WINDWARD ISLANDS RESEARCH & EDUCATION FOUNDATION

2005 Annual Report



Mission Statement:

Founded in 1994, WINDREF seeks to advance health and environmental development through multi-disciplinary research and education programs. WINDREF strives for program excellence by promoting collaborative relationships between internationally recognized scholars and regional scientists and by adhering to the highest ethical and academic standards in the design and conduct of research.

WINDREF's primary goals include:

- To provide a scientific resource center capable of coordinating international collaborative research of the highest caliber in the areas of medical and veterinary public health, anthropology, ecology, marine and terrestrial biology and ethics.
- To provide a first rate academic opportunity to scientists from the Caribbean and around the world offering unique research opportunities to enhance the knowledge and welfare of local and international communities.
- To conduct applied scientific research for the benefit of community and health development at the local, national and international levels.
- To share relevant scientific information with local and international communities.

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1.0. Highlights from 2005 Director's Report

2005 was a year we were able to refocus our attention on the research programs, whilst the rebuilding activities following Hurricane Ivan of September 7th 2004 continued. Collaborative research projects continued in Grenada (dengue, water quality testing, marine biology, medicinal plants and the genetic correlation of addictive diseases). Internationally projects continued in Guyana (lymphatic filariasis), the Dominican Republic (sanitation and intestinal parasitoses), Uganda (wildlife zoonoses), Turkey and Romania (cystic echinococcosis), and at Rockefeller University in the USA (genetic correlation of addictive diseases).

Two new projects were started in Grenada in response to monitoring some of the effects of Hurricane Ivan. The first was supported from a grant by the Pan American Health Organization (PAHO). This study examined whether changes in the birthrate occurred following the loss of electrical and cablevision services for a number of months. The study is ongoing and details of the outcome will be presented in next year's annual report. The second study was initiated through Dr. Kotelnikova's Caribbean Environmental Research Initiative

Environmental Research (CERI) program. The aim was to improve the quality of drinking water for the village of Apres Tout in St. Andrew's Parish and in so doing reduce the incidence of childhood diarrhea. An initial meeting was held with the Minister of Health, the Hon. Ann David-Antoine, and the Environmental Health officer, Mr. Worme, NAWASA officials, the stakeholders from Apres Tout and the funders (Just a Drop, a charitable trust in the UK) to plan the project.



Participants who attended the Apres Tout Meeting. WINDREF, June 2005.

The 6th Annual WINDREF lecture was presented by Dr. Mary-Jeanne Kreek (below) a distinguished physician scientist who is the Professor and Head of the Laboratory for Addictive Diseases at Rockefeller University in New York. Her lecture was entitled "Drug Abuse and Addictions: Some scientific approaches to a global health problem".



Professor Mary-Jeanne Kreek, MD

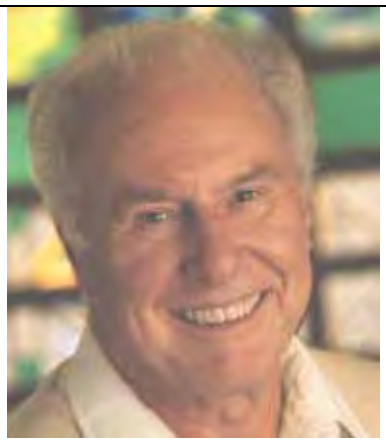
In 2005 WINDREF (UK) welcomed Baroness Howells of St. David, OBE, to their Board of Trustees. Baroness Howells was the first black woman to sit on the Greater London Council's Training Board; the first female member of the Court of Governors of the University of Greenwich and was the Vice Chair at the London Voluntary Services Council. Baroness Howells was born in Grenada and was raised to the peerage as Baroness Howells of St David, of Charlton in the London Borough of Greenwich in 1999. She received her early education at St. Joseph's Convent in Grenada before moving to the South West London College and City College in Washington DC.



Baroness Howells of St. David, OBE

The WINDREF (USA) board of directors welcomed Dr Karen Lawson to the board. Dr Lawson brings a wealth of experience to the board. She also serves as the president of the Bartholomew J. Lawson Foundation for Children.

WINDREF last a very valued senior research scientist, Dr. Mike Fisher, in 2005. Mike joined Merck in 1957 and worked with them until he had a stroke in early 2004. He was vice president of research and head of a lab of 60 research scientists. It was his scientific intellect and observational scholarship which led to perhaps his most profound discovery of ivermectin.



Dr. Mike Fisher, 1926 – 2005

In the 1970's Mike's lab was receiving thousands of soil and plant samples from all over the world which he was screening for their effects on a number of organisms. One sample came from a bunker from a golf course in Japan that contained a fungus called *Streptomyces avermillis*. This fungus proved to be lethal to Mike's lab mice, and when others may have discarded the compound, Mike persevered and tried ever minute doses of the substance. He was amazed at how little compound completely removed nematodes from the mice …. and a new powerful drug against roundworm parasites was born. For his discovery Mike received the Thomas Edison award for creative discovery, and the veterinary and medical world received a compound that revolutionized the treatment and cure of a myriad of infectious diseases. Today as a result of the discovery of ivermectin over 35 million people no longer live under the threat of inevitably going blind from onchocerciasis (river blindness), millions more have been spared the gross disfigurement from lymphatic filariasis (elephantiasis and hydrocoele) and dogs and cats (heartworm), pigs, cattle, sheep, goats and horses live a healthier life because of ivermectin. Shockingly, if the astute observation on ivermectin had not been made by Mike, all of these benefits may never have evolved for the organism has never again been found in its natural state in the wild. Mike was one of the most modest self effacing scientists, a real gentleman, and it was indeed a great honor to have known him. Mike passed away at his Bel Air plantation home on 20th April 2005. So many people and animals have benefited from Mike's work, his legacy will not be forgotten.

During 2005 a number of papers were published in peer reviewed journals and oral presentations were delivered at scientific meetings held in Italy, Turkey and the USA. I would like to thank all involved with our research carried out in WINDREF during the year. Funding for WINDREF during the year came from a number of sources, and I take this opportunity to thank them all for their continued support of our activities. Finally I thank everyone who participated in our research projects in 2005 in the many different countries we worked in around the world



Ms Hollie Schramm and Cal Macpherson working on an anesthetized young lion in Queen Elizabeth National Park in Uganda, June 2005. The project looked at zoonotic infections in the predator population in the Park.

Dr. C.N.L. Macpherson, PhD, DIC
Director

1.1. WINDREF Humanitarian Program

Our initial program that began in 2004 continued into 2005. Several countries sent representatives to assess



US Secretary of State Colin Powell's plane with the St. George's University in the background.

the gravity of the situation. The information gathered was fed back to their respective leaders and people. This helped in maintaining continued donation support from overseas to the WINDREF/SGU Relief Fund.

Donated funds assisted greatly in the refurbishment of two schools in Grenada. Two of the projects completed at Presentation Brothers College were the repair of the Leonard Dennehy Wing and the restocking of the Science laboratory with all the apparatus, instruments and chemicals.



SJ convent students and members of the SGU student body working together.

Another school, St. Joseph's Convent (SJC), suffered terrible damage to their roof and wooden floors. WINDREF/SGU Relief undertook the task of rebuilding the Caribbean Examination Council (CXC) wing of SJC, a priority to ensure the children would be able to take their exams in the summer.

The CXC students at SJC, under the guidance of the Principal, Sister Maureen, were able to complete their exams following the repair process carried out by WINDREF/SGU students and members of the local community.



WINDREF/SGU Relief relocating a SJC classroom into UNICEF tents while the convent is repaired.

The SJC students performed very well in the CXC examinations, achieving a 91.1% pass rate, one of the highest pass rates ever achieved. One of the SJC students won the La Grenade cup. An award given to the student with the highest grades in technical subjects.



The completed CXC examination hall in St. Joseph's Convent.

Some assistance was also given by our alumni in the form of The SGU Docs for Grenada program. These SGU alumni provided a much appreciated support network for the existing physicians on the island. These doctors provided supportive roles in several different specialties. This program came to a close during the first half of the year.

Following Hurricane Ivan, several students assisted in different capacities. Over the summer, four students, two volunteer medical students Carlos Rial and Michael Swan from Imperial College, London, and two premed Texas A & M students on the Fogarty International grant for Minority Health and Health Disparities International Research Training (MIRT) program, Jeniece Carter and Jenelle Rhinehart, worked in the health sector, assisting in burden analysis around the time of Hurricane Ivan.



Burden analysis team including UK medical student, Carlos Rial and two premed MIRT students, Jeniece Carter and Jenelle Rhinehart, with Dr. B Noel.

This assistance program was facilitated by WINDREF in conjunction with the Department of Medicine and was run over an eight week period.

Grenada, Carriacou and Petit Martinique were hit by Hurricane Emily a Category 1-2 Hurricane in 2005. While the severity of Emily paled in comparison to Hurricane Ivan, it affected our re-roofing program, causing an increase in the demand for building materials. The re-roofing program continues albeit on a smaller scale.

The next area of concentration for WINDREF will be the play ground project. WINDREF/SGU Relief members had meetings with both the Minister of Health and the Minister of Tourism to discuss the feasibility of building playgrounds for the children of Grenada. In 2006, we received written permission from both Ministries to secure funding for a major playground project. It is anticipated that this project will be funded by the Bartholomew J. Lawson Foundation for Children.

Submitted by Trevor Noel
Assistant Director, WINDREF

2.1. WINDREF Research Institute Board of Directors

In 2005 we welcomed Dr Karen Lawson to the Board.

- Dr. Keith B. Taylor, MD (President)
- Dr. Calum N.L. Macpherson, PhD, DIC (Vice President)
- Ms. Margaret Lambert, MA (Secretary / Treasurer)
- Dr. Karen Lawson, PhD
- Mr. Trevor P. Noel, MPH (Assistant Director)
- Dr. Allen Pensick, PhD

2.2. WINDREF St. Vincent and the Grenadines Board of Directors

- Dr. Ed Johnson, MD, Director
- Sir Fredrick Ballantyne, MD, Associate Director

2.3. WINDREF Research Institute Scientific Advisory Board

- Sir Frederick Ballantyne, MD
- John R. David, MD
- John J. Ferguson, MBChB, FRCGP
- Malcolm Ferguson-Smith, MBChB, FRCP, FRCPath
- Edmond Fischer, DSc
- C. James Hospedales, MB, BS, MSc
- Sir Malcolm MacNaughton, MD, LLD, FRCPG, FRAC
- Calum Macpherson, PhD, DIC
- Thomas W. Meade, CBE, DM, FRS
- Graham Serjeant, MD, FRCP, CMG
- Sir Kenneth Stuart, MD, DSc (Hon)
- M.S. Swaminathan, DSc
- Keith Taylor, DM, FRCP
- John B. Zabriskie, MD

2.4. WINDREF Research Institute Research Fellows

The following investigators have been appointed to the Windward Islands Research Institute as research fellows and are currently conducting collaborative research projects.

2.4.1. Senior Research Fellows

- Paul Fields, PhD, Brigham Young
- Paul Garner, PhD, Liverpool School of Tropical Medicine
- Mary Glenn, PhD, Humboldt State
- Duane Gubler, ScD, Hawaii Uni
- Ruth Milner, MSc, Vancouver Hosp.
- Stephen Morse, PhD, Columbia
- Leslie Ramsammy, PhD, DSC (Hon) Minister of Health, Guyana
- Stanley Weiss, MD, UMDMJ



Marios Loukas, MD, PhD, who recently joined the department of anatomical sciences, was appointed as a research fellow in WINDREF. Dr. Loukas has a keen interest in continuing to develop anatomical research at SGU and to try to attract research funds to facilitate this goal.

2.4.2. Research Fellows

- Zuri Amuleru-Marshall, PhD
- Glennis Andall, PhD

- Charles Avgeris, MSc
- Orazio Giliberti, MD
- Richard Kabuusu, DVM, MPH
- Svetlana Kotelnikova, PhD
- Matthias Lorenz, PhD
- Marios Loukas, MD, PhD
- Theresa McCann, MPH, PhD
- Barrymore McBarnette, MD
- Craig McCarty, PhD
- Clare Morrall, PhD
- Shamdeo Persaud, MD, MPH
- Shanti Singh, MD, MPH

2.5. WINDREF Research Institute Research Scientists

Research Scientists appointed to the Research Institute include: John Adamski, Sadiq Al-Tamini, Sumita Asthana, Yitzhack Asulin, Bishara Baddour, Jean-Pierre Barakat, Matthew Beeson, Keith Bensen, Matthew Boles, Karen Brennan, William Brown, Ella Cameron, Nicholas Caputo, Jessica Clayton, Mmakgomo Coangae, Rae Connolly, Abraham El-Sedfy, Daniel Firer, Scott Forman, Vamsi Guntur, François Hallé, John Holleran, Anthony Junck, Sebastian Kreitzschitz, Erik Lacy, Richard Lehman, Setshidi Makwinja, Paul Mancuso, Baher Maximos, John McCormack, David Melamed, Kirk Minkus, Jessica Morlok, Kevin Neill, Bayela Nfila, Yolanda Ng, Michael Nillas, Steve Nimrod, Andre Panagos, Rakesh Patel, Barry Politi, Sandeep Pulim, Sean Ramsammy, Tarek Refaie, Alan Rhoades, Laura Robinson, Karin Schioler, Corey Schwartz, Christopher Skaff, David Steinberg, Derrick Tlhoiwe, Sarah Treter, Nghia Truong, James Tsai, Dan Twyan, Frank Van Natta, Ru-Amir Walker, Juliette Williams, David Winokur, Colleen Wunderlich, Elliot Yung.

2.6. WINDREF Research Institute Administration

Mrs. Isha English continued as Administrative Assistant and Ms. Meg Conlon as Executive Secretary.

3.0. WINDREF (USA)

WINDREF (USA) was established to facilitate coordination of the USA activities and to administer charitable donations from the United States to the WINDREF Research Institute. As a non-profit organization, its goal is to enhance the development of WINDREF's research and educational programs. The offices are located on Long Island in New York to provide administrative and logistical support for the WINDREF Research Institute. Ms Candyce Armenti replaced Mrs. Melissa Conway-Nyhan as program coordinator in the New York Office.

4.0. WINDREF (UK)

WINDREF (UK) was set-up in Winchester, England in 1999 to promote collaboration between WINDREF scientists and academic centers of research in the United Kingdom. It is hoped that by reaching out to a larger scientific community, WINDREF will broaden its research opportunities by forming collaborations with scientists from the European community.

4.1. WINDREF (UK) Board of Trustees

A Board of Trustees was appointed in 1999 to oversee the activities of WINDREF (UK). In 2005 we welcomed Baroness Howells of St David to the Board.

- Lord Soulsby of Swaffham Prior, PhD, DSc, DVM (Chairman)

- Sir Kenneth Calman, KCB, FRCSE
- Baroness Howells of St. David, OBE
- Sir Kenneth Stuart, MD, DSc
- Richard Summerfield, MB, BChir,
- Keith B. Taylor, DM, FRCP
- Calum Macpherson, PhD, DIC (Ex Officio)

4.2. WINDREF (UK) Administration

Ms. Sue Huntington continues as Executive Secretary. Ms. Huntington provides the administrative support and expertise that is central to WINDREF's (UK) fundraising, administrative and collaborative activities.

5.0. SGU IRB

The Institutional Review Board was registered in the USA in March 2003 with the US Office of Human Rights Protection, Department of Human and Health Services (DHHS). IRB members include members of the Grenadian community as well as SGU faculty and staff. In August 2005, the officers of the IRB rotated, with Dr. Theresa McCann replacing Dr. Cheryl Cox Macpherson as Chair.

IRB forms and information may be found on www.sgu.edu - look for links on SOM page → MD Program, or use the Office of Research link on 'My SGU' page (forms page). Proposals that meet the criteria for expedited review are usually reviewed within approximately two weeks. All applications must be submitted electronically to the IRB Administrator. For more information, please contact Meg Conlon: mconlon@sgu.edu or irb@sgu.edu or phone (473) 444-4175 x 2221

The IRB approved the following projects in 2005:

- Jonathan Kibble, Professor, Associate Professor, Physiology, Effectiveness of Supplementary Instruction in Medical Physiology.
- Shohreh Sameni, MPH student, Public Health Impact of a Natural Disaster on Birth Rates and Antenatal Facilities on a Small Island Nation.
- Michelle Chen, MSc student, Microbiology, Development of a Model System to Study Detachment of Biofilm in Urinary Catheters.
- Ashley Crisp, MSc student, Microbiology, Nasal Carriage of Staphylococcus aureus in Medical Students.
- Matthew Beeson, SOM/WINDREF student, Assessment of the Effect of Treating E. coli Biofilms with Phage and Antibiotics Successively.
- Reccia Charles, Assistant Professor, School of Arts and Sciences, the Relationship between National Culture and Attitudes towards Higher Education.
- Daniel Duffy, GRENED, Brandeis University undergraduate, Poverty and Entitlement in Grenada's Relief and Rehabilitation Efforts following Hurricane Ivan.
- William Brown, MD/MSc student, WINDREF, How Improving Living Conditions Affects Prevalence and Reinfection Rates of Intestinal Parasitoses, Focusing on Proper Disposal of Human Feces.
- Valentin Fuster, President, World Heart Federation, and Thomas Pearson, Dean, Rochester University, Grenada Heart Project Rapid Assessment Profile.
- Valentin Fuster, President, WHF, Grenada Heart Project.

