

**INTL 8200: TECHNICAL BACKGROUND FOR WMD NON-PROLIFERATION POLICY
PRACTITIONERS**

Fall 2016

Mondays, 12:30-3:00PM, CITS 1st Floor Conference Room (Holmes/Hunter Academic Building)

Dr. Sara Z. Kutchesfahani: szk@uga.edu
Holmes/Hunter Academic Building: Room 120B

COURSE DESCRIPTION:

This class is designed to introduce International Affairs graduate students to the technology behind various types of WMDs and the associated technical requirements for an effective WMD non-proliferation policy. Specifically, it will explain why certain items are controlled and the challenges associated with maintaining such controls. The unique aspect of this course is that it will offer a STEM-based understanding of the issue area, an increasingly essential component in the competitive government/NGO job market. The course will be taught by experts with practical experience in each of the WMD silos.

At the conclusion of this course, students will have acquired an understanding of technical topics related to WMD technology, including:

1. An overview of basic science for nuclear, biological, and chemical processes for social scientists
2. Nuclear fission
3. Nuclear fusion
4. The nuclear fuel cycle
5. Enrichment
6. Reprocessing
7. Reactor types
8. Detector technology
9. Chemical weapons agents and technology
10. Biological weapons agents and technology
11. Missile delivery systems

INSTRUCTORS' BIOS:

Ms. Pamela McKinsey (B.S., M.S. Microbiology) will cover the biological weapons sections of the class. She has over 30 years of experience in many aspects of biology, biochemistry, and chemistry – environmental, medical, detection, and instruction. She is currently a Senior Technical Advisor in the Nonproliferation Policy Support group at the Savannah River National Laboratory (SRNL) at the DOE's Savannah River Site (SRS) near Aiken, SC. For much of her career, Ms. McKinsey's work focused on applied and environmental microbiological research including development of bio detection technologies, environmental cleanup through biological processes, and characterization of subsurface microbial populations. Since 2004, her work has centered on strengthening US and global efforts to prevent the proliferation of WMD/CBRNe related materials, equipment and technologies with special focus on biological and chemical commodities of WMD/CBRNe concern. Email: micromamma48@yahoo.com

Mr. Walter Sansot (B.S., M.S. International Policy Management) will cover the nuclear weapons and missile aspects of the class. He has more than 37 years' experience in the nuclear field, with more than 15 years operating and managing U. S. Department of Energy (USDOE) nuclear material production facilities. He currently provides support to the USDOE's International Nonproliferation Export Control Program. Mr. Sansot is employed by Battelle, the manager of the Pacific Northwest National Laboratory in Richland, Washington. Prior to his service with Battelle, Sansot was a Program Manager for Westinghouse Savannah River Company, operator of the Savannah River Site in Aiken, South Carolina, where he managed the operation of several nuclear material production facilities. Mr. Sansot has worked in the commercial nuclear industry as well as almost ten years in the United States Navy Submarine Service. Email: wsansot@gmail.com

Dr. Julie Thompson (Ph.D. and M.S. Inorganic chemistry; B.S. Chemistry) will cover the chemical weapons sections of the class. She has over 20 years of experience in the field of chemistry, and has worked on non-proliferation projects for the past ten years. She worked on chemical security and nonproliferation projects at the Center for International Trade and Security (CITS) at the University of Georgia from 2014 to 2016. Prior to her work at CITS, Dr. Thompson worked at Los Alamos National Laboratory for twelve years. She supported the International Nonproliferation Export Control Program as a technical expert in chemicals and chemical equipment. Dr. Thompson has also worked in industry developing technology to remove heavy metal ions from industrial process streams, managing materials analysis, and evaluating patent applications. Email: juliethompson01@msn.com

TOPICAL OUTLINE FOR THE COURSE:

The course syllabus is a general plan for the course; deviations announced to the class by the instructors may be necessary. A detailed course schedule and reading assignments can be found in the following pages, but a topical outline for the course includes lectures on the following:

1. Introduction of the course
2. Overview of WMD Technology
3. Overview of global WMD non-proliferation efforts
4. Dual-use items
5. Controlling dual-use items
6. Challenges with controlling dual-use items
7. International WMD organizations (including IAEA, OPCW, NSG, AG, etc.)
8. Nuclear Weapons Technology
9. Chemical Weapons Technology
10. Biological Weapons Technology
11. Missile Delivery Systems

REQUIRED READINGS:

A list of readings has been provided for each week. Students are expected to read everything on the list since the readings will facilitate class discussion and enhance understanding of the topics covered in class. Students are expected to come prepared to class each week to discuss the issues raised from what they have read with their fellow students and instructor(s).

