**Anth 561: Eco-immunology**

Syllabus

**Class Time:** Tue Thur 12:00-1:15

**Location:** College Hall 138

**Instructor:** Aaron Blackwell

**E-mail:** aaron.blackwell@wsu.edu

**Website:** Blackwell-lab.com

**Office:** College Hall 367

**Office Hours:** TR 1:30-2:30

**Course Overview:**

This course is an introduction to eco-immunology, the study of how ecology and immunology interact. We will cover topics such as: 1) Fundamentals of the immune system 2) How immunity trades-off with other life history demands like growth and reproduction 2) Immune strategies and trade-offs between branches of immunity 3) Host-pathogen interactions, ecology, and coevolution 4) Immune-endocrine interactions, and 5) Methods for measuring immunity

**Readings:**

This class is reading intensive. You will be required to read 3-4 chapters or papers per week. There are two books you will have to buy, since we will be reading them in their entirety. Both books are available in paper or digitally.

1. How the Immune System Works (The How it Works Series) 6th Edition, by Lauren M. Sompayrac (Author). ISBN-13: 978-1119542124. ISBN-10: 111954212X
2. An Epidemic of Absence: A New Way of Understanding Allergies and Autoimmune Diseases, by Moises Velasquez-Manoff. (Author) ISBN-13: 978-1439199398. ISBN-10: 1439199396.

All of the other readings will be posted to a dropbox folder, the link will be distributed in class.

**Class Format and Grading:**

This class will include a mixture of about 30% lecture and 70% discussion and student presentations. Thus, it is imperative that you keep up with the readings and participate in class discussions. In addition, each student will sign up to give a short introduction and lead discussions on a given day. On the day for which you signed up, you will give a brief (10-15 minute) overview of the articles assigned for that week, and then have prepared a set of discussion questions so that you can lead the class in discussion of the topic. Grading is as follows:

 Participation and attendance 35%

 Presentation and discussion 15%

 Midterm Essays 25%

 Final Essays 25%

Grades will be posted on blackboard. **It is your responsibility to check your grades regularly and notify me if there are any problems.**

**Exams:**

Exams will be take-home and will include essay prompts for which you must write answers. You should think of your answers as short papers, as your answers are expected to be proofread, edited, and well-conceived.

**Class Schedule and Readings**

**Week 1 – No class, get started on readings**

August 20 / August 22

No-class meetings. Use the time to get started on readings

HISW Chapter 1

HISW Chapter 2

**Week 2 – Intro / Innate and Adaptive Immunity**

August 27 / August 29

HISW Chapter 3: B Cells and Antibodies

HISW Chapter 4-6: T Cells

**Week 3 – Tolerance**

September 3 / September 5

HISW Chapter 8: Restraining the Immune System

HISW Chapter 9: Self Tolerance and MHC

HISW Chapter 10: Immunological Memory

**Week 4 – Costs of Immunity and Life History Theory**

September 10 / September 12

Lochmiller RL, Deerenberg C. 2000. Trade-offs in evolutionary immunology: just what is the cost of immunity? Oikos 88:87–98.

Energetics of Immunity (Ecoimmunology Chapter 8)

McDade TW. 2005. Life history, maintenance, and the early origins of immune function. Am J Hum Biol 17:81–94.

Sheldon BC, Verhulst S. 1996. Ecological immunology: costly parasite defences and trade-offs in evolutionary ecology. Trends Ecol Evol 11:317–321.

**Week 5 - Methods for measuring immune function**

September 17 / September 19

Davies. Ch 1. Intro to Immunoassay Principles

McDade TW, Williams S, Snodgrass JJ (2007) What a drop can do: dried blood spots as a minimally invasive method for integrating biomarkers into population-based research. Demography 44: 899-925.

Eco-immunology lab tour and demonstration

**Week 6 - Tolerance**

September 24 / September 26

Kutzer MAM, Armitage SAO. 2016. Maximising fitness in the face of parasites: a review of host tolerance. Zoology 119:281–289.

Maternal Modulation of Offspring Immunity (Ecoimmunology Chapter 6)

Read AF, Graham AL, Råberg L. 2008. Animal defenses against infectious agents: Is damage control more important than pathogen control? PLoS Biol 6:2638–2641.

**Week 7 – Trade-offs with immunity**

**Midterm Exam Questions Published**

October 1 / October 3

Urlacher SS, Ellison PT, Sugiyama LS, Pontzer H, Eick G, Liebert MA, Cepon-Robins TJ, Gildner TE, Snodgrass JJ. 2018. Tradeoffs between immune function and childhood growth among Amazonian forager-horticulturalists. Proc Natl Acad Sci:201717522.

Blackwell AD, Snodgrass JJ, Madimenos FC, Sugiyama LS. 2010. Life history, immune function, and intestinal helminths: Trade-offs among immunoglobulin E, C-reactive protein, and growth in an Amazonian population. Am J Hum Biol 22:836–48.

Graham AL, Hayward AD, Watt K a, Pilkington JG, Pemberton JM, Nussey DH. 2010. Fitness correlates of heritable variation in antibody responsiveness in a wild mammal. Science 330:662–5.

**Week 8 - Immunocompetence Handicap Hypothesis**

**Midterm Exam Due October 10 at noon.**

October 8 / October 10

Nunn CL, Lindenfors P, Pursall ER, Rolff J. 2009. On sexual dimorphism in immune function. Philos Trans R Soc Lond B Biol Sci 364:61–9.

