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FORMAT 1

Submit original with signatures + 1 copy + electronic copy to Faculty Senate (Box 7500).

See http://www.uaf.edu/uafgov/faculty-senate/curriculum/course-degree-procedures-/ for a complete description of the rules governing curriculum & course changes.

TRIAL COURSE OR NEW COURSE PROPOSAL

SUBMITTED BY:

Department	Biology & Wildlife	**College/School**	CNSM
Prepared by	Andrea Ferrante	**Phone**	907-474-5916
Email Contact	aferrante@alaska.edu	**Faculty Contact**	Andrea Ferrante

1. ACTION DESIRED (CHECK ONE): Trial Course [X] New Course [ ]

2. COURSE IDENTIFICATION: Dept BIOL Course # 694 No. of Credits 3

Justify upper/lower division status & number of credits: This course has several upper-division prerequisites.

3. PROPOSED COURSE TITLE: Advanced Immunology

4. To be CROSS LISTED? *YES/NO* Yes If yes, Dept: Chemistry & Biochemistry Course # [ ]

(Requires approval of both departments and deans involved. Add lines at end of form for additional required signatures.)

5. To be STACKED? *YES/NO* No If yes, Dept. [ ] Course # [ ]

Stacked course applications are reviewed by the (Undergraduate) Curricular Review Committee and by the Graduate Academic and Advising Committee. Creating two different syllabi—undergraduate and graduate versions—will help emphasize the different qualities of what are supposed to be two different courses. The committees will determine: 1) whether the two versions are sufficiently different (i.e. is there undergraduate and graduate level content being offered); 2) are undergraduates being overtaxed?; 3) are graduate students being undertaxed? In this context, the committees are looking out for the interests of the students taking the course. Typically, if either committee has qualms, they both do. More info online – see URL at top of this page.

6. FREQUENCY OF OFFERING: Fall Odd-numbered years

Fall, Spring, Summer (Every, or Even-numbered Years, or Odd-numbered Years) — or As Demand Warrants

7. SEMESTER & YEAR OF FIRST OFFERING (AY2013-14 if approved by 3/1/2013; otherwise AY2014-15) Fall AY2013-14

8. COURSE FORMAT:

NOTE: Course hours may not be compressed into fewer than three days per credit. Any course compressed into fewer than six weeks must be approved by the college or school's curriculum council. Furthermore, any core course compressed to less than six weeks must be approved by the core review committee.

COURSE FORMAT: (check all that apply) [ ] *1* [ ] *2* [ ] *3* [ ] *4* [ ] *5* [X] *6 weeks to full semester*

OTHER FORMAT (specify)

Mode of delivery (specify lecture, field trips, labs, etc) Lecture

9. CONTACT HOURS PER WEEK: [3] LECTURE hours/weeks [ ] LAB hours /week [ ] PRACTICUM hours /week

Note: # of credits are based on contact hours. 800 minutes of lecture=1 credit. 2400 minutes of lab in a science course=1 credit. 1600 minutes in non-science lab=1 credit. 2400-4800 minutes of practicum=1 credit. 2400-8000 minutes of internship=1 credit. This must match with the syllabus. See http://www.uaf.edu/uafgov/faculty-senate/curriculum/course-degree-procedures-/guidelines-for-computing-/ for more information on number of credits.

OTHER HOURS (specify type)

10. COMPLETE CATALOG DESCRIPTION including dept., number, title, credits, credit distribution, cross listing and/or stacking (50 words or less if possible):

Example of a complete description:

FISH F487 W, O Fisheries Management
3 Credits Offered Spring

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JAN 15 2013
Dean's Office
College of Natural Science & Mathematics

Governance 2/22/13 TLP

Theory and practice of fisheries management, with an emphasis on strategies utilized for the management of freshwater and marine fisheries. ***Prerequisites: COMM F131X or COMM F141X; ENGL F111X; ENGL F211X or ENGL F213X; ENGL F414; FISH F425; or permission of instructor.*** **Cross-listed with NRM F487. (3+0)**

BIOL 694 Advanced Immunology
3 Credits Offered Fall odd-numbered years
Advanced level of knowledge and understanding of the structural and molecular basis of the innate and adaptive immune responses in terms of a complex system. Prerequisites: BIOL 465 (Immunology) and BIOL 261 (Introduction to Cell Biology) or BIOL 360 (Cell and Molecular Biology) or equivalent; or permission of instructor. Cross listed with Biochemistry (###)

11. COURSE CLASSIFICATIONS: Undergraduate courses only. Consult with CLA Curriculum Council to apply S or H classification appropriately; otherwise leave fields blank.