GRADING: The course is assessed by:

1. Topical Quizzes (20%)

There will be 3-4 topical multiple choice quizzes throughout the semester. These will not be announced ahead of time, which is why reading for every class is important, as well as mandatory attendance to each class. **If students are absent during any of these topical quizzes, they will receive a grade of zero for this assessment.**

2. Seminar Presentation (30%)

On the last day of class, students will present their end of semester presentations to the rest of the class and all instructors. Presentations should be no more than 30 minutes long and should outline which of the issues discussed in class pose the biggest threat to U.S. and international security, and why. Specific issues areas will be assigned to the students at the beginning of the semester to avoid any repetition. **Powerpoint presentations need to be emailed to Dr. Kutchesfahani by 9AM on December 5. Late submissions will result in a grade of zero for this assessment.**

3. Policy Briefs (30%)

Students will prepare 2 policy briefs that address a contemporary (for the first brief) and historical (for the second brief) WMD policy and technical challenge – there are many from which to choose. These 2 pagers should (1) outline the scope of the issue, (2) discuss policy options, (3) assess international implications, and (4) offer policy recommendations with justification. Students may select any WMD-related policy issue as long as it has an international dimension. The first brief must be of a contemporary WMD policy and technical challenge and **is due, by email, to Dr. Kutchesfahani by 9AM, on October 3.** The second brief must be of a historical WMD policy and technical challenge and **is due, by email, to Dr. Kutchesfahani by 9AM, on October 31. Late submission of papers will result in a grade of zero for this assessment.**

4. Class Participation (20%)

Active class participation and discussion is required. **All students will be required to come to class each week with one question to pose to the rest of the group about the week's topic. These questions will comprise part of the overall grade.**

DEADLINES:

These deadlines are absolute – **NO EXTENSIONS ARE GIVEN.** Failure to turn in the policy briefs and the seminar presentation by the due dates will result in a grade of zero for these assessments. In order to avoid a penalty for a late submission, students must have evidence of extenuating circumstances (e.g., a doctor's note for illness), which must be submitted to Dr. Kutchesfahani prior to the time of the deadline.

Regular attendance is expected. 2 unexcused absences will be permitted, but Dr. Kutchesfahani must be notified of each absence ahead of class. ½ final letter grade penalty will incur for each additional unexcused absence. Valid excuses include illness (doctor's note required) and family emergencies.

Punctuality to class is a must. If you have a situation where you will be habitually late, please notify the instructor as soon as possible. Repeat latecomers will incur a ½ final letter grade penalty.

No computer use during class. You must silence, and put away, any and all wireless devices you bring to class.

We will use the 100-point grading system. Students will receive a letter grade for their final grade according to the following cutoffs:

A ≥ 93; A- ≥ 90; B+ ≥ 87; B ≥ 83; B- ≥ 80; C+ ≥ 76; C ≥ 70; C- ≥ 68; D ≥ 60; F < 60

OFFICE HOURS:

My office is 120B Holmes/Hunter Academic Building. Office hours are by appointment. Please e-mail me for an appointment at szk@uga.edu.

ACADEMIC HONESTY POLICY:

As a University of Georgia student, you have agreed to follow the University’s academic honesty policy, “A Culture of Honesty,” and the Student Honor Code. All academic work must meet the standards contained in “A Culture of Honesty” found at: <http://ovpi.uga.edu/academic-honesty/academic-honesty-policy>. Lack of knowledge of the academic honesty policy is not a reasonable explanation for a violation. Questions related to course assignments and the academic honesty policy should be directed to the instructor.

