The University of the West Indies
Cave Hill Campus

Department of Biological and Chemical Sciences

SUMMER RESEARCH PROJECTS
2014-2015

BIOC3950
BIOL3950
ECOL3950
ERSC3900
MICR3950
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Wild type *Salmonella typhimurium* lab strains tend to grow poorly as biofilms. We have found that our wild type strain SB3507 is no exception. However, if this strain is grown aerobically in rich medium (LB*) to stationary phase and the cells are removed from the medium, the resulting “conditioned medium” supports robust biofilm growth of the same strain (V. Bideau, C. Crawford, O. Kirton, BIOC3950 projects). This effect could be due to (a) a factor produced by the culture and released into the medium that activates biofilm growth of the same strain, or (b) depletion of something from the medium, which results in activation of biofilm growth. The latter has been reported, using other *S. typhimurium* strains; conditioned medium supported robust biofilm growth, and the effect was reversed (at least partially) by adding back LB* or a mixture of phosphate and nitrate (Gerstel & Römling 2002). In our case, the conditioned medium lost its stimulatory effect during several days’ storage in the refrigerator, but not on heating at 60 or 100 °C for 15 minutes. Freezing prevented the loss of activity during storage (O. Kirton, BIOC3950 project). These properties are not consistent with depletion, but suggest that the stimulatory effect is due to a heat-stable protein that is slowly degraded by a heat-stable protease during storage at refrigerator but not freezer temperatures.

The student taking on this project will attempt to stabilize the prospective factor using protease inhibitors and then to isolate and concentrate it. This will allow further studies to be done to characterize and identify the factor, and/or to characterize biofilm growth of SB3507 starting with a consistent baseline. Interestingly, conditioned medium from SB3507 does not support biofilm growth of two strains that form robust biofilms in LB*. Once the stimulatory factor is isolated, its effect on biofilm growth of these other strains can also be tested.

**Project can accommodate more than one student.**

**References:**


### Course (s)

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### Title

Effect of Growth Conditions on Quantity and Distribution of *Escherichia coli* Biofilms.

### Supervisor (s)

Dr. Sarah Sutrina

*E. coli* strain 15 forms robust biofilms on glass surfaces, and both the quantity and the form of the biofilms depends on the growth medium. For example, cells that are “hungry” for nutrients or oxygen tend to grow as thin biofilms at the liquid/solid interface. In rich medium with or without sugar, biofilms form as rings at the air/liquid interface, and in minimal medium, biofilms form covering the bottom of the tube (liquid/solid interface) or as rings (air/liquid interface) depending on the carbon and energy sources available. High levels of sugar repress biofilm growth, and cAMP relieves this repression under some conditions but not others. This project will continue an investigation into these phenomena.

**Project can accommodate more than one student.**

**References:**


**Course (s)**

| BIOC3950 |

**Title**

Determination of the Biological Methane Potential of Various Grasses Across Barbados.

**Supervisor (s)**

Dr. Sarah Sutrina, Dr. Francis Lopez & Mr. Nikolai Holder

Bioenergy can be defined as the energy contained in living or recently living biological organisms and is obtained from the use of biofuels\(^1\). These biofuels can be solids, liquids or gasses, but they must be obtained from biological sources\(^1\). The energy in biofuels is found in what is known as biomass, which can be any organic material that can be converted to fuel, and different sources of biomass have different rates of decomposition and different metabolic products which can affect biogas production\(^2\). Biogas is the term used to refer to gas produced from the biological metabolism of organic material in an anaerobic setting\(^3\). Biogas is comprised mainly of methane (\(~65\%) and carbon dioxide (\(~35\%), with trace amounts of other gasses, such as hydrogen sulphide or nitrogen dioxide\(^3,4\). In the biofuel industry anaerobic digesters are used to generate a controlled environment to manage the decomposition of the organic matter and the use of the gas produced. Anaerobic digesters are devices which are essentially a tank containing a slurry of microorganisms, which digest the organic material placed in it\(^5\).

There are numerous organic materials that are considered to be waste and are simply discarded, which have a high potential of producing energy. One of these substrates is grass, of which there are numerous types growing on the island. It can be seen on golf courses, football and cricket fields as well as growing wild, and uncontrolled. Currently the grass cuttings are collected and dumped, or even used as compost, without first utilizing them as a source for energy.

This study seeks to determine the biological methane potential of the different types of grasses grown on the island. If found to be viable, this project will lead to further work in the area, and possibly a working system to utilise the grass cuttings as a form of energy.

