

1. (4 pts) Key code, EID , and name. Fill in (A B) to indicate your key for this version of the exam. Be sure your name and EID number are correctly bubbled in on the scantron and that you have put your name on this exam copy.

Brain Flaws

2. (4pts) Lecture listed and explained several ways in which our brains are intrinsically prone to mislead us (away from the scientific truth). Which of the following are true? MTF

- A) Searching for additional evidence to find out whether a particular model is supported is an example of reinforcement.
- B) Lotto advertisements that show actual winners but not the millions of losers was said to take advantage of our responding to perceived risks rather than actual risks.
- C) The spread of urban legends and success of scams would be an example of drawing causation from correlation.
- D) The use of anecdotes, responding to emotional factors, and memory reconstruction were all included in the list.

3 (5pts) Lecture on this topic was introduced with a perspective for the themes/chapters that would be presented for the remainder of the semester. All were reasons why it may be difficult to obtain or recognize scientific 'truth'. Which are true? MTF

- A) Nature works against us. Some problems are not easily attacked/approached with the scientific method because they have properties that slow or thwart the scientific method.
- B) Our brains work against us so that we often do not objectively look at evidence in making decisions.
- C) The scientific method works against us because (as before) all models are false.
- D) Other people work against us – conflict.
- E) It was suggested that most of these difficulties could be overcome by having multiple people analyze the data.

Intrinsic Difficulties

4. (5pts) Which of the following options accurately explains an intrinsic difficulty and/or correctly explains why it constitutes a special difficulty for the scientific method? MTF

- A) Rare events: this difficulty refers to sampling error and the consequence that one needs to observe at least half a dozen occurrences to reasonably estimate a rate.
- B) Complexity: this difficulty refers to the general phenomenon that problems in science are often much more complicated than first guessed.
- C) Humans make difficult subjects: This problem is primarily that humans are uncooperative research subjects.
- D) Time lags: this difficulty slows down the scientific method. A delay between the cause of an outcome and the time the effect appears introduces a delay in each cycle of the scientific method.
- E) Rare events: a 'dispersed' event (not concentrated in time or space) was given in the book as one manifestation of a rare event.
- F) Complexity: this phenomenon was illustrated in class with flash powder.

5-9. These questions ask for the intrinsic difficulty illustrated by the given statement. **Do not assume any more than what is explicitly given in the question.** That is, address only the difficulties specifically mentioned. **(One answer only per question)**

(A)	(B)	(C)	(D)	(E)
Rare events are difficult to quantify	Time lags slow progress	Complexity (interactions)	Humans make difficult experimental subjects	None

5. (3pts) The following quote (from USA Today, 23 Nov 04) describes some problems encountered with a statin drug that had been FDA approved and was later withdrawn (Baycol).

“Patients who took Lipitor, Pravachol or Zocor [statins] had similar, low rates of hospitalizations for [the muscle disorder] rhabdomyolysis – an average of one out of every 20,000 patients per year. Among those who also took a fibrate, another cholesterol-lowering drug, the rhabdomyolysis hospitalization rate was about 12 out of every 20,000 patients per year.

Among patients who took only Baycol for their cholesterol, more than 10 out of every 20,000 were hospitalized each year with the muscle disorder. But the rate soared to 2,070 per 20,000 – or one in 10 – per year among those who took a fibrate as well as Baycol.”

What type of intrinsic difficulty is indicated by the higher rate of problems caused when a fibrate is taken with Baycol than when a fibrate is taken with other statins?

(A) (B) (C) (D) (E) (one)

6. (3pts) Which difficulty would explain why it is harder to identify a poison that kills only when two ingredients are present than a poison which kills by either of two ingredients? (A) (B) (C) (D) (E) (one)

7. (3pts) Algae are being intensively researched as sources of biofuels. When grown in small quantities under ideal conditions in the lab, the yield of oil is high per volume, and if one scales these yields up several thousand-fold, the yield per acre far exceeds all other biofuel crops (e.g., corn, sugar cane, switchgrass). However, attempts to recover algae from large ponds have not met with success, because the algae do not grow as well in large, outdoor ponds as in the small volumes in the lab. As a consequence, there has been little success with algae for biofuels. What intrinsic difficulty accounts for the difficulty of getting fuel from algae outdoors? (A) (B) (C) (D) (E) (one)

8. (3pts) Progress in solving crimes (and finding the right perpetrator) has been immensely aided by DNA technology. Until we understood just how unique each person is at the DNA level and had the ability to work with DNA, it was not possible to apply this technology. DNA technology has been aided by many advances, such as the ability to amplify DNA and to easily ‘type’ people at highly variable regions of their chromosomes, and some discoveries that led to these advances can be traced to the early 1900s. The long time it took to acquire the necessary knowledge and technology for DNA typing is an example of which intrinsic difficulty?