- Lucia McLendon, SOM student, Empowering Caribbean Women.
- Shunling Tsang, SOM student, Effects of Health Education on Personal Hygiene and Sanitation Knowledge.
- Catherine Gribbin, SOM student, Prevalence of Diabetes and Hypertension in St. David's Parish.
- Lian Doble, MSc student, SOVM, Prioritization of Disease Control for Urban and Per-urban Pig Production Systems, Kampala, Uganda.
- Edé Langevine, MSc student, WINDREF, Comparative Analysis of the Socio-economic Impact of Lymphatic Filariasis in Georgetown Guyana.

6.0. Current Projects

The projects currently being undertaken at WINDREF are briefly reviewed below.

6.1. The Dengue Diagnostic Lab at WINDREF

The Dengue Diagnostic Lab located at WINDREF continues to offer its diagnostic services to the University Health Services and the Grenadian community.

The dengue virus belongs to the genus *Flavivirus*, family Flaviviridae and is spread primarily by the *Stegomya aegypti* mosquito, which is ubiquitous throughout the Caribbean and the wider tropics.

The samples are processed by RT-PCR (Reverse Transcriptase – Polymerase Chain Reaction) and a commercially available immunoassay kit. The RT-PCR process identifies the specific serotype of dengue virus present while the immunoassay seeks to detect the presence of immunoglobulin indicative of primary or secondary infections with the dengue virus.

In 2005, 20 samples were analyzed yielding three (3) positives: one (1) positive IgM to dengue virus, indicative of a primary dengue infection and two (2) for Dengue- 3 virus.

Dengue fever, which in most cases is self-limiting, sometimes leads to a more complicated or life-threatening forms; dengue shock syndrome or dengue hemorrhagic fever.

The reduction in the number of cases of dengue could be due to a number of factors. One of the interventions that may play a part is the increase in vector control activity carried out by the Ministry of Health (cleaning drains, removing solid waste, cleaning brush, and fogging adult *stegomya aegypti* population formerly *aedes aegypti*). Another factor may be a reflection of the increase herd immunity to dengue-3 which was introduced in 2001 and resulted in an epidemic. Dengue immunity is lifelong but restricted to each of the four serotypes. Immunity is for the exposure to the specific type and confers no cross protection to the other three serotypes (Dengue-1/4).

Submitted by
Grant Lambert

6.2.1. Lymphatic Filariasis Elimination Program in Guyana

INTRODUCTION

The National Program for the Elimination of Lymphatic Filariasis (LF)

in Guyana entered its second year of implementation in 2005, following the launch of DEC fortified cooking salt as the major strategy for the interruption of the transmission of *Wucheria. bancrofti*, the lymph dwelling parasite which causes filarial disease. The programme experienced some technical difficulties about 4 months after the DEC-salt launch with some change in color of the product, and then in September 2004, damage to the salt plant in Jamaica by Hurricane Ivan caused another break in supplies. Production resumed in June 2005 and the programme is now on track and shows much promise in eliminating LF from Guyana.

BACKGROUND

Following the WHO resolution in 1997 for the elimination of LF as a public health problem, the Government of Guyana embarked on the establishment of the National Lymphatic Filariasis Elimination Programme in 1999. Guyana was identified as one of 80 countries worldwide, and one of only seven in the Americas, to have reported continued transmission and resultant filarial disease over the last 20 years. Initially the Ministry of Health was tasked with developing a draft national plan for the elimination programme and to recommend a program structure and funding source for the activities identified in the plan. A joint working group was established with the MoH and PAHO/WHO that produced the draft plan in 2000. Following a series of national consultations and stakeholder involvement the national plan was finalized.

PROGRAM STRUCTURE

The program was formally established in 2001 with the establishment of a National Task Force for the Elimination of LF in Guyana (NTF-LF) and a programme management structure within the Ministry of Health to implement the project and activities of the programme. The NTF-LF consisted of a wide range of Government agencies, local stakeholders, local and international NGO's, Universities (University of Guyana and St. George's University) and international organizations focused on health in Guyana. The Chief Medical Officer chairs the National Task Force and the National Programme Manger served as the secretary to body.

FUNDING

The Ministry of Health provided initial start up funding for the program's establishment through the Department of Disease Control. Funds were available to support staffing and over-head costs for the programme, but this was inadequate for the full implementation of the national plan. A proposal was developed and major funding was secured for a period of two years from the Bill and Melinda Gates Foundation to implement the DEC-salt program. Resources from this grant administered by PAHO through the local PAHO office in Guyana were allocated mainly to the social mobilization and social marketing campaign of the programme. Additionally, Emory LF Support Centre and the CDC (USA) supported PAHO/WHO in establishing the DEC-salt production capacity and the DEC-salt quality control system. The WHO procured and shipped all the DEC active ingredient needed to fortify salt need by Guyana for at least three years. Through a grant from the CDC Nutrition Project, UNICEF was able to support the local salt importers in quality control and in

reducing the impact of the increases in salt price associated with the packaging and labelling of DEC/Iodised-salt. A grant was awarded to Windward Island Research and Education Foundation from the Liverpool LF Support Centre in 2002 for the development of human resource need to sustain and develop the Guyana programme.

DEC SALT INTERVENTION

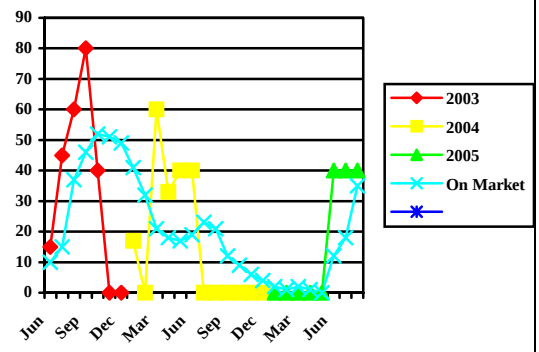
In July of 2003, the first batch of DEC fortified salt was received in Guyana and a successful public lunch of the program took place. DEC/Iodised salt was well received by the Guyanese public already sensitised by the ongoing social mobilization campaign. Additional targets for promotion especially from the rural communities were planned and active promotion at schools and health facilities were initiated. Since the intervention was applied through the commercial salt distribution system marketing intervention were also developed and implemented.



A packet of DEC salt

The supply of DEC/Iodized salt increased over the last four months of 2003 until some technical difficulties with the salt production halted importation. It was recognised by shopkeepers and consumers that DEC/Iodised salt was slowly becoming "blue" once it was exposed to the moist air. This colour change was not acceptable and as such the decision to halt production and correct the difficulty was recommended. It took the technical team about 3 months to solve the problem of the colour and for DEC/Iodised salt production to recommence. By then the public interest was lost and market demand waned.

Hurricane Ivan in the summer of 2004 caused some structural damage to the salt plant in Jamaica, the only facility producing DEC/Iodised salt in commercial quantities. The facility underwent extensive structural modification for 9 months and resumed production in June 2005. During the time of interrupted supplies, the sensitised public was left without the well-promoted DEC/Iodised salt.



Graph: DEC/Iodised Salt importation and market availability in Guyana (2003 – 2005)

The National programme, while working with its partners in resolving salt issues, continued to implement other aspects of the initiative such as training and the Morbidity Reduction Program. By June 2005 DEC-salt was re-introduced onto the local market. Efforts are now actively persuaded to enhance

the marketing and social mobilization in all the targeted regions.

SOCIAL MOBILIZATION

The aim of the social mobilization component of the programme is to increase the use of DEC-salt throughout Guyana so that at least 80% of the "at risk" population is regularly taking meals with DEC-salt. The approach shares vital information on filarial and the benefits of DEC-salt through trained volunteers with members of the community predominantly on a "one on one" or group basis. The new social marketing strategy focuses on a "door to door" approach in high burden areas and more general community promoting in other areas. Targets for the "door to door" activities for the last quarter of 2005 include the high prevalent areas in South and East Georgetown where 3 large communities are covered, and in Linden and New Amsterdam. Additionally, market site promotions are planned for large shopping areas in Regions 4, 6, and 10. DEC-salt is now supplied to all facilities preparing meals for groups of persons such as hospitals and care homes.

RESEARCH

As a part of the WINDREF grant, the National Programme Manager, Dr. Shamdeo Persaud, was offered a fellowship to read for the Doctor of Philosophy (PhD) in infectious diseases control. The fellowship commenced in January of 2003, and following a period of four months of theoretical pre-research training, a proposal was developed to examine the outstanding question of the efficacy of DEC-salt in suppression of microfilaria (Mf) production long enough to ensure interruption of transmission. The proposal focused on the survival of adult filarial worms (by the presence or absence of the filarial dance sign on ultrasonographic examination) in infected persons following DEC-salt treatment, and hypothesises that the low continuous dose of DEC supplied by DEC-fortified salt will not only suppress Mf production by adult filarial worm but will also ensure clearance of mature adult worms capable of continuously producing Mf. This is almost absolutely necessary to ensure interruption of transmission.

The project will also examine the impact of additional recommended intervention, e.g. the addition of albendazol to the mass treatment regimen since albendazol is known macofilaricidal effect. Additionally the newer recommendations for the use of the antibiotic doxycycline against the *Wolbachia* bacteria, which has a symbiotic relationship with the adult filarial worms, may prove against the macrofilarial parasite. These additional interventions can effectively reduce the chance of the re-establishment of LF transmission, and by shortening the life span of the adult worm, can reduce undesirable lymphedema and hydrocele.



Dr. Shamdeo Persaud displays a packet of DEC salt

The proposal is now ready for ethical review and for IRB approval by the University IRB. Additional training in the area of ultra-sonographic visualization of adult worms in the known site in males was completed with assistance from the Filaria Research Centre in Recife in Brazil. The sample consisting of males tested positive for *W. bancrofti* antigen using ICT from endemic lymphatic filarial areas in Guyana during the preparatory stages of the national programme already exists. Once ethical approval is obtained, participants of the study will be taken through an informed consent process and the double-blinded intervention study will begin.

PLAN FOR 2006

The Lymphatic Filariasis Elimination Programme targets 2006 for rapid up scaling of all activities including the production and importation of DEC salt, social marketing, morbidity control, and monitoring and evaluation.

The required amount of salt for household use in Guyana is on average 1,200 tons annually. The programme hopes to increase from the 240 tons imported in 2005 to at least to 1,000 tons by the end of 2006. Social mobilization will be ongoing with a focuses on hard to reach communities and the regions with lower prevalence in the hinterland.

The morbidity control component targets an increase of 50% over the already 17 centres in operation and that at least 2,000 persons with lymphedema know how to CARE for the swollen legs. The establishment of at least 6 support groups in high burden areas in addition to the one that is currently operational.

The second sentinel site survey is planed for February of 2006 in the two fixed sites in Lodge and Tucbur. Two spot check sites will also be studied during this period to ascertain uptake of the intervention and its impact in the wider community. The first coverage survey for DEC/Iodised-salt is scheduled for between March and June 2006. Several market type surveys are also planed and depending on resources, these will be implemented in the second and third quarter of 2006.

Submitted by Dr. Shamdeo Persaud
WINDREF Research Fellow

6.2.2. A comparative analysis of the Knowledge, Attitudes, Practices, Beliefs and Socio-economic impact of Lymphatic Filariasis (LF) in Georgetown, Guyana

Lymphatic Filariasis (LF) is a mosquito borne, parasitic, worm disease that has been identified as one of the six diseases targeted for elimination. *Wuchereria bancrofti* which accounts for 90% of all filariasis cases world-wide, affects 107 million people. It is also the second leading cause of disability world-wide with chronic clinical manifestations (CCMs) such as elephantiasis, lymphoedema and hydrocele. In childhood, there are more reports of lymphadenopathy than in any other category of development Therefore, this allows for early, preliminary, diagnosis by the parents of an infected child.

The GPELF (Global Programme for the Elimination of LF) was started in 1998 with the aim of eliminating LF by 2020. Studies have found that 90% of the population in Guyana is at risk and as many as 30% of children are positive for the *W. bancrofti* worm antigen. The

concern is that if even a small proportion of those children develop the chronic disease, it would be unacceptable. In Guyana, the Ministry of Health (MoH), in collaboration with PAHO/WHO, decided to address the transmission and morbidity issues associated with LF. The activities of the LFEP (LF Elimination Programme – Guyana) included: mapping of LF infection using the ICT card test which identifies those persons carrying filarial worm antigen and stained blood smears which detect the presence of microfilariae in the blood (microfilaremia), assessing morbidity and developing a strategy of mass treatment to reduce the level of microfilaremia and stop transmission.

The DEC (Diethylcarbamazine) salt strategy was chosen, since it was safe and effective, and it could be incorporated into existing iodization and fluoridation programmes, making it self-sustaining. This strategy would succeed once an 80% national market penetration is achieved and sustained for one year.

Since the launch of the programme in 2003, DEC salt use has been irregular as the availability of the product has been inconsistent. There were plans to have the salt provided in January, 2005. However as a result of the severe flooding in January of 2005, attention was diverted to other health related, post flood clean up activities. PAHO representatives did indicate that the persons recruited would be targeting poorer areas and would also be offering information about LF and DEC salt.

The socio-economic burden of the disease is tremendous because of the accompanying disability and disfigurement. Some of the social issues include stigma, sexual dysfunction and reduced marital prospects. Studies have shown that patients consider themselves an economic burden to their families. The individual, his or her household, the community and the government all feel the economic impact of this disease.

The economic and social costs have been documented in a number of studies done in Africa and Asia, however little information is available about the impact of LF in the Caribbean and in South America, and especially in the context of a country that is using the DEC salt intervention strategy. There is also scant, documented information on the knowledge, attitudes and perceptions of the persons who are chronically infected with LF.

The purpose of the study is to investigate the knowledge, attitudes, practices and beliefs of persons with and without chronic clinical manifestations of LF, with respect to early diagnosis in children, transmission and prevention/control of LF, DEC salt use and LFEP

It will also provide baseline information as to whether having chronic/overt LF has affected socio-economic status

The hypothesis of this cross-sectional study is therefore that the knowledge, attitudes, practices, beliefs and socio-economic impact of LF is significantly different for persons who have chronic, clinical manifestations (CCMs) than for those who do not have any CCMs

Two groups will be selected, namely a case group and a comparison group. Cases will be selected from Filariasis Clinics in Georgetown, Linden and East Coast Demerara, and they must have overt/chronic clinical manifestations of LF and must have had the condition for at least 1 year. The participants from the comparison group will be selected from those persons

attending care sites/health centres in the same areas. They will be matched according to age, sex and race and must have no history of overt/chronic LF.

Comparison group may include individuals who have acute LF or who are positive for the LF antigen.

A questionnaire and personal observations will be used to collect information. The first few questions of the questionnaire will address demographics including gender, age, marital status and average income. Participants will also be asked about their perceptions and also specific examples of how their condition has affected them both socially and economically. Some questions will focus on the source and extent of interviewee's knowledge of LF and the LF Elimination Programme and DEC salt. Others will deal with the attitudes, beliefs and practices. There will be a section which will focus on the structure and external environment of the interviewee's home.



Edé Langevine (left) discusses results with a medical student.

This study will be significant to both Governmental and non governmental institutions since there will be documented evidence of the impact with relevance to Guyana and its use of DEC salt. The study will also provide information about the likely effectiveness of the elimination strategy

It will also ensure that any information concerning LF elimination is given in such a way that persons with acute and chronic disease as well as the at-risk population are involved for the long term duration of the programme.

Submitted by Edé Langevine
Research Scientist

6.3. How improving living conditions affects prevalence and reinfection rates of intestinal parasitoses; focusing especially on proper disposal of human feces

The aim of the study is to compare the efficacy of helminth control in populations of Haitian refugee children receiving the currently recommended WHO regimen of deworming medication versus populations of such children that have been provided with proper, in-house sanitation facilities. The relative efficacy of control is being measured by the two treatments' individual abilities to prevent reinfection with the intestinal helminth *Ascaris lumbricoides*.

This project was divided into several stages. During the summer of 2005, phase I of the study was completed. During this phase a fecal sample was obtained from each participant and cross-sectional prevalence rates of Ascariasis were determined in two groups of school aged children; one cohort which has recently been provided with in-house toilets by

an independent, privately-funded organization, the other cohort lacking such in-house sanitation facilities. At the close of phase I, all the participants were dewormed with a single dose of Albendazole, as per the recommendations of the WHO.

During the summer of 2006 the second and final phase of the study will be completed. In this phase all participants will again provide a stool sample which will be analyzed for evidence of infection with *Ascaris lumbricoides*.



A study participant turns in his stool sample.

Each newly reported case will be regarded as a reinfection with the pathogen and will contribute to the overall rate of reinfection for the group to which that participant belongs. Once all the samples have been analyzed, the overall rates of reinfection in the two groups will be compared and appropriate conclusions will be drawn regarding the two treatments and relative efficacies of controlling intestinal helminth infections.

