



**DEPARTMENT of CHEMISTRY
AND BIOCHEMISTRY**

**ACADEMIC GUIDANCE
2010-2011**

PROGRAMS

B.S. in Chemistry

B.A. in Chemistry

B.S. in Biochemistry

**B.S. in Physical Sciences
with specialization in
Chemistry**

ROWAN UNIVERSITY DEPARTMENT OF CHEMISTRY AND BIOCHEMISTRY
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ACADEMIC GUIDANCE BROCHURE

INTRODUCTION

This guide is intended as an aid in planning course work in the programs offered by this department. The following programs are presently offered:

1. Chemistry - B.S. (American Chemical Society Approved)
2. Chemistry - BA
3. Biochemistry - B.S.
4. Physical Science - B.S.
 - a. Chemistry Specialization

Graduates of the **B.S. Degree in Chemistry** program are well prepared to pursue graduate studies in chemistry or to enter one of the many careers for chemists in industry and government. The program provides training in all five areas of chemistry following the recommendations of the Committee on Professional Training of the American Chemical Society. After completion of the basic courses there are numerous choices for advanced electives and the degree is capped off with a research experience. For those students already employed, all chemistry courses are offered in the evening as well as during the day (upper division courses on a rotating basis).

The **B.A. Degree in Chemistry** program is designed primarily to prepare graduates to teach at the high school level. To follow this career path a student must also earn a **B.A. in Education**. A dual degree of Chemistry and Education would lead to a teaching certificate for teaching Chemistry at high schools. Both degrees must be selected upon entrance to Rowan. The program contains the core elements of the five sub-areas of chemistry. The capstone experience is a seminar course and a research project. Not only does completing this program well prepare students to teach but can also provide the foundation for science related careers in industry and government.

The **B.S. Degree in Biochemistry**, an interdisciplinary program, is designed to prepare students for a career in biochemistry or graduate studies. Completion of the degree requirements can also increase a student's chances of success in medical, dental, pharmacy or other related health programs by helping students develop a strong academic foundation needed for success in such professional schools.

The program combines the value of a liberal education with appropriate classroom and laboratory training in chemistry, biology, math and physics. The focus is on a molecular approach to studying living systems. The biochemistry major can choose to specialize in related areas of chemistry, molecular biology, genetics or structural biology by a careful selection of elective courses. The emphasis in all courses is on the acquisition of a solid knowledge base combined with hands-on laboratory work using modern equipment. Each student is expected to carry out a laboratory based research project.

A student's program will be certified by the American Chemical Society if the BS in Biochemistry is completed and he or she selects Instrumental Methods and Advanced Inorganic Chemistry as restricted electives.

The **B.S. in Physical Science program** is designed for those students who are preparing for careers in fields requiring broad, basic background in the physical sciences such as applied science and teaching of physical science. The program has many credits of free electives available which may be used to pursue certification to teach physical science subjects, to complete a second specialization, to acquire the background in order to pursue a science related career or to build strength in an area such as mathematics or computer science.

The Physical Science, Biochemistry and Chemistry Programs are excellent preparations for students who plan to do science based graduate work such as provided in medical, dental, veterinarian, pharmacy, and optometry schools. They also provide preparation for work in industry, environmental science; and federal, state, and municipal governments. A minimum grade point average of 2.0 in all physical science courses is required for graduation in these programs.

The following basic courses are required in all of the above programs: Chemistry I and II (or Advanced Chemistry I & II) Physics w/Calculus I and II, and Calculus I. Students entering as freshmen complete these courses in their first two years at Rowan. Transfer students entering as junior Physical Science majors are expected to have credit for these courses prior to entrance, while those entering as junior Chemistry or Biochemistry majors are also expected to have credit for Organic Chemistry I and II.

COURSE REQUIREMENTS FOR A MAJOR IN CHEMISTRY (B.S.)

GENERAL EDUCATION REQUIREMENTS 37 SH

Science and Mathematics (MS) -11 SH

MATH 01.130 Calculus I*^{†MS}

PHYS 02.200 Introductory Mechanics*^{†MS}

CS 01.104 Intro to Scientific Programming

Communications (COM) -6 SH

COMP 01.111 College Composition I ^{†COM}

COMP 01.112 College Composition II ^{†COM}

Social and Behavioral Sciences (SBS) -6 SH

History, Humanities and Languages (HHL) -6 SH

PHIL 09.369 Philosophy of Science-WI ^{†HHL}

Non-program Electives -8 SH (Cannot be chemistry courses.)

