

# BIO 400

## Immunology

### Fall 2015 Syllabus

“When it came time for me to give my talk on the subject, I started off by drawing an outline of the cat and began to name the various muscles.

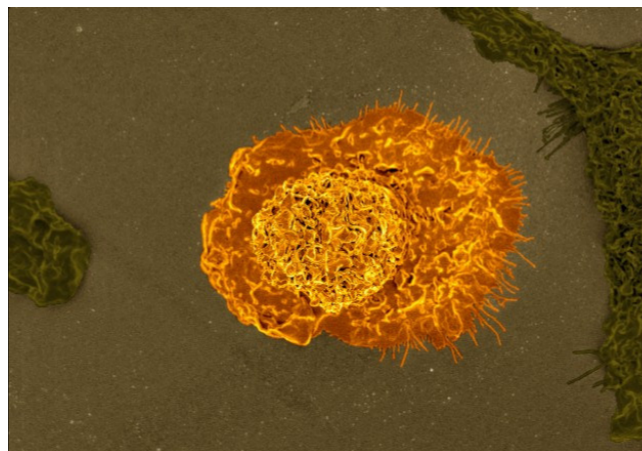
The other students in the class interrupt me: ‘We *know* all that!’

‘Oh,’ I say, ‘you *do*?’ Then no *wonder* I can catch up with you so fast after you’ve had four years of biology.’ They had wasted all their time memorizing stuff like that, when it could be looked up in fifteen minutes.”

~Feynman RP, *Surely You’re Joking Mr. Feynman!* (1985) p. 72

**Faculty Name:** Dr. Nicholas A. Pullen  
**Office Hours:** TWR 2-5pm, and by appointment  
**Office Location:** Cox Science & Language 205  
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**WWU Mission:** An independent voice in higher education, William Woods University distinguishes itself as a student-centered and professions-oriented university committed to the values of ethics, self-liberation, and lifelong education of students in the world community.



“Macrophage” NLAID, May 5, 2015

**Course Description:** A study of the molecular and cellular interactions and principles of the immune system. Topics include immune system development, humoral & cell-mediated immunity, disease and treatments involving immunization, immunodeficiency, and autoimmunity.

**Course Prerequisites:** CHM 124 (General Chemistry II) and BIO 231 (Genetics)

**Required Texts:** Parham, P. *The Immune System* (4<sup>th</sup> ed.) 2015 Garland Science.

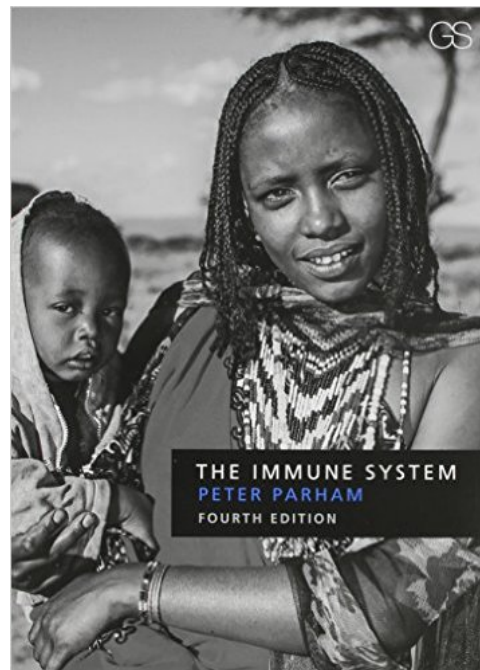
**Other Resources:** Useful resources that are often referenced include: *Science*, *Nature*, *Nature Reviews: Immunology*, *The Journal of Immunology* (a.k.a. “JP”), *Annual Reviews of Immunology*, *Janeway’s Immunobiology*, *Kuby Immunology*  
[www.aai.org](http://www.aai.org) (American Association of Immunologists)  
<http://www.liai.org> (La Jolla Institute for Allergy & Immunology)  
<https://www.benaroyaresearch.org> (Benaroya Research Institute)  
<http://www.niaid.nih.gov> (National Institute of Allergy and Infectious Diseases)  
<http://www.nhlbi.nih.gov> (National Heart, Lung, and Blood Institute)

I keep issues of *Science* and *JI* in my office, available for brief borrowing periods. I also have *Annual Reviews*, *Janeway*, and *Kuby*, but these books are limited to use within the building when I am available.