The results from phase I of the study showed a cross-sectional prevalence of Ascariasis of only 15% in those children with in-house sanitation facilities and 58% in those that lacked such facilities. The calculation of an odds ratio showed that children without in-house toilets were nine times more likely to be infected with *Ascaris lumbricoides* than those with toilets in their homes. The group with toilets in their homes showed a 76% disease protection compared to those without toilets. This means that those children with toilets in their homes have a 76% reduced risk of infection with the pathogen. The phase I data was also able to show that 61 cases of Ascariasis have been prevented in the 135 children that benefit from in-house sanitation facilities. Consequently, with a Number Needed to Treat of 2.2, we see that for approximately every two children that receive adequate sanitation facilities one case of Ascariasis is prevented.

Once the reinfection data is obtained from phase II of the study, and the identification of the cost of treatment per person per month that is associated with providing in-house sanitation facilities, practical recommendations can be made as to how limited resources can be most efficiently used to combat the global problem of infection with intestinal helminths.



Research scientist Will Brown in the laboratory in the Dominican Republic.

Submitted by William C. Brown III
Research Scientist

6.4. Characterization of novel bacterial species and genera

My PhD research deals with novel microorganisms I isolated from my MSc research. It is necessary to sequence the DNA and determine the optimum growth conditions as part of the classification of a novel species or genera of bacteria. The bacteria I isolated produced substances that inhibited biofilm formation (up to 84.5%, p=0.024) and eukaryotic fouling (up to 45.4%, p=.009) *in situ*.

To confirm previous results from 16S rRNA gene sequencing or fatty acid analysis (FA), the isolates were sent for additional sequencing. Table I lists the results are listed in *Table 1* and the isolates now have results from both 16S rRNA sequencing and FA.

Table 1. Optimum salinity comparison of isolates P2-2, P3-2, P4-4, and P5-2 with their closest relates species.

Strain	Optimum salinity (% NaCl)	Closest related species (16SrRNA,FAME)*	Optimum salinity (% NaCl)
P2-2	1-10	*Desemzia incerta* (n.d., 0.367)**	2-3.75
P3-2	4	*Aerococcus viridans* (0.91%, 0.523)	0
P4-4	5-15	*Psychrobacter immobilis* (5.15%, 0.554)**	2-3
P5-2	4	*Staphylococcus warneri* (0.00%, n.d.)	(0)

*= 16S rRNA gene sequencing (of 500 bp) percent difference greater than 5% indicates the isolate is not in the database. FA similarity index value of 1.000 = exact match, 0.600 = good species match, between 0.400 and 0.600 = isolate is not in database.
**= indicates distantly related and possibly novel genera.
Parenthesis indicates result for *Staphylococcus aureus*.

To determine the optimum temperature and salinity for the isolates, they were grown at different temperatures in the Artificial Sea Water broth, ranging from 10-45^{o}C, and salinities, ranging from 0-15 g/L NaCl. The optical density was measured with a spectrophotometer at 590nm approximately every 2 hours, and growth curves were made based both on optical density and CFU.

Table 2. Optimum temperature comparison of isolates P2-2, P3-2, P4-4, and P5-2 with their closest relates species.

Strain	Optimum temperature (^{o}C)	Closest related species (16SrRNA,FAME)*	Optimum temperature (^{o}C)
P2-2	24-45	*Desemzia incerta* (n.d., 0.367)**	37-40
P3-2	37	*Aerococcus viridans* (0.91%, 0.523)	35
P4-4	24	*Psychrobacter immobilis* (5.15%, 0.554)**	25-30
P5-2	24	*Staphylococcus warneri* (0.00%, n.d.)	25

As expected, the optimum salinities differed from the distantly related species, indicating that they may be novel genera, however, the optimum temperature ranges were similar.

As expected, the temperatures ranges were similar between isolates whose closest related species indicated a close match however, their optimum salinities differed. Since these microorganisms were isolated from the marine environment they may be atypical halophilic strains.



Dr. Kotelnikova with pre-med research assistants Kabelo Thusang and Tommy Palai, who assisted with the project.

Submitted by Cynthia Bruno, MSc

6.5. Novel Antimicrobial Compounds from Tropical Marine Environments

Background

Recent surveys on nosocomial infections by CDC and WHO indicate that bacterial resistance to contemporary antibiotics is rising at an alarming rate. This study sought to find new avenues for the derivation of novel antibiotics. We screened for antimicrobials derived from microorganisms living in biofilms on tropical marine abiotic surfaces. Our main goal was to answer the question of whether or not there are microorganisms inhabiting biofilms of sea rocks sampled from the coastal floors around Grenada that produce antimicrobial compounds. We hypothesized that there must be novel bacteria producing antimicrobial substances waiting to be discovered.

Methods

Samples were collected off the shores of Grenada at five locations via Scuba diving and cultured in reduced salinity artificial sea water agar (salinity=36 ppt) in the microbiology labs at St. George's University. 141 marine isolates were cultured. These marine isolates were screened for antimicrobial activity against pathogens frequent in nosocomial infections *Staphylococcus aureus* (ATCC BAA-44), *Enterococcus faecalis* (ATCC 700802), *Enterobacter cloacae* (ATCC 39979), *Klebsiella pneumoniae* (ATCC 700603), *Escherichia coli* (ATCC BAA-196), and *Streptococcus pneumoniae* (ATCC 51936) with high rates of antibiotic resistance, via a modified Kirby-Bauer assay. 141 isolates were characterized by colony morphology, color, and Gram stain. Those that were shown to produce active antimicrobials were also characterized by physiology and biochemistry through the use of API test strips.

Results

Fifty sea rocks from five distinctly different locations around the southwestern coast of the island nation of Grenada were sampled. From these, 141 strains were isolated and characterized morphologically. Fifteen of the 141 isolates showed antimicrobial activity, and 8 of these 15 (11%) showed activity greater than that of Penicillin (the positive control). The data collected on these eight were then subjected to a paired t-Test with 5% ά level. Of these eight, four showed inhibition of one or more of the pathogens that was statistically significant ($p<0.05$). Four of these isolates, PB 4-31, PB 5-21, DB 9-33, DB 2-31, were found to either significantly inhibit number of pathogens ($p<0.05$) stronger than penicillin. Strain PB 7-11 and TB 4-32 inhibited *S. aureus* but weaker than penicillin. Strain PB 6-33 inhibited *S. aureus* stronger than penicillin.

Pathogen	*S. aureus*	*E. faecalis*	*E. cloacae*	*K. pneumonia*	*E. coli*
Marine isolate					
TB 4-32	0.16	-	-	-	-
TB 5-22	-	0.01*	0.04*	0.01*	0.09
DB 2-31	-	-	-	-	0.01*
DB 9-33	-	-	-	-	0.04*
PB 7-11	0.36	-	-	-	-
DB 6-33	0.05*	-	0.46	-	0.42
PB 5-21	-	-	0.08*		
PB 4-31	-	-	-	-	0.015*

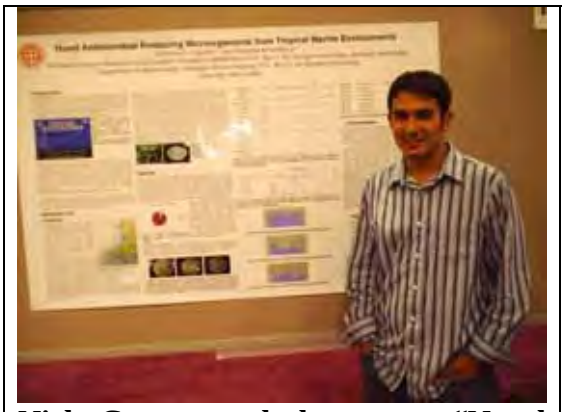
Table 1 shows which marine isolates significantly inhibited (bolded*) the pathogen it was tested against.

Physiological characterization indicated that the organisms were halophilic and related to *Vibrio, Serratia* and *Marinococcus.* All isolates stored in 5% glycerol at -80°C in a culture collection in the Microbiology Culture Collection at St. George's University.

Conclusion

Antibiotic resistance is a rapidly growing problem in healthcare systems throughout the world. The attention it has been receiving has not satisfied those experts in the field who are trying to address this problem. This study was started in response to that problem. In addition, it was hoped that this study would raise awareness of the problem, as well as expand the field of marine microbiology further into marine-derived medicines.

This project has provided a valuable contribution to the field of marine microbiology, suggesting that antimicrobials can be derived from the biofilms of microorganisms that inhabit sea rocks. Further investigation into this topic must be carried out so that the full potential of these substances for combating increasing bacterial resistance can be revealed.



Nick Caputo and the poster "Novel antimicrobial producing organisms from tropical marine environments" presented at the "Microbes in the Changing World" conference in San Francisco, California, 23-28 July 2005.

Submitted by Nicholas D. Caputo, Research Scientist and Svetlana Kotelnikova, PhD

6.6. The Effect of Water Quality on the Students of St. George's University

Water quality is of paramount concern to the prevalence and incidence of gastrointestinal diseases in the human population. Microbial contamination is the most common and widespread health risk associated with poor water quality. The students on the True Blue Campus at St. George's University may be exposed to two sources of water; pipe borne and sea water from the surrounding beaches. Diarrheal disease is the most common presentation of gastrointestinal disease that is caused by the water borne pathogens (WHO 2004). The microbial quality of the water should be assessed periodically, to ensure acceptable levels of microorganisms for safety purposes.

An estimated 2,038 Americans became ill from 17 outbreaks associated with drinking water during 1997–1998, according to the Centers for Disease Control and Prevention's most recent survey of water-related outbreaks. During the same period, more than 2,000 people became ill from 32 outbreaks associated with recreational waters — beaches, lakes, and rivers. Most (29) were caused by infectious bacteria, viruses or protozoa (American Society for Microbiology, 2002).

For microbial water quality, verification includes microbiological testing. The analysis of faecal indicator organisms and specific pathogen densities is routine. This should be done immediately after treatment of the water. Water that is not properly treated before disposal into the sea, also affects the quality of the water for recreational swimming. This will increase the likelihood of persons acquiring

pathogens in the seawater that may cause gastrointestinal disease (WHO 2000)

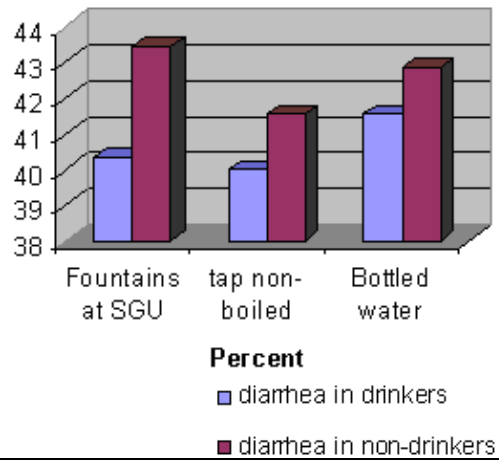
Verification of the water for microbial quality involves testing for *Escherichia coli* as an indicator of faecal pollution. This organism should not be present in drinking water. Bacteria are not only known to cause disease when they enter a human body through food, surface water may also be an important source of bacterial infection.

Diarrhea is the passage of loose or liquid stools more frequently than is normal for the individual. It is primarily a symptom of gastrointestinal infection. Depending on the type of infection, the diarrhea may be watery (for example in cholera) or passed with blood (in dysentery for example). Diarrhea due to infection may last a few days, or several weeks, as in persistent diarrhea (WHO 2000). Symptoms of diarrhea include frequent watery motions, loss of appetite, stomach pains and dehydration.

There are a variety of factors that contribute to gastrointestinal disease as a result of poor water quality. It is with this information that the project seeks to classify the present quality of water with respect to the microbial load and evaluate the relationship between the microbial load present in drinking water and recreational water in Grand Anse and True Blue Black Sand Beaches, and the occurrences of gastrointestinal outbreaks in the SGU student population.

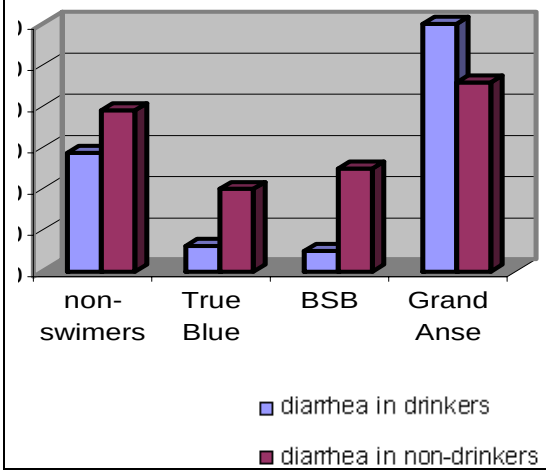
To achieve the aim, 80 SGU students accommodated on True Blue Campus were interviewed during spring term 2005 using a closed end questionnaire to enable quantitative statistical analysis. Our results demonstrated that 71% of the students drank from water fountains, 60% purchased bottled water and only 18% drank water from the tap without boiling. T-test showed no statistical differences in frequencies of diarrhea in students that drank water from the fountains and that purchased the bottled water, 40.35 and 41.54%, respectively. Tap-drinkers did not have any higher incidence of diarrhea, 40%. Comparison of frequency of diarrhea in students which were drinking water from the studied sources and non-drinking water from the sources did not show any significant difference (Figure 3) which means the studied sources of the drinking water did not affect the incidence of diarrhea in the studied population. The results indicated that the presence of non-faecal coliforms in the drinking water during the studied period translated into the absence of drinking water-dependent diarrhea. However, the results are not conclusive because of the small studied population (80 students); beside there are a number of factors that might have contributed to the incidents such as using the tap water for dishing, food preparation, water off the campus, and examination anxiety.

Figure 3. Effect of drinking water sources on the incidence of diarrhea in SGU students (80), spring 2005.



The next question was if recreational swimming in a variety of beaches could contribute to the observed frequencies of diarrheas. Only 71% of the students were swimming sometimes, while 29% never swam. Most of the swimmers used Grand Anse (60%), 5% used True Blue Bay and 6% used Black Sand Beach. It was noted that only 30% of the students who swam had from one to four diarrhea episodes during last two month before the question was administered while non-swimmers had 40% of diarrhea incidents (Figure 4). Figure 4 shows distribution of swimmers and percent of diarrhea between the varieties of studied beaches and compared to the respective values for non-swimmers. Frequencies

Figure 4. Effect of recreational water on the incidence of diarrheas in SGU students, spring 2005.



of *Enterococcal* pollutions of the beach water during January-May of 2005 did not correlate (r^2=0.32) with the frequencies of diarrhea incidents in the swimmers. The results indicated that the opportunistic microbial pathogens and indicators observed in the recreational water did not translate into any increase of diarrheas due to swimming. Vice versa, the recreational swimming could have contributed to relaxation from the stress. When analyzing our results the reader should keep in mind that the studied population consisted of young people which are not non-immune-compromised.

Our results indicated that the quality of drinking and swimming water in and around the SGU campuses have not affected the gastrointestinal health of the SGU student population.



Students who contributed to the project. Second from left, Michael Klug, Marisa Nimrod, Mehram Massumi.

Submitted By Marisa Nimrod, Michael Klug, Jessica Kramer, Mehram Massumi, Dawn Adams and Svetlana Kotelnikova, PhD

6.7. Summer 2005 - Apres Tout Water Project

Water is fundamental to life and having a clean source for drinking is crucial to the public health of a community. However, when there are instances of contaminated water or lack of suitable water for consumption, health consequences can be dramatic. The costs of such consequences can be direct monetary costs of care, loss of productivity, disability, and death.

The Apres Tout water project was initiated in May of 2005 and is a

collaboration between Just a Drop charitable foundation, the National Water and Sewage Authority of Grenada (NAWASA), the Windward Islands Research and Education Foundation (WINDREF), and the Environmental Testing Unit at the Microbiology Department at SGU. This project has its main objective the provision of safe drinking water for the community of Apres Tout, Grenada. This community has been identified as having water quality issues, even before Hurricane Ivan, by the Caribbean Environmental Research Initiative (CERI) group of WINDREF, supervised by Dr. Kotelnikova. This goal will be achieved through the building of a new purification system. It will be maintained through monitoring of the local water supply and education of the community on drinking water safety.



Newly built water treatment system in Apres Tout, November 2005.

NAWASA plans to build a sand filtration system to replace the existing structure. In conjunction with NAWASA's plans, bacteriological tests were carried out via the membrane filter technique by students working in SGU Microbiology labs in September, October, and November 2004 and February, May, June and July 2005. This was undertaken to monitor the quality of water prior to the intervention and subsequent to it, for comparative purposes. The quality of the spring water was compared to the tap and dam water.

The spring water contained rich microflora, however it was free of the indicator organism. Fifty percent of samples collected from the dam between May and July 2005 contained *Echerichia coli* at numbers too many to count, which indicated pollution with intestinal microflora of warm-blooded animals. The land around the drinking water dam is currently used as a pasture for animals, which explains the results. The tap water showed countable coliforms (5-250 cells/ml) including *E. coli*, *Klebsiella oxitoca*, and *Klebsiella pneumonia*. Sixty-seven percent of interviewed inhabitants used the tap water for drinking without boiling, fifty percent of the people with very low incomes have to buy bottled drinking water or bring drinking water from the spring.