RETURN OF GRADED POLICY BRIEFS

The aim is to return graded policy briefs within 2 weeks after the submission date. Papers will be returned to you with an indicative letter grade, ranging from A-F. **ONCE A GRADE IS AWARDED, UNDER NO CIRCUMSTANCE WILL IT BE CHANGED.**

Course Schedule and Deadlines

DATE	TOPIC	DEADLINES
August 15	Introduction and class overview	
August 22	Overview of WMD Technology	
August 29	Overview of global WMD non-proliferation efforts	
September 5	NO CLASS – LABOR DAY	
September 12	International WMD organizations (including IAEA, OPCW, NSG, AG, etc.)	
September 19	Nuclear Weapons Technology – 1	
September 26	Nuclear Weapons Technology – 2	
October 3	Nuclear Weapons Technology – 3	Policy brief #1 is due
October 10	Chemical Weapons Technology – 1	
October 17	Chemical Weapons Technology – 2	
October 24	Biological Weapons Technology – 1	
October 31	Biological Weapons Technology – 2	Historical Policy brief #2 is due
November 7	Missile Delivery Systems	
November 14	Challenges with controlling dual-use items	
THANKSGIVING BREAK: November 21-25		
November 28	CLASS DISCUSSION: Current WMD Proliferation Challenges	
December 5	SEMINAR PRESENTATIONS	

CLASS OVERVIEW AND READING ASSIGNMENTS:

Week 1 (August 15): Introduction and class overview – Dr. Sara Z. Kutchesfahani

- Overview of class, grading, expectations, etc.

Readings:

- Please read the syllabus and come to week 1's class with any questions you may have about the syllabus and the class

Week 2 (August 22): Overview of WMD Technology – Mr. Walter Sansot

- What is a WMD?
- Why is an understanding of this topic important?
- Definitions/differences
- History
- Use
- Proliferation methodology

Readings:

- Video: "Nuclear Tipping Point" (54 minutes): <https://vimeo.com/20532059>
- "Weapons of Mass Destruction": <https://www.hampshire.edu/pawss/weapons-of-mass-destruction>
- NRC Fact Sheet on Dirty Bombs, December 2012: <http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/fs-dirty-bombs.html>
- 26 Countries' WMD Programs; A Global History of WMD Use: <http://usiraq.procon.org/view.resource.php?resourceID=000678>

Week 3 (August 29): Overview of global WMD non-proliferation efforts – Mr. Walter Sansot

- WMD Conventions
 - NPT
 - CWC
 - BTWC
- Convention Implementing Organizations
 - IAEA (including a discussion on the AP)
 - OPCW (including a discussion on the OPCW-UN Joint Mission)
- UNSCR 1540

Readings:

- Text of the NPT: <http://www.armscontrol.org/documents/npt>
- Text of the BWC: <http://www.armscontrol.org/treaties/bwc>
- Text of the CWC: http://www.armscontrol.org/act/1997_04/cwctext
- Eric R. Terzuolo, "How the Iran Deal Erodes the Nonproliferation Treaty," *The National Interest*, August 5, 2015: <http://nationalinterest.org/feature/how-the-iran-deal-erodes-the-nonproliferation-treaty-13492>
- IAEA Safeguards Serving Nuclear Non-Proliferation, June 2015: https://www.iaea.org/sites/default/files/safeguards_web_june_2015_1.pdf
- Fact Sheets: Treaty Membership and Signatory Status of NPT, CWC, BWC: <http://www.armscontrol.org/factsheets/treatymembership>

Additional Reading:

- Kenneth Katzman and Paul K. Kerr, "Iran Nuclear Agreement," Congressional Research Service, May 31, 2016: <http://fas.org/sgp/crs/nuke/R43333.pdf>
- Text of the JCPOA: <http://www.iaea.org/sites/default/files/gov-2015-72-derestricted.pdf>
- George Perkovich, Mark Hibbs, James M. Acton, and Toby Dalton, "Parsing the Iran Deal": <http://carnegieendowment.org/2015/08/06/parsing-iran-deal/iec5>
- Ramesh Thakur, Jane Boulden, and Thomas G. Weiss, "Can the NPT Regime be fixed or should it be abandoned?," *Dialogue on Globalization*, Occasional Papers No. 40, October 2008: <http://library.fes.de/pdf-files/iez/global/05760.pdf>
- IAEA Safeguards in Practice: <https://www.iaea.org/safeguards/safeguards-in-practice>

