Name _____
Date _____Per _____

# Student Handout:
# Activity #2 Question Set
# (The Structure & Function of GeneChip Microarrays)

**Directions**: The following questions go with Activity #2 reading on the structure and function of GeneChip microarrays. Answer each question as thoroughly and detailed as possible.

## Part I – Intro, and Gene Expression Microarrays

(1) What is gene expression? What can affect gene expression?

(2) Are all genes expressed in all cells? Explain why or why not. How do scientists study gene expression?

(3) What would researchers have to do in order to make a hypothesis about gene expression in the past, before the use of the microarrays? What can they know do with the use of microarrays?

(4) How many genes are found in the human genome according to the latest studies?

(5) Write the complementary (opposite match) DNA strand to AGGCTAGAC.

(6) What is the term for the short piece of DNA bound to the glass chip? How many base pairs long is this piece of DNA? What does it represent?

(7) Why does the probe not have to represent the entire gene? What does the binding of the RNA to the probe show?

(8) What is hybridization? How is the process of hybridization used by microarrays?

(9) How specific and accurate is the detection of microarrays?

(10) Describe the surface of the microarray chip. Be sure to include the dimensions of the entire array and a single feature. Also discuss the probes in each feature.

(11) What are the first few steps done when using a Gene Expression microarray?

(12) What is the purpose of the biotin and the fluorescent molecules? What happens when the RNA sample is washed over the microarray?

(13) How can you tell if the sample matches a probe? What if it doesn't?

(14) How can you tell if the gene was highly expressed?

(15) How can a Gene Expression microarray be used to determine which genes are taking part in the disease or trait being studied? What can scientists do once they have identified the specific genes responsible?

(16) Using heat map results, how could a scientist classify a disease based on genetics? What advantage does that give the researchers?

(17) In the black and white gene expression image, what colors represent a strong intensity? What does that tell you about the gene expression level of the gene the feature represents? In a colors display image, what gene expression level does each color indicate?

(18) Before developing a treatment, what must a scientist who has identified a disease pathway do? How can Gene Expression microarrays be used for this?

(19) How could Gene Expression microarrays be used to find a successful drug? What else can microarrays tell scientists about the affects of the drug?

(20) What is personalized medicine? How can these microarrays be used for this?

**Part II – The GeneChip Genotype Microarray for SNPs**

(21) Define genotype. Explain what a person's genotype is and give an example.

(22) What is a SNP? Explain.

(23) How can genotyping SNPs be used to find a disease gene?

(24) Why won't a DNA with the sequence ATCATG bind to DNA with the sequence TATGAC?

(25) How does knowing the sequence of one DNA strand help you to determine the SNP genotype the person has? How are probes built to find this out?

(26) How many SNPs are on the newest Genotyping arrays?

(27) Where is the SNP found on the 25 base long probe?

(28) Once the probes and the microarray are made, what is the first step to genotyping a sample with a genotyping array? How is this different from the use of gene expression arrays?

(29) What are the rest of the steps to get a DNA sample ready for genotype analysis?

(30) Why does a sample that binds to an ATTCATG probe have the C/G genotype?

(31) Explain the difference between someone heterozygous for a genotype versus someone who is homozygous for a genotype. Which is implicated in causing more diseases? Why?

**Part III – GeneChip Resequencing Microarrays**

(32) Why is this array known as a "resequencing" array? Give an example.

(33) What are some of the uses of the GeneChip Resequencing microarray?

(34) How many probes are used to determine each base in a DNA sequence?

(35) How many bases make up each probe? Which one is the variable base that is used to determine the base at the specific spot in the sequence? Draw a simple diagram that illustrates this and explains how a probe set can detect the base at a specific spot.

(36) If a hybridization occurs at a probe with C as its' variable base, why is the actual DNA base read as a G?

(37) Draw a simplified GeneChip Resequencing microarray readout for the following sequence: ATGCCTAAGTCT