Name: [redacted] Date: _____ Period: _____

## STUDENT SHEET 1.1: **Conducting Research on Smoking Behavior**

1. How did the scientists in the interviews become interested in science and research?
   ~~Se~~ Theresa got interested is science b/c she read forensics books when she was young. That got her interested in it.
   Joel wanted to go out there in the world, not just work with computers.

2. What personal connections do these scientists have with their work?
   Theresa had personal connection with their work because she believes that the minority ~~are~~ is very important in her research. Joel had personal connection with his work b/c he wanted to work outside of just computers.

3. Using your experience and any information from the interviews, describe what you think happens in science. What do scientists do? How do they do experiments? Where do scientists do science? In science, people make hypothesis on how the body works, the psycology of animals & how things work in general. They do tests on those & they keep trying to answer the questions that come up. They do experiments
   They do science in a lab

4. How are the ways that these scientists do work similar or different from how you do science in school or at home?
   They use computers so gaps & tests & data of the topic or question will be
   - produce more data.
   - Gather information & synthesize ~~it~~ thoughts of investigation

5. What are some ways that you see science being applied in your everyday life?
   Science can be applied to my own every day life by studying how parents interact with their children. Also, by seeing how certain factors effect someones grades.

6. How do scientists work together to solve problems and answer new questions?
   They answer these questions by forming experiments to form new hypothesis so they know whether or not its valid. Its very collaborative ~~wor~~ & ~~peo~~ scientists have to get information & how you get that experiment to work.

7. What surprised you about these scientists? About the kinds of science they talk about?
   H surprised me that ~~undergrads actually help out scientists~~ people actually do the same things or work with the same topic, & you'll have to figure out who's actually doing that so ~~they~~ you won't waste your time trying to figure it out for yourself.

Name: [redacted] Date: [redacted] Period: [redacted]

STUDENT SHEET 2.1: **Why do some people become smokers and others do not?**

As you read and discuss the smoker profiles, answer these questions.

1. What patterns do you see across the profiles? Did people start smoking around the same age? When? What other similar do things you notice?
   some people do it to be cool, some people do it because they feeled pressure; ~~but~~ some started around age 14-16 but they could start at age 25.
2. What factors influence people:
   a. to begin smoking?
   Francis Doesnt Recall.
   - relax
   - death in family
   - to be cool
   - to ~~eat~~ be calm
   - peer pressure
   - family
   - society - cool factor
   - didnt know bett
   health issues
   - ~~relax~~ stress from s
   b. to continue smoking after they have started?
   addiction, couldnt quit, use cigarets to help headaches.
   - warm
   - comforting
   - buzz
   - withdraul
   - cool & sexy
   - not afraid of risks
   - irritability
   - loss of focus.
   - hunger
   - feel good
   - crav
3. Why do they have difficulty quitting?
   - No point since the person is too old & ~~is~~ has emphysema
   - Addicted
   - Discomfort hurt them.
4. What other information might you want to know from these people?
   - Why didnt you feel pressured?
   - What different types of ways did you try to quit?
5. What aspects, factors related to smoking behavior would you want to investigate further?
   - if they dont smoke, what happens to their psycological being?
   - calming in the mind or the body?
6. What statements or claims can you make that address the question: "Why do some people become smokers and others do not?" Provide evidence from the profiles for those claims. For example, someone who has a parent who smokes is more likely to be a smoker. Someone who ~~has~~ is old & has health problem is more likely t
   Some people become smokers because they feel more calm and it seems like for some people ~~that~~ like Frances that theres no sense quitting because she's been ~~gone~~ smoking for so long that she might as well just stick with ~~it~~ it.

Name: [redacted] Date: [redacted] Period: [redacted]

STUDENT SHEET 2.2 **Observations about smoking behavior**

## WHY PEOPLE START SMOKING

- cool
- relax G
- stress
- family E
- peer pressure E
- family did it E
- all friends did it E
- media E
- curious E
- didnt know bad E

## WHY PEOPLE CONTINUE TO SMOKE AFTER TRYING IT

- cool & sexy E
- withdrawl G
- craving G
- feels good G
- not afraid of risks E
- buzz G
- pleasurable G
- hunger G
- easy to get E
- addiction
- peer pressure
- warm & comforting G