**Technology Use Expectations:** Messages via WWU email are official communication; students are responsible for regularly<sup>1</sup> checking their WWU email accounts<sup>2</sup>. Course documents, and grades will be available on the relevant Ownet page(s). Technology issues should be directed to UTT (ext. 4224; [helpdesk@williamwoods.edu](mailto:helpdesk@williamwoods.edu)).

<sup>1</sup> That means, like, at least once a day.

<sup>2</sup> I probably won’t even receive emails from your other accounts. For good reasons our institutional spam filter zaps most external email addresses. Treat this as an opportunity to upgrade from your [fluffybunnyfroofroo@hotmail.com](mailto:fluffybunnyfroofroo@hotmail.com) address and be taken seriously. (I claim no responsibility if you actually try to email that made up address, by the way. If you end up in some weird scam to help a besmirched “prince” recover his “lost fortune,” well that’s your fault, but I hope you learn something from it.)



## Course Objectives:

Successful students enrolled in this course will:

1. Gain knowledge of the development of the various cells and tissues of the human immune system.
2. Describe the differences between and necessary integration of innate and adaptive immunity.
3. Model the physiological and pathological functions of the immune system at a molecular/genetic level.
4. Describe major modern techniques used in and influenced by immunology.
5. Develop comfort and skill with oral and written scientific communication.
6. Learn how to find and critically evaluate primary immunology literature, and place popular tertiary sources in an appropriate scientific context.

## Biology Program Objectives:

1. Demonstrate knowledge of cell ultra-structure and basic cellular processes and develop an understanding of the requisites of life.
2. Converse with the basic tenets of transmission, molecular, developmental and population genetics.
3. Contributes to an overview of the major organ systems of the human body and the normal and pathological functioning of those organ systems.
4. *Demonstrate knowledge of the diversity and taxonomy of organisms, and the significance of variation in morphology, behavior, and life history.*
5. Explain the role that natural selection, genetic drift, and other phenomena have had on the production of biological diversity and the role evolution has in integrating explanations of both the unity and diversity of life.
6. Demonstrate knowledge of scientific methodologies and usage of current scientific equipment and technologies.

*This course does not directly address Biology Program Objective 4.*

**Assessment Procedures and Course Assignment Details:** Grades are earned through the completion of scheduled unit exams, a final exam, homework, in-class work, and a short technique paper. All assignments for this course support mastery of the aforementioned course and Biology Program Objectives. Information addressing all of the above objectives is presented through assigned text & case readings, literature research, PowerPoint presentations, videos, in-class activities, and seminar-style discussions. While student work for this course is not directly part of the annual Biology Assessment Plan, exams and the paper are subject to *post hoc* analysis.

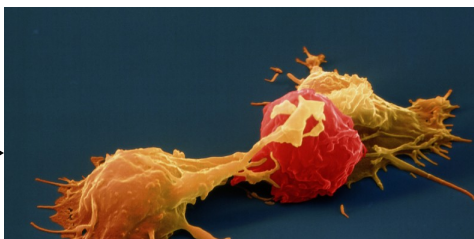
Unit Exams: These will be taken during scheduled course meeting times. They will be cumulative where necessary (e.g. T-Cell Receptor activation requires knowledge of what antigen processing is). Exams consist of multiple-choice, modeling problems, short and long essays, *and may cover reading material not directly discussed in class meetings. Make-up exams are offered only in consideration of extraordinary circumstances. In the case of absence from an exam, because of a University-sponsored activity, the student should arrange a time to take the exam beforehand.*

Final Exam: A final, comprehensive exam will be given **Thursday, December 10, starting at 9:25AM**. Make-up final exams cannot be arranged. Absence will result in a score of 0.

Homework: Homework questions are given with each major topic, usually toward the end of our in-class discussions on that topic. Responses will be due by the next class meeting. The questions will usually be short answer, illustration, and essays. I encourage you to draw diagrams and tables before writing to describe something. *You may work on these with your peers;* however, each student must submit her/his own work for grading, and it should not be a verbatim copy of another student's document. Late homework is generally not accepted: if you are on the road for a university-sponsored event, I will email the assignment to you. On the first day of class we will take an anonymous poll to determine if homework is to be submitted online or as a hard copy.

