COURSE CODE: BIOL3772
COURSE TITLE: Plant Development
NO. OF CREDITS: 3
LEVEL: 3
SEMESTER: 2
PREREQUISITE(S): BIOL 2XXX Cell and Developmental Biology and either BIOL 2XXX Physiology of Plants or BIOL2761 Plant Physiology

COURSE CAPACITY ENROLLMENT: 48 students (maximum)

COURSE DESCRIPTION
This course provides an advanced level focus on the molecular genetic, biochemical and physiological bases of plant development. Concepts of signal perception and transduction are initially reviewed. Students will be introduced to important experiments that have led to understanding many basic principles of plant development. Of particular importance is the use of mutation genetics as a tool to study development. Students in dissecting these experiments would be required to perform planned experiments and present their results and analysis in a group presentation format.

COURSE RATIONALE
BIOL3xxx is included in the Plant Biology option of the Biology degree. This course builds upon aspects of plant developmental biology and plant physiology taught in Year II of the programme. The student, upon completion of this course, should have a comprehensive understanding of the role of phytohormones in development, and the various developmental processes underlying the nature of some of the major plant organs.

INSTRUCTOR INFORMATION
Name of course coordinator: Dr. Georgette Briggs
Office address and phone: Biochemistry Office, Floor 2, Old wing, Natural Sciences Building
Email address: georgette.briggs@sta.uwi.edu
Office hours: Wednesdays 2:00-4:00 pm
Preferred method of contact: Email
Communication policy: Students should use their UWI email account for communication and can expect a response within 48 hours.
CONTENT
The hormonal control of plant development is first examined by discussing in significant detail the biosynthesis, signalling and developmental effects on growth of each of the major plant hormones (ABA, GA, Brassinosteroids, Ethylene and Auxin). The second portion of the course, seeks to examine in detail the genetic control of development of all the major plant organs, including the seed, shoot, root and flower.

GOALS/AIMS:
On completion of this course, students should have:
- An understanding of the hormonal pathways and interactions that underlie fundamental processes operating during plant development
- An appreciation of the role of developmental processes in plant disease
- An understanding of the theory that underlies the genetic basis of plant developmental pathways
- Developed laboratory skills in working with the model plant *Arabidopsis thaliana*
- The ability to interpret the outcomes of experimental scenarios
- Acquired the knowledge and ability to aid in critically evaluating scientific experiments and their findings
- Acquired specific analytical skills with respect to problems in plant development
- Gained skills in presenting and defending a logical, scientifically supported argument

LEARNING OUTCOMES
Students completing this course should be able to:
- Relate the importance of the study of plant development to the fields of plant anatomy and plant physiology.
- Explain the discovery, biosynthesis, forms, conjugates, bioassays, physicochemical measurement and effects of applied phytohormones on plants of commercial significance
- Explain the processes and genetic interactions involved in the development of the seed coat, the seed, the flower, the root and the shoot of the plant.
- Dissect the role of hormonal cross-talk and the effect it can have on developmental responses
- Critically evaluate scientific research papers, assessing the relevance and importance of the scientific findings

COURSE ASSESSMENT
In-course test : 10%
Group research project 25%
- Group seminar presentation (10%)
- Written report (15%)
Written analysis of a scientific article 5%
Participation in online forums/Seminars 10%
Final examination (2 hours) 50%
Group research project (25%): Students work in groups of four and are assigned a research topic (Week 2), regarding one aspect of plant development. Students must design an experiment, perform that experiment and record data. The experiment must utilize one of the provided developmental mutants in Arabidopsis thaliana. A few key references are provided by the lecturer. These topics are discussed over the three sessions of student group meetings, where experimental design and analysis/interpretation of relevant research papers are the main focus.

Written report (15%): The written report should reflect the experimental design, methodology, results and interpretation of results, of the experiments performed by the group. The complete report is due in Week 9.

Seminar presentation (10%): The seminar presentation would be 15-20 minutes duration, and would be presented to the class. These presentations would begin in Week 10 and should be completed in Week 12. Each group will also produce a one page summary of their topic for fellow students. These should be brought to the presentation session and will contribute to the presentation assessment.

Participation in online forums/Seminars (10%): Marks are awarded for student participation during seminar presentations. Students participation in scheduled online discussion forums are also awarded here.

Written analysis of a scientific article (5%): This assignment is due in Week 12 and is a 1000 word analysis of an approved scientific research article that addresses one of the key plant development themes discussed in the lectures.

EVALUATION
The elected Class Representative and/or Deputy will attend meetings with the course teacher(s) organized at every 4th week, and present feedback from the students attending that course or stream. This feedback is normally provided both orally and in written form for transmission to the lecturer. Apart from that the representatives will be attending the Liaison Committee meeting, and give their feedbacks to the committee.

Students may comment on any aspect of the course or facilities. Students will be encouraged to submit their feedback (oral/written) during tutorials directly to the course teacher and appropriate actions will be taken by the teacher then and there.

Results of in-course tests, and other course assignments will be analyzed and presented in the class. This will help students to check their progress constantly and also helps the instructor to identify the weak areas and thereby could alert and advise students individually to alter their approach of study and completing the work.