**References**


The ghost crab, *Ocypode quadrata* is a common inhabitant of sandy beaches. It makes its burrows in the drier areas of the beach and moves down the beach into the swash zone to feed. In recent years the invasion of *Sargassum fluitans* has resulted in large quantities of this sea weed washing onto east coast beaches and accumulating on the beach in piles at times greater than 1m high. This project will investigate the impact of this accumulation of sea weed on ghost crabs in Barbados. The student will be expected to determine the abundance of ghost crabs on selected beaches. Sediment analysis and water and organic content of the sand will be measured. Burrow morphology will also be investigated as described in (Seike, K. and M. Nara. 2008).

**Reference**

Coral rubble is formed through the erosive action of strong wave action on a reef. Fragments of reef are rock are broken off the reef and in some instances may be transported into the near shore and come to lie on the beach seaward of the beach face. In Barbados, coral rubble beds are found mostly on the south coast. Coral rubble provides a habitat for benthic and cryptic fauna (Bailey-Brock et al. 2007; Meesters et al. 1991). Bailey-Brock et al. (2007) note that the significance of benthic rubble communities to coral reef ecosystems is often overlooked. In this project, the organisms inhabiting the inside and underside of rubble rock (the cryptic habitat) will be identified. This will be done by collecting reef rubble from the rubble beds at Drill Hall. The surface area of the sub-rubble surface will be determined and the organisms on this surface identified and quantified. Infauna will be extracted using the method described in Brock and Brock (1977).

References


SOME ADVICE FOR STUDENTS

The Research Project courses afford students the opportunity to carry out research themselves and to add to our knowledge of the world. Research is time-consuming, often frustrating, but also exciting and undertaking a project gives you a chance to see whether a research career is for you. Several students before you have carried out projects to such a high standard and with novel results that these have been published in internationally refereed journals!

CARRYING OUT THE PROJECT WORK

Before commencing work it is important that you have a clear picture in your mind of what you are setting out to achieve. Discuss the project fully with your supervisor(s) and ensure you are clear as to the aim(s) of the project. Your research should not just be an open-ended exercise that finishes when you have a sizeable body of data but must have clear, realistic goals. It is you, not your supervisor, who will have to defend the project design so be prepared to be critical of any aspect of the planned study at this early stage. Your supervisor will help you plan your work schedule. Regular consultation between the two of you on your progress is vital to project success. You may need certain keys to the building and these can be obtained by paying a deposit to the Departmental Secretary and completing the necessary form. It is important you keep a record of all your project work in a notebook dedicated to the purpose, not scraps of loose-leaf paper. Success in this course is based on the effort you put in.

Your supervisor will advise you on the best way to commence writing up your research but you are encouraged to start writing the Methods (also termed Materials & Methods) section of the report as you go along. You will early on be directed to certain key references to help you understand the nature of the problem you are investigating. This literature review will also be vital to the writing of the Introduction section of your report. On completion of the experimental work, cleaning up of your work area is mandatory. Your project will not be considered complete unless this has been done and you will receive a low mark for your quality of work. Also, your key deposit will not be refunded unless your supervisor indicates that you have cleaned your work space.

THE PROJECT SEMINAR

On completion of your practical work you will be required to present your findings to members of the department. This will be assessed and contributes 15% toward your final mark. In the case of year-long projects, you are also required to present an initial seminar outlining what you are setting out to do. This is not for credit but will help you build confidence for the final assessed seminar and may provide valuable feedback on your project intentions.

It is vital when presenting your work that you explain to the audience early on what is the aim of your project. Surprisingly, such a key aspect of a presentation is often overlooked. In the time available you should explain why this is a problem that needs investigating, e.g. by referring to previous studies. The methods you have used should be presented in sufficient detail to allow the audience to understand what you have done. You should then present your results, interpret these and maybe suggest future work. The audience will then ask you questions arising out of what you have presented.

You should practice your talk beforehand ensuring you keep to the allotted time. Ideally, you should speak to your visual aids rather than read word for word from notes. Ensure you’re your audience can easily read your slides. Simple with a single idea is best. Try to avoid complicated backgrounds. These can be distracting and/or make the slides difficult to read. Check that your
presentation will run adequately on the system in the Demonstration Room and that your slides look good when projected. Colours do not always look the same as on your computer screen. A trial should be carried out the day before.

THE PROJECT REPORT

NB: This particular format might not be the best for your project. Your supervisors will advise you. This works for most biological projects.

The grade you receive in this course will depend largely on the quality of your Project Report since it accounts for 70% of your mark. Good presentation is important, but an attractive report that says nothing will not give you a passing grade. Likewise, fantastic results scrappily presented and shoddily written up will not give you even a passing grade. It will take time to compose and type the Report, prepare figures and have it bound. The submission deadline is final so ensure you budget 2-3 weeks for this. **THE PENALTY FOR LATE SUBMISSION IS 5% PER DAY.** Your report must be written in the format of a scientific paper and your supervisor will provide you with a sample paper and or previous report to guide you as to what is appropriate. Your supervisor will help you in planning how to write the report and will comment on draft portions to ensure you are on the right track. You must write in Standard English, carefully proof-reading the final draft. For all sections incorrect spelling and grammar will be penalised. Do not depend on a spell checker to find all spelling errors or a grammar checker to correct your grammar. Your Report will be graded in accordance with the enclosed marking scheme.