The potential for illness was demonstrated in the water supply; it translated into the epidemiological data gathered. The data gathered showed that rates of diarrhea or gastroenteritis among the community of Apres Tout were significantly higher (incident of 15.4%) than average in Grenada as a whole (0.65%). The number of diarrhea cases per 200 inhabitants correlated ($r^2=0.90$) with numbers of indicator organisms per ml in the tap water (Figure 1). Between 7 and 8% of the interviewed had problems with skin disorders and vomiting. Sixty percent of children of school and under school age experienced colds. In summary, the tests showed that the water supply being piped into the community was of low quality. The full report was submitted to the Grenada Ministry of Health, Social Security, the Environment and Ecclesiastic Relations.

The monitoring was performed by PUBH-890 candidate Mr. Thirath Chau and Life Science candidate Mrs. Shakeera James, using the facilities of the Environmental Testing Unit in the Department of Microbiology. The activity was funded by the charitable organization "Just a Drop", UK via WINDREF, Grenada.

Further work on this project will include the monitoring of the water supply to ensure its safety after the new filtration system is implemented. Additionally, further epidemiologic investigations are warranted since some of the bacteria can cause illnesses outside of the gastro-intestinal system. Furthermore, education on the drinking water safety is needed in the community.



Participants of the project: S. Kotelnikova, Mr. Josef Johnson, Mr. Charles Daniel (Just a Drop), Trevor Noel, Andre Worme, Annette Gerlach, Thirath Chau and Shakeera James.

Submitted by Thirath Chau, Shakeera James and Svetlana Kotelnikova, PhD

6.8. New Species Isolated from the Bottom of the Sea, Grenada, West Indies

Antibiotic resistance in bacteria has become a serious problem. Thus the search for new antibiotics is an important endeavor and very much needed. Nicholas Caputo originally conceived a project entitled 'Novel Antimicrobial Producing Microorganisms from Tropical Marine Surfaces'. He hypothesized that due to the evolutionary pressure of competition, as well as the variety of life in tropical ecosystems, biofilms from marine environments will possess novel micro-organisms from which secondary metabolites may be derived and purified for anti-microbial use. He had taken samples from various deep sea bottom biofilms around Grenada (Figure 1).

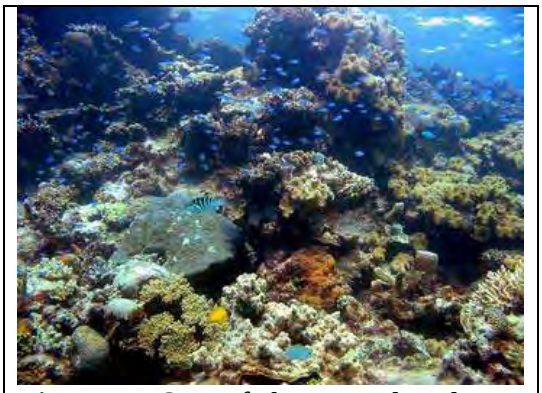


Figure 1. One of the typical isolation sites. Coral reef covered bottom of the sea at the 15 m depth.

He had then cultured them in the microbiology labs at St. George's University. The compounds produced by these marine isolates were extracted and tested against pathogens of known drug resistance via Kirby-Bauer assays and the fast agar slab test. Among the 141 pure cultures isolated from the deep marine biofilms and screened for

antimicrobials against above-mentioned pathogens, fifteen of the isolates (~11%) were found to have antimicrobial activity. Eight of the fifteen met a set of standards as compared to the positive control, penicillin. The data collected on these eight were then subjected to a number of statistical procedures. Four of the isolates were found to significantly inhibit one or more of the pathogens. Unfortunately he was unable to complete his project due to the unexpected arrival of Hurricane Ivan. Later, seven of the most active antibiotic-producers were analysed using fatty acid methyl esterase analysis (FAME) and sequencing their 16S rRNA gene. The results were compared to the FAME and GeneBank databases and the most closely related organisms were identified. 16S rRNA gene based phylogenetic trees were produced (Figure 2). The project was continued due to efforts of PMED 390 undergraduate students (Figure 5) supervised by Dr. Kotelnikova, director of CERI.



Figure 2. Phylogenetic tree constructed based on 16S rRNA gene comparison of strain PB 7-11 with the GeneBank. Our strain is designed as C16843 PB7.

Since the purpose of this study was to characterize phenotypes of the seven strains by comparing them to their closest known related species, 50 different tests were performed for the phenotypic characterization and identification of the isolates. In terms of gross morphology, the shapes, sizes, and colors of the colonies formed were observed. In terms of microscopic characteristics, Gram-staining was used to determine the shape and the size of individual cells as well as their cell wall characteristics. Motility was observed by looking at the live isolate through a microscope. For biochemical characterization, we used API® strip tests, CTA tests and MacConkey tests. Finally we identified the optimal salinities for bacterial growth. All 50 characters were used for numerical comparison with the closest relatives identified with the molecular techniques. The results are described below.

Dissimilarities between TB 4-32 and *Rahnella aquatilis*

Strain TB 4-32 showed the same results for cell morphology, gram staining, motility and growth for the rest of biochemical tests and traits as *R. aquatilis*. *Rahnella aquatilis* is the only species of genus *Rahnella*, in the *Enterobacteriacae* family. It is a rare enteric, gram-negative, small, rod-shaped bacterium. It is facultative anaerobic and its natural habitat is water. *R. aquatilis* and TB 4-32 showed number of differences: TB 4-32 is halotolerant, gram-negative rod, oxidase-positive and catalase-negative, ferments/oxidises inositol and produces yellow pigment, whereas *R. aquatilis* does not. In total, we were able to identify at least nine phenotypical differences between the strain and the most closely related reference organism, *R aquatilis*, in accordance with the 16rRNA gene sequencing, comparison and dissimilarity of 0.19% and FAME (DI=0.760) which indicates that strain TB 4-32 most probably represents a new species of genus *Rachnella*.

Dissimilarities between DB 9-33 and *Serratia marcescens*

Strain DB 9-33 was a member of genus *Serratia* in accordance with the molecular indicators, 16rRNA gene sequencing, comparison and dissimilarity of 0.19% from *S.*

marcescens and FAME (DI=0.581) *S. odorifera*. DB 9-33 showed the same results for cell morphology, pigmentation at 37C, gram staining, lack of swarming motility, motility and growth the rest of biochemical tests and traits. Our study demonstrated at least seven phenotypic differences between the strain DB 9-33 and *S. marcescens. S. marcescens* was positive for both acetyl-methyl-carbinol production (Vogel Proskaur test) and beta-galactosidase, whereas DB 9-33 was negative for the same tests. DB 9-33 was positive for fermentation of D-lactose, produced indol from L-tryptophan, however it did not produce the red pigment, likely, prodigiosin, on RSASWA at 30°C, was halotolerant and had high growth rate between 9 to 160 g/l of NaCl. Based on molecular and phenotypic features the strain qualified to be considered a new halotolerant species of genus *Serratia*.

Dissimilarities between DB 2-31 and *Serratia marcescens*

DB 2-31 produced a compound with colicin properties (active selectively on *E. coli*. *S. marcescens* is known to produce two types of bacteriocins A and/or B that are selectively active against *E. coli* K-12. *S. odorifera* did not produce any of the bacteriocins. DB 2-31 showed the same results as compared to *Serratia marcescens* for cell morphology, pigmentation, gram staining, motility and growth the rest of biochemical tests and traits, however DB 2-31 did not produce the red pigment, likely, prodigiosin, on RSASWA at 30C, did not reduce nitrate, and it showed negative reaction in the test for tryptophan deaminase, was halotolerant and grew at 9 to 100 g/l of NaCl, oxidized arabinose, mellibiose and produced gas from glucose, while *S. marcescens* did not. In total, we were able to identify seven phenotypical differences between the strain and the most closely related reference organisms in accordance with the 16rRNA gene sequencing, comparison and dissimilarity of 0.19% from *S. marcescens* and FAME (DI=0.581) *S. odorifera* which indicates that strain DB 2-31 most probably represents a new species of genus *Serratia*.

Dissimilarities between PB 5-21 and *V. campbellii*

There were a number of characteristics that were dissimilar for strain PB 5-21 and *V. campbellii.* However, there is a clear difference in colour: while *V. campbellii* is colourless, strain PB 5-21 demonstrated dark yellow mucus on both types of media, TSA (Tryptose Soya Agar) and RSASWA (Reduced Salinity Artificial Sea Water Agar). Strain PB 5-21 showed swarming and metabolized sucrose and rhaffinose, while *V. campbellii* did not. The optimal salinity for Strain PB 5-21 is within a fairly wide range (345-1034 mM), while *V. campbellii* prefers a slightly higher salinity of 280 mM. Strain PB 5-21 did not metabolize mannose, citrate and amygdaline, while *V. campbellii* did. For example the PB 5-21 strain did not have an active ornithine decarboxylase while this enzyme is supposed be active in *V. campbellii.* On the other hand, the strain under study metabolizes both sorbitol and inositol, but we were unable to use this data since we have nothing with which to compare it.

Cell morphology and gram staining, swarming motility, Growth at 30 and 35 C, and the rest of biochemical tests and traits are identical between PB 5-21 and *V. campbellii*.

We were able to identify at least nine phenotypical differences

between the strain PB 5-21 and the most closely related reference organisms, *V. campbelii*, in accordance with the 16rRNA gene comparison and dissimilarity of 0.84% and *V.fluvialis* in accordance with FAME (DI=0.789) which indicates that strain PB 5-21 most probably represents a new species of genus *Vibrio*.

Dissimilarities between DB 6-33, *V. harveyi* and *V. campbellii*

There are at least nine differences between the two organisms. Strain DB 6-33 developed bright yellow mucus swarming spreading colonies on TSA, while *V. campbellii was* colourless and did not show swarming motility. The upper limit of the salinity range for strain DB 6-33 is much higher (2586 mM) than the upper limit of 320 mM preferred by *V. campbellii*, making the strain in the study much more halophilic.

Strain DB 6-33 metabolized sucrose alike *V. harveyi*, while *V. campbellii* did not. Unlike *V. campbellii*, DB 6-33 did not produce acetone (VP test), did not metabolise starch, tryptophan or citrate but did acidify rhaffinose, metabolize beta-galactosidase (ONPG) and fermented rhamnose. The strain DB 6-33 was more similar to *V. campbellii* because it did not oxidize mellibiose while *V. harveyi* did oxidize mellibiose.

Cell morphology and gram staining, swarming motility, growth at 30 and 35 C, and the rest of biochemical tests and traits were identical between DB 6-33, *V. harveyi* and *V. campbellii.*

We were able to identify at least nine phenotypical differences between the strain and the most closely related reference organisms, *V. campbelii*, in accordance with the 16rRNA gene comparison and dissimilarity of 0.93% and *V .harveyi*, in accordance with FAME (DI=0.969) which indicates that strain DB 6-33 most probably represents a new species of genus *Vibrio*.

Similarities between PB 4-31 and *V. alginolyticus*.

There are a few very differences between PB 4-31 and *V. alginolyticus* in the colouration of the colonies: the opaque yellow mucus produced by PB 4-31 when grown on TSA and the blue spreading on the RSASWA differentiates it from the colourless *V. alginolyticus*. Also PB 4-31 was tolerating a higher concentration of NaCl (Figure 3) and it was not able to oxidize citrate while *V. alginolyticus* was able to. Every other characteristic is identical between the two organisms. We were able to identify at least three phenotypical differences between the strain and the most closely related reference organism, *V .alginolyticus*, in accordance with the 16rRNA gene sequencing, comparison and dissimilarity of 0.37% from *V. alginolyticus* and FAME (DI=0.709, *V. fluvialis*) which indicates that strain PB 7-11 most probably represents a new species of genus *Vibrio*.

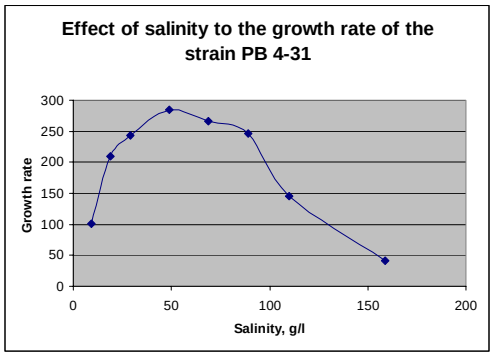


Figure 3. Effect of salinity to growth of the strain PB 4-31**.**

Dissimilarities between PB 7-11 and *V. alginolyticus*

There are three differences between the two. The green-yellow mucus that PB 7-11 produced

differentiates it from *V. alginolyticus* when grown on TSA medium. The upper limit of the optimal salinity range for PB 7-11 (2586 mM) is just under the 2070 mM preferred by *V. alginolyticus*. *V. alginolyticus* also metabolizes gelatin and citrate, while PB 7-11 does not.

We were able to identify at least three phenotypical differences between the strain and the most closely related reference organism, *V .alginolyticus*, in accordance with the 16rRNA gene sequencing, comparison and dissimilarity of 1.63% *(Figure 2)* and FAME (DI=0.829, *V. natiegenes*) which indicates that strain PB 7-11 most probably represents a new species of genus *Vibrio*.

After conducting the experiment, by performing phenotypic characterization of the strains and comparing them to their closest known relatives, we can conclude that sodium was required for growth and stimulated the growth of PB 5-21, DB 6-33, PB 4-31 and PB 7-11 (Figure 4), that was typical for *Vibrio* and *Photobacterium*. 16S rRNA gene and fatty acid methyl ester (FAME) comparison showed that our strains were related to *Vibrio* and *Photobacterium*, however the salinity optima and ranges of our isolates were higher than for any member of the genera.

While all of the seven strains showed phenotypic characteristics confirming the molecular identification at genus level, they showed a number of phenotypic differences which indicated that these strains qualified for new taxa classification. However, we would encourage further studies on the subject since we truly believe that there is potential for new antimicrobial compounds to be produced by these organisms. We found that 16S rRNA gene and FAME data provided reliable indication of relatedness, however, the differentiation power of these methods have been shown to be low. DNA-DNA hybridization would provide the final confirmation of relatedness of the isolates to their counterparts.

The importance of our findings is evident based on known pathogenicity of the close relatives of our isolates. *V. harveyi* have been reported to cause devastating pathological effects upon marine invertebrates, prawn hatcheries in the Philippines, Thailand, Indonesia and northern Queensland, the spiny lobster in India and the pearl oyster in Western Australia. The disease, termed vibriosis, has a high mortality rate and causes significant financial loss to marine aquacultures of shrimp larviculture facilities. It is a proven pathogen for shrimp and cultured red drum. *V. fluvialis*, is one of the major components of the microbiota of several bivalve species such as mussels, clams and oysters. However, it was first isolated in Bangladesh, from human faeces. *V. alginolyticus* has been associated with several diseases of marine animals, including fish, shellfish and echinoids, causing important economic losses. *V. campbellii* is a known pathogen for the marine invertebrates such as the Atlantic Blue Crab, shrimp, coral and others. It was first isolated from seawater in Hawaii. The genes of *V. campbellii* and *S. marcescens* were associated with white pox disease of coral reefs at Key West, Florida. The disease was also observed around Grenada. *S. marcescens* is an opportunistic pathogen; it tends to affect hospitalized patients where it colonizes the urinary and respiratory tracts causing nosocomial infections. Some new research has even found strains of *S. marcescens* that can biodegrade petroleum products.



Undergraduate students who contributed to the project: Eugeniya Varicheva, Stacey Trim (non-participant), Bhavna Bhimarasetty, Judith Birungi.

Submitted by Eugeniya Varicheva, Bhavna Bhimarasetty, Judith Birungi and Svetlana Kotelnikova

6.9. The Antimicrobial Properties of the Nutmeg

It is known that nutmeg has antimicrobial properties, as this was observed against *E. coli.* Organic extracts of ground nutmeg inhibited growth of *S. sonnei*, *S. typhimurium* and *E. coli* (Kotelnikova, S, WINDREF Annual Report 2003). 30-55% of the seed consists of oils of which 45-60% consists of solid matter including cellulose materials. The two types of oils contained therein are the essential oil, which accounts for about 5-15% of the seed, and the fixed oil, which makes up approximately 24-40% of the seed. Nutmeg oil is prominently used in the pharmaceutical industry. Historically, nutmeg has been used as a form of medicine to treat many illnesses ranging from those affecting the nervous system to the digestive system. Today, nutmeg oil is prominently used in the pharmaceutical industry, with many companies incorporating nutmeg essential oil in their products. For instance, in 1992, according to published information by Product Alert, nutmeg oil was the major ingredient in Procter and Gamble's alcohol-free, non-drowsy Vicks cough syrup. Easy Breather Tissue, developed by Robinson-Health Care in Britain, which helped clear congestion, was developed using the oil as an active ingredient. Again in 1991, a pain relieving ointment named Ramedica Herbal Wonder Balm was marketed in the US by Ramedica International Corp. Grenadian bush doctors recommend the use of ground nutmeg against diarrhea. Nutmeg oil is composed of trimyristin (84%), triglycerids of oleic acids (3.5%), resinous material (2.3%), glycerid of linilenic acid (0.6%), formic, and acetic acids. Myristic acid, a carboxylic acid, is one by-product of trimyristin. Aminated form of myristic acid is structural analog of dopamine and may interfere with membranes. At high concentration myristicin is known to cause nausea, hallucinogens, epilepsy, convulsions, tachycardia, psychosis, strong neurotoxic effects and brain damage, coma and death. (Figure 1). This component has important biological properties.