The final reflective feedback and comments about the entire course and teaching will be collected on the last day of the course. This will be saved for analysis and utilized as a base for improvement for the next offering in the following year.
COURSE DELIVERY & TEACHING STRATEGIES

The instruction for this course would comprise 2 lectures per week (50 mins each), and one tutorial session. In total, 24 one-hour lectures will be delivered, supplemented with 4 tutorial sessions, and 3 student group meetings. The student group meetings facilitate project discussion and journal discussions. The lecturer would be present at these sessions to guide the meetings. Theses are in-class opportunities for the lecturer to observe and guide the student group interaction and interpretation of the scientific research papers. Students would use these sessions to have confusing concepts clarified and to also submit up-to-date planning on experimental design for the project. Online forum discussions, seminar presentations and written reports would also be used to encourage student participation and collaborative learning. In addition students will have the opportunity to gain skills in oral communication, and collaborative group research and presentation. This format therefore addresses a range of learning styles, as outlined in the DLS undergraduate handbook. This course is also my e-learning supported, and many other resources are readily available for the students.

RESOURCES

Required reading:
Biochemistry and Molecular Biology of Plants Buchanan, B, Gruissem, W, and Jones, R .

Recommended reading:

Further Reading:
Key review papers and research papers would be used in discussion of the relevant topics. An example of the phytohormone Auxin reading list is included:

# COURSE CALENDAR

<table>
<thead>
<tr>
<th>WEEK</th>
<th>LECTURE</th>
<th>ACTIVITY</th>
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| 1    | **Lecture 1:** Course introduction and Overview of plant development  
      **Lecture 2:** Review of Signal Perception and Transduction Pathways. The classical hormone concept. Review of plant embryogenesis |  |
| 2    | **Lecture 3-4: Auxins** – discovery, biosynthesis, natural vs synthetic auxins, conjugates, bioassays and physicochemical measurement, effects of applied auxins and commercial uses. | Student group and topic assignments determined | TUTORIAL |
| 3    | **Lecture 5-6: Gibberellins** – discovery, biosynthesis, range of compounds, conjugates, bioassays and physicochemical measurement, effects of applied gibberellins. Commercial uses of gibberellins, gibberellin biosynthetic inhibitors and genetic engineering of gibberellin biosynthesis. |  |
| 4    | **Lecture 7-8: Cytokinins** – discovery, biosynthesis, range of compounds, bioassays and physicochemical measurement. Effects of applied cytokinins and commercial uses. | TUTORIAL  
      Online discussion forum |  |
| 5    | **Lecture 9-10: Ethylene** – discovery, biosynthesis, physicochemical measurement, effects of applied ethylene. Commercial uses of ethylene, ethylene biosynthetic inhibitors and genetic engineering of ethylene biosynthesis. |  |
| 6    | **Lecture 11-12: Abscisic acid** - discovery, biosynthesis, bioassay, physicochemical measurement, effects of applied abscisic acid. | TUTORIAL  
      Online Exam |  |
| 7    | **Lecture 13-14: Brassinosteroids** - discovery, biosynthesis, bioassay, physicochemical measurement. Effects and uses of applied brassinosteroids. |  |
| 8    | **Lecture 15-16:** Seed coat development, seed development & dormancy | TUTORIAL  
      Online discussion forum |  |
<p>| 9    | <strong>Lecture 17-18:</strong> The molecular analysis of Flower Development (the ABC model) | SUBMISSION OF WRITTEN REPORT | <strong>STUDENT GROUP MEETING</strong> |</p>
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<thead>
<tr>
<th>WEEK</th>
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<th>ACTIVITY</th>
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<tbody>
<tr>
<td>10</td>
<td><strong>Lecture 19-20:</strong> Roots – The initiation, growth and differentiation of roots</td>
<td>GROUP PRESENTATIONS (X3)</td>
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<tr>
<td>11</td>
<td><strong>Lecture 21-22:</strong> Shoots – stem, leaf &amp; bud development</td>
<td>GROUP PRESENTATIONS (X3)</td>
</tr>
<tr>
<td>12</td>
<td><strong>Lecture 23-24:</strong> Cross-talk: Combinatorial and Conflicting effects of hormones on specific developmental processes. (e.g. Auxin and Ethylene; Auxin and Brassinosteriods) Abnormal plant growth (deregulation of hormonal processes).</td>
<td>GROUP PRESENTATIONS (X3) Written Analysis of Scientific Paper due.</td>
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**ADDITIONAL INFORMATION**

**Student Attendance**

Attendance in the in-course exams and participation in the online discussions. Any student who misses any of the mandatory activities, is advised to consult immediately in person or by email with the course instructor regarding their make-up options. Absence must be accompanied by a written excuse or medical submitted to the Main office, Life Sciences within 7 days of the missed session. Any student who was inexcusably absent or who does not write an in-course exam or a quiz will receive 0% for that exercise. Students are strongly advised to attend the student group meetings and to participate in the seminars since these are marked activities.

**HOW TO STUDY FOR THIS COURSE**

Students are encouraged to work together in small cohesive groups as much as possible to go through the course content. As we go through the various topics, students should attend the tutorials which are on a weekly basis, and should ensure that they prepare by reading the relevant journals assigned per project group. All comments, questions and concerns provided on a particular topic will be addressed during the discussion segments tutorials, and during student group meetings. To support the material presented in class, several texts have been recommended. These texts, would also be supplemented by various scientific journal articles available to you via the myELearning platform. Use the responses and comments from the online forum discussions, to clarify misconceptions on any topic, and to aid in your understanding of the topics.