Miscellaneous In-Class Questions: Small group items and pop quizzes to encourage reading, curiosity, and engagement in the class community. *These cannot be made-up. Points do not apply for excused absence.*

I needed to take up space on this page, so here's an awesome micrograph of NK cells wrecking a cancer cell.



From Memorial Sloan Kettering Cancer Center

*Technique Paper:* A five-page paper (not including references) on an immunological research technique of your choosing. The technique does not have to be exclusive to immunology, but it should be dependent upon immunological principles. This paper should be doubled-spaced with 1” margins, or less, in a standard 11-point serif font (e.g. Times, Garamond, etc.) printed on 8.5”x11” paper. A minimum of five peer-reviewed references is required cited in the style of *The Journal of Immunology*. There are two deadlines associated with this assignment:

1. The selection of a topic with an introductory paragraph is *due the day of Exam 2*. (10% of grade)
2. The final paper is *due by Tuesday, November 24 at 12:00pm*, this is the last day of class before Thanksgiving Break. (90% of grade)

**Tutoring Information for ALL Students:**

- **Writing:** Kemper 216  
Contact Dr. Greg Smith for questions: [greg.smith@williamwoods.edu](mailto:greg.smith@williamwoods.edu)
- **Math:** Science and Language 313  
Contact Professor Raymond Hune for questions: [Raymond.hune@williamwoods.edu](mailto:Raymond.hune@williamwoods.edu)
- **SmartThinking**  
Online assistance for English, Math, and most other academic subjects is also available 24/7 through Smarthinking, our e-tutoring service provider. Just click on the "Tutoring" tab at the top of your OWLNet main page and follow the simple directions to connect with a dedicated personal tutor!

No separate login is required. You will see a list of basic subjects, and a field to do a subject search. For most subjects there are two options, “Drop-in tutoring” and “Offline questions.” Drop-in allows you to chat live with a tutor, and offline allows you to submit a question and they email you back the answers.

Please contact the Academic Advising Office at [bonnie.carr@williamwoods.edu](mailto:bonnie.carr@williamwoods.edu) if you need additional assistance.

- **Atomic learning**  
All students at WWU have access to this online tutorial program. Atomic Learning is a digital tutorial website with more than 1,500 hours of online professional development and learning resources. This program will assist you in learning how to use different software programs.

Atomic Learning is accessed through OwlNet. Once logged into OwlNet, the Atomic Learning link is on the far right in the grey section under courses. The log in is your email user name and password. If you have any questions or concerns you can contact the UTT helpdesk at [helpdesk@williamwoods.edu](mailto:helpdesk@williamwoods.edu).

**Grading Scale:** points are distributed among course assignments by the following scheme:

<i>Activity</i>	<i>Category Total Point Value</i>
Unit Exams (3)	300
Final Exam	150
Technique Paper	100
Homework (8)	80
Miscellaneous In-class	20
<b>Semester Total</b>	<b>650</b>

Final letter grades are based on the percentage of points earned:

<i>%Points Earned</i>	<b>Letter Grade Ranges</b>	<i>Letter</i>
<60%		F
≥60%, <70%		D
≥70%, <80%		C
≥80%, <90%		B
≥90%		A

**Attendance Policy:** Attendance at every class meeting is expected.

**Class Conduct and Participation Expectations:** Students are expected to ask questions and discuss relevant information. Much information will be borne out of open-ended discussions on immunological pathologies. All participants are expected to be respectful of others.

**Policy on Late Work:** Late work is not accepted for this course.

**ADA Guidelines:**

- Students who choose to disclose a disability are responsible for notifying the University of their disability on a timely basis. Questions about disability services should be directed to the University's coordinator for disability services. Contact information is (573) 592-1194 or [ada@williamwoods.edu](mailto:ada@williamwoods.edu). The office is on the first floor of the Academic Building.

