

STS1207 Introduction to the Psycho-Sociology of Science

Term B 2007
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The new (but too long) title of this course should be **A-Bombs, Moon Rocks and the Discovery of DNA: The Influence of Gender, Personality and Politics on Science**. The theme- though the course does focus in on the key biological discovery of the 20th century with some additional consideration on the debate in science circles about the impact of the Manhattan A-Bomb project of World War II on science. Our primary concern will be the fact that it spawned the Pugwash and Union of Concerned Science movements in the science community, to question the role of science in society, given that governments now considered it too important to leave uncontrolled. The moon rocks section deals with what happens to science when it gets so big and expensive that one can't operate as an individual investigator anymore, but only on a large scale involving whole scientific communities in decisions like where to land and gather lunar rock specimens.

The catalog description should have read as follows:

The discovery of DNA raised questions on topics ranging from gender discrimination and scientific ethics to the nature of scientific discovery. On the other hand, it also touches upon the interdisciplinary nature of science, as chemists and physicists play a large role in the discovery of DNA, and are involved in the debate about the origin of the Moon as well. Included in this major discovery is an insurgency from the physics field, in the form of the Phage Group, that brings X-Ray Crystallography into biology and establishes microbiology; a field of study very different from the old style genetics. Cultural and organizational influences on the DNA discovery are notable, but the influence of external politics is better illustrated by the Apollo program and the reaction of the scientific community to its growing social significance in the post war era of the 20th century. Resistance to government direction of science is best illustrated by the emergence of the Pugwash Movement in the aftermath of the Manhattan Project, during the Cold War.

The theme of STS 1207 as traditionally offered has been broader than this, essentially a description of the debates in the Sociology of Science and study of Creativity in Psychology that spawned the new field of the Psycho- Sociology of Science. Ultimately one theme of the course becomes an effort to follow the experience of 4 different kinds of scientists (with different patterns of cognitive ability) who tend to make different kinds of contributions through their careers. They are different types of learners, researchers and even peer reviewers and managers of teams. We can start with their experience in HS regarding what type of science texts they like and whether they take AP classes when they are offered, go on to how they do on the SAT, and how the student population of a place like WPI differs from the general HS student population of a city like Worcester or one of its suburbs as a result of the college selection and admissions process.

More is known about what they do at a science and technology oriented school like WPI, in terms of how the Freshman year goes, whether they change majors and finally how the MQP goes in terms of grades and interpersonal dynamics. There is also data on whether they are likely to graduate on time or not and graduate with distinction or not. Moving on into their careers, there are studies of industrial and academic scientist's relative success and type of contribution by cognitive style.

Mitroff's study of the Apollo Moon scientists is especially revealing about scientific research styles as the scientists experience them amidst interpersonal conflict. I did a follow-up study which converts these cross perceptions of colleagues into the cognitive styles as measured using formal indicators. He used a different cognitive styles indicator in his study, but we now use both together quite effectively. They complement each other.

Meanwhile, the class members are studying famous scientists who made great discoveries via an in depth consideration of the DNA case, We will speculate on which cognitive types the different players in that drama were based on their research styles and contributions. One of them then goes on to contribute in a whole different way as a founder of the Pugwash Movement. What cognitive abilities foster that kind of critical edge is of considerable interest, especially given the tendency of engineers and scientists to move into management positions in later career.

Four social roles that will get special attention in this course are those of the theoretically dissident scientist, the technical innovator, the politician of science and the social critic. The first two have a significant impact on the internal processes of science and the latter two shape the relationship between science as an institution and the larger community. Social controversies have raged about the implications of scientific advance since the time of Galileo, but in this course our attention will focus on two developments of the latter half of the 20th century. These are the efforts of scientists to control the nuclear arms race and protect the public from epidemics and other threats associated genetic manipulation and the emergence of biotechnology out of DNA research. In both cases, but particularly the former, the Pugwash Movement has been a key player in fostering the notion that scientists have an ethical obligation to be politically active. Otherwise they totally lose control of how the fruits of their labor will be applied.