Public Policy or Media
Physiological
Family

## WHY PEOPLE HAVE DIFFICULTY QUITTING SMOKING

- consumed thoughts
- attracted E
- die anyway E
- peer pressure E
- habit G
- liked it G
- surrounded E

## RELATED TERMS

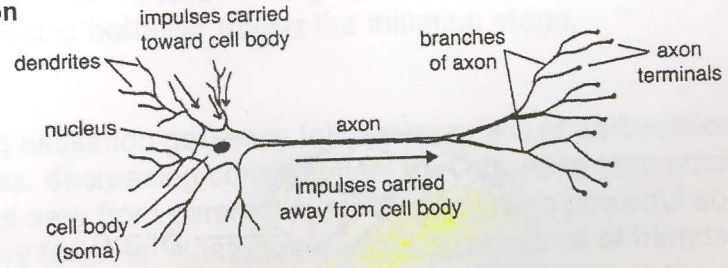
Multifactorial - influenced by genetics & environment.

Name:_____ Date: _____ Period: _____

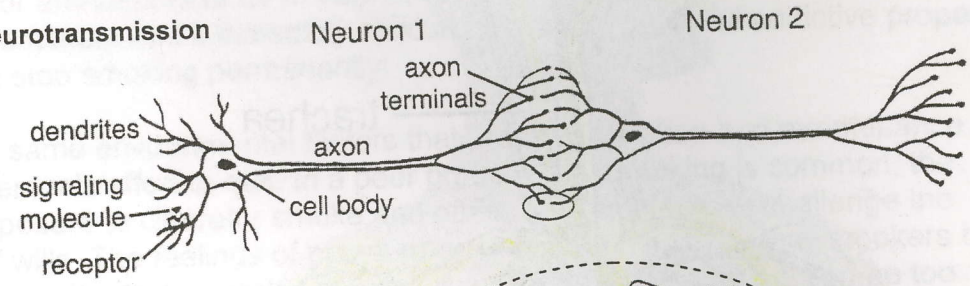
STUDENT SHEET 3.2: **Neurons, Neurotransmission, and the Giant Neuron**

During the class discussion of neurons and neurotransmission, take notes on diagrams a, b and c. Then label the parts of the giant neuron in part d.