H = Humanities		S = Social Sciences	

Will this course be used to fulfill a requirement for the baccalaureate core? **If YES, attach form.**	**YES:**		**NO:**	x

IF YES, check which core requirements it could be used to fulfill:

O = Oral Intensive, **Format 6**		W = Writing Intensive, **Format 7**		Natural Science,("X" for Core) **Format 8**	

11.A Is course content related to northern, arctic or circumpolar studies? If yes, a "snowflake" symbol will be added in the printed Catalog, and flagged in Banner.

YES		**NO**	X

12. COURSE REPEATABILITY:

Is this course repeatable for credit?	**YES**		**NO**	x

Justification: Indicate why the course can be repeated (for example, the course follows a different theme each time).

How many times may the course be repeated for credit?		**TIMES**
If the course can be repeated for credit, what is the maximum number of credit hours that may be earned for this course?		**CREDITS**
If the course can be repeated with variable credit, what is the maximum number of credit hours that may be earned for this course?		**CREDITS**

13. GRADING SYSTEM: Specify only one. Note: Later changing the grading system for a course constitutes a Major Course Change.

LETTER: X **PASS/FAIL:**

RESTRICTIONS ON ENROLLMENT (if any)

14. PREREQUISITES

Prerequisites: BIOL 465 (Immunology) and BIOL ~~461~~ 261 (Cell Biology) ~~and~~ or BIOL ~~453~~ 360 (Molecular Biology)

These will be *required* before the student is allowed to enroll in the course.

15. SPECIAL RESTRICTIONS, CONDITIONS

16. PROPOSED COURSE FEES $

Has a memo been submitted through your dean to the Provost for fee approval? **Yes/No**

17. PREVIOUS HISTORY

Has the course been offered as special topics or trial course previously? **Yes/No** No

If yes, give semester, year, course #, etc.:

18. ESTIMATED IMPACT

WHAT IMPACT, IF ANY, WILL THIS HAVE ON BUDGET, FACILITIES/SPACE, FACULTY, ETC.

Dr. Ferrante is a new faculty member and this is part of his standard workload. Beyond space for lectures there should be no impacts on resources.

19. LIBRARY COLLECTIONS

Have you contacted the library collection development officer (kljensen@alaska.edu, 474-6695) with regard to the adequacy of library/media collections, equipment, and services available for the proposed course? If so, give date of contact and resolution. If not, explain why not.

No	X	Yes	

As of today I have not found any textbook that covers all the topics I am planning to discuss during the course. I am going to provide the students with Lecture notes, Power Point slide handouts, and access to important research and review papers which will be sufficient for a detailed understanding of the matter. This statement is subject to revision if a suitable textbook is available by the time this course starts in the fall of 2013.

I will indicate the handbook adopted for the Basic Immunology course as a required reading since I expect that knowledge and I will refer to relevant sections for the students to review as I go through this course. Both the recommended and the suggested textbooks are already available in the BioSciences library.

20. IMPACTS ON PROGRAMS/DEPTS

What programs/departments will be affected by this proposed action?

Include information on the Programs/Departments contacted (e.g., email, memo)

Biology & Wildlife /Chemistry & Biochemistry

21. POSITIVE AND NEGATIVE IMPACTS

*Please specify **positive and negative** impacts on other courses, programs and departments resulting from the proposed action.*

This course will provide advanced training for graduate students with an interest in immunology, which to date has not been available. No negative impacts are foreseen.

JUSTIFICATION FOR ACTION REQUESTED

The purpose of the department and campus-wide curriculum committees is to scrutinize course change and new course applications to make sure that the quality of UAF education is not lowered as a result of the proposed change. Please address this in your response. This section needs to be self-explanatory. Use as much space as needed to fully justify the proposed course.