The story of the first 10 Pugwash conferences, and the organization's later receipt of the Nobel Peace prize for this kind of activism, as well as the spinning off of the Student Pugwash Movement in 1978, will be covered in some detail. It is one of the best existing examples of what the Science- Society interface should and could look like if the role of ethically grounded social critic was fostered in the Scientific Community. Why it is not being fostered, and hence these cases of morally grounded protest by socially concerned technical experts are so rare will be the final question raised by the course. Since WPI claims to produce a different kinds of socially concerned scientists and technologists the question is particularly important to us here.

Texts : THE DOUBLE HELIX by James Watson (Norton and Company)
Reviews Edited by Gunter Stent (1980)

ROSALIND FRANKLIN: THE DARK LADY OF DNA by Brenda Maddox or
A FEELING FOR THE ORGANISM: THE LIFE OF BARBARA McCLINTOCK by E. Keller

LOOKING AT TYPE: the Fundamentals by Charles Martin

Alternative Accounts of the DNA Discovery and Reference Materials:
FRANCIS CRICK; DISCOVERER OF THE GENETIC CODE by Matt Ridley
THE SEARCH FOR DNA'S SECRETS by Mahlon Hoagland
THE EIGHT DAY OF CREATION by Horace Judson
THE PATH TO THE DOUBLE HELIX by Robert Olby
ROSALIND FRANKLIN AND DNA by Anne Sayre
GENES, GIRLS AND GAMOW: AFTER THE DOUBLE HELIX by James Watson
TOWARD THE HABIT OF TRUTH by Mahlon Hoaglund

Reading Assignments will be discussed on or after the day that they are due- not necessarily on that day- but you are responsible for them as of that day.

Reading Schedule

Tuesday, Oct. 23, 2007- Organizational Meeting

Lecture on the Mertonian Perspective using the example of Robert Merton's research on the "Puritan Spur to Science" as an illustration of "classical" sociology of science.

Thursday, Oct. 25- Comparison of the Mertonian and Kuhnian Perspectives on the Nature of Science

The class as a whole is assigned excerpts from Kuhn's "The Structure of Scientific Revolutions", specifically the sections on the nature of "Normal Science" and "Anomalies" p 10-42 and 52-65. (Xerox Copies will be handed out in case the MyWPI area for the course is not set up yet.)

MBTI Forms will be distributed in class

Friday, Oct 26- Continued Comparison of the Mertonian and Kuhnian Perspectives.

The class as a whole is assigned to read Merton's article on "Priorities in Scientific Discovery" and try to pick out a list of the five "norms of science" from this wordy article dealing with the reward structure of science and the importance of "priority disputes".

MBTI forms collected in class.

Monday, Oct. 29- Closing Session on the Mertonian and Kuhnian Perspectives

Read Pages 1-50 in Watson's "The Double Helix"

Recommended Reading on MYWPI : Roger Krohn's Article "The Secularization of Science and Sociology" which heralds the new sociology of science coming out of the work of Kuhn, Ben David, Gordon and others.

Those who do the recommended reading will get extra credit for this if they write up a 1-2 page "reading" reaction to one or both of these recommended readings and bring it to class.

MBTI Feedback Session in Class.

Tuesday, Oct 30- The Interdisciplinary Case Study Literature on Discovery in Science

Continue Reading in Watson's "The Double Helix" p 51-100

Discussion of the first half of "The Double Helix", Watson's perspective on what happened and who did what, with special attention to the roles of Crick, Wilkins and Franklin vis a vis his own contribution. Why was this account written? Why was the book controversial.? What issues does it raise for the Mertonian description of the norms of science?

Class Discussion of how to form teams, diverse or homogeneous
Teams will be formed in class on Thursday. You will take the Midterm together in these teams and do a lab exercise together dealing with how to live on the Moon given what we learned from the Apollo Lunar samples. There will be team presentations on your lab solutions.

Thursday, Nov 1 -

Read Mullins, Nicholas “ The Development of a Scientific Specialty: The Phage Group and the Origins of Molecular Biology” We will discuss it as an attempt to use Kuhn’s paradigm theory to explain a historical case study. (The paper is in MYWPI)

Discussion in class of the key players and their likely personality types in MBTI terms will start if time permits.

Class will form into teams of 3-4 students each based on MBTI data.