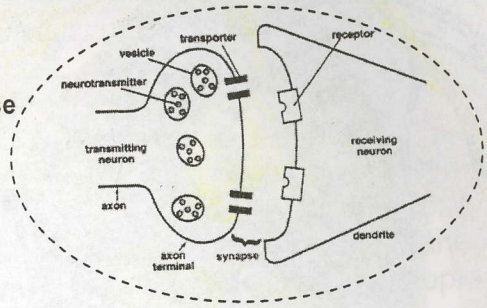
**a. A typical neuron**



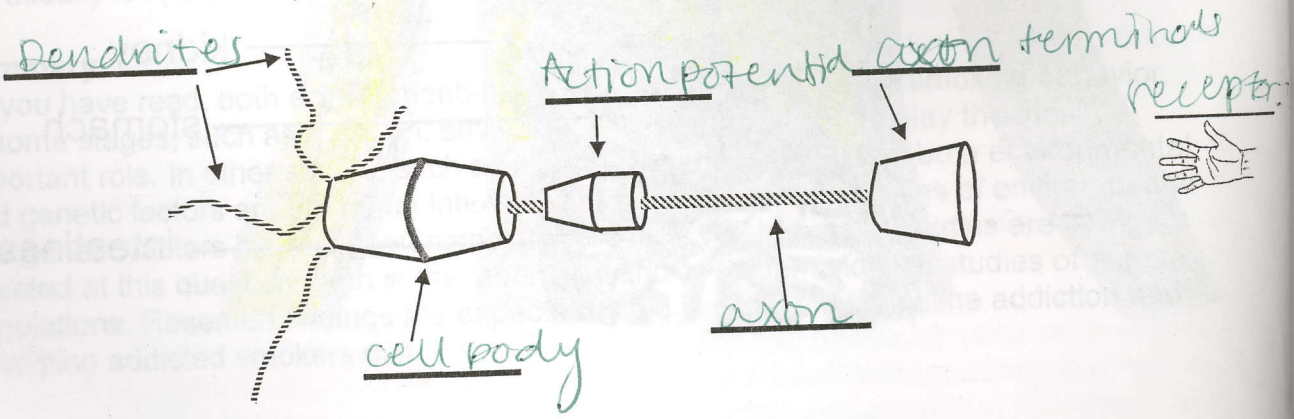

**b. Neurotransmission**




**c. Close-up of neural synapse**




**d. Sketch of the giant neuron**



Name:_____ Date: _____ Period: _____

STUDENT SHEET 3.3: **Genetic Exposures in the Smoking Behavior Study**

As a class, look at Question 103 in the Hypothesis Testing view of the smoking behavior database. Under "3. Identify answers corresponding to your exposure," there is a list of four possible answers for the C957T region of the *DRD2* gene. Work with your class to answer the questions below.

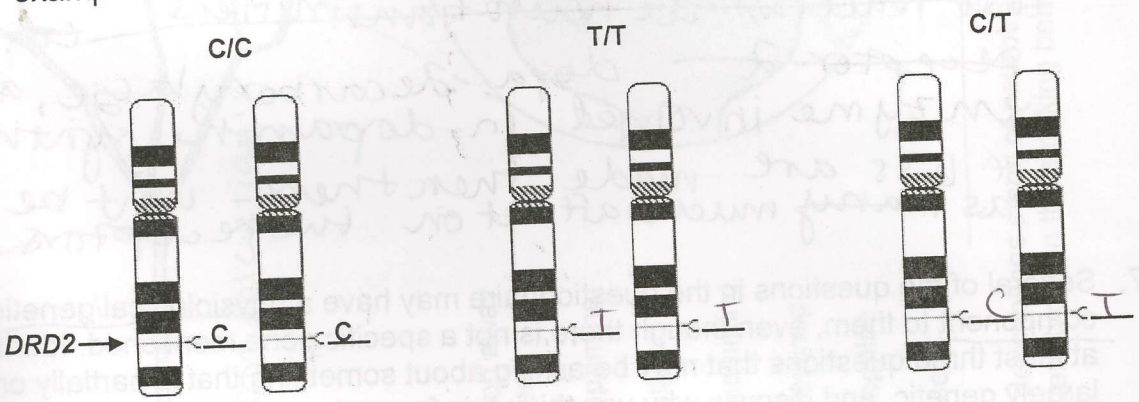
1. How many possible genotypes (combinations of genes) are there for this gene region?

   3

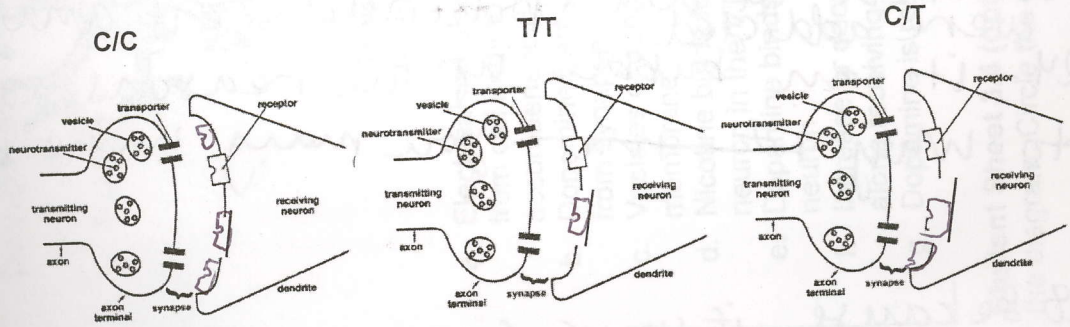
2. Why does each genotype have two letters associated with it (C/C, T/T, C/T)?

   Because 1 comes from the mom & the other comes from the dad

3. *DRD2* is on the long arm of chromosome 11, shown by the arrow at the left in the figure below. Draw the genotypes on the chromosome pairs, as shown in the example at the left. Why are there two chromosomes for each genotype?




4. *DRD2* codes for the dopamine receptor. The T allele of the C957T gene region results in fewer receptors than the C allele. Draw the number of receptors you expect for each genotype in the diagrams below. One receptor is shown in each figure.



STUDENT SHEET 3.3, Continued

5. You just learned that the *DRD2* gene codes for the dopamine receptor. What is the function of this protein? How might making less of this protein (compared to "normal") affect a person's smoking behavior? (Hint: Think about the giant neuron and the effect of nicotine on dopamine release).