Peters A. 2000. Testosterone treatment is immunosuppressive in superb fairy-wrens, yet free-living males with high testosterone are more immunocompetent. Proc R Soc B Biol Sci 267:883–889.

Trumble BC, Blackwell AD, Stieglitz J, Thompson ME, Suarez IM, Kaplan H, Gurven M. 2016. Associations between male testosterone and immune function in a pathogenically stressed forager-horticultural population. Am J Phys Anthropol:1–12.

**Week 9 - Reproduction and Immunity**

October 15 / October 17

La Rocca C, Carbone F, Longobardi S, Matarese G. 2014. The immunology of pregnancy: Regulatory T cells control maternal immune tolerance toward the fetus. Immunol Lett 162:41–48.

Natri H, Garcia AR, Buetow KH, Trumble BC, Wilson MA. 2019. The Pregnancy Pickle: Evolved Immune Compensation Due to Pregnancy Underlies Sex Differences in Human Diseases. Trends Genet 35:478–488.

Aghaeepour N, Ganio EA, Mcilwain D, Tsai AS, Tingle M, Gassen S Van, Gaudilliere DK, Baca Q, Mcneil L, Okada R, Ghaemi MS, Furman D, Wong RJ, Winn VD, Druzin ML, El-Sayed YY, Quaintance C, Gibbs R, Darmstadt GL, Shaw GM, Stevenson DK, Tibshirani R, Nolan GP, Lewis DB, Angst MS, Gaudilliere B. 2017. An immune clock of human pregnancy. 2946:1–12.

**Week 10 - Behavioral Immune Function**

October 22 / October 24

Davey GCL. 2011. Disgust: the disease-avoidance emotion and its dysfunctions. Philos Trans R Soc Lond B Biol Sci 366:3453–65.

Tybur JM, Inbar Y, Aarøe L, Barclay P, Barlow FK, de Barra M, Becker DV, Borovoi L, Choi I, Choi JA, Consedine NS, Conway A, Conway JR, Conway P, Adoric VC, Demirci DE, Fernández AM, Ferreira DCS, Ishii K, Jakšić I, Ji T, van Leeuwen F, Lewis DMG, Li NP, McIntyre JC, Mukherjee S, Park JH, Pawlowski B, Petersen MB, Pizarro D, Prodromitis G, Prokop P, Rantala MJ, Reynolds LM, Sandin B, Sevi B, De Smet D, Srinivasan N, Tewari S, Wilson C, Yong JC, Žeželj I. 2016. Parasite stress and pathogen avoidance relate to distinct dimensions of political ideology across 30 nations. Proc Natl Acad Sci:201607398.

Tybur JM, Lieberman D. 2016. Human pathogen avoidance adaptations. Curr Opin Psychol 7:6–11.

Vedhara K, Gill S, Eldesouky L, Campbell BK, Arevalo JMG, Ma J, Cole SW. 2015. Personality and gene expression: Do individual differences exist in the leukocyte transcriptome? Psychoneuroendocrinology 52:72–82.

**Week 11 - Sickness Behavior / Depression**

October 29 / October 31

Maes M. 2011. Depression is an inflammatory disease, but cell-mediated immune activation is the key component of depression. Prog Neuropsychopharmacol Biol Psychiatry 35:664–75.

Stieglitz J, Trumble BC, Thompson ME, Blackwell AD, Kaplan H, Gurven M. 2015. Depression as sickness behavior? A test of the host defense hypothesis in a high pathogen population. Brain Behav Immun.

Anders S, Tanaka M, Kinney DK. 2013. Depression as an evolutionary strategy for defense against infection. Brain Behav Immun 31:9–22.

**Week 12 - Stress and Immunity**

November 5 / November 7

Cole SW, Levine ME, Arevalo JMG, Ma J, Weir DR, Crimmins EM. 2015. Loneliness, eudaimonia, and the human conserved transcriptional response to adversity. Psychoneuroendocrinology 62:11–17.

Snyder-Mackler N, Sanz J, Kohn JN, Brinkworth JF, Morrow S, Shaver AO, Grenier J-C, Pique-Regi R, Johnson ZP, Wilson ME, Barreiro LB, Tung J. 2016. Social status alters immune regulation and response to infection. Science 354:Under Review.

Miller GE, Chen E, Parker KJ. 2011. Psychological stress in childhood and susceptibility to the chronic diseases of aging: moving toward a model of behavioral and biological mechanisms. Psychol Bull 137:959–97.

Petrovsky N, Harrison LC. 1998. The chronobiology of human cytokine production. Int Rev Immunol 16:635–649.

**Week 13 - Hygiene Hypothesis**

November 12 / November 14

HISW Chapter 12: Immunity Gone Wrong

Epidemic of Absence: Chapter 1-5 (99 pages)

**Week 14 - Hygiene Hypothesis**

November 19 / November 21

Epidemic of Absence: Chapter 6-9 (95 pages)

**Week 15 – No classes Thanksgiving**

**Week 16 - Hygiene Hypothesis**

**Final Exam Questions Published**

December 3 / December 5

Epidemic of Absence: Chapter 10-15 (108 pages)

**Week 17 – Finals Week**

December 13 - Final Exam Due at 8pm