The ten resulting teams will be responsible for:

- 1) Taking attendance and bringing those who miss a class up to date. (It affects the group’s class participation grade to have low attendance.)
- 2) Doing a class presentation on an article length case study together. Two teams will assigned to each of 5 cases case, one to do a 10 minute oral report to the class and the other to produce a written handout on the case for the class.
- 3) Taking the Midterm together
- 4) Writing a Comparative Group Book Review together. There are three possibilities.
 - A) (Teams 1-5) Compare the Watson and Maddox accounts of the Discovery of DNA and comment on whether the Nobel Prize Committee should review the case of who gets credit for the DNA discovery to include Franklin or omit Wilkins. These teams should also comment on whether Watson’s behavior calls for review by an ethics committee.
 - B) (Teams 6-7) Alternatively, a team can decide to cross examine the interpretation of the DNA discovery case as presented by Watson and Maddox with reference to portions of another account of the DNA discovery, (Hoagland’s (Team 6_ or Sayre’s (Team 7) or Ridley’s (Prof. Wilkes).
 - C) (Teams 8a and 9a) Two teams can decide to look into the treatment of women in the sciences by looking at another case, particularly Keller’s account of “A Feeling for the Organism: The Life and Work of Barbara McClintock”. Such teams would “double team” to compare Keller’s book with Maddox’ account of Franklin’s Life and Work (Teams 8b and 9b) . Thus, the a teams team forego reading the Maddox account of the DNA discovery for their second book review to read about McClintock. The teams exchange reviews and have a discussion of the two cases out of class but to which the instructor is invited. This could be during office hours.
- 5) Three or Four groups together will be formed into a Lab unit. Once or twice the Lab teams will be asked to accomplish a task in competition with the two other labs.

Distribute handout on the difference between a book review and a book report- This was done by email so feel free to ask questions in class.

Friday, Nov 2 - – Finish Reading Watson’s “ The Double Helix” p. 101-143.

GCSI Administered in Class- Taken from the Creativity literature-. This is really important and though I may be in Baltimore that day, this needs to happen whether or not I am around to administer the Cognitive Indicator.

Monday, Nov. 5- A 3-5 page individual Book Review on “ The Double Helix” is due.

Discussion in class of the key players and their likely personality types in MBTI terms will be completed if it started earlier, or start and finish this day. If time permits, a discussion of Watson’s point of view will occur on this day. What happened and what issues does it raise? Be ready to talk about the paradigm state of the field at the outset of

the book and why you think he wrote the book? On the whole is it good news or bad for Kuhn? Merton?

Tuesday, Nov 6 - . Continue Discussion of Watson case with a treatment of internalist and externalist treatments of science, and a discussion of which one this is? The Watson- Crick and Franklin-Wilkins relationships discussed.

Start reading the Maddox account of the DNA discovery or Keller's account of the life and work of McClintock, a woman working in biology who did get a Nobel Prize.

Thursday Nov 8- Read Wilkes, "Niches and Strata" Chapter 10 in Shaddach and Fuller's edited book, The Psychology of Science, (1994). on the GCSI Measure and Paradigm theory.

Feedback session for the GCSI results gathered a week earlier- and a look at your teams and the players in the DNA discovery case in these terms.

Read your case studies (on My WPI) and get ready to present them on Friday and Monday . You will have 10-15 minutes of class time on Friday to make preparations.

Friday, Nov 9 - Short Case Study Presentations by 3 Teams

Team 1& 6-19th Century Medicine- Ben David

Team 2& 7 – Meteorites- Westrum

Team 3&8a-b- Floppy Eared Rabbits-Barber and Fox

These are to be 10 minute oral presentations supported by a handout for the class. They do not have to be power point and in bullet form, but can be. One team will take primary responsibility for the oral presentation and one for the written handout. Alternatively, you can have 2-3 members of the pool of 6 people volunteer for each role, but it will be a team grade unless the authorship and division of labor is noted to be otherwise.

Each team is encouraged to talk to me about why I assigned this particular article as part of a larger effort to assess the explanatory value of the paradigm concept. Some illustrate the paradigm concept well, but others suggest there are important lapses in Kuhn's formulation of "normal" science.

Those teams not presenting read in their second book .

Monday, Nov 12- Short Case Study Presentations by the other 2 Teams and an overall look at the picture emerging out of all 5 of these cases- and the Phage Group/DNA case.

Team 4& 5- Roles and Innovations-Ben David

Team 9a-b- Demise of Phlogiston-Margolis

Tuesday, Nov 13- The Apollo Moon Scientists- and the different kinds of Scientists

Read Mitroff and Fitzgerald, " On the Psychology of the Apollo Moon Scientists", Human Relations, vol. 30, No 8, 1977 It is in the MyWPI site.