There is a growing interest by medical sciences, including physiology, pathology and pharmacology, in using structural approaches to understand the function of key molecules of the immune system, and their involvement in the cellular mechanisms of the immune response. Because the immune system is composed of dozens of different cell types and hundreds of intersecting molecular pathways and signals, systems approaches can be used to predict how the immune system will respond to a particular infection or vaccination. Computational immunology (or systems immunology) involves the development and application of bioinformatics methods, mathematical models and statistical techniques for the study of immune system biology, or it can help understand how best to design an immunotherapy. In addition, computational approaches are increasingly vital to understand the implications of the wealth of gene expression and epigenomics data being gathered from immune cells.

Currently our curriculum does not include a course that integrates elements of structural biology, genomics, cell signaling described both in analytical way and in the context of the whole system. The course in advanced immunology brings together expertise from a variety of scientific disciplines to discuss topics in vaccine response, host-pathogen dynamics, cell-fate choices, immune genomics, immune informatics, and many other topics. Students interested in advanced immunology will be taken on an intriguing journey, and they will experience one important instance of systems biology, that we consider to be the main stream in biomedical sciences in this century.

APPROVALS: Add additional signature lines as needed.

Signature, Chair, Program/Department of:	Biology & Wildlife	Date Jan 14, 2013
Signature, Chair, College/School Curriculum Council for:	CNSM	Date 2/20/2013
Signature, Dean, College/School of:	CNSM	Date Feb 21 2013

Offerings above the level of approved programs must be approved in advance by the Provost.

Signature of Provost (if above level of approved programs)	Date

ALL SIGNATURES MUST BE OBTAINED PRIOR TO SUBMISSION TO THE GOVERNANCE OFFICE

Signature, Chair Faculty Senate Review Committee: ___Curriculum Review ___GAAC ___Core Review ___SADAC	Date

ADDITIONAL SIGNATURES: (As needed for cross-listing and/or stacking)

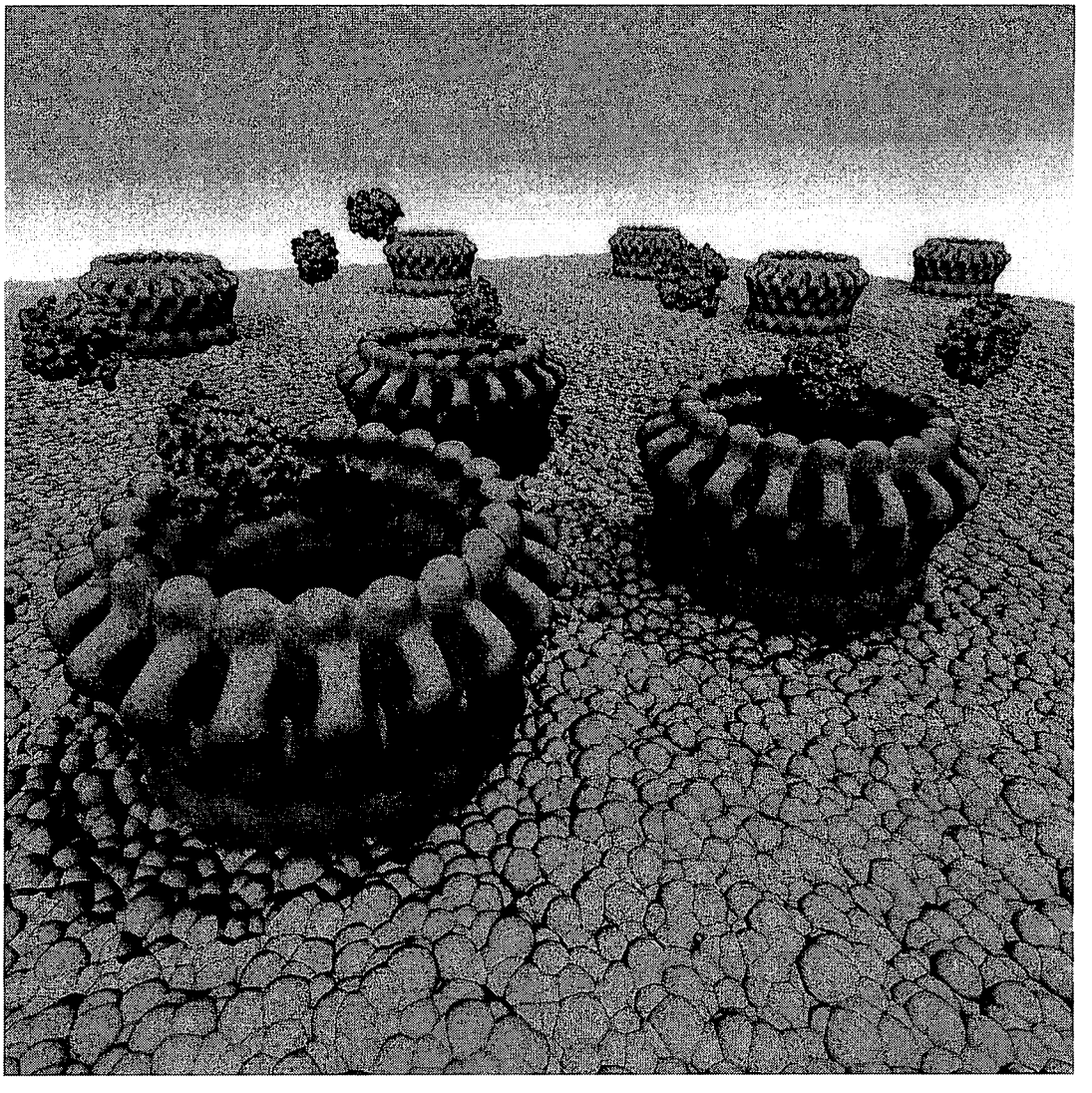
Signature, Chair, Program/Department of:	William Simpson Chemistry & Biochemistry	Date 28 Jan 2013
Signature, Chair, College/School Curriculum Council for:	CNSM	Date 20 Feb 2013
Signature, Dean, College/School of:	CNSM	Date Feb 22, 2013