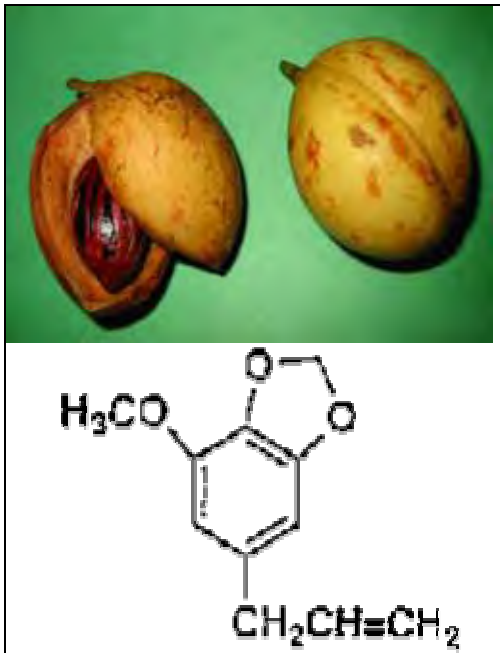


Figure 1. Nutmeg flush, mace, seed (by Kotelnikova, S.) and formula of myristicine

Elemicin is another important component of nutmeg oil. Nutmeg essential oil (*Myristica fragrans*) and its composition were reported by Masada. The major components by GC/MS were identified as α-pinene (26.7%), β-pinene (20.7%), sabinene (14.5%), limonene (9.4%) and terpinen-4-ol (4.4%) in nutmeg essential oil. 33 and 37 constituents have been identified representing 99.9% and 99.3% of the total mace and nutmeg essential oils, respectively. A Major component was terpinen-4-ol (20.0% and 31.3%), respectively in mace and nutmeg essential oils. Antifungal properties of mace and seed oil was demonstrated on *Aspergillus flavus, A. niger, Candida albicans, Microsporum canis, Pseudallescheria boydii, Trichopyton mentagrophytes.*

It is not known, however, whether the nutmeg oil is more efficient at inhibiting the pathogenic bacteria and fungi than the other components (i.e. ground and nutmeg waste). The goal of this study, conducted by students of Research Methods course SAS-390, was to explore which of the nutmeg parts has the most potent anti-microbial properties and to research aspects of new anti-microbials. To test the anti-microbial/ antifungal effects, the different parts of the Nutmeg plant were extracted and tested using the modified Kirby-Bauer method on pure cultures of reference strains of the following pathogenic microorganisms: *Klebsiella pneumoniae* ATCC 13883, *Shigella sonnei* ATCC 25931, *Escherichia coli* ATCC 25922, *Enterobacter cloacae* ATCC 23355, *Pseudomonas aeruginosa* ATCC 27853, *Enterococcus faecalis* ATCC 19433, *Salmonella typhimurium ATCC* 14028, and *Candida albicans* SGUCC 23 (Table 1). Two different components of nutmeg (ground nutmeg and nutmeg waste) were extracted as 20 weight percent into 70% alcohol while nutmeg oil was extracted by steam distillation of the nutmeg seeds Then sterile disks were soaked with filter sterilized extracts of oil, waste and ground nutmeg in separate sterile Petri dishes. The bacteria were inoculated onto sterile NA. Penicillin disks were dispensed into one sector labelled as positive control in each dish. The solvent (70% alcohol) was used as negative control. Each of the soaked disks was placed in their respective sectors at least 10mm from the edge of the plate. The inhibition zones were measured in all repeats during two independent experiments. Average data are presented in Table 1.

The experimental data (Figure 3) concluded that the oil shows the most potent inhibition towards the various pathogenic bacteria and yeast

Table 1. Antimicrobial and antifungal effects of different nutmeg parts to microbial pathogens

Pathogen	Oil, instant extract	Seed extract, 20w%	Waste extract, 20w%
K.Pneumoniae	**11 ± 1.35**	**1.8 ± 0.58**	**0**
S.Typhinium	**6 ± 1.15**	**1±1.67**	**2.7 ± 0.58**
E.Faecalis	**8 ± 1.57**	**3.83 ± 2.89**	**4.5 ± 0.29**
S.Sonnei	**5 ± 2.00**	**0**	**1.3 ± 0.5**
E.Coli	**7.8 ± 6.21**	**1.5 ±2.18**	**1.7 ± 5.8**
E.Cloacae	**8.7 ± 5.51**	**0**	**1 ± 1.7**
P.Aeruginosa	**17 ± 4.62**	**5.67 ± 0.58**	**6 ± 2.6**
C.Albicans	**4.8 ± 0.67**	**0.67 ± 1.15**	**0**

- Average Inhibition Zone is presented as the difference between experiment and negative control and Standard Deviation of Nutmeg Components on each Microbe. *****The unit of the Inhibition Zone is in mm.
- Minimal inhibiting concentrations were measured as the last dilution of an extract (20% w) inhibiting visible growth of a pathogen. The results are presented in Table 2.

Table 2. MIC of nutmeg oil for different microbial pathogens

Pathogen	Oil, instant extract, MIC
K.Pneumoniae	**10-5**
S.Typhinium	**n.d.**
E.Faecalis	**n.d.**
S.Sonnei	**10-5**
E.Coli	**10-10**
E.Cloacae	**10-2**
P.Aeruginosa	**10-9**
C.Albicans	**10-3**

Inhibition of Pathogens by Nutmeg

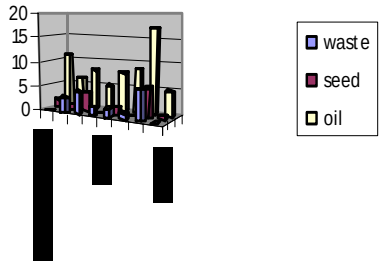


Figure 3. Effect of different parts of nutmeg plant on pathogenic microorganisms

compared to ground ($p<0.01$) and waste nutmeg ($p<0.04$). All of the pathogens tested were significantly inhibited by the essential oil, however *P. aureginosa and E. faecalis* were shown to be the most sensitive. *P. aureginosa and E. faecalis* are involved in most of the clinically important and nosocomial biofilm-associated infections. Resistance of pathogens to anti-microbial drugs is rising faster then new drugs are developed. Biofilms are hundreds of times more resistant to antibiotics compared to the planktonic cell. Therefore the discovered effect of different components of nutmeg to microbial pathogens has a promising future, especially for external application as an anti-biofilm-forming agent. Toxicity of diluted oil should be studied before it may be used against diarrheal symptoms. The mechanism of inhibition of oil on microbes remains unknown, it may be due to the lysis of membrane or interfering with microbial signalling. The similarity of myristicin (Figure 1) to dopamine alludes that it may be mimicking the microbial signalling molecule as well. Since oil is immiscible with water, it is hydrophobic, it adheres easily to the hydrophobic part of the bacterial phospholipids membrane of the Gram-negative and Gram-positive cell walls. This provides a much easier transference of anti-microbial chemicals from the nutmeg oil to the microbe, as compared to the nutmeg waste or ground nutmeg. The mechanism is recommended for future research.



Field trip of SGU students Rex Omabu and Daniel Rochard with Dr. Mathias Lorenz to collect samples of nutmeg.

Submitted by Rochard Daniel, Smith Jaime and Svetlana Kotelnikova, PhD

6.10. Evaluating the level of perceived fear and desensitization towards HIV/AIDS in Botswana

At present Botswana ranks as one of the hardest hit countries by the pandemic in the world. The country is home to only 1.6 million people, of whom 350,000 are living with HIV/AIDS and 33 000 are said to have lost their lives to the disease. This

gives Botswana an adult HIV prevalence rate of 37.3% (Anon, 2004a). The HIV/AIDS prevalence rates among 15-19 and 20-24-year old respectively estimates at 22.8% and 38.6%. Moreover the prevalence rate is highest among 25-29 year olds, estimated at 49.7% in 2003 (Anon, 2004b). Thus the HIV/AIDS pandemic forms a serious threat to the reproductive and economically productive population of this country. At present, there are 120 000 AIDS orphans in need of proper care and an estimated 25 000 children under the age 15 living with HIV/AIDS in Botswana (Anon, 2004a). This is a major cause of concern, especially given the fact that Botswana already has an undersized population (Stephenson, 2000).

To date, even after multiple strategies to curbing the pandemic, the HIV/AIDS situation in Botswana remains an urgent matter, which, without an alternative form of action, will continue to devastate the society.



Figure 1: Map of Botswana

After a slow start, the Botswana government has shown signs of progress in terms of preventative and treatment measures against HIV/AIDS. The government's commitment to curb this pandemic has grown stronger over the past few years. The Republic of Botswana has been able to establish a comprehensive approach, including prevention, treatment and care as part of a national response to the pandemic. In addition, the Botswana government has made tremendous success in distributing the interventions to the population at large.

Despite the fact that Botswana has advanced in making HIV/AIDS prevention and treatment accessible nationwide, many of the statistic indicators show a low rate of participation by Batswana in these interventions. Moreover, Batswana's behavior towards HIV/AIDS is still of major concern. Although various initiatives to change behavior have been put in place, behavioral elements such as attitudes towards sex, alcohol consumption, misconceptions, beliefs, and other traditions and customs that are vital to HIV/AIDS prevention, have shown little change. Stigma and discrimination, which have fuelled silence and denial, still remain as major barriers to HIV/AIDS prevention in this country.

However, as highlighted above, the Botswana government has made key adjustments to rectify these many obstacles to the prevention and treatment of HIV/AIDS. Unfortunately, these programmes have achieved very little success, a fact verified by the small number of Batswana utilizing these interventions, and the country's devastating HIV/AIDS environment. The question now is: why are Batswana not taking advantage of the free services that the Botswana government has been providing to them?

In trying to explain the misfit between availability of HIV/AIDS preventative intervention in Botswana and the low responsive behavior to these interventions among Batswana, we hypothesized the following:

Batswana are living in fear of HIV/AIDS, hence are controlling the

threat posed by HIV/AIDS by defensively avoiding HIV/AIDS related issues. This section of the study will be guided by the extended parallel process model (EPPM)., which incorporates some of the original explanation from: Drive Model (McGuire, 1968, 1969); Parallel Process Model (Leventhal, 1970, 1971); Protection Motivation Theory (Rogers, 1975, 1983) and thus named Extended Parallel Process Model (Witte, 1992). The EPPM also adapts the Fear Appeals theory, which Witte defined as persuasive messages that scare an audience into adopting a recommended response by describing the consequences that will occur if they do not take action (Witte, 1992).

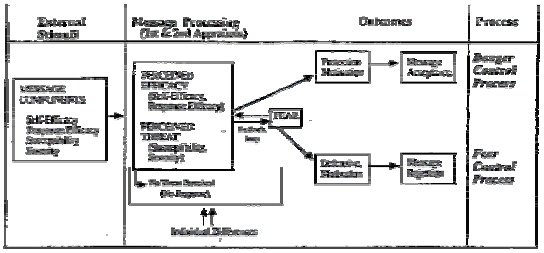


Figure 2: The Extended Parallel Process Model (EPPM)

Based on the above theory, we hypothesized that Batswana are living in fear of HIV/AIDS, hence are controlling the threat posed by HIV/AIDS by defensively avoiding HIV/AIDS related issues. The rationale underlying our thinking is that people in Botswana have been conditioned to fear HIV/AIDS, hence are controlling their fear instead of controlling the danger of HIV/AIDS. That is, they believe they are at risk of HIV/AIDS (high perceived threat), however, they also believe there is nothing they can do about it (low self-efficacy), therefore they are controlling their fear of AIDS, thus putting themselves at even greater risk by avoiding issues regarding HIV/AIDS.

The second hypothesis argues that due to the prolonged exposure to the HIV/AIDS environment, Batswana have been desensitized towards HIV/AIDS and thus are less responsive to issues regarding HIV/AIDS. Practically everyone has been affected by the HIV/AIDS pandemic. HIV/AIDS is all around us, bombarding us on every level. It is so widespread and pervasive that we rarely give it a second thought. Unfortunately, the vast amount of information on the subject of HIV/AIDS in Botswana has failed to bring about the appropriate behavioral changes needed by the society to survive this crisis.

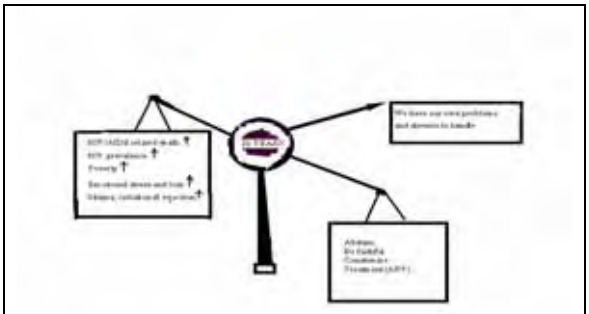


Figure 3: An illustration of desensitization towards HIV/AIDS

It is difficult to explain why so much preventative information and exposure on HIV/AIDS has not resulted in the appropriate behavioral changes. One hypothesis involves the concept of "desensitization". People hear reports on this topic on a daily basis, recommendations/interventions are pitched them non-stop, however, statistics on AIDS related death and number of new HIV infection do not seem to change. As researchers we hypothesized that people are now desensitized towards the topic of HIV/AIDS, hence are less responsive to HIV/AIDS recommendations. This hypothesis is supported by Batswana's low response rates to the many interventions that have been distributed

all over Botswana and provided to them free of charge.

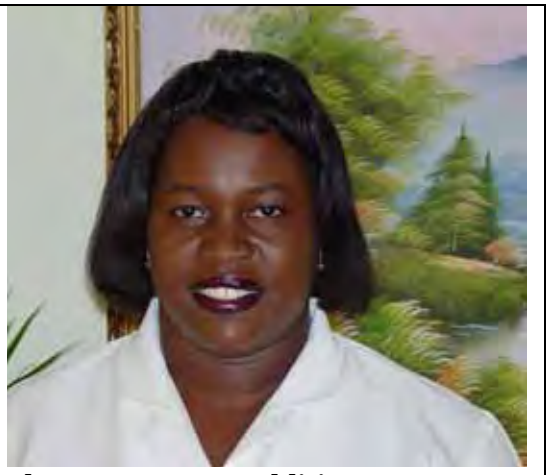
The goal of this study is to investigate why a small number of people in Botswana are enrolled or using the HIV/AIDS intervention provided to them. The study will be divided into five sections. The first section begins with a brief discussion of the effects of the HIV/AIDS pandemic. It includes a global picture of the pandemic, the current HIV/AIDS situation in sub-Saharan Africa and a brief rundown of the HIV/AIDS situation in southern Africa. This section will also give us a summary on the challenges faced to date with regards to the pandemic, with emphasis on availability and access to HIV/AIDS prevention and treatment interventions. The second section provides background information on Botswana and discuses the current HIV/AIDS situation in Botswana and how Botswana has responded to the pandemic, including some of the challenges it still faces to date. This will then be followed by a critical discussion on the theories and literature relevant to this study in section three. The relationship between fear and human behavior will be explored. This section also looks at the desensitization theory.

The aim of the study is to come up with recommendations regarding fear of HIV/AIDS and sensitivity towards HIV/AIDS related issues based on the results. Analysis of the results will also provide a better insight into the current HIV/AIDS situation in Botswana. This should be helpful in formulating future strategies to encourage Batswana to utilize the HIV/AIDS prevention intervention provided.

Submitted by Bayela Nfila
Research Scientist

6.11. Genetic Correlates of the Addictive Diseases: Cocaine, Alcohol and Marijuana Addiction - Grenada, W.I.

Following several setbacks caused by hurricane Ivan, the study on Genetic Correlates of addictive diseases, cocaine, marijuana and alcohol began on the 13th April 2005. Nurse Nestar Edwards and most recently Nurse Beverly Mends have been entrusted with the process of receiving a signed informed consent form and drawing the bloods and administering the Family Origin Questionnaire and the KMSK scale to the participants.



The newest addition to our collaborative team, Nurse Beverley Mends, Research Nurse, Rathdune Clinic, Mt. Gay Hospital.

This process has proven at times to be quite testing. One of the problems we faced with this process was the participant may complete the questionnaire but change their mind about allowing the drawing of blood, or allowing the draw of blood and refusing to answer the questions posed in the family origin form or the KMSK questionnaire.

In Grenada, blood samples are taken from either normal volunteers,

drug-free former cocaine users, drug-free former marijuana users, drug-free former alcohol users, or current drug and alcohol users. To assess the levels and types of addiction, a standard scale – developed by the Kreek Lab – is used for each patient, called the KMSK scale.