PHYS 02.201 Introductory Electricity & Magnetism•^{†MS}

MATH 01.131 Calculus II*^{†MS}

ROWAN EXPERIENCE ≥6 sh

- CMS 06.202 Public Speaking

- Art or Creative Experience course

The Rowan Experience must include:

1. At least one broad-based course that is categorized as Literature Based.
2. At least one course categorized as Multicultural/Global Studies. This course need not be a general education course.
3. At least one course categorized as Writing Intensive. This course need not be in the major.

PROGRAM REQUIREMENTS

Common core courses 50 SH

MATH 01.230 Calculus III

CHEM 06.100, .101 Chemistry I*^{RS} & II*

or CHEM 06.105, .106 Advanced Chemistry I* and II*

CHEM 06.300 Advanced Inorganic Chemistry

CHEM 07.200, .201 Organic Chemistry I* and II*

CHEM 07.348 Biochemistry

CHEM 09.250 Quantitative Analysis

CHEM 08.400, .401 Physical Chemistry I and II

CHEM 08.402, .403 Physical Chemistry Lab I and II

CHEM 09.410 Instrumental Methods

CHEM 05.435 Co-op or CHEM 05.440 Research I

CHEM 05.450 Seminar I

Restricted Electives 12 SH

Chosen with the approval of your advisor. 8 SH must be in upper level chemistry and must have a Physical Chemistry prerequisite. The remainder of the 12 SH may be chosen in chemistry or in subjects closely related to chemistry such as physics, biology or mathematics. Students planning graduate study would find a course in differential equations, linear algebra, or advanced physics helpful. See the list of Approved Restricted Electives below.

FREE ELECTIVES 15 SH

Chosen with the help of advisor and with consideration for future educational and career plans.

TOTAL 120 SH

* Grade of C or better is required in these courses.

† Can be counted towards General Education requirements.

MS – Can be counted toward Math/Science General Education requirement.

COM – Can be counted toward Communications General Education requirement.

HHL - Can be counted toward History, Humanities and Foreign Languages General Education requirement.

SBS - Can be counted toward Social and Behavior Sciences General Education requirement.

RS – Rowan Seminar

List of Approved Restricted Electives

CHEM 05.430: Advanced Topics in Chemistry

CHEM 07.405: Introduction to Polymer Chemistry

CHEM 07.410: Medicinal Chemistry

CHEM 07.470: Organic Spectroscopic Analysis (Lecture and Lab)

CHEM 07.408: Advanced Biochemistry

CHEM 07.464: Advanced Organic Chemistry I (Lecture) – WI

CHEM 07.405: Intro to Polymer Chemistry

CHEM 07.475: Polymer Synthesis

CHEM 07.478: Polymer Characterization

MATH 01.210: Linear Algebra

MATH 01.231: Ordinary Differential Equations

PHYS 02.300: Modern Physics (Lecture and Lab)

PHYS 02.305: Optics and Light (Lecture and Lab)

PHYS 02.315: Analytical Mechanics (Lecture Only)

PHYS 02.325: Mathematical Physics (Lecture Only)

PHYS 02.399: Electric Circuits (Lecture and Lab)

PHYS 02.430: Electricity and Magnetism I

INTR 01.486: Interdisciplinary Materials Science

A POSSIBLE BS CHEMISTRY MAJOR PROGRAM

First Semester		Second Semester	
Chemistry I	4	Chemistry II	4
Calculus I	4	Calculus II	4
Intro to Scientific Programming	3	Introductory Mechanics	4
College Composition I	3	College Composition II	3
Term Total	14	Term Total	15
Third Semester		Fourth Semester	
Organic Chemistry	4	Organic Chemistry II	4
Calculus III	4	Quantitative Anal	4
Intro Electricity & Magnetism	4	General Education Elective	3
Public Speaking	3	General Education Elective	3
		General Education Elective	3
Term Total	15	Term Total	17
Fifth Semester		Sixth Semester	
Physical Chemistry I	3	Physical Chemistry II	3
Physical Chemistry Lab I	2	Physical Chemistry Lab II	2
Biochemistry	4	Restricted Elective	3
General Education Elective	3	Instrumental Methods	4
Free Elective	3	Philosophy of Science	3
Term Total	15	Term Total	15
Seventh Semester		Eighth Semester	
Seminar I	1	Restricted Elective	3/4
Advanced Inorganic	4	General Education Elective	3
Research I	3	Free Elective	3
Restricted Elective	3	Free Elective	3
Free Elective	3	Free Elective	3
Restricted Elective	3		
Term Total	17	Term Total	15/16

COURSE REQUIREMENTS FOR A MAJOR IN CHEMISTRY (B.A.)