ADVANCED IMMUNOLOGY
BIOL 694 (3 units); CRN XXXXX

COURSE SYLLABUS

Andrea Ferrante, M.D.
University of Alaska Fairbanks
Fall Semester 2013

Classes: D/D/D HH:MM – HH:MM,



Course Information
Advanced Immunology, BIOL 694 (3); CRN xxxxx
Meeting Times: D/D/D hh:mm – hh:mm,
Prerequisites: BIOL 465 (Immunology) and BIOL 261 (Intro to Cell and Molecular Biology) ~~and~~or BIOL 360 (Cell and Molecular Biology) or equivalent; or permission of instructor.

Instructor
Andrea Ferrante, M.D., Assistant Professor of Immunology
Office: Arctic Health Research Building 2W04
Laboratory: Arctic Health Research Building 2W11
Phone: 474-5916 (office)
E-mail: aferrante@alaska.edu
Mailbox: Irving I Room 211
Office hours: TBD or by appointment

Course Readings/Materials
Textbooks: *as of today I have not found any textbook that covers all the topics I am planning to discuss during the course. I am going to provide the students with Lecture notes, Power Point slide handouts, and suggest important research and review articles, which will be sufficient for a detailed understanding of the matter. This statement is subject to revision if a suitable textbook is available by the time this course starts in the fall of 2013.*

*I will indicate the handbook adopted for the Basic Immunology course (*Coico and Sunshine, *Immunology, a short course*, 6th edition, Wiley & Blackwell*) as a required reading since I expect that knowledge and I will refer to relevant sections for the students to review as I go through this course.*

Blackboard Page: Information from the lecture will be provided on UAF's Blackboard system following the lecture as PowerPoint lecture slide handouts, PDF lecture notes and possibly as podcast (audio only). These tools do not serve as a replacement for attendance at lecture. For access, go to https://classes.uaf.edu/webapps/login/ ad log in using your UAF ID and password. If you are using Blackboard for the first time, click on the first-time users for information. All course handouts will be posted here. Contact me by email (aferrante@alaska.edu) if you are unable to access this site.

E-mail Notifications: On occasion, students will be contacted via email. I will assume that each student will check his or her university-assigned email address on a regular basis (at least daily).

Journals in Immunology: Cell, Nature, Science, Immunity, Nature Immunology, The Journal of Immunology, Proceedings of the National Academy of Science, Molecular Immunology, Nature Structural and Molecular Biology, Chemistry and Biology, Journal of Biophysics.