The KMSK scale is a brief survey that is 90-100% effective in screening for alcohol, marijuana, cocaine and heroin addiction. This scale is used for all patients studied in the Kreek Lab. The patients are also asked about their family origin, as this information may play a role in further genetic studies done by the Kreek Lab.

To date 20 subjects have completed the full questionnaires and blood draws in Grenada. The samples and KMSK and family origin questionnaires that are administered are sent to Rockefeller University (New York) where they are analyzed.



Mary Jeanne Kreek (centre front) with the laboratory team from Kreek Lab at Rockefeller University, New York.

The Kreek Lab collaborates with WINDREF in Grenada in an effort to gain a better understanding of the biology of addictive diseases, particularly the genetic basis of addiction. Grenada provides a unique study sample as heroin and other such opiates have yet to enter the country. In most countries, opiate and cocaine addiction is rampant and sometimes may go hand in hand. Thus, the Grenada study acts as a control for any heroin-cocaine addiction comorbidity observed in previous genetic studies of addicts.

Whole blood samples taken from subjects in Grenada are shipped to the Kreek Lab at Rockefeller University for DNA isolation. The DNA is further analyzed by lab members who look for any polymorphisms – variations in DNA – that may occur in specific regions of the DNA: mu and kappa opioid receptor genes being two of the many.



Nurse Mends administering the KMSK scale and blood draw on a participant.

Projects of a similar nature are being run in several other areas of the world, Stockholm, Lund, and Uppsala in Sweden, Oslo in Norway, Tel Aviv in Israel, and Las Vegas in Nevada and Oakland in California, in the USA.



The collaborative team includes members from WINDREF, Rockefeller University (New York), Mt. Gay Hospital (Grenada), Ministry of Education (Grenada) and Ministry of Health (Grenada).

Submitted by Trevor Paul Noel
Assistant Director, WINDREF

6.12. An Investigation of Pediatric Botanical Medicine for Acute Respiratory Infections, with emphasis on *Streptococcus pneumonia* and *Streptococcus pyogenes*

Ethnobotanical investigations have provided great insight into the medical community. Cultural influences as well as application of bioactive phytochemicals for medical purposes have advanced the degree of medicine. Throughout history as well global, anthropologists, botanists and the culmination of these fields, ethnobotanists, have explored the vast and diverse application of our native pharmacopeias, the green pharmacy.

In particular, the Caribbean offers a unique and powerful source for medical application of plants. These habitants of these Caribbean islands have utilized bush teas for hundred of years. Ethnobotanical investigations on the island of Grenada have opened the door to connecting the cultural influences of tropical herbs along with the healing properties for remedies. There exists a true harmony between the natural environment and the utility of such resources.

This study investigates the medicinal plants recommended by experienced traditional healers for children with acute respiratory infections. Eighteen traditional healers from Grenada, and several from the neighboring islands of Carriacou and Petit Martinique, will help target the plants applicable for this study.

The proper investigation for this type of research requires a dichotomous approach encompassing ethnobotanical investigation and *in vitro* antimicrobial experimentation of the plant extracts against bacterial strains *S. pneumonia and S. pyogenes*.

The majority of ethnobotanical interviews have been conducted in Grenada, while Carriacou and Petit Martinique remain for data collection. Below is a list of the potential plant species that will be utilized during the laboratory phase. The particular species, medicinal use, and approximate dosage (in lay terms relayed by the traditional healers) are indicated. Along with the identification of medicinal plants commonly used, the cultural and ceremonial aspects will also be exemplified.

Plant Species	Common Name
Coleus spp.	Big Thyme
Cordia curasavia	Black sage
Kalanchoe pinnatum (Bryophyllum)	Wonder of the world
Lantana camara	Sugardish
Lippia alba	Santa maria
Neuroloma lobata	Zeba pique
Momordica charantia	Coolie pawpaw

Laboratory assays will include a number of experiments to help isolate the active compounds in order to adequately test them contra the focused bacteria. The MIC (minimum inhibitory concentration) as well as the MBC (minimum bactericidal concentration) tests will initially be used for preliminary experiments. The above species have illustrated bioactive properties against other organisms, however this study will focus entirely on the two mentioned above. There is excitement in the medical and scientific community to discover new alternatives for health as well as combat the increasing resistance to pharmaceutical drugs. The Tri-Island State should be prosperous for knowledge in regards to future advances.



***Momordica charantia* (Coolie pawpaw) has been used globally for alleviating symptoms of diabetes, colds and flu's.**

Submitted by Daniel J. Firer
MD/MSc Student

6.13.1. Marine Protected Areas Realization in Grenada, Caribbean

In September 2005, the United States National Fish and Wildlife Foundation announced that Dr. Clare Morrall had been awarded a grant to support development of coral reef conservation in Grenada**.**
Dr. Morrall, an Associate Professor in the School of Arts and Sciences, Director of Marine Programs at St. George's University and WINDREF Research Fellow, applied for, a grant of US$25, 000 through WINDREF. When the grant is received it will fund a project entitled 'Marine Protected Area Realization in Grenada, Caribbean,' which will be conducted over a period of twelve months. To assist with the running of the project, Dr. Morrall hired a former student and volunteer Stephen Nimrod, B.Sc. (Hons.) as Project Manager. Mr Nimrod started a B.Sc. Degree in Marine Biology at St. George's University in 1999 and later transferred to University of Plymouth in the United Kingdom where he completed his B.Sc. degree in Marine Biology.



Project manager Mr. Stephen Nimrod

Following the passage of Hurricane Ivan in 2004, concerns were raised by local dive operators and other key stakeholders regarding damages to the marine environment, particularly that the coral reefs, may have suffered. This prompted swift action and Dr. Morrall was instrumental in organizing a team of volunteers to conduct a post hurricane marine assessment. This initial marine assessment served as the basis for the project proposal for which funding was requested. Implementation and completion of the funded project will allow the marine environment in Grenada to get the much needed attention it deserves.

After close observation and evaluation of the effectiveness of the current Marine Protected Area (MPA) management plan, it became apparent to Dr. Morrall and Mr. Nimrod that realization of Grenada's MPA is needed

in order to advance coral reef protection for the ecological and economic benefit of Grenada. Taking this into consideration, the project is geared towards the implementation of coral reef protection, using a partnership approach to develop an adaptive management plan and coral reef monitoring program at the designated MPA in Grenada.



Volunteers for post hurricane marine assessment 2004.

Mr. Nimrod, who will be based at WINDREF, and Dr. Morrall, will be working closely with the Grenada Fisheries Division, the body responsible for MPA's in Grenada, and other stakeholders to enhance management capacity of the Moliniere MPA. In an effort to develop an effective management plan for Grenada's MPA, The WINDREF/SGU collaborators will review the current management plan with fisheries personnel and key stakeholders. Following this review we will visit the Soufriere Marine Management Authority (SMMA) in St. Lucia, a successful case study of MPA management, to study daily operations and management strategies.

Coral reef systems within the Moliniere MPA on the west coast of Grenada will be surveyed along with a similar reference site using the well established and internationally accepted 'Atlantic and Gulf Rapid Reef Assessment' (AGRRA) methodology. This research will involve the collection and characterization of benthic and fish population data, thus establishing a baseline database for the Moliniere MPA. Community involvement will be an integral component of the project, and as such, a team of volunteers will be trained in SCUBA and (AGRRA) methodology and will assist with the data collection during this research. Results from coral reefs surveys conducted will be summarised in the form of a poster and scientific paper. This will be presented at the Gulf and Caribbean Fisheries Institute (GCFI) annual meeting in Belize in November 2006 by Dr. Morrall and Mr. Nimrod.



Stephen Nimrod with volunteer Katie Bryant after a reef survey.

The research team will assess the knowledge of key stakeholders and other users of the marine environment, as it relates to the importance of, and threats to, coral reefs and other related marine ecosystems. They will also sensitize through educational outreach programs, stakeholders and the public as to the importance of MPAs as they relate to coral reef conservation and protection.

The project will be guided by the expertise of Dr. Michael Risk from McMaster University, Dr. Craig Dahlgren from Perry Institute for Marine Science, Bahamas, and the Nature Conservancy (TNC).



Dr. Phillip Kramer from the Nature Conservancy demonstrating AGGRA survey method.

The Nature Conservancy, an international conservation organization, has been working in Grenada since 2001 through the USAID funded 'Grenadian Parks in Peril' Program, which has the main goal of strengthening the conservation effectiveness of the marine protected area system in Grenada and St. Vincent and the Grenadines. Moreover, Grenada is a signatory nation on the Convention on Biological Diversity and as such is committed to establishing effectively managed marine protected areas by 2012. To help achieve this target, TNC is providing support in the areas of conservation planning and management, institutional capacity building, and environmental education. We have already attended one in a series of conservation management and planning workshops held in Carriacou. The workshop was facilitated by TNC in collaboration with the Caribbean Regional Environment Program (CREP) Sandy Island/Oyster Bed Marine Park.



Key stakeholders at the TNC management and planning workshop in Carriacou, 2005.

We are keen to work with the Grenadian people over the next twelve months. We look forward to making a significant contribution to marine conservation in Grenada and the Caribbean as a whole.

Submitted by Stephen Nimrod and Dr. Clare Morrall.

6.13.2. A project pre-proposal to the US National Fish and Wildlife Foundation (NFWF) for a Grenada-based Marine Protected Area project

The US based Conservation organization 'The Nature Conservancy' (TNC) and Dr. Michael Risk, a coral reef expert currently based in Canada, both gave assistance with this proposal. A full proposal was requested by NFWF and finally in August we received the eagerly anticipated and joyous news that our project funding had been approved! Former SGU Marine Biology student Mr. Steve Nimrod and recent graduate of the University of Plymouth has been hired as project manager for this project. Steve is based at WINDREF and is currently working on building and strengthening ties with the Grenada

Fisheries Division, the Grenada Scuba Diving Association and other partners who will play key roles in the Marine Protected Area (MPA) project.

This year has been busy with workshops. The Nature Conservancy (TNC) continue to support capacity building in Grenada for protected area development through their 'Parks in Peril Project'. We have been fortunate to have been among the Grenada representatives supported by TNC at a variety of training workshops.

In May 2005, four Grenada representatives from attended a week-long 'Caribbean Workshop on Marine Protected Area Effectiveness and Adaptive Management' in St. Croix. Mr. Paul Phillip and Mr. Jerry Mitchell from the Grenada Fisheries Division, Mr. Martin Barriteau, Project Manager for the Carriacou Sandy Island and Oyster Bed Marine Protected Area project, and Dr. Morrall attended and worked together for the week. The workshop participants were from a wide variety of Caribbean islands and much was learnt from information exchange as well as at the formal workshop sessions.



The Grenada team in St. Croix. Left to right: Paul Phillip, Martin Barriteau, Clare Morrall, Raquel Seybert (TNC), James Byrne (TNC) and Jerry Mitchell.

In June, TNC supported three Grenada representatives to attend a week-long training workshop on the Atlantic and Gulf Rapid Reef Assessment (AGRRA) survey technique. Again Mr. Jerry Mitchell from Grenada Fisheries and Dr. Morrall attended along with reef survey volunteer and local dive store manager Mr. Frank Collymoore. The workshop was based at the Bellairs Research Institute of McGill University in Barbados and was run by a team of AGRRA experts including one of the Grand-Daddies of coral reef ecology, Dr. Robert Ginsberg from the University of Miami, and Dr Judith Lang. The week was intensive but highly rewarding with long dive sessions (despite quite foul weather!) and classroom sessions running late into the evenings.



AGRRA Training Team- including, from far left: Dr Robert Ginsberg and Dr. Judith Lang. Front row left to right: Clare Morrall, Frank Collymoore and Jerry Michell.

This fall semester we have been in Carriacou on two occasions. In September Dr. Morrall participated in a week-long reef survey training and data collection trip along with Mr. Paul Phillip, Mr. Jerry Mitchell and a number of Carriacou based representatives. The training was run by Dr. Phillip Kramer and Mr. James Byrne, both from the Nature Conservancy. After a couple of days in the classroom, we spent the rest of the week offshore barely surfacing between survey dives! An enormous

amount of reef data was collected, including data from badly hurricane damaged shallow reefs off the south coast of Carriacou and the deeper but close to pristine reefs surrounding the rocky outcrops known as the Sisters. In October Dr. Morrall made another trip to Carriacou, this time accompanied by Mr. Steve Nimrod and MSc. student Mrs. Lisa McCartney, to attend a two day MPA management meeting. The meeting was attended by a variety of stakeholders including fishermen, water taxi drivers and hoteliers. The same meeting format will be used for the NFWF funded Grenada MPA project.

In June Dr. Morrall attended the Association of Marine Laboratories of the Caribbean (AMLC) Executive Board Meetings and Scientific Meeting in Curacao in the Netherland Antilles. The AMLC are interested in holding their 2009 scientific meeting in Grenada, and we very much hope that this will be possible.

In early November we attended a one day 'Sea Turtle Action Planning Meeting' held in St. George's. The meeting was run by Ms. Rebecca King and Mr. Carl Lloyd from the local Marine Conservation organization 'Ocean Spirits' and was supported by turtle expert Dr. Karen Eckert from the Wider Caribbean Sea Turtle Conservation Network (WIDECAST) based at Duke University, and Mr. Crafton Isaac from the Grenada Fisheries Division. The meeting was very well attended and was highly informative. It is hoped that progress can be made soon to better protect Grenada's sea turtles from a range of deleterious human activities.

Visiting scientists Dr. Ernesto Weil and Dr. Aldo Crocker from the University of Puerto Rico spent a week conducting coral disease surveys around Grenada in October. Dr. Weil has World Bank funding to complete disease surveys at sites spanning the globe. Dr. Weil completed surveys in Grenada in 2001 and plans to return again in a couple of years to reassess the condition of Grenada's reefs. Our MSc. student Lisa McCartney and Mr. Steve Nimrod assisted the scientists in the field and gained valuable experience from their hands-on help with the survey work. Permanent survey sites were established at two reef sites. It is hoped that thermal loggers will be installed at these sites in the near future. This year's high sea surface temperatures have resulted in an intensive and widespread coral bleaching event throughout the Caribbean and Grenada's reefs have been badly affected. It is hoped that the sea temperatures will reduce speedily to allow the coral's to recover. During his stay Dr. Weil gave a dynamic and interesting seminar at WINDREF on Coral Reef Diseases which was well attended by students and representatives from local dive stores.

Finally, through our work with local NGO 'Conservation Grenada Inc.' Dr. Morrall took responsibility as the Grenada co-coordinator for The Ocean Conservancy International Coastal Cleanup in September. Six teams of volunteers cleaned up a variety of coastal and underwater sites around Grenada. A total of 534 trash bags were filled, representing a weight of around 8,300 lb! Dr. Martin Forde from the department of Public Health and Preventative Medicine organized his Environmental Health class to take part in the cleanup and were based in the Grand Anse Beach area. Other SGU representatives took part in the cleanup, contributing to the success of the event.

The cleanup effort was well supported by local businesses. Data from the Grenada cleanup will be published in an Ocean Conservancy report and the will also be sent to the Ministry of Health and the Environment, the Grenada Solid Waste Authority and the Ministry of Tourism. We hope to get greater support both from the St. George's University population and the Grenada population for the 2006 Coastal Cleanup.



Figure three. Conference Bay cleanup bagged up!



Figure four. Carenage underwater cleanup results!

Submitted by Dr. Clare Morrall,
WINDREF Research Fellow,
Chair of Life Sciences,
SGU/SVM Marine Development Program Director

6.14. The Implementation and Evaluation of the Grenada Return to Happiness Program



Return to Happiness Logo

The *Return to Happiness* program is a psycho-affective recovery program for children who have experienced the trauma of armed conflict or natural disasters. It has been implemented in many nations, including Mozambique, Columbia, Honduras, El Salvador, East Timor, Ecuador, Venezuela, Nicaragua, Belize, Peru, Paraguay, and most recently, Grenada. The program employs the strategies of play therapy and creative arts to encourage children to express their concerns, fears, anxieties, and other emotions related to their experiences during and following a disaster. Adolescent and young adult volunteers work with children ages 6-12 in small groups, using program materials, such as puppets, cloth dolls, wooden toys, arts and crafts, plays and storybooks.

Responding to the trauma associated with experiencing Hurricane Ivan, a category 3 hurricane that passed through Grenada on September 7, 2004, UNICEF recognized the immediate need to address issues of child protection and recovery. In cooperation with the government of Grenada, UNICEF implemented the *Return to Happiness*

program in eight sites, serving approximately four hundred of Grenada's children. Following this project, it was decided by the Ministry of Education and UNICEF that all of Grenada's children should benefit from a program designed to address their unique psychosocial recovery needs.



SGU Psychological Relief Team: Dr. Terry Ruthrauff, Dr. Omowale Amuleru-Marshall, Dr. Zuri Amuleru-Marshall, Ms. Novia John, Ms. Nadine Baksh.