GENERAL EDUCATION REQUIREMENTS 35 SH

Science and Mathematics (MS) -11 SH

MATH 01.130 Calculus I*†^{MS}

PHYS 02.200 Introductory Mechanics†^{MS}

PHYS 02.201 Introductory Electricity & Magnetism†^{MS}

Communications (COM) -6 SH

COMP 01.111 College Composition I †^{COM}

COMP 01.112 College Composition II †^{COM}

Social and Behavioral Sciences (SBS) -6 SH

History, Humanities and Languages (HHL) -6 SH

PHIL 09.369 Philosophy of Science-WI †^{HHL}

Non-program Electives -6 SH (Cannot be chemistry courses.)

ROWAN EXPERIENCE ≥6 sh

- CMS 06.202 Public Speaking

- Art or Creative Experience course

The Rowan Experience must include:

1. At least one broad-based course that is categorized as Literature Based.
2. At least one course categorized as Multicultural/Global Studies. This course need not be a general education course.
3. At least one course categorized as Writing Intensive. This course need not be in the major.

MAJOR REQUIREMENTS

Core courses

MATH 01.131 Calculus II*†^{MS}

CHEM 06.100, .101 Chemistry I* & II* or CHEM 06.105, .106 Advanced Chemistry I* and II*

CHEM 07.200, .201 Organic Chemistry I* and II*

CHEM 09.250 Quantitative Analysis

CHEM 07.348 Biochemistry

CHEM 08.400 Physical Chemistry I

CHEM 05.450 Seminar I

CHEM 05.435 Co-op or CHEM 05.440 Research I

Advanced elective (4 SH) (Either CHEM06.300 Advanced Inorganic Chemistry
or CHEM09.410 Instrumentation Methods)

III. Free Electives 39 SH

Chosen with the help of advisor and with consideration for future educational and career plans.

TOTAL 120 SH

* Grade of C or better is required in these courses.

† Can be counted towards General Education requirements.

MS – Can be counted toward Math/Science General Education requirement.

COM – Can be counted toward Communications General Education requirement.

HHL - Can be counted toward History, Humanities and Foreign Languages General Education requirement.

SBS - Can be counted toward Social and Behavior Sciences General Education requirement.

RS – Rowan Seminar

A POSSIBLE BA CHEMISTRY MAJOR PROGRAM

First Semester		Second Semester	
Chemistry I	4	Chemistry II	4
Calculus I	4	Calculus II	4
Free elective	3	Introductory Mechanics	4
College Composition I	3	College Composition II	3
Term Total	14	Term Total	15
Third Semester		Fourth Semester	
Organic Chemistry I	4	Organic Chemistry II	4
Free elective	3	Quantitative Analysis	4
Intro Electricity & Magnetism	4	General Ed/Free Elective	3
Public Speaking	3	General Ed/Free Elective	3
		General Ed/Free Elective	3
Term Total	14	Term Total	17
Fifth Semester		Sixth Semester	
Physical Chemistry I	3	Philosophy of Science	3
Biochemistry	4	Restricted Elective	4
General Ed/Free Elective	3	General Ed/Free Elective	3
General Ed/Free Elective	3	General Ed/Free Elective	3
Free Elective	3	General Ed/Free Elective	3
Term Total	16	Term Total	15
Seventh Semester		Eighth Semester	
Seminar I	1	General Ed/Free Elective	3
Research I	3	General Ed/Free Elective	3
General Ed/Free Elective	3	Free Elective	3
Restricted elective (or Sp before)	4	Free Elective	3
Free Elective	3	Free Elective	3
Free Elective	3		
Term Total	17	Term Total	15

COURSE REQUIREMENTS FOR A MAJOR IN BIOCHEMISTRY (B.S.)