Course Description and Goals

1) To acquire an advanced level of knowledge and understanding of the structural and molecular basis of the innate and adaptive immune responses. The purpose of the Advanced Immunology course is to provide immunological knowledge at the structural, molecular, cellular and functional levels of innate and acquired immunity. By the end of the course each student should be able to 1) describe structural and molecular mechanisms of innate and adaptive immunity phenomena; 2) know structural and molecular aspects of immune regulation including cell signaling and activation; 3) describe cellular receptors and soluble mediators; 3) describe fundamental aspects of immunogenomics, immunoproteomics and immunoglycomics; 4) know structural and molecular bases of (immuno-)therapeutics and immunochemistry; 5) indicate the impact of molecular changes upon immunological challenge at the tissue level.

2) To acquire the ability of describing the immune response in terms of a complex system. As stated by the National Institute for General Medical Sciences (NIGMS): "Systems biology is an emergent field that aims at providing a conceptual framework for the analysis of complex biological systems. Such systems derive from interactions among many distinct components in varying contexts. These systems exhibit properties, such as nonlinear dynamics and emergent behavior that cannot easily be inferred from studies of components in isolation. Systems biology relies on mathematical methods and computational models to generate hypotheses and to design new experiments. Iteration between theory and experiment is crucial. The quantity and quality of data required for these approaches often challenge current technologies, and the development of new technologies and cross-disciplinary collaborations may be required. When applied to human health, systems biology can be a powerful tool to test hypotheses relevant to health and disease, particularly the results of therapeutic interventions".

Within this context, each student is expected to understand (1) structure of the immune system, including gene regulatory and biochemical networks, and physical structures, (2) dynamics of the immune system, both in quantitative and qualitative terms, as well as construction of theory/model with powerful prediction capability, (3) control methods of the immune system, and (4) design methods of the immune system.

There are a number of exciting and profound issues that are actively investigated with a systems biology approach, such as the robustness of the immune systems, network structures and dynamics, immunopathology, and applications to drug discovery. Systems immunology, as a branch of systems biology, is in its infancy, but this is the area that has to be explored and the area that we consider to be the main stream in biomedical sciences in this century.

3) To learn how to critically read and evaluate peer-reviewed articles from the primary literature. We will discuss classic and current papers in molecular and system immunology, usually original research, but in some cases review articles. Each student will be required to read the papers beforehand and participate in all discussions as well as act as discussion leader for one of the sessions. *(The frequency of this "journal club" will be adjusted on the basis of the number of enrolled students)*.

4) To improve writing and oral presentation skills. During the course, the students will be pooled in "research" groups and will be invited to write a paper and to prepare a poster regarding a relevant topic in immunology. As the students will work on their projects, they will be introduced to several methods of data collection and data analysis routinely adopted in Structural and System Immunology.

Policies

Grading

Grades will be based on the percentage of total points earned out of the total possible points based on the scale below. Please, notice that the cut-off point for A- is not 90% but 88%. The comparable is true for the B-, C- and D- cutoffs. The reason for this is that under the plus/minus grade system, a C earns 2.0 in terms of GPA calculation. A C- earns only 1.7 on terms of GPA calculation, and does **not** count as successful completion of the course. **You must earn a C or higher for the course to count.** I think that if you have earned a 70% in this course, you have earned a C and 2.0 in terms of GPA credit, so I have set up the grading scale accordingly.
I will not grade "on a curve" for individual exams.

Missed assignments and exams: times for assignments and exams will be designated well in advance. Completion of assignments and exams at the designated time will be the responsibility of the student. Accommodations will only be made for legitimate and documented contingencies that are determined by the instructor. If you have a conflict with exam dates, please come talk to me immediately at the beginning of the semester.

Grade	% of Total Points
A+	97-100
A	90-96
A-	88-89
B+	86-87
B	80-85
B-	78-79
C+	76-77
C	70-75
C-	68-69
D+	66-67
D	60-65
D-	58-59
F	0-57

The point breakdown for this course is approximately as follows:

Component	Points	% of Grade
Lecture attendance/participation	80	8
Article discussion	80	8
Homework (6 at 15 pts./each)	90	9
One-hour test (4 at 75 pts./each)	300	30
Two-hour final written test	150	15
Group assignment	100	10
Oral exam	200	20
Total	**1000**	**100**