Week 4 (September 12): International WMD organizations – Dr. Julie Thompson

- Main WMD multilateral regimes:
 - Nuclear Suppliers Group
 - Missile Technology Control Regime
 - Australia Group
 - Wassenaar Arrangement – Basis of Control List Structure used for Dual-Use Items
- Other programs:
 - Proliferation Security Initiative
 - Container Security Initiative
 - World Customs Organization
 - Interpol

Readings:

- The Missile Technology Regime: <http://www.mtcr.info/english/public.html>
- Multilateral Export Control Policy: The Coordinating Committee: <http://www.princeton.edu/~ota/disk3/1979/7918/791810.PDF>
- Nuclear Suppliers Group: <http://www.nuclearsuppliersgroup.org/en/>
- Australia Group: <http://australiagroup.net/en/>
- Mark Hibbs, "Toward a Nuclear Suppliers Group Policy for States Not Party to the NPT," Carnegie Endowment for International Peace, February 12, 2016: <http://carnegieendowment.org/2016/02/12/toward-nuclear-suppliers-group-policy-for-states-not-party-to-npt/itxg>
- World Customs Organization: <http://www.wcoomd.org/en/topics/enforcement-and-compliance/instruments-and-tools/guidelines/wco-strategic-trade-control-enforcement-implementation-guide.aspx>
- Proliferation Security Initiative: <http://www.state.gov/t/isn/c10390.htm>
- Container Security Initiative: <https://www.cbp.gov/border-security/ports-entry/cargo-security/csi/csi-brief>
- Container Security Initiative in Summary, May 2011: https://www.cbp.gov/sites/default/files/documents/csi_brochure_2011_3.pdf
- Interpol: <http://www.interpol.int/Crime-areas/CBRNE/CBRNE>
- Jeffrey Muller, "Shields up!" *CBRNe World*, April 2015: http://www.cbrneworld.com/uploads/download_magazines/Shields_up.pdf

Additional Reading:

- MTCR Annex and Annex Handbook: <http://www.mtcr.info/english/annex.html>
- “What the Missile Technology Control Regime is All About,” News18.com, June 8, 2016: <http://www.news18.com/news/tech/what-the-missile-technology-control-regime-is-all-about-1253600.html>
- NSG Documents: <http://www.nuclearsuppliersgroup.org/en/nsg-documents>
- NSG Guidelines: <http://www.nuclearsuppliersgroup.org/en/guidelines>
- Australia Group Common Control Lists: <http://australiagroup.net/en/controllists.html>

Week 5 (September 19): Nuclear Weapons Technology 1 – Mr. Walt Sansot

- Radiological and Nuclear Principles
- Nuclear Fuel Cycle
- Nuclear Material Production: Nuclear Reactors

Readings:

- The Nuclear Fuel Cycle Overview – World Nuclear Association: <http://www.world-nuclear.org/information-library/nuclear-fuel-cycle/introduction/nuclear-fuel-cycle-overview.aspx>
- Stages of the Nuclear Fuel Cycle, NRC: <http://www.nrc.gov/materials/fuel-cycle-fac/stages-fuel-cycle.html>
- Radiation Protection, NRC: <http://www.nrc.gov/about-nrc/radiation.html>
- Plutonium Manufacturing and Fabrication: <http://nuclearweaponarchive.org/Library/Plutonium/>

Additional Reading:

- Technical Description of Fuel Cycle Facilities and Evaluation of Diversion Potential: <http://www.princeton.edu/~ota/disk3/1977/9586/958607.PDF>
- Kelsey Hartigan, Corey Hinderstein, Andrew Newman, Sharon Squassoni, “A New Approach to the Nuclear Fuel Cycle: Best Practices for Security, Nonproliferation, and Sustainable Nuclear Energy,” CSIS/NTI, February 2015: http://www.nti.org/media/pdfs/150320_Squassoni_NuclearFuelCycle_Web_final.pdf?_=1426863720