GENERAL EDUCATION REQUIREMENTS 38 SH

Science and Mathematics (MS) -12 SH
MATH 01.130 Calculus I*^{MS}
MATH 01.131 Calculus II*^{MS} or MATH 02.260 Statistics I
PHYS 02.200 Introductory Mechanics *^{MS}
Communications (COM) -6 SH
COMP 01.111 College Composition I ^{COM}
COMP 01.112 College Composition II ^{COM}
Social and Behavioral Sciences (SBS) -6 SH
History, Humanities and Languages (HHL) -6 SH
PHIL 09.369 Philosophy of Science-WI ^{HHL}
Non-program Electives -8 SH (Cannot be chemistry courses.)
PHYS 02.201 Introductory Electricity & Magnetism *^{MS}
BIOL 01.106 Biology 2*[†]

ROWAN EXPERIENCE ≥6 sh

CMS 06.202 Public Speaking
Art or Creative Experience course

The Rowan Experience must include:

1. At least one broad-based course that is categorized as Literature Based.
2. At least one course categorized as Multicultural/Global Studies. This course need not be a general education course.
3. At least one course categorized as Writing Intensive. This course need not be in the major.

PROGRAM REQUIREMENTS

A. Common Core 44 SH

CS 01.102 Introduction to Programming ^{MS} or CS 01.200 Computing Environments
CHEM 06.100 Chemistry I* (or CHEM 06.105 Advanced Chemistry I)
CHEM 06.101 Chemistry II* (or CHEM 06.106 Advanced Chemistry II)
CHEM 07.200 Organic Chemistry I*
CHEM 07.201 Organic Chemistry II*
CHEM 09.250 Quantitative Analysis
CHEM 08.305 Introduction to Biophysical Chemistry
BIOL 01.203 Biology 3*
CHEM 07.348 Biochemistry (with lab)
CHEM 07.408 Advanced Biochemistry
CHEM 07.409 Advanced Biochemistry Lab
CHEM 05.440 Research I or CHEM 05.435 Co-op
CHEM 05.450 Seminar I

B. Restricted Electives 20 SH

Chosen with approval of advisor. Choose at least two chemistry courses from the approved list. Two biology courses from the following:
BIOL 22.450 Molecular Genetics or BIOL 22.410 Human Genetics
BIOL 01.430 Cell Biology or BIOL 01.428 Developmental Biology
BIOL 11.330 Microbiology

FREE ELECTIVES 12 SH (13 SH)

Chosen with the help of advisor and with consideration for future educational and career plans.

Total Credits for Program 120 SH

* Grade of C or better is required in these courses.

† Can be counted towards General Education requirements.

MS – Can be counted toward Math/Science General Education requirement.

COM – Can be counted toward Communications General Education requirement.

HHL - Can be counted toward History, Humanities and Foreign Languages General Education requirement.

SBS - Can be counted toward Social and Behavior Sciences General Education requirement.

RS – Rowan Seminar

List of Approved Restricted Electives

CHEM 07.410 Medicinal Chemistry

CHEM 09.410 Instrumental Methods (Lecture and Lab)

CHEM 06.300 Advanced Inorganic Chemistry

CHEM 08.401 Physical Chemistry II (Lecture)

CHEM 07.470 Organic Spectroscopic Analysis (Lecture and Lab)

CHEM 07.430: Advanced Topics in Biochemistry

CHEM 07.405 Introduction to Polymer Chemistry

CHEM 05.430 Advanced Topics in Chemistry

CHEM 07.357 Chemical Biology

BIOL 11.330 Microbiology

BIOL 11.338 Immunology (With approval and variance)