Recommended: Stephen Brush's article on how the Apollo Moon Scientists came to consensus on the Origin of the Moon. "Nickel for your Thoughts: Urey and the Origin of the Moon". *Science*, 217: 891-98 (1982). HMPP JSTOR

The theories of Harold C. Urey (1893-1981) are discussed in relation to earlier ideas, especially G. H. Darwin's fission hypothesis. Urey's espousal of the idea that the Moon had been captured by the Earth and has preserved information about the earliest history of

the Solar System led him to advocate a manned lunar landing. Results from the Apollo missions, in particular the deficiency of siderophile elements (such as nickel) in the lunar crust, led him to abandon the capture selenogony and tentatively adopt the fission hypothesis.

Which scientists in the DNA account were which, in Mitroff's terms?

Thursday, Nov 15 - Sayre and Hoagland Teams Offer 15 minute presentations on differences between the Watson Account of the DNA Discovery, and the one they read. Please prepare a handout for the class as well. Hopefully, the Hoagland team will also comment on the image of scientific progress (evolutionary or revolutionary) and credit for scientific accomplishment that comes from their account.

Note that you do not need to write and submit individual book reviews on these cases. It is to be a team effort to cover this extra account and compare it to the two others you all read as individuals and share your conclusions with the class about the credibility of Watson's account. If you do read a whole book as an individual (and submit a review suitable to share with the class) on the book about who Hoagland was, for example, that would be worth extra credit as an individual. Your team might benefit indirectly too.

Friday, Nov. 16- Discussion of the Maddox book “Rosalind Franklin: The Dark Lady of DNA” Our goal will be to understand Rosalind’s side of the story and what happened; personality clash, administrative error, culture (French and British styles of science) clash or gender discrimination? Then we will be ready to tackle the question of whether the Nobel Prize committee created or perpetuated an injustice. Should Wilkins have been dropped or Franklin added or did they get it just right?

Second (Individual) Book Reviews (Maddox or Keller) are due and electronic versions as well as paper copies need to be sent to me so that I can post them or email them to the class members who did not read the books in question. These will be commented and graded as check minus, check or check plus but if not submitted will count against class participation.

It is the group reports (for people who did not read the book) and reviews that you create out of these individual submissions on the subjects of scientific credit, gender and science and comparing accounts of the DNA discovery that will be the important written grade. These are due 10 days later, Nov 26th (the day you get back from Thanksgiving break). However, feel free to drop them off Wed. Nov 21st (at my office) as you leave for the break if they are completed by then.

Monday Nov. 19- Mid Term Exam Review Day

Bring to class a written list of 5 key concepts covered in the class that you think should be covered on the exam. The teams will decide which 5 are most likely and propose their list to the class.

(Essay Portion of the Exam Distributed)

Larger 3“lab” teams are formed for a special activity to prepare for which will be done soon after the Thanksgiving Break.

Teams 1, 6, 8a and 8b NASA Kennedy, Glenn, Johns Hopkins APL and Goddard SFCs
Teams 2, 7, 9a and 9b California University Consort. (USC, UCLA, Cal Tech and JPL)
Teams 3,4,and 5 British University Consortium (Oxford, Cambridge and U of London)

Officially, you will be competing for a contract from LUNA Corp and there are going to be three problems that have to be solved to get the contract to build a lunar system. Each sub-team will have a special assignment- but it is the quality of the overall solution that really matters. You get to know what the problem is before you leave on break and can develop a division of labor. Each of the 3 consortia has one area of advantage over the other two. You will have to decide whether to cooperate or compete as soon as you get back based on what you know by then.

Tuesday, Nov. 20- Group Mid-Term Exam administered.

(Work independently for 40 minutes and compare answers for 15 minutes.)

Thursday –Friday, Nov. 22-23 Thanksgiving Break. –

Monday, Nov. 26 Team reports based on the Second Book reviews are due. There should be a book report part to the review and commentary on the Keller book in the case of Teams 8 and 9. Since the a parts of these teams are writing for people who did not read the book they are reviewing and not just commenting on a book both parties have read more description is needed. The Keller book report portion of the review should take the form of an outline suitable to be a handout that can be distributed to the whole class at the time of the oral report to be given on Nov 27th, when we discuss Gender and Science.