(A) (B) (C) (D) (E) (one)

9. (4pts) The FAA, which oversees airline safety, has recently instituted a model of accidents (crashes) that uses data on near misses. Near misses are perhaps a poor model of crashes, but they are much more frequent than actual crashes. Airline safety has gotten to the point that there are not enough crashes to obtain adequate data on their causes. What difficulty explains why the FAA has resorted to this alternative model of crashes?

(A) (B) (C) (D) (E) (one)

Biological Determinism (BD, for short)

10. (5pts) Which of the following are true, as covered in class? MTF

- A) The essence of inheritance is that offspring resemble parents, if the environment is constant.
- B) Some states in the U.S. practiced 'eugenics' during the 1900s with policies such as forced castration.
- C) The justification of castration of 'feeble-minded' individuals on eugenics grounds requires at least a partial inherited basis of their feeble-mindedness.
- D) Eugenics in the U.S. was based heavily on and thus was borrowed from the Nazi eugenics views.
- E) It was noted in class that biological determinism in the broad sense (that a person's behavior is not due entirely to their choice) has influenced some criminal penalties issued by U.S. courts in recent years.

11. (5pts) Sexual preference in humans: which are true? MTF

- A) Themes for this topic included 'humans make difficult subjects' and 'correlation does not imply causation'
- B) Several characteristics of men differ from those of women and also show correlations with sexual preference among men. For several of these characteristics, gay men are OVERmasculinized.
- C) A correlation has been observed between male sexual preference and the frequency of sounds made by ears (otoacoustic emissions).
- D) There are few known anatomical brain differences between men and women. Those few formed the basis of looking for brain differences between gay and heterosexual men.
- E) The only evidence presented of a biological basis for sexual preference in men (that sexual preference is not merely a choice) was correlational; studies suggesting an inherited basis are lacking.

12. (4pts) LeVay's study on the brain of gay and heterosexual men: which are true? MTF

- A) This study observed a small but absolute anatomical difference between the brains of gay men and the brains of heterosexual men (there was no overlap between the two groups).
- B) All of the gay subjects had died from AIDS. However, the main result of the study held up when AIDS death was controlled for.
- C) The pattern observed suggested that gay men were under-masculinized compared to heterosexual men.
- D) In the brain shown in class, the region studied by LeVay (*known as the anterior hypothalamus*) was on the outside front of the brain.

Tragedy of the Common (ToC)

13 (4pts) Each of the following options contrasts two properties of a vaccine, disease, or population. Mark those in which the *first* property (*italicized*) is more likely to result in a ToC conflict than the second property. MTF

- A) *herd immunity is absent for the disease* / herd immunity exists
- B) *individuals avoid vaccination for selfish reasons* / individuals get vaccinated for selfish reasons
- C) *the infectious agent spreads from person to person* / the agent does not spread person-person
- D) *the vaccine does not prevent an individual from getting infected but does prevent transmission from the infected individual* / the vaccine prevents the individual from getting infected

14 (8pts) Which of the following explicitly describes aToC conflict or outcome? MTF

- A) Aquifers are underground reservoirs of water, usually in gravel and sand beds. Although the water moves slowly in horizontal directions, landowners that pump heavily from the aquifer under their lands also draw water from the part of the aquifer that underlies neighbors; over time, the draw-down can extend for miles. This means that, although water is a precious resource for every rancher/farmer, a rancher/farmer cannot hoard their share of the aquifer when neighboring properties are pumping. So ranchers have little incentive to conserve water.
- B) Ten individuals collectively own a patch of forest that contains the last population of a plant with medicinal value. The owners calculate that it is financially beneficial to harvest all remaining individuals of the plant and invest the money, rather than to maintain the population. Their calculation is based on a conservative estimate of the future value of the plant, which proves to be wrong. In future years, they realize that they would have made more money if they had maintained the population.
- C) Each of three individuals puts \$10,000 into a common bank account. The interest, a flat 3% of the total (compounded daily) is shared equally. One individual gets nervous and withdraws 1/3 of the money and removes their name from the account. Shortly thereafter, another withdraws their share (which is now half of the remaining total) and also removes their name from the account. The remaining individual is thus left with \$10,000 plus their share of the interest.
- D) Oil is an important resource in our society. We have become so used to its cheap availability that we have invested in many industries and products that rely on it. Now, as the supply is dwindling, we find the price increasing because the demand is great relative to the supply, and the companies that own the oil rights are making large profits.

Other conflict and Bias

15. (4 pts) Which of the following are true about conflict in general, not just “tragedy of the common?” Some options require distinguishing conflict from bias. MTF

- A) Factors affecting goals were listed and included all of: material gain, emotions, ego, and politics
- B) The FC video showed examples of people that had vested interests in not accepting the results of the tests; their alternative goals presumably included material gain (for Bicklen) and emotions (parents).
- C) Semmelweis was used as an example in which country politics led to the non-acceptance of his ideas.
- D) Bias usually appears in the evaluation stage of a study; conflict usually appears in the design.