The function of this protein is that it codes for the proteins receptors that react w/ the neurotransmitters.

the affect ~~a person~~ this would have is the more receptors, there will be more of a reaction. If there were less, the effects would not be as significant

6. What protein does the *DDC* gene code for? What is the function of this protein? How might making less of this protein (compared to "normal") affect a person's smoking behavior?

these genes code for the ~~proteins the receptors that react w/ the neuro transmitters to dopamine receptor 2~~ dopa decarboxylase, an enzyme involved in dopamine synthesis. If less are made then there won't be as ~~many~~ much affect on the receptors

7. Several of the questions in the questionnaire may have a physiological/genetic component to them, even though there is not a specific gene mentioned. Identify at least three questions that may be asking about something that is partially or largely genetic, and discuss why you think this for each question.

Q26 – You can see if your parents may or may not have smoked at all if one or both or none of your parents smoked at all you could see if any of them were addicted.

Q24 – it can bubble up the reasons as to why ~~it was~~ you may have been

Q28 because if your siblings have a certain genotype & is addicted but you aren't & you quit, that can show that your parents might have had different genotypes.



STUDENT PAGES – Lesson 3

Name:_____ Date:_____ Period:_____

STUDENT SHEET 4.2. **Comparing Experimental Studies and Case Control Studies**

Use the information in each of the two research studies described below to complete the blanks in Table 4.1.

**Scenario**

The Beta Fraternity House held a party on Friday night. By 4 pm on Saturday afternoon, 17 people who had been at the party had called Doug, the frat house manager, complaining of headaches and severe nausea. None of the frat brothers who were absent from the party reported feeling sick. What should Doug do to figure out what was making people sick?

Research Study 1 (case control study): Doug reported the outbreak to Student Health Services. The public health team there designed a case control study to try to find out what had made the students sick. Their study design consisted of giving a questionnaire and a health exam to as many students as they could locate who had been to the party, including those who got sick and those who didn't. Both groups of students in the study—those that got sick and those that didn't—included males and females in the age range of 18 to 22. The questionnaire asked students about what foods they had eaten, what beverages they had consumed, and how much alcohol they drank. It also asked them to list the people they had been in contact with during the party. During the health exam, the nurse measured the students' temperature, blood pressure, and other vital signs, as well as asking them how they felt. The students who took the questionnaire were asked to report back to Student Health Services one week after the party for a follow-up health exam. Results from the study were analyzed to see whether there were any differences between the students who got sick and those who didn't. They learned that 95% of the students who were sick had hugged and kissed Sally, who had just returned from a long trip. Sally did not feel good at the party, but she was excited about seeing her friends so went to it anyway.

Research Study 2 (experimental study): People stricken with the "Beta Bash" sickness were severely ill for 5-8 days, and many developed a rash. Public health researchers determined that all of the sick students had hugged and kissed Sally, who had just returned from doing research on desert mice in New Mexico. They hypothesized that Sally had contracted a viral or bacterial infection from the mice she was studying. To test whether the infectious agent could also make mice sick, they injected 20 Strain X lab mice with Sally's saliva. Another group of 20 mice were injected with saliva from a student who did not get the sickness. The two groups of mice were cared for in separate facilities and observed for the next four weeks. Researchers monitored the two groups of mice to see whether they got sick or died. Of the 20 mice injected with Sally's saliva, 17 were weak and lost weight, and three died. All of the control mice injected with saliva from the healthy student remained healthy through the study.

Table 4.1. Experimental study vs. case control study. Answer the questions in the table.