Week 6 (September 26): Nuclear Weapons Technology 2 – Mr. Walt Sansot

- Nuclear Material Production
 - Uranium Enrichment
 - Reprocessing

Readings:

- Uranium Enrichment, NRC: <http://www.nrc.gov/materials/fuel-cycle-fac/ur-enrichment.html>
- Uranium Enrichment, World Nuclear Association: <http://www.world-nuclear.org/information-library/nuclear-fuel-cycle/conversion-enrichment-and-fabrication/uranium-enrichment.aspx>

- How uranium ore is made into nuclear fuel, World Nuclear Association: <http://www.world-nuclear.org/nuclear-basics/how-is-uranium-ore-made-into-nuclear-fuel.aspx>
- Processing of Used Nuclear Fuel. World Nuclear Association: <http://www.world-nuclear.org/information-library/nuclear-fuel-cycle/fuel-recycling/processing-of-used-nuclear-fuel.aspx>
- Nuclear Proliferation and Safeguards, Office of Technology Assessment, June 1977: <http://www.princeton.edu/~ota/disk3/1977/7705/7705.PDF>

Additional Reading:

- Civilian HEU Reduction and Elimination Resource Collection, NTI: <http://www.nti.org/analysis/reports/civilian-heu-reduction-and-elimination/>
- William F. Shughart II, "Why Doesn't U.S. Recycle Nuclear Fuel?" *Forbes*, October 1, 2014: <http://www.forbes.com/sites/realspin/2014/10/01/why-doesnt-u-s-recycle-nuclear-fuel/#3691456c7db4>
- Nuclear Reprocessing: Dangerous, Dirty, and Expensive, Union of Concerned Scientists: <http://www.ucsusa.org/nuclear-power/nuclear-plant-security/nuclear-reprocessing#.V3K41Vfw8RF>
- George Perkovich, Jessica T. Mathews, Joseph Cirincione, Rose Gottemoeller, Jon B. Wolfsthal, *Universal Compliance: A Strategy for Nuclear Security*, March 2005: http://www.nti.org/media/pdfs/analysis_carnegie_universalcompliance_2005.pdf?_id=16466791

Week 7 (October 3): Nuclear Weapons Technology 3 – Mr. Walt Sansot

- Nuclear Weaponization
 - Process
 - Testing
- Detection Technologies
 - Nuclear testing
 - Radiation Detection

Readings:

- Detecting Radiation, NRC: <http://www.nrc.gov/about-nrc/radiation/health-effects/detection-radiation.html>
- Radiation Detection and Measurement: <http://hyperphysics.phy-astr.gsu.edu/hbase/nuclear/rdtec.html>
- How Can You Detect Radiation? Health Physics Society: <http://hps.org/publicinformation/ate/faqs/radiationdetection.html>
- Detecting Radioactivity: <http://www.darvill.clara.net/nucrad/detect.htm>

Additional Reading:

- "CTBT at 15: Status and Prospects," Arms Control Association, October 2012: http://www.armscontrol.org/files/ACA_CTBT_Report_Vienna_2012.pdf
- Text of the CTBT: <http://www.armscontrol.org/node/2491>
- Nuclear Testing Fact Sheets: <http://www.armscontrol.org/factsheets/nucleartesting>
- How to Detect a Secret Nuclear Test (<4 minute video): <https://www.youtube.com/watch?v=daZ7IQFqPyA>

Week 8 (October 10): Chemical Weapons Technology 1 – Dr. Julie Thompson

- Intro to chemical weapons
 - History
 - WWI Use
 - WWII Use (Germany and China)
 - Iran-Iraq War – impetus for CW nonproliferation
 - International response: CWC and AG
 - Syria
 - Physiological Effects
 - CW vs Explosives
 - CW vs TICs
- Chemical precursors
- Management of CW precursors in trade

Readings:

- Sarah Everts, “When Chemicals Became Weapons of War”:
<http://chemicalweapons.cenmag.org/when-chemicals-became-weapons-of-war/>
- Sarah Everts, “Who was the Father of Chemical Weapons?”:
<http://chemicalweapons.cenmag.org/who-was-the-father-of-chemical-weapons/>
- Chemical Weapons Then and Now: <http://cen.acs.org/content/dam/cen/93/8/09308-cover3timeline.pdf>
- Elaine Seward and Sarah Everts, “How Chemistry Changed WWI”:
<http://chemicalweapons.cenmag.org/how-chemistry-changed-wwi/>
- Controlled Chemicals, OPCW: <https://www.opcw.org/our-work/non-proliferation/controlled-chemicals/>
- OPCW Scheduled Chemicals: <https://www.opcw.org/chemical-weapons-convention/annexes/annex-on-chemicals/>
- Australia Group Chemical Equipment Control List: Chemical Weapons Precursors:
<http://www.australiagroup.net/en/precursors.html>

Additional Reading:

- First-hand Accounts of the First Chlorine Gas Attack:
<http://chemicalweapons.cenmag.org/first-hand-accounts-of-the-first-chlorine-gas-attack/>
- Jonathan B. Tucker, “Trafficking Networks for Chemical Weapons Precursors: Lessons from the Iran-Iraq War of the 1980s,” CNS Occasional Paper No. 13, November 2008:
http://cns.miis.edu/opapers/pdfs/op13_tucker_edited.pdf

Week 9 (October 17): Chemical Weapons Technology 2 – Dr. Julie Thompson

- Chemical process to make chemical agents
- DU Equipment
- OPCW Facilities declarations
- Controlled chemical DU equipment and industry

Readings:

- World Customs Organization Strategic Trade Control Enforcement Implementation

Guide – p.41-42: www.wcoomd.org/en/topics/enforcement-and-compliance/instruments-and-tools/guidelines/wco-strategic-trade-control-enforcement-implementation-guide.aspx

- Australia Group Chemical Equipment Control List: http://www.australiagroup.net/en/dual_chemicals.html
- Jannis Brühl, “Where Did Syria’s Chemical Weapons Come From?” *ProPublica*, September 25, 2013: <https://www.propublica.org/article/where-did-syrias-chemical-weapons-come-from>
- Iraq Survey Group: Comprehensive Report of the Special Advisor to the DCI on Iraq’s WMD, 30 September 2004, Volume III of III: <https://www.gpo.gov/fdsys/pkg/GPO-DUELFERREPORT/pdf/GPO-DUELFERREPORT-3.pdf>

Additional Reading:

- Mary Beth D. Nikitin, Paul K. Kerr, Andrew Feickert, “Syria’s Chemical Weapons: Issues for Congress,” Congressional Research Service, September 30, 2013: <http://www.fas.org/sgp/crs/nuke/R42848.pdf>
- Christopher M. Blanchard, Carla E. Humud, Mary Beth D. Nikitin, “Armed Conflict in Syria: Overview and U.S. Response,” Congressional Research Service, October 9, 2015: <http://www.fas.org/sgp/crs/mideast/RL33487.pdf> (p.25-27)

Week 10 (October 24): Biological Weapons Technology 1 – Ms. Pamela McKinsey

- Intro to Biological Weapons
- Historical Overview of Biological Weapons
 - WWI through WWII
 - Cold War era
 - Bioterrorism
- Bioagents of weapons concern
 - Agents targeting humans
 - Agents targeting agriculture
- Bioweapon Discussion Topic
 - Prevention vs Deterrence vs Aggression

Readings:

- V. Barras, G. Greub, “History of Biological Warfare and Bioterrorism,” *Clinical Microbiology and Infection*, Vol. 20, Issue 6, June 2014: 497-502: <http://www.sciencedirect.com/science/article/pii/S1198743X14641744>
- Australia Group Common Control Lists: Human and Animal Pathogens and Toxins: http://www.australiagroup.net/en/human_animal_pathogens.html
- Australia Group Common Control Lists: Plant Pathogens: <http://www.australiagroup.net/en/plants.html>
- Mary Beth D. Nikitin, Amy F. Woolf, “The Evolution of Cooperative Threat Reduction: Issues for Congress,” Congressional Research Service, June 13, 2014: <http://fas.org/sgp/crs/nuke/R43143.pdf> (p.1-6; 37-42)
- “Lugar applauds opening of Nunn-Lugar Bio-Threat Laboratory in Tbilisi, Georgia,” US Senate Committee on Foreign Relations, March 17, 2011: <http://www.foreign.senate.gov/press/ranking/release/lugar-applauds-opening-of-nunn-lugar-bio-threat-laboratory-in-tbilisi-georgia>