**Academic Integrity Policy**

- William Woods University, founded on the principle of honesty, has long endeavored to maintain an atmosphere of academic integrity. In all academic work, it is important that the ideas and contributions of others be appropriately acknowledged, and that work that is presented as original is, in fact, original. Insuring the honesty and fairness of the intellectual environment at William Woods University is a responsibility that is shared by the entire campus community. Details of the Academic Integrity Policy can be found at the following web address: [https://www.williamwoods.edu/catalogs/1516/undergraduate/policy\\_detail.aspx?Policies\\_id=51](https://www.williamwoods.edu/catalogs/1516/undergraduate/policy_detail.aspx?Policies_id=51)

**Student Outcomes Assessment Policy:** 2015-2016 Academic Catalog  
[https://www.williamwoods.edu/catalogs/1516/undergraduate/policy\\_detail.aspx?Policies\\_id=30](https://www.williamwoods.edu/catalogs/1516/undergraduate/policy_detail.aspx?Policies_id=30)

**Additional Academic Policies can be found at:** 2015-2016 Academic Catalog:  
<https://www.williamwoods.edu/catalogs/1516/undergraduate/policies.aspx>

**Academic Credit Hour Definition:** The University has adopted the following United States Department of Education definition of a credit hour:

*A credit hour is an amount of work represented in intended learning outcomes and verified by evidence of student achievement that is an institutionally-established equivalency that reasonably approximates not less than:*

- (1) *one hour of classroom or direct faculty instruction and a minimum of two hours of out-of-class student work each week for approximately fifteen weeks for one semester or trimester hour of credit, or ten to twelve weeks for one quarter hour of credit, or the equivalent amount of work over a different amount of time.*

**Expected Outside Time Commitment:** Following the US DOE definition, students should expect to spend a minimum of 90h outside time for this course since it is a 3-credit course. Estimated time is given by activity in the course schedule table (next page) with a sum estimate of 92.5h outside time for this course.

**Add/Drop Deadlines and Other Important Dates:**

- Last day to add a class – August 28, 4:30 PM.
- Last day to drop a class during refund period – September 21, 4:30 PM
- Last day to drop a class or withdraw from the University – October 30, 4:30 PM
- End of Midterm – October 16
- Midterm grades reported – October 20
- Daylight Saving Time ends – November 1
- Finals Week – December 7 -11

## TENTATIVE COURSE SCHEDULE

Exam dates will not change.

Topics may change and will be announced in class.

Reading numbers correspond to Parham Chapters.

Date	Topics	Reading (time required)	Assignment Due (time required)
25-27 Aug	Intro & Expectations; Elements of Immunity	1 (3h); 2(3h)	Homework 1 – Intro (1.5h)
1-3 Sep	Innate Immunity: Complement (classical & alternative)	2; 3 (4h)	
8-10 Sep	Innate Immunity: TLR, MBL, NK cells, neutrophils, Mφ, DCs	2; 3 continued	Homework 2 – Innate Immunity (1.5h)
15-17 Sep	Intro. to adaptive immunity, and antibody structure	4 (3.5h)	<b>EXAM 1: 15 Sep (8h)</b>
22-24 Sep	Antibody (not antibiotic!) structure, specificity, diversity, and generation	4	Homework 3 – Antibodies (1.5h)
29 Sep-1 Oct	T Cell Receptor (TCR) and MHC	5 (4h)	
6-8 Oct	B Cell Development and B Cell Receptor (BCR)	6 (4h)	Homework 4 – TCR & BCR (1.5h)
13-15 Oct	T Cell Development	7 (3h)	<b>EXAM 2: 13 Oct (8h)</b> paper topic and introduction – hard copy (2h)
20-22 Oct	T Cell Mediated Immunity	7, 8 (4h)	Homework 5 – T Cells (1.5h)
27-29 Oct	T Cell and B Cell Mediated Immunity	8, 9 (4h)	
3-5 Nov	B Cell and Antibody mediated immunity	9	Homework 6 – B Cells (1.5h)
10-12 Nov	Vaccination	11(3h)	<b>EXAM 3: 10 Nov (8h)</b>
17-19 Nov	Hypersensitivity, spec. IgE and allergy	14 (3h)	Homework 7 – Vaccination and Hypersensitivity (1.5h)
24 Nov	Cancer Immunology*	17 (3h)	Technique Paper – hard copy (10h) <b>NO CLASS 26 Nov</b>
1-3 Dec	Cancer Immunology; evolution of the vertebrate immune system*	17, 12 (3h)	Homework 8 – TBD (1.5h)
10 Dec	<b>FINAL EXAM 9:25AM</b>		<b>THURSDAY</b>

\*These topics are open to change, they just happen to be popular. With exam 3 there will be a poll to determine what we talk about the last two weeks of normal class.