16 (5 pts) The video on Facilitated Communication (FC) illustrated several examples of bias. Which are true? *The FC administrator at Syracuse University was named Doug Bicklen.* MTF

- A) Some parents interviewed supported their belief in FC with anecdotes.
- B) Bicklen claimed that no amount of failed tests (negative results) should be taken as grounds for rejecting FC. This is an example of ‘refusal to admit that a model may be wrong.’
- C) Character assassination was illustrated when one family attempted to discredit the tests of FC by looking into the criminal records of the psychologists doing the tests.
- D) Bicklen attempted to discredit the tests by claiming that the autistic children just aren’t good at word-finding.
- E) One or more of the psychologists interviewed claimed that emotional factors had led to their premature and uncritical acceptance of FC.

17. (4 pts). Which apply to "controlling the null model?" MTF

- A) Treatment groups (as opposed to control groups) are chosen to favor one particular model.
- B) The experimental design is chosen to bias the outcome of the study.
- C) "Controlling the null model" refers to a procedure in which the control group for the null model is chosen in a biased fashion, hence the word "controlling."
- D) For FDA approval of drugs and food additives, the null model of "harmful until proven safe" seems to protect consumer interests.

18 (6pts) Which of the following options describe the examples of bias used by drug companies, as mentioned in class or the book? The option should give an example that was covered and describe it correctly. MTF

- A) Comparison of drugs confounded by dose differences. Two virtually identical drugs were compared in a trial, but the old drug (whose patent had nearly run out) was used at a lower dose than the new drug (whose patent was just starting).
- B) Use of ghostwriters. At the completion of a study, people are hired to write the first draft of the article that will be published.
- C) Use of wrong age group. Trials are often conducted on patients younger than those who will be the main users of the drug.
- D) Inappropriate control. A new painkiller was compared with a control group that got no painkiller. A more appropriate control would have been a currently available painkiller. As a consequence, the new drug proved superior to no drug, but it was not possible to tell if the new drug was any better than drugs already available.
- E) Ingratiate doctors to prescribe their medicine by providing them gifts, free trips, and free lunches.
- F) Broaden the market, to sell the medicine for a much wider range of conditions than used in the trials.
- G) Publishing ads in medical journals that appear to be research articles.

19 (5pts) Bias can often be recognized from non-scientific arguments. Which in the following list were given as examples of non-scientific arguments indicative of bias? Do not include options that describe how bias is created. MTF

- A) character assassination of opponent
- B) conceal true protocol
- C) make non-random assignments
- D) build causation from correlation
- E) identify major flaws in an opponent's model
- F) use anecdotes to defend a model
- G) assay for a narrow spectrum of results
- H) appeal to authority

20 (4pts). Each of the following options lists a practice that affects the possibility of bias in a study. For which of the following options is the impact of that practice to facilitate reducing bias? If the practice would have no obvious effect on bias, do not mark it. MTF

- A). Identify and anticipate conflict of interest.
- B) Publish the raw data instead of just summaries of the data.
- C). Specify the evaluation criteria before obtaining the results rather than after obtaining results.
- D). Publish protocols at the completion of the study rather than in advance of the study.

21-24 (3pts each) Some examples of bias are given in options A-E below. Which of those apply to the following questions? **One answer only per question**

(A) assay for a narrow spectrum of unlikely results	(B) Either-or arguments	(C) Build causation from correlation	(D) Require refutation of all alternatives	(E) Heresy implies correctness	(F) None
---	-------------------------	--------------------------------------	--	--------------------------------	----------

21. *The person shown in the NOVA episode on Secrets of the Psychics during the horoscope experiment argued that he was not convinced that there was 'nothing to this' (meaning nothing to horoscopes) despite the uniformly positive response to an obviously bogus horoscope.* Which of A-F is illustrated by this defense of horoscopes? (A) (B) (C) (D) (E) (F) (one only)

22. In an attempt to show that a gambling house is biased against the customer, a lawyer neglects to count many of the customers that have net winnings. (A) (B) (C) (D) (E) (F) (one only)

23. A lawyer in a suit against the British government argues that nuclear power plants are causing cancers in nearby residents because they have higher incidences of cancer than the population at large. (A) (B) (C) (D) (E) (F) (one only)

24. Many creationists argue that, if weaknesses exist in modern theories of evolution, their view must be correct that life was created by an Intelligent Designer. (A) (B) (C) (D) (E) (F) (one only)

25 (4pts). Which are true, as given in the economics of drug development lecture (Monday)? MTF

- A) Cancer treatments/drugs are most often developed for slow-growing tumors (rather than fast-growing ones) because there is more time to measure a response before the patient dies.
- B) It was suggested that new technologies will soon provide drugs for all sorts of diseases (including uncommon ones that have not received much attention). The rate-limiting step in the drug-to-market pipeline has been the research to create the array of compounds needed for testing.
- C) Drug companies pursue only those drugs with patent protection.
- D) Major side effects of a drug have caused its withdrawal from the market, even when the side-effect rate was as low as 1 per 10,000.