, *The Cofi*

- lin activity pathway in metastasizing mammary tumour cells*, (UBC), 2009
45. Rajakaruna, H., Strasser, C., Lewis, M.A. *A novel approach to indentify non-invasible habitats for marine copepods using temperature-dependent R_0 as a metric* (submitted to **Biological Invasions**)
 46. Rajankaruna, H., Potapov, A., Lewis, M.A.: *Impact of stochasticity on risk of invasion windows under propagule flow* (in revision at **Theoretical Population Biology**)
 47. (MSc thesis): V. Rajani, *Quantitative Analysis of Single Particle Tracking Experiments: Applying Ecological Methods in Cellular Biology*
 48. Vishaal Rajani, Gustavo Carrero, David E. Golan, Gerda de Vries, and Christopher W. Cairo, *Analysis of molecular diffusion by first-passage time variance identified the size of confinement zones*, submitted to **Biophysical Journal**.
 49. S.Strohm, *The effect of habitat fragmentation on cyclic population dynamics: a numerical study*, **Bulletin of Mathematical Biology**, 2009
 50. S.Strohm, *The effect of habitat fragmentation on cyclic population dynamics: a reduction to ordinary differential equations*, submitted to **Theoretical Ecology**
 51. Sudmant PH, Kitzman JO, Antonacci F, Alkan C, Malig M, Tsalenko A, Sampas N, Bruhn L, Shendure J; 1000 Genomes Project (including *Hajiresouliha I*), Eichler EE.
Diversity of human copy number variation and multicopy genes. **Science**. 2010 Oct 29;330(6004):641-6.PMID: 21030649
<<http://www.ncbi.nlm.nih.gov/pubmed/21030649>>
 52. Sushko I, Novotarskyi S, Körner R, Pandey AK, Cherkasov A, Li J, Gramatica P, Hansen K, Schroeter T, Müller KR, Xi L, Liu H, Yao X, Öberg T, Hormozdiari F, *Dao P, * Sahinalp C, Todeschini R, Polishchuk P, Artemenko A, Kuz'min V, Martin TM, Young DM, Fourches D, Muratov E, Tropsha A, Baskin I, Horvath D, Marcou G, Muller C, Varnek A, Prokopenko VV, Tetko IV.
Applicability domains for classification problems: benchmarking of distance to models for ames mutagenicity set. **J Chem Inf Model**. 2010 Dec 27;50(12):2094-111. Epub 2010 Oct 29.PMID: 21033656
<<http://www.ncbi.nlm.nih.gov/pubmed/21033656>>
 53. Tania N, Prosk E, Condeelis J, Edelstein-Keshet L (2011) *A temporal model of cofilin regulation and barbed end generation in invasive tumor cells*, under revision for **Biophys J** (favorable reviews) 23 pages, Jan 2011.

54. Treanor B, Depoil D, Gonzalez-Granja A, Barral P, Weber M, Dushek O, Bruckbauer A, Batista FD (2010) *The membrane skeleton controls diffusion dynamics and signaling through the B cell receptor*. **Immunity** 32: 187-199.
55. (MSc thesis):R. Wong, *Study of Animal Movement and Group Formation with a Lagrangian Model*, (UAlberta), 2010.
56. Yu NY, Wagner JR, Laird MR, Melli G, Rey S, Lo R, *Dao P*, Sahinalp SC, Ester M, Foster LJ, Brinkman FS.
PSORTb 3.0: improved protein subcellular localization prediction with refined localization subcategories and predictive capabilities for all prokaryotes. **Bioinformatics**. 2010 Jul 1;26(13):1608-15. Epub 2010 May 13. PMID: 20472543 <<http://www.ncbi.nlm.nih.gov/pubmed/20472543>>