| | **Case Control study** (students) | **Experimental study** (mice) |
|---|---|---|
| **Kind of Study** | Observational, retrospective (looking backward in time) | Experimental, prospective (looking forward in time) |
| **Experimental design** | Participants already have the condition or outcome being studied. The research looks backward in time to identify factors that might have caused that condition. | Participants are assigned to a treatment (the manipulated variable) and followed to see if they develop the condition or outcome. |
| **Variables** | The two groups of subjects are **matched** so that they are the same in as many features as possible.<br>***How are the subjects matched?***<br>those in the frat who got sick & those in the frat who didnt | **Controlled variables** are the variables that are kept the same among all samples or subjects strain X lab mice<br>***What are the controlled variables?***<br>Mice injected by ~~mice~~ saliva from students who didnt get sickness |
| | The **exposure** is a factor observed by researcher to be different between the two groups of subjects.<br>***What are the exposures?***<br>Food<br>Drinks<br>Air-components<br>contact | The **manipulated (independent) variable** is the factor that is deliberately changed by the researcher. source of saliva<br>***What is the manipulated variable?***<br>Mice injected by saliva from ~~students~~ who dt dnt get ~~sickness~~ sally |
| | The **outcome** is the factor that defines how the two groups of subjects differ and is chosen by the researcher at the start of the study.<br>***What is the outcome?***<br>Those who hugged/kissed sally got sick. | The **responding (dependent) variable** is the factor that changes in response to the manipulated variable and is measured by the researcher.<br>***What is the responding variable?***<br>Death ~~of~~ & weakness of ~~it~~ mice |
| **What experiment shows** | The exposure is associated with the outcome.<br>***Were any of the exposures associated with outcome in Study 1?***<br>yes, contact to sally. | The manipulated variable causes the responding variable.<br>***Did the manipulated variable cause the responding variable in Study 2?***<br>Yes<br>~~Sallys~~ sitar infected saliva |

Name:_____ Date:_____ Period:_____

STUDENT SHEET 5.1. **2x2 Table and the Car Passenger Case Control Study**

**The contribution of passengers to car accidents—a case control study (2007)**

Whether the presence of passengers in an automobile contributes to car accidents is an important safety issue and has implication for public policy and law. A study conducted in Perth, Western Australia in 2003-2004 assessed the contribution of passengers to accidents resulting in non-fatal injuries. The presence of passengers in cars involved in injury-causing accidents and cars not involved in accidents were compared. The study included drivers aged 17 and older. Controls were matched to cases by location (recruited from nearby service stations), time of day, day of the week, and road and driving conditions.

Among 274 drivers having injury car accidents, 73 had one or more passengers in the car. The control group consisted of 1096 drivers not involved in car accidents, and among these drivers, 190 had one or more passengers in the car.

1. Fill out the Case Control Study Design form below for the car passenger study

**Case Control Study Design**

**Research Question:** Did the # of ppl in cars made car accidents more likely?

**Outcome:** Passenger accidents w/ injury of car accidents

**Exposure:** # of people, age, time of day, day of week, road/driving conditions

**Study Population:** Drivers age 17 or older in ~~a~~ Perth Western Australia.

**Study Size:** ~~1370 drivers that had injury/not involved.~~ 1370 people who are involved.

**Cases:** those involved in car accidents that had an ~~accident.~~ injury. ← exposed to exposure

**Controls:** Not involved in car accidents

STUDENT SHEET 5.1: **Car Passenger Case Control Study *(continued)***

2. On the table below, label who the cases were and who the controls were.

3. What is the exposure (the factor you think may have caused the outcome)? Label the "Exposed" and "Not Exposed" rows.

4. Fill in the shaded boxes with the appropriate numbers from the study.

| | **Cases** 274 involved in car accidents | **Controls** 1096 Not injured car drivers in accidents |
|---|---|---|
| **Exposed** 1+ Passenger | 73 | 190 |
| **Not Exposed** No passenger | 201 | 906 |
| Total | 274 | 1096 |

5. What are the odds that a **case** was carrying 1 or more passengers? Show your work. Remember that odds is:

number of times an event occurs (i.e. cases were carrying 1 or more passengers)
number of times an event does not occur (i.e. cases were not carrying passengers)

$= \frac{73}{201} = 36.32\%$

6. What are the odds that a **control** was carrying 1 or more passengers? Show your work. Remember that odds is:

number of times an event occurs (i.e. controls were carrying 1 or more passengers)
number of times that event does not occur (i.e. controls were not carrying passengers)

$= \frac{109}{906} = 20.97\%$

favorable outcomes / unfavorable outcomes  1/3  10/30



7. The odds ratio (OR) is a comparison between two ratios. What is the odds ratio for this study? Show your work.

OR = Odds the cases have the exposure (odds that cases were carrying 1 or more passengers)
Odds the controls have the exposure (odds that controls were carrying 1 or more passengers)

= 73 / 109

$\frac{(73/201)}{(109/906)} = \frac{36.32\%}{20.97\%} = 1.73\times$ case are more likely to have been exposed than controls.