**Abstract:** The abstract summarizes your findings and possibly your interpretation of your results. Look at Abstracts from several papers related to your study and ensure you understand what constitutes an Abstract. It is usually about three-quarters of a page of your report. The most common fault here is that the student does not understand what an abstract is and writes what amounts to a mini-Introduction.

**Introduction:** The Introduction sets the scene. It provides a literature review of the area and explains the nature of the problem to be investigated. It will often include the socio-economic reasons why this investigation is warranted. It is important in reviewing the literature to get the balance right, e.g., an introduction to a project looking at the biochemistry of softening in mango fruit might have a sentence explaining that mango is but one species of the genus *Mangifera* but to spend a page reviewing the taxonomy of mango would be inappropriate in this case. Another common mistake is in the citing of the literature. Firstly, you must credit the sources of the information you present and you must do so correctly (see References section overleaf). Another common error is to cite the reference but then not list this in the reference section. If you have read about a study by Jones (1990) in a paper by Smith (1999) but not actually read the Jones paper it is incorrect for you to cite the Jones paper directly. Instead, you should cite this as (Jones, 1990, cited by Smith, 1999). Remember plagiarism is a serious offence that can be avoided by citing sources correctly and paraphrasing what you have read. **Give the objectives of the experiments in the introduction.**

**Materials & Methods:** Anyone reading this section should be able to repeat what you have done (and get the same results). The focus for this section is therefore accuracy and completeness. Look at relevant scientific papers as a guide to how this section is written. Where you are following a published method cite the reference. It is normal in this section that the full scientific name of the organism being studied
is given if it has not appeared first in the Introduction. At the first mention of the scientific name the authority for the name must also be included (but dropped thereafter). This last rule does not apply to prokaryotic organisms. Also avoid all sorts of abbreviations that you have not previously defined in the text.

**Results:** A Results section is not simply Figures or Tables of data. In this section the results obtained are stated, though usually not interpreted. For this reason there is not usually any citing of the literature in this section. In this section, where appropriate there should also be the results of statistical analysis of the data. Raw data is more appropriately included in an Appendix to the report. Your supervisor will guide you on this. Figures and Tables should each bear a legend which provides enough information to make the Figure/Table intelligible without reference to the text. The Figures and Tables are numbered in order of their appearance in the text, i.e. the first figure referred to, is Figure 1. Photographs are also considered Figures. The Figures and Tables should appear in the text rather than *en masse* at the end.

**Discussion:** This section constitutes your interpretation of your results, what the results suggest and how these relate to previous published studies. You will therefore be carefully citing the literature where appropriate in this section. Where there has been major experimental failure you will want to discuss here why this transpired and how you would repeat the study so as to actually get data. The Discussion supervisor may advise that you combine the Results & Discussion sections but even in such a case the foregoing comments apply. As a guide you could consider the following:

- Give explanations for the results you obtained.
- Why did you obtain these results?
- How do these results satisfy the objectives of these experiments?
- What were the difficulties encountered?
- How would you proceed to get better results?
- What can you conclude from your results?
- What else could be done to support these conclusions?
- How could these experiments be improved?
- Compare your results with similar results in the literature

**References:** The Reference section must list the References in a standard accepted format. References are usually arranged alphabetically by author and then by year but they may also be assigned a number and listed in the order in which they are cited in the text. Consult with your supervisor as to what format you should follow. When you start using a format for your references, adhere to it. Students often do “copy-paste” of references from different journals that have different formats. Be careful to check that ALL your references are in the SAME format.
Acknowledgments & Appendices:

If you wish to acknowledge help given this should be done in an Acknowledgements section following the Discussion. If you have received substantial help from anyone this must be pointed out in the Acknowledgements section. If your project involved a survey you might want to include the Survey Form in an Appendix or if there are raw data that need including, the Appendix is an appropriate place for this. This optional Appendix will be the last section of the report.

SAFETY

General safety rules apply to all activities in laboratories. Food and drink must NOT be taken into any laboratory. Lab coats are mandatory for the experimental parts of most projects. If you are not certain, consult your supervisor.

SAFETY IN FIELDWORK

This section provides an outline of some of the issues that need to be considered when undertaking a project that includes an element of fieldwork. Further details can be found in the Department of Biological and Chemical Sciences Safety Manual.

DEFINITION OF FIELDWORK

Fieldwork is defined as any practical work carried out by staff or students of the University for the purpose of teaching and research in places which are not under University control but where the University is responsible for the safety of its staff and students and others exposed to their activities. The definition includes activities as diverse as archaeological digs, social survey interviews as well as more recognised survey/collection work.