BIOL 01.430 Cell Biology

BIOL 01.428 Developmental Biology

BIOL 22.410 Concepts in Human Genetics

BIOL 22.450 Molecular Genetics

A POSSIBLE BIOCHEMISTRY MAJOR PROGRAM

First Semester		Second Semester	
Chemistry I	4	Chemistry II	4
Calculus I	4	Calculus II / Statistics	4/3
Biology 2	4	Biology 3	4
College Composition I	3	College Composition II	3
Term Total	15	Term Total	14/15
Third Semester		Fourth Semester	
Organic Chemistry I	4	Organic Chemistry II	4
Introductory Mechanics	4	Quantitative Analysis	4
Intro to Programming	3	Intro Electricity & Magnetism	3
Public Speaking	3	General Ed/Free Elective/RE	3
Term Total	14	Term Total	17
Fifth Semester		Sixth Semester	
Biophysical Chemistry	4	Philosophy of Science	3
Biochemistry	4	Advanced Biochemistry Lecture	3
Biology Restricted Elective	4	Advanced Biochemistry Lab	2
General Ed/Free Elective/RE	3	Biology Restricted Elective	4
		Restricted Elective (Chem)	3/4
Term Total	15	Term Total	15/16
Seventh Semester		Eighth Semester	
Seminar I	1	Restricted Elective (Chem)	3/4
Research I	3	Restricted Elective (Chem)	3/4
Restricted Elective (Chem)	3/4	Free Elective	3
General Ed/Free Elective	3	Free Elective	3
Free Elective	3	Free Elective	3
Term Total	13/14	Term Total	15/16

COURSE REQUIREMENTS FOR A MAJOR IN PHYSICAL SCIENCE-Chemistry (B.S.)

GENERAL EDUCATION REQUIREMENTS Min 35 SH

Science and Mathematics (MS) -11 SH (Cannot be chemistry or physics courses.)

GEOG 06.130 Geology I

MATH01.130 Calculus I

CS 01.104 Intro to Scientific Programming or Comp Sci & Programming

Communications (COM) -6 SH

COMP 01.111 College Composition I

COMP 01.112 College Composition II

Social and Behavioral Sciences (SBS) -6 SH

History, Humanities and Languages (HHL) -6 SH

PHIL 09.369 Philosophy of Science-WI

Non-program Electives -6 SH (Cannot be chemistry courses.)

ROWAN EXPERIENCE Min 9 SH

- CMS 06.202 Public Speaking

- Art or Creative Experience course

The Rowan Experience must include:

1. At least one broad-based course that is categorized as Literature Based.

2. At least one course categorized as Multicultural/Global Studies. This course need not be a general education course.

3. At least one course categorized as Writing Intensive. This course need not be in the major.

Total GE and RE must be 42 SH.

MAJOR REQUIREMENTS

Common Core 45-47 SH

MATH01.131 Calculus II

CHEM06.100 Chemistry I

CHEM06.101 Chemistry II

PHYS02.210 Intro to Thermo, Fluids, Waves & Optics

PHYS02.200 Introductory Mechanics

PHYS02.201 Introductory Electricity & Magnetism

CHEM07.200 Organic Chemistry I

CHEM09.250 Quantitative Analysis

PHYS02.300 Modern Physics

An approved course from Astronomy, Atmospheric Science, Geology or Investigations in Physical Geography

Approved Career Track course: — 3-4

Approved Career Track course: — 3-4

Specialization in Chemistry 14-15 SH

CHEM07.201 Organic Chemistry II

CHEM08.400 Physical Chemistry I

CHEM07.348 Biochemistry

An approved Chemistry Elective

FREE ELECTIVES 33-34 SH

TOTAL 120 SH

A POSSIBLE PHYSICAL SCIENCE MAJOR PROGRAM

Chemistry Specialization

First Semester		Second Semester	
Chemistry I	4	Chemistry II	4
Calculus I	4	Calculus II	4
Introductory Mechanics	4	Intro Thermodynamics, Fluids, Waves, & Optics	4
College Composition I	3	College Composition II	3
Term Total	15	Term Total	15
Third Semester		Fourth Semester	
Organic Chemistry	4	Organic Chemistry II	4
General Ed Choice	3	Quantitative Anal	4
Intro Electricity & Magnetism	4	Astrophysics	4
Public Speaking	3	General Ed Elective	3
Intro to Scientific Programming	3		
Term Total	17	Term Total	15
Fifth Semester		Sixth Semester	
Physical Chemistry I	3	Biochemistry	4
Modern Physics	4	Philosophy of Science	3
General Ed Elective	3	Chemistry Restricted Elective	3/4
Free Elective	3	Astron/meteor	3/4
Term Total	15	Term Total	15/16
Seventh Semester		Eighth Semester	
Geology I	4	Restricted Elective	3/4
General Ed Elective	3	General Ed Elective	3
Free Elective	3	Free Elective	3
Free Elective	3	Free Elective	3
Free Elective	3	Free Elective	3
Term Total	16	Term Total	15/16

NJ Teacher Certification in Chemistry or Physical Sciences

Students who wish to teach high school chemistry or physics or both must now get the K-12 Subject Matter Specialization Certification. This means they must fulfill the requirements for the BA in Education as well as the BS in Chemistry or Physics. To teach both a student must get a BS in Physical Sciences with either Specialization.