The St. George's University Psychological Relief Team, under the leadership of Dr. Zuri Amuleru-Marshall, Professor of Behavioral Sciences, planned this nationwide implementation, as well as its evaluation. The members of the team are Dr. Omowale Amuleru-Marshall, Chair and Professor, Department of Public Health and Preventive Medicine; Dr. Terry Ruthrauff, Acting Director, Counseling Services, Ms. Novia John, Assistant Registrar; and Ms. Nadine Baksh, Assistant Registrar. The evaluation was administered by the Health Promotion Research Center in the Department of Public Health and Preventive Medicine. A proposal was submitted and approved for full funding by UNICEF, Caribbean Area Office.

The goal of the Return to Happiness demonstration in Grenada was to provide each primary school child, between the ages of 6 and 12, with a structured opportunity to process his/her experience of Hurricane Ivan and the crises associated with its aftermath. The expectation was that this would enable these children to recover from any acute emotional trauma and return to a state of confidence, security and hope.

The strategies employed included extensive inter-agency collaboration, community empowerment, materials adaptation and development, volunteer recruitment and training, multiple simultaneous implementations at sites across the island, and systematic data collection for the program evaluation. There was very effective collaboration between the UNICEF Regional Office, the Ministry of Education, the Department of Youth in the Prime Minister's Office, the schools, St. George's University – Psychological Relief Team and Health Promotion Research Center in the Department of Public Health and Preventive Medicine, and the participating NGOs – the Grenada Red Cross, GRENCODA, the Agency for Rural Transformation (ART), and NCH Action for Children.



Locally Produced Toys for Kits.

CULTURAL ADAPTATION OF THE PROGRAM

The original RTH kits were adapted to fit the Caribbean context. This adaptation included the local development of a new logo, new stories and plays, the production of new puppets, dolls and toys, and the

identification of appropriate songs and games.



Storytelling Students with Volunteer.

An international renowned Grenadian artist/author, Richardo Keens-Douglas, assisted with many of these adaptations, and also permitted the use of some of his books and songs in the program. A total of 100 backpacks were produced locally for the program.



Creative Arts students with Dr. Amuleru-Marshall.

IMPLEMENTATION

This was a massive undertaking, which involved every public primary school in Grenada, Carriacou, and Petite Martinique. The onsite program activities were housed, for the most part, in school facilities, immediately after normal school hours. Volunteers from the school communities were recruited by the NGOs and trained by program staff to use the materials and strategies when working with the participating children over the 10-day implementation period at each school. A daily snack prepared by a local vendor was provided for participants, and on the 11th day, a program celebration was held. The program was implemented in six sequential phases from January 2005 to June 2005. Each phase included full program implementation for 6 to 11 schools. The total participation of schools, volunteers, and students is quite impressive:

- 51 schools
- 588 community volunteers (21% served in more than 1 phase)
- 7,239 primary school children

EVALUATION

The evaluation effort was managed by the Health Promotion Research Center in the Department of Public Health and Preventive Medicine at St. George's University. The Department accepted the evaluation of the Return to Happiness program as a project within its Center and provided leadership, secretarial assistance, office resources, as well as fully equipped office space for the data entry clerks as in-kind contributions to the project. The St. George's University Psychological Relief Team provided periodic consultation to the evaluation team.

The evaluation plan included both process and outcome components, requiring extensive continuous data collection and analysis. The outcome evaluation design is a pre-post comparison group design involving the participants in phases 4 and 5. This design controls for a number of potential threats to the validity of the study, including maturation, history, regression, and testing. It does not control for selection however, because the two groups are not randomly selected or assigned. There were four schools in

phase 4 and four schools in phase 5. While the program did not achieve all of its outcome objectives, it was found to be effective, at a statistically significant level, in reducing one of the most salient features of distress – anxiety. Clearly, decreasing children's levels of anxiety is an important contribution to their psycho-emotional recovery from the experience of trauma.

The evaluation has provided useful information to program sponsors and planners regarding the fidelity of the program's implementation, as well as the program's effectiveness in achieving its goal of children's psychoaffective recovery from the experience of Hurricane Ivan. As usual, there are many recommendations for improvement; however, the Return to Happiness Program as implemented in Grenada, was found to be very promising.

Submitted by
Dr. Zuri Amuleru – Marshall, PhD
Professor of Behavioral Sciences, SGU
and Research Fellow, WINDREF

6.15. The MIRT Research Group Uganda study results for the summer activities in 2005

The Uganda Wildlife Authority's (UWA) research plan for 2003 to 2008 highlights the priority of investigating wildlife diseases and human wildlife conflicts in all game conservation areas and national parks. Specifically of interest were studies to investigate the epidemiology of common livestock zoonotic diseases. The ongoing collaboration between St. George's University, WINDREF and Makerere University, which culminated in the signing of a memorandum of understanding between the two institutions in June 2004, facilitates the long term planning of combined research activities. The current research plan were developed closely with Dr. Ludwig Sieffert of the Department of Wildlife Medicine at Makerere and focused on Cystic Hydatid Disease. In the summer of 2005, given the larger than usual number of students who were able to travel to Uganda, it was felt prudent to expand the research activities along the lines set by UWA. We summarize here the research activities conducted.



A Park Ranger watches out for other members of the anesthetized lion's pride who scattered when the individual was tranquilized. Data on infectious diseases in the large predators was collected.

All research projects were carried out in the Queen Elizabeth National Park (QENP) in western Uganda. Projects were divided into three main areas based on the UWA priority list, vis; large predator viral project; livestock/wildlife brucellosis project, and a tick project to examine potential zoonotic diseases; wild animal/ human conflicts and solutions with regard to elephants; a new study was initiated to carry out a census of the chimpanzee population in the Kyambura Gorge was started at the

request of the chief game warden. Each of the 10 students on the team prepared a management by objectives form, which facilitated the priority purchases for each of the projects. All materials, reagents, and test kits were purchased in the US and shipped with the students to Uganda. Unused supplies were left in the lab at Mweya. Implementation of the projects was conducted using established protocols. The data was left with Dr Sieffert.



Dr Sieffert explains the darting technique to the MIRT students.

A total of six lions (2 males and 4 females) and one male leopard aged between 2 – 7 years were anesthetized in the Park and samples were collected from the same. All of the large carnivores tested negative for Feline Leukemia Virus (FeLV) and canine parvovirus but positive for Feline Immunodeficiency Virus (FIV). The fact that all tested positive for FIV antibodies may be due to the close contact between the lion population, such as grooming and possible fighting which will readily facilitate transmission of the virus. The present depressed numbers of predators (the lion population is currently estimated to be 65 individuals) means that transmission opportunities will be more frequent and it is likely that all may be exposed to the virus. The absence of FeLV seen in this study may be due to the virus not having been introduced to date into QENP. The negative FeLV results is consistent with the absence of this virus elsewhere in Africa in wild lion populations. Further studies on these viruses within the lion and leopard population in QENP are required. Such studies done in conjunction with other work, particularly with community education and appreciation of the importance of these species for tourism, could yield important new data which would help to further help the survival of these species within the park.



Ms Hollie Schram placing the leopard in the shade to recover from the anesthetic.

Blood and fecal samples were collected from 48 healthy and 2 ill thrift cattle in the villages of Kahendero and Katwe which lie inside the boundaries of QENP. In the blood smears of the 2 sick cows sampled at Kahendero *Thelileria* sp. and *Anaplasma marginale* was found. At Katwe 20 blood and fecal samples were taken. In the fecal samples taken from both Kahendero and Katwe mixed infections with *Bunostomum*, *Eimeria*, *Monezia*, and Strongyle species were found. The milk ring test for brucellosis was positive in a number of cattle and this is likely to be an important zoonoses in the area.

Speciation of ticks requires specialist analysis and the results are not yet available.



Elephants require large areas to move in creating increasing conflicts with the expanding human population.

Elephant numbers in QENP have risen to almost 2,500 individuals and large numbers of elephants were seen. Raided farms were found to be used for both sustenance and income and ranged from 0.5 to 2 acres in size (estimate). Elephants consumed beans, tomatoes, mango, papaya, maize, banana, and sorghum. Communities most often chose to use deterrent methods that covered large areas and protected many individual farms. Long trenches covering up to 10km were dug in Kyambura, Kikarara and Kahihi to keep elephants away from crops and Muhokya is currently requesting UWA to help in construction of one for their village. Many factors account for which deterrent methods are used. The village of Katwe, for example, did not often use deterrent methods other than noise, due to the position of the town on a hill allowing villagers to see elephants approaching the village. Katwe is not officially allowed to grow crops so is not actively assisted by UWA. One method that is effective in deterring elephants but not as common is Mauritius thorn bush (*Caesalpinia decapetala*) planted as a fence. Both methods, such as trenches and Mauritius thorn fences, are paid for by UWA and villagers carry out the initial labor, for which they are paid, and maintenance for which they are not paid. The digging of a 5ftx7ft trench costs around 3,000 Uganda shillings (approximately US $1.63) per meter, while planting thorn scrub costs 3,000 shillings per kilogram of seed, which can be spread up to one kilometer.

Before the implementation of large-scale elephant deterrent measures local farmers commonly spent nights in guarding huts located within the fields.



A trench dug between farmland and QENP to keep elephants from entering fields in Kyambura, Uganda.

They used fire and noise to deter crop-raiding elephants but were not often successful. Although both *Mauritius* thorn fences and trenches have been effective to deter elephants there are disadvantages. Both must be maintained. The trench in Kikarara, for example, was not weeded or kept at the correct depth to effectively deter elephants. Villagers in Kyambura claimed that the trench limited access to drinking water and that elephants walked to the end of the trench causing a

disproportionate amount of damage to farms in that location.

The local communities work together with UWA to determine which elephant deterrent measures are best for each situation. Villagers are made aware of the benefit of elephants to tourism and the environment.



Deans Macpherson, Sis from WINDREF and St. George's University with Dean Kabaasa from the School of Veterinary Medicine, Makerere, University, Uganda with the MIRT project students following their presentations in WINDREF.

The chimp study provided few results as time did not permit the rigorous study required to fully assess the chimpanzee numbers in Kyambura Gorge.

We would like to thank UWA for permission to conduct the above studies and for facilitating their implementation in QENP. Although given the time frame available, the studies were not exhaustive and do not provide enough information for an evidence based approach to their resolution, it is our hope that the little information obtained will add to the information collected over the years as a whole. We also thank the head of WORM, Dr. Michael Ochaido Thank you to the chief game warden of QENP, head of community relations, Gertrude. Thank you Josephine Afema, Joel Zewa, MZ and Dr. Ludwig Sieffert for facilitating the fieldwork. Thanks to our sponsors, Fogarty International, for the grant made to Texas A and M and its facilitation to the Windward Island Research and Education Foundation at St. George's University. Finally thanks to Dr. Sis, the PI, Dr. Calum Macpherson for field co-ordination and to Dr. Richard Kabuusu for his help.



Dr. Sieffert and Dr. Joel Ziwa and members of the MIRT team in QENP, June 2005.

Submitted by
Dr Cal Macpherson, Sarah Scott and the MIRT students

6.16. Studies on the role of ultrasound in evaluating the need for an *Echinoccus granulosus* control program: Field studies in Eastern Turkey

Cystic echinococcosis (CE) is a major economic and public health problem in Turkey. The parasite mainly circulates in a sheep intermediate host dog definitive host life cycle and humans become infected indirectly through environmental contamination with

Echinococcus eggs. The vast majority of the Turkish population is Muslim whose religious teachings preclude close associations with dogs. Dogs are regarded as being very useful as guards and in most areas they are kept for this purpose. This study was carried out at the request of the Turkish president of the CE association, Dr. Nazmiye Altintas, Professor of Parasitology from Izmir University in Western Turkey. Because of the importance of CE in Turkey, mass community based ultrasound screening programs are planned to identify more accurately the public health importance of the disease throughout the country. Based on surgical records collected from regional hospitals the rural area around Kars, in Eastern Turkey, was selected for the initial survey (map).



Map of Turkey showing the city of Kars (arrowed) in Eastern Turkey. The study was conducted in small rural villages surrounding this historic city between September 26th – October 1st 2005.

The villages to study were previsited a few weeks earlier by a local veterinarian and an associate professor at the University of Kars. Dates for the survey were set and a team of physicians, veterinarians, scientists and students set off daily to the predetermined sites. Informed consent was counseled during the early visits. The arrival of our team was announced from the Mosque by the local Imam who also re-iterated the terms of participation in the study … that the screening was free, what diseases were to be looked for, what procedures would be carried out on the volunteer participants (questionnaire, ultrasound screening and blood samples from positive cases and a few controls) and that the results would be instant. Only those who wanted to be screened need participate in the study. Experience in other parts of the world has shown that the level of participation is extremely high and the data obtained is a very accurate refection of the true disease status in a community.



Participants in the ultrasound screening program first complete a questionnaire which helps to collect data on risk factors and also serves as an educational tool for the participating population.

The screening program started with the children, then the women and finally the men of each village. Schools were selected as the screening venue as they had multiple rooms and were invariably located near the center of the village. Questionnaires were completed using faculty and graduate students. Ultrasound examinations were carried out by CNLM behind a screen and positive cases were confidentially counseled. Positive VDU images were

recorded digitally. Blood samples were taken from all suspected CE patients.



The ultrasound team arrives at a village school in preparation for the screening.

Of the 2001 people screened by us, 5 (0.24%) were found to have CE lesions, all located in the liver. One of the lesions was classified as CE Type 1, one was CE Type 4 and the other three were cystic lesions. In addition to the CE lesions, two patients had marked punctuate calcified lesions of unknown etiology. The prevalence found was much lower than expected, given the risk factors prevailing in the area. These included a large dog population usually kept close to the house, feeding hydatid cysts, when found, to dogs, poor hygiene and large numbers of sheep. The reasons for the low prevalence will be investigated further by the local veterinarians at Kars University.

Submitted by
Cal Macpherson, PhD, DIC
Director, WINDREF

7.0. Acknowledgements

WINDREF works in close collaboration with a number of local and internationally based institutions and individuals. In Grenada, we would like to thank the Ministry of Health, Ministry of Education, Ministry of Agriculture and the National Parks and Protected Areas Department, Ministry of Tourism and the Forestry Department for their help and cooperation with the research projects. We would also like to thank Senator Ann David-Antoine, the Minister of Health, Dr. Bert Brathwaite, Chief Medical Officer, for their considerable input during 2005.

7.1. Associated faculty, staff and institutional collaborators

Collaborator	Projects
Ms. Josephine Afema	Uganda
Mr. Dave Alexander	Addictive Diseases
Dr. B. Amelingmeier	Intestinal Helminths
Dr. J Amelingmeier	Intestinal Helminths
Dr. T. Andrews	Novel Antimicrobial
Aquanauts	Novel Antimicrobial
Dr. Bert Brathwaite	Addictive Diseases
Ms. Cynthia Bruno	Novel Antimicrobial
Mr. Nicholas Caputo	New Species
Dr. Tom Champney	Novel Antimicrobial
Min. Clarice Charles	All Projects
Dr. Wendy Crawford	CERI
Mr. Charles Daniel	Apres Toute
Sen. Ann David-Antoine	All Projects
Ms. Grace Dolphin	CERI
Nurse Nestar Edwards	Addictive Diseases
Dr. Paul Fields	All Projects
Mr. Peter Giesler	Novel Antimicrobial
Ms. Suzanne Hall	Novel Antimicrobial
Sister Sharon Harris	Addictive Diseases
Welles Henderson	Novel Antimicrobial
Dr. David Johnson	Novel Antimicrobial
Ms. Fiona Jeffrey	Apres Toute
Dr. Richard Kabuusu	Uganda
Dr. Mary Jeanne Kreek	Addictive Diseases
Mr. Grant Lambert	Novel Antimicrobial
Dr. David Lennon	Micro Projects
Mr. Tarami Long	Intestinal Helminths
Dr. Matthias Lorenz	Nutmeg
Dr. C.N.L. Macpherson	All Projects
Dr. Fran McGill	Relief
Dr. Eugeny Martin	Novel Antimicrobial
Ms. Trisha Martin	Novel Antimicrobial
Ms. Rebecca Melfi	Intestinal Helminths

Nurse Beverly Mends . Addictive Diseases
Microbiology Division..... CERI
Ministry of Education . Addictive Diseases
Ministry of Health..... All Projects
Dr. Winston Mitchell ..... Relief
Dr. David Molyneux..... LF
Mr. Mandlenkosi Mthunzi Classification of species
Ms. Ruella Munro ..... Nutmeg
Mr. Trevor Noel..... CERI
Mr. Tom Nutley. ..... Apres Toute
Dr. Michael Ochaido..... Uganda
Mr. Rex Omabu ..... Nutmeg
Ms. Beula Patterson ..... CERI
Mr. Tommy Pelai..... Classification of species
Dr. Allen Pensick..... All Projects
Mr. Arthur Pierre ..... Addictive Diseases
Dr. Ateef Qureshi..... Novel Antimicrobial
Dr. Leslie Ramsammy ..... LF
Dr. Joanna Rayner..... Novel Antimicrobial
Mr. Thorne Roberts..... Addictive Diseases
Dr. Mirta Roses ..... Return to Happiness
Dr. Zara Ross ..... Novel Antimicrobial
Dr. Ludwig Sieffert..... Uganda
Dr. Ray Sis..... Uganda
Mr. Kabelo Thusang Classification of species
Mr. Baogo Tapela ..... Classification of species
Dr. Keith Taylor..... All Projects
Mr. Terrance Walters .. Addictive Diseases
Ms. Heidi Wiegandt .. Intestinal Helminths
Mr. Joel Zewa ..... Uganda

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An arthroscope was donated to WINDREF by the alumni of the University College of Cork, Ireland, and Dr. William McAveney from the Virginia Rotary Club. Dr. Cal Macpherson handed over the equipment to Dr. Douglas Noel, the head of the Department of Orthopedics at the General Hospital.