- Patrick Goodenough, “Russian Official Accuses U.S. of Using Lab in Caucasus for Bio-Warfare,” CNS News, October 15, 2013: <http://www.cnsnews.com/news/article/patrick-goodenough/russian-official-accuses-us-using-lab-caucasus-bio-warfare>
- Mike Wheatley, “Russia Accuses U.S. of Placing Bio-Weapons Labs on its Borders,” Russia Insider, June 17, 2015: <http://russia-insider.com/en/politics/russia-accuses-us-placing-bio-weapons-labs-its-borders/ri8082>
- Puccinia graminis (stem rust of cereals), Invasive Species Compendium: <http://www.cabi.org/isc/datasheet/45797>
- Cyrille Saintenac, Wenjun Zhang, Andres Salcedo, Mathhew N. Rouse, Harold N. Trick, Eduard Akhunov, Jorge Dubcokvsky, “Identification of Wheat Gene Sr35 That Confers Resistance to Ug99 Stem Rust Race Group,” *SCIENCE*, Vol. 341, Issue 6147, 16 August 2013: 783-786: <http://science.sciencemag.org/content/341/6147/783.full>
- Pathotype Tracker - Where is Ug99? http://rusttracker.cimmyt.org/?page_id=22
- Wheat Stem Rust – Ug99: <http://www.fao.org/agriculture/crops/rust/stem/rust-report/stem-ug99racettksk/en/>
- Kerry Grens, “Putting Up Resistance,” *The Scientist*, June 1, 2014: <http://www.the-scientist.com/?articles.view/articleNo/40085/title/Putting-Up-Resistance/>

Week 11 (October 31): Biological Weapons Technology 2 – Ms. Pamela McKinsey

- Processes for bioagent to bioweapon
 - Dual Use Equipment
 - Is it really “easy”?
- Bioweapon concepts
 - Biotechnology
 - Biological research fueled by bioterrorism concerns
 - Ethical considerations

Readings:

- Australia Group Common Control Lists: Control List of Dual-Use Biological Equipment and Related Technology and Software: http://www.australiagroup.net/en/dual_biological.html
- Hilary Rodham Clinton, Remarks at the 7th Biological and Toxin Weapons Convention Review Conference, Geneva, Switzerland, December 7, 2011: <http://www.state.gov/secretary/20092013clinton/rm/2011/12/178409.htm>
- Capabilities Analysis of Bioterrorism: Roadblocks Facing Non-State Actors’ Use of Bioweapons, *Global Biodefense*, May 20, 2014: <http://globalbiodefense.com/2014/05/20/bioterrorism-roadblocks-facing-non-state-actors-use-of-bioweapons/>
- Michael J. Selgelid, “Governance of Dual-Use Research: An Ethical Dilemma,” *Bulletin of the World Health Organization* 2009, 87: 720-723: <http://www.who.int/bulletin/volumes/87/9/08-051383/en/>
- Stephen Strauss, “Ebola Research Fueled by Bioterrorism Threat,” *Canadian Medical Association Journal*, November 4, 2014; 186 (16): 1206: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4216251/>
- Crystal Boddie, “Federal Funding in Support of Ebola Medical Countermeasures R&D,” *Health Security*, February 1, 2015; 13 (1): 3-8: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4389695/>

Week 12 (November 7): Missile Delivery Systems – Mr. Walt Sansot

- Ballistic and Cruise Missile Technology
- Unmanned Aerial Vehicles
- Missile subsystems
- Missile Technology Control Regime

Readings:

- Karl Tate, “How Intercontinental Ballistic Missiles Work (Infographic)”, Space.com, February 1, 2013: <http://www.space.com/19601-how-intercontinental-ballistic-missiles-work-infographic.html>
- Trajectories: <http://hyperphysics.phy-astr.gsu.edu/hbase/traj.html>
- HyperPhysics Concepts: <http://hyperphysics.phy-astr.gsu.edu/hbase/hph.html#mechcon>
- The Materials Ballistic Missiles are Made of: <http://missilethreat.com/the-materials-ballistic-missiles-are-made-of/>
- Missiles of the World (Ballistic, Cruise, All): <http://missilethreat.com/missiles-of-the-world/>

Additional Reading:

- Kelsey Davenport, “Iran’s Missile Tests Raise Concerns,” *Arms Control Association*, April 2016: http://www.armscontrol.org/ACT/2016_04/News/Irans-Missile-Tests-Raise-Concerns
- Kelsey Davenport, “Worldwide Ballistic Missile Inventories,” *Arms Control Association*, July 2014: <http://www.armscontrol.org/factsheets/missiles>

Week 13 (November 14): Challenges with controlling dual-use items – All instructors (TBD)

- Dual Use goods – historically controlled based on control lists created by supplier states
- How to effectively engage industry
 - In light of other pressing international security measures, can we expect governments and companies to focus on DU goods like corrosion resistant valves for example?
- In an age of expanding international trade and production, what does controlling Dual Use goods mean? Idea of supplier states may be becoming obsolete.
- How is new technology affecting idea of “controlling DU goods”? E.g. 3-D printing? Micro chemistry? Interface of bio and chemistry?

Readings:

- Sybille Bauer and Mark Bromley, “The Dual-Use Export Control Policy Review: Balancing Security, Trade, and Academic Freedom in a Changing World,” EU Non-Proliferation Consortium Non-Proliferation Papers, No. 48, March 2016: https://www.sipri.org/sites/default/files/EUNPC_no-48.pdf
- Renaud Chatelus, “The Role of Customs in Strategic Trade Controls: Challenges and Potential. Taking a States’ Enforcement Perspective,” CITS/UGA: http://cits.uga.edu/uploads/documents/chatelus_customs.pdf
- “3D Printing may lead to export control crackdown,” *The Export Compliance Journal*, November 27, 2013: <https://www.ecustoms.com/blog/?p=67&p=67>

- David Ivey, “Perspectives on Challenges/Problems in Export Control Compliance,” October 29, 2015:
http://sites.nationalacademies.org/cs/groups/pgasite/documents/webpage/pga_169005.pdf
- Stephanie Lieggi and Diana Lee, “Tracking Growth in Dual Use Commodities in Southeast Asia: Keeping Ahead of Proliferation Networks,” May 20, 2015:
<http://www.nonproliferation.org/tracking-growth-dual-use-commodities/>
- Jonathan B. Tucker, ed., *Innovation, Dual Use, and Security: Managing the Risks of Emerging Biological and Chemical Technologies*, Cambridge, MA: MIT Press, 2012: 235-248.

Week 14 (November 28): Current WMD Proliferation Challenges – Class discussion moderated by Dr. Julie Thompson

Possible issues for consideration, but students are welcome to raise other topics:

- Nuclear
 - Declared NWS – Modernization and increasing arsenals and stockpiles
 - China, US, Russia, UK, France
 - India, Pakistan
 - DPRK, Iran
- Biological
 - Technology advances
 - Lack of verification mechanism
- Chemical
 - Incomplete CW stockpile destruction
 - Continued use of CW in Syria and Iraq
 - Prevalence of chemical industry throughout the world and need for dual-use equipment
- Non-state actors
- Role/responsibility of scientists in non-proliferation
- Controlling technology – is it even possible?

Week 15 (December 5): Student end of semester seminar presentations

Students will present their end of semester presentations to the rest of the class and all instructors. Presentations should be no more than 30 minutes long and should outline which of the issues discussed in class pose the biggest threat to U.S. and international security, and why. Specific issues areas will be assigned to the students at the beginning of the semester to avoid any repetition. **Powerpoint presentations need to be emailed to Dr. Kutchesfahani by 9AM on December 5. Late submissions will result in a grade of zero for this assessment.**