Monday Nov 26 cont.

Mid term Exams returned and discussed
Presentation on Gender and Cognitive Style: The Shadow Variable issue and how gender stereotypes and cognitive style interact to affect patterns of encouragement males and females get to enter scientific fields (The WISS study)

No additional reading to prepare- work on your multi-team project after the team reports are completed and submitted

Tuesday Nov. 27 The Gender and Science issue in the mid and late 20th Century

Teams 1-7 will read 4 newspaper articles to prepare:

“ MIT Women Win a Fight Against Bias” March 21, 1999

“ An MIT Professor’s Suspicion of Bias Leans to a New Movement for Academic Women” Dec. 3, 1999.

“Leaders of 9 Universities Pledge to Improve Conditions for Female Scientists” Feb. 9, 2001

“ Women and Science: the Debate Goes On” March 4, 2005.

Teams 8 and 9 will be presenting.

We will be comparing the Maddox (Rosalind Franklin) and Keller (Barbara McClintock) accounts. First up will be a report on “ A Feeling for the Organism”. The 8a and 9a teams will present orally (20 minutes) and distribute a handout on the book. In the DNA story this case is a vindication of the old style geneticists and the story of Barbara McClintock- an “intuitive” research style scientist with a cognitive gift. However, we are trying to see if there is a case for gender prejudice in science or sex discrimination evident in the stories of these two careers.

Hence, there will be two more (10 minute) presentations by the 8a and b and 9 a and b teams who will distribute handouts or copies of their team reports to the class and comment on whether they see prejudice or discrimination in these cases or rather a clash between different personalities or kinds of scientists some of whom happen to be women, but men that different would still treat each other the same way. Gender roles and stereotypes can lead the same behavior to be interpreted quite differently.

Thursday, Nov. 29- .Read “The Scientific Intellectual”, by Lewis Feuer

This is an article on the scientists of the Manhattan Project, especially those who were “managerial technicians” and advocated the use of the bomb to end the war.-and their critics in the scientific community described as more “cosmopolitan and humanistic.” Science had been an international community and got drawn into WWII in a new way, as partisan nationalists, important and thus subject to national security controls.

The teams are assigned to play national delegations on Friday to debate whether the current treaty forbidding any nation (or corporation) to claim territory on a celestial body should be changed to allow property/mining rights to be claimed on the Moon (or Mars). A Recommended Reading booklet on “Space Security or Space Weapons” goes to each delegation, but there is no formal preparation requirement. Just Google your country’s space agency looking for a description and policy statement regarding the Moon

Team Assignments:

Team 1- Britain	Team- 6- Japan
Team 2- France	Team 7 -India
Team 3- Brazil	Team 8a and b - USA
Team 4 –Russia	Team 9a and b -China
Team 5- Germany	Pugwash –UNOOSA admin.

Friday, Nov. 30- Presentation (15 min.) by Student Pugwash Officers on the discovery in lunar samples retrieved by the American Apollo program (and Russian unmanned sample recovery missions) of the presence of Helium-3 on the Moon. Other social issues raised by the return to the Moon in 2018-2020 by the PRC and USA and the announcements by India and Russia and the European Space Agency that they will be active on the Moon by 2025 may also be mentioned. The likelihood of a New Space Race is discussed. (5 min).

Half hour model UN event in which each delegation gets 1 minute to state its position and then a general debate follows. The debate is moderated by “UNOOSA” as the UN administrators try to see if there is enough consensus in the “Committee on the Peaceful Use of Space” (COPUOS) to take a resolution to the General Assembly.

Monday, December 3- Large Lab Group Presentations (and defense of solutions against critics)

Each Lab consortium group will turn in a written formal solution report in the form of a “Letter Proposal” “ no more than 3 pages long- about one page for each of three problems to be solved. The teams will have ten minutes each to present the oral argument and four minutes each to comment on the other two oral proposals offered in competition

Tuesday, Dec 4- The Pugwash Movement and the Problem of Atomic Weaponry

Einstein, Russell and the Pugwash Manifesto

All teams read the Pugwash Manifesto.