# IMMUNOLOGY CLASS FAQs!

1. **Is this class awesome?**
  - a. Of course it is! You really have to ask that? Immunology is the most awesome area of biology! It is also terrific and every other superlative that can be spun into a positive light.
2. **Is this class hard?**
  - a. Yes. (what?! Did he really just admit that!?) Some might argue that this is the “hardest” undergraduate biology class you will ever take. However, it’s easy to make this class not hard by recognizing, up front, some things:
    - Probably more so than any other science field, immunology suffers from *a lot of really stupid naming paradigms that have never been corrected*. This will become apparent on day 1 with complement, for example. So recognizing this problem will help you get past it and to studying the important stuff. Don’t get hung up on bad names.
    - Most of what we read and talk about was discovered in *your lifetime* and is still subject to significant revision. For example, until this past summer (2015) it was dogma in neuroscience that the CNS was a totally immune-privileged organ system: however we now have solid proof that there are lymphatic vessels in the brain, that dendritic cells and Tregs circulate into and out of brain tissue, and that microglia really are resident macrophages (rather than an independent glial lineage as the brain scientists thought for about a century). I hope by now you understand that’s science, but this is particularly acute with immunology. My job is to guide you to one frontier of human knowledge with this class; I hope you enjoy the adventure.
    - Most of what we read and talk about is at a molecular and cellular level. People have a hard time understanding what they cannot see directly. We have some excellent experimental techniques to visualize what we know, and we will talk about that as we go along (and you’ll write a paper about one!). If you understand at the outset that most of what happens in immunology is due to receptor and signaling *proteins* then you already have a good start. Proteins people... don’t make me go back to BIO 114 to review the major classes of biomolecules...
    - The proteins we talk about are mostly an alphabet + number soup of naming. The best way to handle this is to physically write out charts/tables defining them. Study this with your buddies.
    - There is a lot we still don’t know. Ph.D. projects my friends: go forth and earn them.
    - I’m not trying to make this hard or be a difficult turd. I am here to help you learn about the most important aspect of biology, ever.
3. **The reading is really dense.** (obviously not a question but a common gripe in immunology)
  - a. Yep, and if you don’t do it I *guarantee* you will struggle with this class. Stop insulting your reading comprehension and use those eyeballs + brain (ew! eyes!).
4. **Do I need to take notes? Your voice is ambrosia, and I learn so much more by “osmosis.”**
  - a. This is garbage nonsense, and if you believe in it you are being intellectually dishonest with yourself (never mind the improper use of “osmosis”). That note taking in a classroom is detrimental to learning is one of the biggest layperson misconceptions in modern education/psychology: too often note taking is confused with multitasking, **it is not**. Multitasking is using your laptop to cruise unrelated websites during class. Note taking is a form of participation in class. You can always record my lectures, but these are intellectual property for your personal use only.
5. **Why is genetics a pre-requisite?**
  - a. Because if you don’t have that biology-karate-belt you will not understand a single thing we talk about when we get to lymphocytes. We don’t have time to learn what the typical eukaryotic gene looks like – I expect you to know that. Some aspects of the immune system are genetically “privileged” in that they have additional mechanisms that would probably kill you if found elsewhere in your body (by causing cancer). Lymphocyte development and activation is so genetically “weird” that most geneticists either don’t know about it, or choose to ignore it.
6. **Can I see you for extra help?**
  - a. YES OF COURSE! I have office hours and you can even setup a regular, recurring appointment.

## And now, some testimonials from WWU alumni:

“During the 8-weeks we did immunology that first year there was a lot of crying, and feelings of helplessness, among the students who never had exposure to the topic in undergrad (about half the class!). I’m glad I wasn’t one of them!”

~Current DVM Student



“Medical immunology crushed, no, it **destroyed** the people who didn’t take immuno in college.”

~Current M.D. student

Hugo Gernsback, *Life* (1963).