9.0. Past, present and future research projects (present research projects bolded)

9.1. Non-communicable diseases

- Angiotensin converting enzyme and angiotensinogen gene polymorphisms in the Grenadian population: relation to hypertension
- Development of a decision rule for screening Obstructive Sleep Apnea and its epidemologic relevance to the people of Grenada
- Prevalence and associated risk factors of hypertension in a sample population of native Caribbean's in Grenada, West Indies
- Assessing the prevalence of diabetic complications by examining type I and type II adult diabetics for signs of retinopathy, neuropathy, nephropathy and dermatological changes associated with poor glucose control within the native Caribbean population of Grenada
- Hypertension management and control in two Caribbean countries
- Assessment of the effectiveness of broad-spectrum treatment to children with protozoan and nemathelminthic parasitic infections on diarrhea and school attendance
- The effects of iron-deficiency anemia on cognition and behavior in infants
- Diurnal variation of urinary endothelin-I and blood pressure: related hypertension
- Alcohol consumption in Grenada
- The incidence and mortality of cancer in Grenada over the ten year period: 1990-1999
- The prevalence of abnormal haemoglobin traits in Grenadian secondary school adolescents
- Knowledge, attitudes, beliefs and practices of Sickle Cell Anemia in Grenadian Primary and Secondary school children
- Decompression sickness among the indigenous fishing population in Grenada: Assessing the burden of disease
- **WINDREF / SGU Hurricane Relief**
- **Spice Research Program**
- Sulfate-Reducing Bacteria in Oxidized Freshwater of Tropical Mangroves
- **Novel Antibiotics from Tropical Marine Environments: Drug Development in Grenada**
- **Study of the Mutacin C-7A**

- Gram-negative bacteria isolated from aquatic environments of Grenada (61.4°W, 12.0°N), West Indies
- **Identification of bacteria producing antibiotics isolated from deep marine biofilms of Grenada**
- **SGU Environmental Testing Unit (ETU)**
- **Post-hurricane water surveillance in problematic areas of Grenada**
- Evaluation of the relocation potential for villagers residing in Queen Elizabeth National Park, Uganda
- Study of the Calls of the Spotted Hyena at Feeding
- Survey on the attitude of villagers in Queen Elizabeth National Park, Uganda towards the threat of lions, leopards and hyenas
- Epidemiology of Human Injuries Resulting From Wildlife in Ten Villages within Queen Elizabeth National Park, Uganda
- Rural Ugandan Village Perspective on Lion, Leopard and Hyena Conservation
- Epidemiology of Human Injuries by Wildlife in Six Villages within Queen Elizabeth National Park, Uganda
- Prevalence of *Campylobacter fetus* subspecies *venerealis* and other Microorganisms in the Reproductive Tracts of Cattle from the Southern Region of Santo Domingo, Dominican Republic

9.2. Infectious diseases

- Investigation of the prevalence of SIV in the mona monkey (*Cercopithcus mona*) in Grenada
- Seroprevalence of HIV-I and HIV-II in pregnant women in Grenada, W.I. Their knowledge of AIDS and their exposure hazards to the virus
- A cross sectional study of the current status of *Schistosoma mansoni* in St. Lucia by field surveys and supplementary data collection
- Identification and characterization of hantaviruses among the mammal population of Grenada
- HIV/AIDS health education and evaluation program in Grenada
- The seroprevalence of *Toxoplasma gondii* in a population of pregnant women and cats in Grenada, West Indies
- The efficiency of diagnosing women of *Toxoplasma gondii* using PCR techniques in comparison with ELISA
- Dengue virus in Grenada: seroprevalence and associated risk factors
- A current appraisal of dengue virus in Grenada - serotype analysis and vector assessment
- A site receptivity study determining the threat of reintroduction of malaria into Grenada through the study of Anopheline spp. mosquito vectors
- Chlamydial infection among STD clinic attenders in Grenada
- Fever in Grenada
- Mosquitoes and Tourism in Grenada
- Effectiveness of a formula feeding/weaning intervention program in preventing transmission of HTLV-1 from seropositive mothers to newborns in Grenada

- A multi-center longitudinal research study of the behavioral significance of the prevalence of HIV-1 infection in pregnant women and their babies on the islands of Grenada and St. Vincent
- A multi-center longitudinal research study of the ethical analysis of informed consent of the prevalence of HIV-1 infection in pregnant women and their babies on the islands of Grenada and St. Vincent
- Determining the role of IL-15 in mediating function of viral-specific CD8+ T cells in the myelopathogenesis of HTLV-1: Symptomatic versus asymptomatic patients
- Intestinal protozoan infections in 6-12 year old children in Grenada
- Intestinal helminth infections in 6-12 year old children in Grenada
- The prevalence of intestinal parasites in school children in rural Guyana
- The prevalence of filariasis and its effects on children aged 8-14 in the central corentyne region of rural Guyana
- The prevalence of streptococcal infection in school children aged 5 – 15 years in Grenada, Carriacou and Petit Martinique
- Studies examining the elimination of lymphatic filariasis as a public health problem in Guyana
- Seroprevalence of heartworm infection in dogs in Grenada.
- Dengue in Grenada
- Assessing the potential risk factors of dengue and dengue hemorrhagic fever in the tri-island state of Grenada, Carriacou and Petit Martinique
- A comparative study to find out if there is an association between sexual practices and knowledge in adult populations of Botswana and Grenada with the prevalence of HIV/AIDS
- HIV/AIDS in rural Botswana differentiating between informing and educating
- **Evaluating the level of perceived fear and desensitization towards HIV/AIDS in Botswana**
- Rheumatic Fever in Grenada
- Isolating T cells from Rheumatic Fever positive blood: Immunofluorescent assay of T lymphocytes via fluorescently labeled monoclonal antibodies
- Possible genetic predisposition to Rheumatic Fever: Demonstrating the inheritance fashion of non-HLA B lymphocyte alloantigen D8/17, a marker for Rheumatic Fever
- ELISA antibody titres against group A streptococcal M protein moiety and cell wall N-Acetyl-D-Glucosamine in Grenadian Rheumatic Fever patients
- Evaluating the effectiveness of educational methods in the prevention of Rheumatic Fever and Knowledge, Awareness and Practices
- Prevalence of intestinal helminth infections in rural Grenadian school children
- Cystic echinococcosis in Morocco and Uganda
- **Elimination of Lymphatic Filariasis in Guyana Program**

9.3. Unique projects

- Characterization of five amphibians inhabiting Grenada and subsequent isolation and antimicrobial assay of potential antibiotics derived from their skin
- Mona Monkey studies in West Africa
- Investigation of medicinal plants in Grenada
- Use of medicinal plants in Grenada
- Medicinal drugs from the sea. What do Grenada's waters have to offer?
- Beekeeping in Grenada: Effects of the mite *Varroa jacobsoni* and its control
- Effects of Grenadian Medicinal Plants on Endemic Microbial causes of Diarrhoeal Diseases
- The neurobiological basis of hypoglycemia-associated autonomic failure
- Stimulation of angiotensin 4 in cardiac fibroblasts activates matrix metalloproteinases through MAP kinases pathways: A model for astrocytes
- REM sleep and memory
- End of life care in Grenada
- Novel antibiotics from tropical marine environments
- **Genetic Correlates of the Addictive Diseases: Cocaine, Alcohol, and Marijuana Addiction– Grenada**
- **An Investigation of Pediatric Botanical Medicine for Acute Respiratory Infections**

10.0. Conferences, meetings, workshops sponsored in 2005

Workshop on the improvement of Apres Tout water quality. A collaboration between Ministry of Health, National Water and Sewerage Authority (NAWASA), WINDREF and SGU.

11.0. Abstracts, Presentations at International Conferences, Invited Plenary / Workshop / Roundtable / Professional

Abell, N., Rutledge, S.E., McCann, T.J., Padmore, J. Intervening in HIV/AIDS Provider Stigma: Assessing Regional Concerns in the West Indies. The University of the West Indies HIV/AIDS Response Programme, the 3rd Annual Scientific and Business Conference, Barbados, 5-8 May 2005.

Brunetti, E., Macpherson, C.N.L. and Richter, J. Short Course on Abdominal Ultrasound in Tropical Medicine, Pavia University, Pavia, Italy, 28 March - 1 April 2005.

Caputo, N. and Kotelnikova S. Novel antimicrobial producing organisms from tropical marine environments, Poster presentation at Microbes in the Changing World, San Francisco, California, July 2005.

Gribbin, C.W., McLendon, L., Tsang, S., Lee, P.J., McCann, T.J. Diabetes type II and hypertension prevalence, education, complications and disease management within a rural community of the island of Grenada. Invited poster presentation at the Annual American Public Health Association's 133rd

Annual Meeting, Philadelphia, 10-14 December 2005.

Kachani, M., Alioua, F., Benazzouz, M., Bouslikhane, M. and Macpherson, C.N.L. Benefits of Physician-Veterinarian Collaboration in the Control of Zoonoses – The Hydatid Disease Control Program in Morocco. Oral paper at WAAVP, Christchurch, New Zealand, 25 October 2005.

Lee, P.J., Tsang, S., Gribbin, C.W., McLendon, L., McCann, T.J. Response to post-disaster health needs through community-based initiatives in Grenada. Invited poster presentation at the American Public Health Association's 133rd Annual Meeting, Philadelphia, 10-14 December 2005.

Macpherson, C.N.L. The role of ultrasound in *Echinococcus* control programs: diagnosis, treatment, surveillance and education, Plenary paper 14th Annual Parasitology Congress, Izmir, Turkey, 23 Sept 2005.

Macpherson, C.N.L. The role of academic institutions in the lymphatic filariasis elimination program in the Americas, 6th Regional PAHO meeting, on the program for the elimination of lymphatic filariasis, Costa Rica.

Macpherson, C.N.L. The use of ultrasound in the epidemiology of parasitic disease, Invited symposium paper, American Society of Tropical Medicine and Hygiene, Washington, 12 December 2005.

McLendon, L., Gribbin, C.W., Tsang, S., Lee, P.J., McCann, T.J. Power of the tool in the hand of the woman: empowering Caribbean women after a natural disaster. Invited oral presentation at the American Public Health Association's 133rd Annual Meeting, Philadelphia, 10-14 December 2005.

Sharma, R.N., Dubey, J.P., Bhaiyat, M.I., De Allie, C., Macpherson, C.N.L., Sreekumar, C., Vienna, M.C.B., Shen, S.K., Kwok, O.C.H. and Lehmann, T. Seroprevalence and isolation of *Toxoplasma gondii* in free ranging chickens in Grenada, Oral presentation at 8th Biennial Conference of the Society for Tropical Veterinary Medicine: Impact of Emerging Zoonotic Diseases on Animal Health, 26 June 2005, Hanoi, Vietnam.

Tsang, S., Lee, P.J., McLendon, L., Gribbin, C.W., McCann, T.J. Effects of health education on personal hygiene and sanitation knowledge in post-disaster rural Grenada. Invited poster presentation at the American Public Health Association's 133rd Annual Meeting, Philadelphia, 10-14 December 2005.

12.0. Publications

Asulin, Y., McCann, T.J., McCarty, C.W., Hage, R.W., Rooney, P. J., Macpherson C.N. L. (2004). Cancer Incidence and Mortality in Grenada: 1990-2000. *West Indian Medical Journal* 2004; 53 (6):368-373.

Dubey, J.R., Bhaiyat, M.I., de Allie, C., Macpherson, C.N.L., Sharma, R.N., Sreekumar C., Vianna, M.C., Shen, S.K., Kwok, O.C., Miska, K.B., Hill, D.E., Lehmann, T. (2005). Isolation, tissue distribution, and molecular characterization of *Toxoplasma gondii* from chickens in

Grenada, West Indies. *Journal of Parasitology*, 91: 557-560.

Loukas, M., Louis, R.G., Kapos, T., Kwiatkowska, M. (2005). A case of a bilateral accessory digastric muscle, *Folia Morfologica* (War) 2005, 64; 3: 233-236.

Macpherson, C.N.L. (2005). Human behaviour and the epidemiology of parasitic zoonoses. *International Journal of Parasitology*, 35, 1319 – 1331.

Noel, T.P., Zabriskie, J., Macpherson, C.N.L. and Perrotte, G. (2005). Beta hemolytic *streptococci* in school children 5-15 years of age with an emphasis on rheumatic fever, in the tri-island state of Grenada. *West Indian Medical Journal*, 54, 22 – 27.

Panagos, A., Lacy, E.R., Gubler, D.J. and Macpherson, C.N.L. (2005). Dengue in Grenada. *Pan American Journal of Public Health*,17: 225-229.

13.0. Thesis Defenses

Cameron, Ella. (2005) Cystic Echinococcus in Morocco: A comparative regional analysis.



Mrs. Ella Cameron MSc following her successful defense with her supervisory committee, Dr. Paul Garner, Dr. Cal Macpherson and Dr. Zuri Amuleru-Marshall.

Caputo, Nicholas. (2005) Novel antimicrobial producing micro-organisms from tropical marine surfaces.

Forman, Scott. (2005) Decompression illness among the indigenous fishing population of Grenadian waters: assessing the prevalence, perceptions and burden of disease.

14.0. Seminars

- Novel Antibiotics from Tropical Marine Surfaces. Nicholas Caputo. 23rd February 2005.
- The mutacin C-7A, a novel antimicrobial peptide. François Hallé. 2nd March 2005.
- Reproductive Health, International Research and Ethics. Dr. Ruth Macklin 16th February 2005.
- Investigation of pediatric botanical medicine. Daniel Firer. 9th March 2005.
- The role of ultrasound in the epidemiology of parasitic disease. Dr. Cal Macpherson. 16th March 2005.
- An assessment of the effect of reacting *E.coli* biofilms with phage and antibiotics successively. Mathew Beeson. 23rd March 2005.
- Diethylcarbamezine, hygiene and skin care to improve quality of life of lymphoedema patients in Guyana. Dr. Karen Cummings. 30th March 2005.
- Nasal carriage of *staphylococcus aureus* in medical students at SGU. Ashley Crisp. 6th April 2005.

- A comparison of two different areas in Georgetown, Guyana as it relates to KAP and prevalence of lymphatic filariasis. Edé Langevine. 13th April 2005.
- Sickle Cell. Dr. Graham Sergeant. 20th April 2005.
- Development of a biofilm model system. Michelle Chen. 27th April 2005.
- Antagonistic properties of reef fish microflora. Cynthia Bruno. 4th May 2005.
- Helminthiasis in Haitian Refugees. William Brown. 11th May 2005.
- Zen of Botox. Dr. David Lennon. 18th May 2005.
- Prions and prion diseases in the USA. Dr. Paul Smith. 31st August 2005.
- Ethnobotany: Is it relevant to clinical medicine? Daniel Firer. 7th September 2005.
- HIV, Gender and ethics. Dr. Cheryl Cox – Macpherson. 14th September 2005.
- Evaluating the level of perceived fear and desentization towards HIV/AIDS in Botswana, Southern Africa. Bayela Nfila. 21st September 2005.
- A new production extraction and purification technique for mutacin C7A. François Hallé. 28th September 2005.
- A comparative analysis of the socio-economic impact of lymphatic filariasis in Georgetown, Guyana. Edé Langevine. 5th October 2005.
- Predator Presentation from Queen Elizabeth National Park, Uganda. Emily Hays, Hollie Schram, Christina Fernandez, Shannon Shaw and Sara Koehn. 12th October 2005.
- Brucellosis in cattle in Queen Elizabeth National Park, Uganda. Samantha Zaplinski and Jill Caldwell. 19th October 2005.
- Elephant crop raiding deterrent methods in Queen Elizabeth National Park, Uganda. Sarah Scott and Adam Calcutt. 19th October 2005.
- Chimps in Queen Elizabeth National Park. Stacie Gallenstein. 19th October 2005.
- Helminthiasis in Haitian refugees: Phase I results. William Brown. 26th October 2005.
- The history of methicillin resistant *Staphylococcus aureus*. Ashley Crisp – Cubbage. 2nd November 2005.
- Hospital Infections. Michelle Chen. 9th November 2005.
- Elephant crop raiding deterrent methods in Queen Elizabeth National Park, Uganda. Sarah Scott. 16th November 2005.
- Antagonistic properties of reef fish microflora. Cynthia Bruno. 23rd November 2005.
- History of Bacteriophage Research 1936 – 2005. Matthew Beeson. 30th November 2005.

15.0. Further information

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