Teams 1-7 will report on one or two of the first 10 Pugwash meetings and one of the last ten or so meetings. Teams 8 and 9 will be assigned to read about Joseph Rotblat and the Nobel Peace Prize received by for Pugwash in 1995 or Student Pugwash. The team report handouts to be given to the other teams will be sure to note who was there by country, how many people there were and what issues were addressed by the scientists involved in the meeting.

p.11-18 Organizing and the First Conference- Team 1 (also the 1996 meeting)

p.18-23 Second and Third Conference- Team 2 (also the 1997 meeting)

p. 23-24 Fourth Conference- Team 3 (also the 1998 meeting)

p. 24-26 Fifth Conference- Team 4 (also the 1999 meeting)

p. 26-28 Sixth Conference- Team 5 (also the 2000 meeting)

Thursday, Dec 6- The Pugwash Movement and the Problem of Atomic Weaponry cont.

p. 28-36 Seventh and Eighth Conference- Team 6 (also the 2001 meeting)

p. 37-44 Ninth and Tenth Conferences- Team 7 (also the 2002 meeting)

Joseph Rotblat and the Nobel Peace Prize of 1995– Team 8 a and b
(also the 2003 meeting) Rotblat has written an article about “Leaving the Manhattan Project”(August 1985, Bulletin of the Atomic Scientists).

The Origins and Purpose of Student Pugwash- Team 9 a and b
See the article by Jeff Liefer in the Proceeding of the First Student Pugwash Conference in 1975. (Also note the theme a location of the 2004 Senior Pugwash conference meeting)

All teams look up the location and themes of the 2005-2007 Senior Pugwash meetings.

Friday, Dec 7- General Discussion of the Senior and Student Pugwash Movements, the concept of “Technological Literacy”, the Union of Concerned Scientists, and the WPI Plan as they relate to the emergence of socially concerned science.

The Pugwash Pledge: Should it be encouraged at WPI?

Recommended reading in My WPI:

“ From Alchemy to Atomic War: Frederick Soddy’s “Technology Assessment” of Atomic Energy, 1900-1915” This is the first person to raise questions about the social benefits of atomic energy by predicting that it will be easier to build a bomb than a power plant and that mankind can’t be trusted not to use this power for evil. How he knew a bomb was possible and what he did with his career once he knew is also of interest. Prior to the World Wars science was optimistic and largely uncontrolled. WW I drew in the chemists. WWII drew in the physicists.

Monday, Dec 10 The Subjective Side of Science and the Emergence of Psycho-Sociology

General Discussion of the Evidence Tying Cognitive Styles to Preferred HS Science Course , SAT Scores, College Majors/Major Changing, MQP Topics, Careers, Fields by Paradigm state, Research Styles and Peer Review on the Science Side. Then turning to the role of the scientist in society, the narrow apolitical specialist, the managerial technician or the socially concerned/politically active scientist, again we see cognitive inclinations in terms of what kind of scientists one will be in these terms. This affects the probability of joining movement like Science for the People or Pugwash.

Tuesday, Dec 11 Review day (and Take Home Final Distributed)

Thursday, Dec. 13- Wrap-up Discussion of the Politics of Science
Take Home Final Due

Closing discussion of what the MBTI and GCSI predict that ties it to the social conscience questions facing science today- as it argues for both autonomy and public support.

Who will emerge as the leaders of a scientific community depends to some extent on the paradigm state of the field. That affects the odds that the scientific community will be politically active and try to control what it is asked to do and what is done with the fruits of its labor. Thus, the norms of science are being reexamined and may be subject to renegotiation due to pressures for proprietary rights and ethical concerns. On the other hand it is not clear how closely scientists ever really adhered to this idealized vision of their behavior. It was politically significant none the less that they be viewed as expert authorities, rational and objective arbitrators of truth and the custodians of reliable knowledge. Public funding for science far exceeds that devoted to supporting the arts.

The overall Grading Criteria for the course are as follows:

Attendance and Class Participation	10%
Individual Book Review on "The Double Helix" by Watson	15%
Group Presentation on a science Case testing the Paradigm concept	5%
Individual Book Review on Maddox or Keller books	5%
Group Report based on Maddox, and Hoagland, Sayre, Keller or some combination of these sources	20%
Group Midterm Exam	20%
Group Presentation on 2 Pugwash Meetings or topics	5%
Individual Final Exam (Take Home- Essay Style)	20%