GENERAL CONSIDERATIONS

Students with any medical condition likely to affect their ability to undertake fieldwork must inform in advance the member of staff in charge.

As a general rule, fieldwork by solitary individuals is NOT allowed. Exceptions to this rule MAY be permissible if the nature of the risks, degree of isolation, nature of the location and experience of the person involved allow. Undergraduate and Masters’ students will only be permitted to carry out fieldwork alone in exceptional, low risk, circumstances.

DO NOT go into the field without leaving contact details with a designated member of staff (usually the project supervisor) and preferably a map showing expected location and time of return. Report to this person on your return.

PREGNANCY

The Department of Biological and Chemical Sciences acknowledges that some laboratory environments may present possible medical hazards to an unborn child. The Department of Biological and Chemical Sciences is committed to the concept and principles of ALARA (as low as reasonably achievable) with respect to hazards that may be present in the course of instruction. As part of this effort, it is also the policy of The Department of Biological and Chemical Sciences
to establish procedures to minimize the potential for adverse health effects to the unborn child of a mother who attends class in an environment in which reproductive hazards may be present.

It is important to note that certain chemicals and biological materials (such as viruses and bacteria) may pose a risk to an unborn child. A project student who works in an environment in which bio-hazardous materials or hazardous chemicals are used – or are suspected to be used - should immediately notify her Supervisor, Department Head or Dean once pregnancy is suspected. The Instructor, Head or Dean (with support from the Safety Committee) must evaluate the work environment for the presence of reproductive hazards and then determine and communicate the risks for the unborn child. Based on this evaluation, the Department of Biological and Chemical Sciences may recommend changes in the environment and activities of the pregnant student or an academic course, or other appropriate accommodation in which there is minimal exposure to the hazard.

PLAGIARISM

The University considers plagiarism a serious offence. The UWI Examination Regulations deal with this subject in section (B) Cheating under Regulation 97 as follows:

(i) Cheating shall constitute a major offence under these regulations.

(ii) Cheating is any attempt to benefit one’s self or another by deceit or fraud.

(iii) Plagiarism is a form of cheating.

(iv) Plagiarism is the unauthorised and/or unacknowledged use of another person’s intellectual efforts and creations howsoever recorded, including whether formally published or in manuscript or in typescript or other printed or electronically presented form and includes taking passages, ideas or structures from another work or author without proper and unequivocal attribution of such source(s), using the conventions for attributions or citing used in this University.

These conventions should be those appropriate for science in work produced for science courses.

In these regulations, examination refers to any written material to be assessed as part of the final mark for a course including project reports.

The penalties for plagiarism are stated in Regulation 103 as follows:

.... the Committee shall disqualify the candidate from the examination in the course concerned, and may also disqualify him/her from all examinations taken in that examination session; and may also disqualify him/her from all further examinations of the University, for any period of time, and may impose a fine ....

If you have not done so, you should also read [http://www.cavehill.uwi.edu/fpas/CurrentStudents/plagiarism.htm](http://www.cavehill.uwi.edu/fpas/CurrentStudents/plagiarism.htm) and the links there.
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**The University of the West Indies - Cave Hill Campus**

**FACULTY OF PURE & APPLIED SCIENCES**

**DEPARTMENT OF BIOLOGICAL & CHEMICAL SCIENCES**

**APPLICATION FOR RESEARCH PROJECT**

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**RESEARCH PROJECT APPLIED FOR:**

- BIIOC3950
- BIOL3950
- CHEM3505
- ECOL3950
- MICR3950
- ERSC3900

**PROJECT CHOICES:**

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Please indicate if you have ever completed a research project within the Department.

If “Yes”, give the name of the project-----------------------------------------------

**Signature**---------------------- **Date**----------------------

FOR DEPARTMENTAL USE

**ACCEPTED FOR:**

- 1st Choice   [ ]  2nd Choice   [ ]  Neither   [ ]

**STUDENT HAS NECESSARY PRE-REQUISITES:**

- Yes   [ ]  No   [ ]

**COMMENTS:**

-----------------------------------------------

**Proposed Supervisor**
Laboratory Safety Regulations Agreement

1. I have received and read the “Safety” section on pages 11 & 12.

2. I agree to keep this safety section on hand in the laboratory and to abide by laboratory regulations and safety procedures.

3. I agree not to begin an experiment until I have studied and understood the purpose of the experiment, the procedures involved, and any particular hazards associated with the equipment and chemicals.

4. I understand that if I violate the laboratory regulations I may be asked to leave the laboratory.

7. I have given all important medical information to the coordinator of the course.

Emergency Contact Name and Number: ________________________________

Printed Name: ________________________________________________________________

Signature: ________________________________________________

Date: ________________________________________________________________

Course: ________________________________________________________________

NB: Please return to Coordinator