8. What does the odds ratio tell us? Use the language in the following statement to say what your odds ratio means.

*If the odds ratio is X, then cases are X times more likely to be exposed than controls.*

$\frac{(73/201)}{(109/906)}$ cases are 1.73 times more likely to be exposed than controls.

9. What would an odds ratio of 1 tell you?

The odds ratio of 1 tell you of how many cases would be ~~to the~~ more exposed than controls depending on the # of controls who

10. What laws or public policies can you think of that may have been influenced by studies like this one?

Yes, drivers ed can influence the amount of people who are ~~driving~~ in accidents.

Name:_____ Date:_____ Period:_____

STUDENT SHEET 5.4. **A Real Case Control Study**

**Smoking and Lung Cancer. A case control study by Doll & Hill (1950)**

The occurrence of lung cancer increased rapidly in the first half of the twentieth century. Why? There were several ideas. During this period, in western nations, manufactured cigarettes were plentiful and easy to obtain. Could increased smoking account for the increase in lung cancer cases? A classic case control study carried out in 1947 by English epidemiologists Sir Richard Doll and Tony Bradford Hill examined the relationship between smoking and lung cancer. Doll and Hill compared the smoking habits of hospitalized London lung cancer patients to the smoking habits of patients hospitalized for other causes. All the patients were men and under the age of 75. Here are their results:

| | **Cases** (lung cancer) | **Controls** (no lung cancer) |
|---|---|---|
| Cigarette Smokers | 1350 | 1296 |
| Non-smokers | 7 | 61 |
| Total | 1357 | 1357 |

1. Fill out the Case Control Study Design below for Doll and Hill's study.

**Case Control Study Design**

**Research Question:** Could increased smoking account for increase in lung cancer cases?

**Outcome:** Lung cancer

**Exposure:** increased smoking

**Study Population:** Hospitalized lung cancer patients vs hospitalized for another cause for 1947 who are men & are less than 75 yrs of age

**Study Size:** 2714

**Cases:** those w/ lung cancer

**Controls:** those w/o lung cancer

2. Using the data provided for this study, calculate the percentage of cases who smoked and the percentage of controls who smoked.

% cases who smoked $\frac{1350}{2714} = 49.74\%$

% control who smoked $\frac{1296}{2714} = 47.75\%$

3. What can you conclude from these percentages and from comparing them?

That almost about the same amount of people ~~have~~ smoke either have ~~lung~~ or dont have lung cancer.

4. What are the odds that a case will be a smoker?

$\frac{1350}{7} = 192.86$

5. What are the odds that a control will be a smoker?

$\frac{1296}{61} = 21.25$

6. What is the odds ratio for this study? Show your work.

$\frac{192.86}{21.25}$ 9.08

7. What does this odds ratio tell you about smoking and lung cancer? Give evidence from your calculations to support your answer.

This ratio of $\frac{(1350/7)}{(1296/61)}$ tells

Then cases are 9.08 X more likely to be exposed than controls because ~~although~~ a lot more controls who dont smoke dont have lung cancer.

**Original Reference**

Doll, R. & Hill, A. B. (1950) Smoking and carcinoma of the lung: preliminary report. British Medical Journal 221, 739-748.

**Supplementary References**

http://www.nature.com/milestones/milecancer/full/milecancer08.html

***Nature Milestones Cancer. Milestone 8. 1950 Smoking and Cancer: Smoking gun. by Ezzie Hutchinson, 2006.***

***CDC Excite curriculum on Cigarette Smoking and Lung Cancer***

***http://www.cdc.gov/excite/classroom/smoking_q.pdf***

***In depth exploration of Doll and Hill's classic case control and cohort studies on smoking and lung cancer.***

HW

STUDENT SHEET 5.6, Continued

**Test Your Knowledge**
Which of the following, made-up studies is an example of each type of error?

| Type of error | Study number |
|---|---|
| a. Random error | 1 |
| b. Selection bias | 4 |
| c. Information bias | 2 |
| d. Confounding | 3 |

**Study 1:** Sam hypothesized that smokers are more likely to have believed they could not become addicted to cigarettes during their experimental smoking phase. Therefore, Sam performed an odds ratio calculation from the smoking behavior database for Question 20: During your experimental smoking phase, did you believe that you could become addicted to cigarettes? Sam found that smokers were 1.23 times more likely to not believe they could become addicted compared to non-smokers. However, the 95% confidence interval (0.76 to 1.98) contains the number one, which means that there is not an association between believing you could become addicted to cigarettes and becoming a regular smoker.