Lectures
Active attendance of lecture is expected. Exams will be primarily based on material covered in lecture. Furthermore, announcements of upcoming exams, assignments, or any changes to the class schedule will be made at the beginning of class, and every student is responsible for that information. During some lectures, I will be doing educational activities that will count for points (research article discussion). I will make a **subjective** assessment of each student's class participation, and assign a grade (8% of the final grade) during final evaluation. Tardiness, absenteeism, inattentiveness and unfamiliarity with course material will all negatively impact this subjective, yet important, assessment. If you know that you will miss a lecture due to an excused absence (e.g. you are participating in a UAF sanctioned event, you become ill, you are participating in a military-required activity) you must inform me of the absence ahead of time in order for the points to possibly be excused for that lecture. Of course these will not negatively impact the subjective assessment of class participation. **The use of laptops, iPad/tablets and mobile/smart phones is not permitted during lecture; exceptions to this policy are granted solely at the discretion of the instructor.**

Exams
You are expected to take all exams at the scheduled time. Check the exam schedule carefully and plan your appointments and travel around the course schedule. Exams will contain various types of questions, including multiple choice, matching, fill in the blank and short answer. **The final exam (written and oral) will be cumulative.**

- *Scheduled absences:* for absences caused by a conflict with a University-sanctioned activity (for example, participation in a competition with a UAF athlete), you must notify us in advance of the exam. You will be expected to take the exam before your absence. Other types of scheduled absences are generally **not** accepted: you are expected to schedule around exams. In particular, make sure that your schedule your flight home or vacation for **after** finals. I will **not** grant requests for early final exams.
- *Unscheduled (emergency) absences:* if an emergency arises the day of the exam that makes you unable to attend the exam, you must inform me **before** the start of the exam by e-mail or phone (leave a message if you cannot reach me). If the nature of the emergency makes it impossible for you to contact me in advance, contact me as soon as possible afterwards. You must a take-up exam within 48 hours of the scheduled exam. It is your responsibility to schedule the make-up. If not taken within 48 hours, the exam will be recorded as a zero. You should expect to provide documentation of emergency. Make-up exams are **not** guaranteed. They are granted at the instructor's discretion.

Homework
Homework will be posted on Blackboard on Friday afternoon by 5 p.m. It is due the following Wednesday by 11:59 p.m. No late assignments will be accepted, as indicated in the following paragraph. The homework assignments will be designed to help you review important topics and to connect theoretical aspects of basic immunology to aspects of "real life" clinical immunology. Homework is open-note and open-book. I strongly encourage you to use the homework as study tool. Try to figure out the answer without looking at your book or notes. Then, before you submit your answer, check it yourself using your book, notes and the hints that are included in the assignment. Once you are confident it is correct, submit the answer. If you were incorrect, try to figure out why before you answer again. The work that you submit must be the product of your own understanding and be your own work.

Late work
Late work is not accepted. Any work turned in after due time will be recorded as a zero. Work will be collected at the beginning of the period in which is due. If you miss class on a day work is due, you must turn it in prior to the start of that class. Submitting work via e-mail is acceptable in

most cases, so long as the e-mail is sent prior to the start of class and contains all of the work that is due. Extensions on work are granted only under extenuating circumstances and must be obtained in advance from the instructor.

Academic honesty

Academic dishonesty will not be tolerated. You are expected to be familiar with the UAF Student Code of Conduct (available on line in the UAF Catalog) and to follow it at all times. The use of any reference materials (notes, books, other people, etc.) or assistance of any type on exams is academic dishonesty. Obtaining an extension on work or delaying an exam through false pretenses is also academic dishonesty. Providing someone with the answer to homework assignments, taking answers from someone else on homework, doing homework for someone else, or allowing someone else to do your homework is academic dishonesty. Although you may work with a partner or partners depending on the nature of the project, your contribution to a collective assignment must be your individual work, clearly indicated and acknowledged by your peers. Any instances of these or any types of academic dishonesty will result in a grade zero on the work involved (this may include all the work in the category, for example, if the academic dishonesty involves a written exam, all the written exam scores may be changed to zeros), forwarding the incident to appropriate University personnel, and may result in an F in the course and/or expulsion from the University. If you are in doubt as to whether something constitutes academic dishonesty, ask your instructor.

Plagiarism is the overt or covert use of other people's work or ideas without acknowledgement of the source. It is a type of academic dishonesty. Plagiarism includes using ideas or data from a classmate or colleague without permission and acknowledgment, including information from journal articles (either in their entirety or with minor changes) in your writing without citing the author, using sentences from published sources without quoting them, or copying parts of a website into your essay. **You cannot use someone's ideas without citing the originator; you cannot use someone's words without quoting the writer. Any deviation from this will be regarded as plagiarism.** When you plagiarize you are stealing the currency that science (and many other endeavors) uses: knowledge.