The coursework for the BA in Education include the following:

Teaching in the Learning Community I *	3sh
Teaching in the Learning Community II	3sh
Teaching Literacy	3sh
Teaching & Learning (Major) Content A	3sh
Practicum A	1sh
Differentiating Instruction	2sh
Teaching & Learning (Major) Content B	3sh
Practicum B	1sh
Clinical Practice (Student Teaching)	10sh
Subject Matter Clinical Seminar	1sh
Teaching Students Linguistic & Culture Diversity	1sh

*Students must apply for this course in the Secondary Ed Office at the beginning of the previous semester to be considered for the class. Acceptance is on a limited basis.

Partial list of guidelines for successful enrollment in clinical practice.

1. Passing Praxis I Scores on file in SE/FE Office prior to acceptance into Teaching & Learning Content A & B Major Courses.
2. Passing Praxis II Scores on file in SE/Ed Office prior to acceptance into Clinical Practice. (Student Teaching).
3. Successful completion of ALL professional education courses prior to enrollment in Clinical Practice. (Student Teaching).
4. GPA of 3.0 or higher average in major and professional education courses.
5. No grades of "D", "F", or Incompletes on transcript for degree required courses.
6. Dean's approval for program admission.
7. Semester reviews of program progress with Secondary Education Academic Advisement Coordinator & Advisor from Major program.

Requirements for Research I

Each chemistry and biochemistry major is required to carry out a research project. This requirement is most often met by enrolling in Research I. When you enroll, you are required to talk with faculty to determine whose research interests you and with whom you are willing to work. The three-credit requirement generally means 8-9 hours per week spent in research activities. You are also required to write a paper describing your work and to make an oral presentation. You will be expected to keep a laboratory notebook of your efforts and turn this notebook over to the research mentor when the project is finished.

Guidelines

- 1) You must speak with at least 3 faculty members in the Department of Chemistry and Biochemistry before choosing your research advisor. When you have selected your advisor, turn in a completed application to the secretary. This should be completed the semester prior to beginning your research. This requirement is not waived for students pursuing an internship or co-op. You will need to fill out a departmental internship application form and submit it to the department chair. This form is due prior to the semester you begin your internship. When speaking with faculty members about their research, tell them in advance that you plan to pursue an internship. Also, speak to the internship advisor (Dr. Chary) before finalizing an internship or co-op to make sure it is acceptable. This requirement will also be waived for students performing their Research I at another university, however you must receive a waiver in advance from the department Chair.
- 2) You should plan to commit at least 80 hours of actual time (about 8-9 hours per week) for the semester. The majority of your work should be done early in the semester or over the summer, if possible. Do not procrastinate as both students and professors have time constraints late in the semester that may prevent efficient work being done at that time.
- 3) In general students will be asked to participate in projects that professors have ongoing in their laboratories. You, in learning the techniques, instrument operation, literature status of the project, etc., must do a considerable amount of the startup work. You should expect to do as much as you can on your own to master these topics. There undoubtedly will be times when you will need close supervision and instruction and your research advisor will provide that as well.
- 4) A large amount of time and energy goes into preparing for a research project, both for you and your research advisor. For that reason we strongly encourage you to think carefully about whom you choose to be your research mentor. Moving to a new advisor disrupts this process and will detract from your learning experience. Changing advisors should happen only infrequently and under unusual circumstances. Being able to contribute meaningfully to a project requires a time investment that occurs over the long term.
- 5) Both an oral and written report must be completed at the end of your project. Oral reports will be presented at the normal seminar times or, better, at STEM in the spring.

Research I Application

Name _____ Major _____

Semester you wish to enroll in Research I: _____

Faculty research mentors you have visited: (signatures required)

1) _____

2) _____

3) _____

Faculty member you wish to work with: _____

Project title:

Your signature: _____

Date: _____