**Study 2:** In a study of chronic back pain, cases were 2.5 times more likely than controls to recall having over-exerted themselves lifting heavy objects in the past 10 years.

**Study 3:** A recent study suggested that people who are overweight are less likely to attend college than people who are in the "normal" weight range. However, when the data were stratified for family income (high, average, and low), there was no observable association between being overweight and not attending college.

**Study 4:** Several participants mentioned that they learned about the study and the $30 gift card at the homeless shelter they frequented. This group was almost entirely smokers, and they tended to be older compared to control participants. On the other hand, several study subjects expressed delight that they could contribute to a study that involved high school students in doing research on why people smoke. In general, this population tended to be younger and was much more likely to be non-smokers. Based on these facts, what bias could occur in question 83: How well off is your current family/household?

## Student Sheet 7.1. Using Hypothesis Generation to Explore Data

**Directions**
Work as a class to complete this activity, which models how to explore the data using Question 12.

1. Your teacher will project the database and select "Preview a project." http://www.sciencemathpartnerships.net/webapp/index.html
2. Watch as your teacher selects Step 1.4 Hypothesis Generation, and then Question 12, "How old were you when you first tried a cigarette, even a single puff?"
3. Notice that in this view, you can see the number of cases and controls who gave each response to the question as both a table and a graph.
4. As a class, decide which responses you will use to define exposed and not-exposed. Select them, choose "Everyone" for the study population, and then "Get odds ratio."
5. In Query 1 below, write the responses you used for exposed and not-exposed, and fill in the 2x2 table, the odds ratio, the 95% confidence interval, and the sample size.
6. In Query 2, use different responses to define exposed and not-exposed, and again use "Everyone" for study population. Select "Get odds ratio." Hint: think about how to get a higher odds ratio.
7. In Query 3, use the same responses to define exposed and not-exposed as you used in Query 2, but select Male or Female for the study population.

**Query 1**

Exposed: Responses to question 12 18+ and description in words: Able to Buy cigarets ≥18

Not exposed: Responses to question 12 18- and description: Not legal to buy cigarets.

Study population = Everyone

| | Cases | Controls |
|---|---|---|
| ***Exposed*** | a= 19 | b= 39 |
| ***Not Exposed*** | c= 139 | d= 100 |

Odds Ratio $\frac{(19/139)}{(35/100)}$ = 0.39

95% confidence interval 0.21, 0.72

Sample size 293

**Query 2**

Exposed: Responses to question 12 16+ and description in words:

If they're able to have a license

Not exposed: Responses to question 12 16− and description:

Not able to have license.

Study population = Everyone

| | Cases | Controls |
|---|---|---|
| ***Exposed*** | a= 38 | b= 59 |
| ***Not Exposed*** | c= 120 | d= 76 |

Odds Ratio 0.41 (38/120)/(59/76)

95% confidence interval [0.25, 0.68]

Sample size 293

**Query 3**

Exposed: Responses to question 12 11+ and description in words:

Those who've had reached age of menstration

Not exposed: Responses to question 12 11− and description:

those who've not reached age of menstration

Study population = Males or Females

| | Cases | Controls |
|---|---|---|
| ***Exposed*** | a= 64 | b= 58 |
| ***Not Exposed*** | c= 7 | d= 4 |

Odds Ratio 0.63 (64/7)/(58/4)

95% confidence interval [0.18, 2.26]

Sample size 133

Questions

1. Comparing Queries 1 and 2, what changes in odds ratio and 95% confidence interval do you notice as the way you defined exposed and not-exposed and thus the numbers in the four cells of the 2x2 table change?

both in the same range the changes in odd ratio is that they're wide spread range nowhere the B is more exposed These affect can't be completely depended on bycause they are do not directly affect the chemical makings of the human.

2. Comparing Queries 2 and 3, how does changing the study population affect the odds ratio and 95% confidence interval?

The study population drops by half & it affects the odds ratio because for 2 it gets higher & the confidence interval gets wider.