A few simple rules to prevent plagiarism:

1. When in doubt about whether you should cite or acknowledge someone, do so.
2. If you are unsure of how to cite someone's writings or ideas, ask one of the instructors for help. Reference librarians are also good source of information for help with citations.

Disabilities

All students, including those with disabilities, are welcome in this course, and I am committed to providing equal access to this course for all students. If you have a disability (including learning disabilities) please inform me during the first week of class so that I can accommodate your specific needs. If you have already done so, you will also need to contact UAF's Office of Disabilities Services (474-7043). Everyone should have the opportunity to participate fully in the course and to complete assignments and exams to the best of their ability. If accommodations are needed to enable you to do so, I will gladly work with you to provide them.

When you need help

Immunology is a fascinating discipline, but as other disciplines describing complex systems, may not be of easy understanding. I will not know if you are having difficulties with the course material unless you tell me. I want to help you; my primary role in this course is to help you understand the structural basis of the immune response and the networks on which it relies. Ultimately, how well you do in the class is not up to me; it is up to you. You have to gain the understanding for yourself. If there is anything I can do to help you with that, PLEASE ASK! If you have any questions or you are finding that you are struggling with a particular topic, assignment or question, there are several things you can do:

- If you have any question during lecture, ask! Don't let me plow on ahead if you are lost.
- Talk to me after lecture or during office hours, or make an appointment to talk to me.
- Talk to a classmate. Setting up study groups can be very helpful.
- If it is a brief question, e-mail me.

Ask for help right away! I am happy to answer your questions and help you succeed.

#	Topic	Homework
1	Introduction: structure, simulation, function, prediction in immunology	
2	Experimental approaches to structural immunology	
3	Molecular architecture I: polypeptide chain, amino acids, degrees of freedom, reverse turns, the alpha helix, the beta sheet	
4	Molecular architecture II: helix-helix packing, helix sheet packing, sheet sheet packing, folding unit classification, sample folds, classification databases	
5	Biochemistry of ligand-receptor interaction	
6	Structural basis of MHC I - restricted antigen presentation – non classical MHC I	**HW1 due**
7	Structural basis of MHC II – restricted antigen presentation	
8	Structural basis of TCR recognition and T cell activation	
9	Cross reactivity	
10	**Exam 1**	
11	B cell receptor / structural basis of Ag-Ab recognition	
12	Chromatin topology and regulation of Ag receptor assembly – T and B cell spectratyping	**HW2 due**
13	Molecular basis of NK cell activation. Cytotoxicity.	
14	Structural element of the complement cascade	
15	Pattern recognition receptors: membrane bound (Receptor kinases, TLR and CLR); cytoplasmic PRRs (NLR, RLR, RNA helicase); secreted PRRs	
16	Cytokine/Cytokine receptors – Chemokine/Chemokine receptors	
17	Histone modifications and regulation of gene expression	
18	Protein-nucleic acid recognition	**HW3 due**
19	**Exam 2**	
20	Jak/Stat signaling pathway	
21	NF-kB signaling	
22	TLR pathways	
23	B cell receptor signaling	
24	T cell receptor signaling	**HW4 due**
25	Apoptosis pathways – death receptor signaling (and autophagy)	
26	PI3K/Akt signaling	
27	Selective transcription in response to inflammatory stimuli	
28	Stem cells development and differentiation I: Wnt/β-catenin, Notch, Hedgehog signaling	
29	Stem cells development and differentiation I: TGF-β, Hippo signaling ESC pluripotency	
30	**Exam 3**	**HW5 due**
31	Structural Immunoinformatics	
32	T cell epitope prediction and MHC binding prediction	
33	B cell epitope prediction and allergenicity prediction	
34	Immunogenomics and gene expression changes in adaptive response	
35	In silico vaccination	
36	Immunoinformatics databases, knowledge bases, ontologies	**HW6 due**
37	Modeling immune responses	
38	Design and engineering of immune therapeutics and diagnostics	
39	Artificial immune system	
40	**Exam 4**	
41	**Group work**	
42	**Final Exam (Written)**	
43	**Final Exam (Oral)**	