

# *GeneChip Microarrays*

## Glossary

1. **adenine** – one of four nitrogen bases that make up the code of DNA; binds to thymine along the center of the DNA; normally abbreviated with the letter A
2. **base** – the basic term for the four nitrogen bases of DNA (A,T,C, and G) that hold the code of life for a cell; found pointing inwards in the DNA molecule
3. **biotin** – a organic molecule used to help label the DNA target during experiments using microarrays; aids in binding the fluorescent molecule used to visualize where the target DNA bound to the microarray probes
4. **cytosine** – one of four nitrogen bases that make up the code of DNA; binds to guanine along the center of the DNA; normally abbreviated with the letter C
5. **deletion** – mutation that involves the removal of one or more bases or segments of the DNA sequence; normally has a large, mostly detrimental affect on the gene where the deletion occurred and the protein it codes for
6. **deoxyribonucleic acid (DNA)** – holds the code of life for all organisms by directing protein synthesis within cells; the macromolecule that holds the code for all proteins that organize and run a cell; primarily made of a code of A, T, C, and G
7. **double helix** – the 3D structure of DNA; two long chains of nucleotide molecules that spiral around each other with the nitrogen bases pointing towards the center; sometimes known as a twisted ladder
8. **DNA sequence** – basic term for the sequence of A's, T's, C's, and G's along a DNA strand; the sequence of the bases is what ultimately contains the code for all the proteins coded for by the DNA
9. **feature** – the single segments or squares that make up the microarrays; some microarrays are made of 1.3 million features as small as 11 micrometers by 11 micrometers; each feature contains thousands of the exact same DNA probes within the square and is designed to look for only one type of DNA or RNA target in the sample
10. **fluorescent** – the release of energy from molecules in the form of a light or glow; used to help track results when using microarrays; when a feature glows this indicates that a target has bound to the probes on that feature

11. **gene** – a segment of DNA that holds the code for a particular protein; a gene can vary in size from 300 to 100,000's bases in length
12. **gene expression** – when a gene directs the production of the protein it codes for, the gene has been “expressed” ; the synthesis of protein coded for by a gene; gene expression is highly regulated within a cell
13. **gene expression microarray** – one of the three types of GeneChip microarrays; monitors the expression level of genes by measuring the amount of specific RNA found in a cell; can tell if a gene is “off” or “on” within a cell and how active the “on” genes are
14. **GeneChip microarray** – a device used to test various genetic aspects of a cell or test for the presence of a specific DNA in a sample; three main types exist – gene expression, resequencing, and genotyping; used in many different types of genetic experiments from looking at genetic variations associated to a disease to discovering new drug targets
15. **genome** - general term used to describe the entire collection of genes and that an organisms has
16. **genotype** – the specific combination of forms of a gene or genes that an organisms contains in their DNA; the specific genetic makeup of an organisms that determines the physical (phenotype) traits – for example a person may have brown eyes by receiving the blue eyed gene from mom and the brown eyed gene from dad; usually shown as the symbols AA, AB, or BB
17. **genotyping microarray** – one of the three types of GeneChip microarrays; tests for the genotype an organism or cell has for a specific gene; can be used to test for the combination of single nucleotide polymorphisms (SNP) that an organism contains in their DNA
18. **guanine** – one of four nitrogen bases that make up the code of DNA; binds to cytosine along the center of the DNA; normally abbreviated with the letter G
19. **heat map** – term used for a type of graphical display that compares the results of a GeneChip microarray experiment of different samples; for example, a gene expression heat map may compare the gene expression patterns and levels of a number of genes involved in cancer from tumors from different people
20. **heterozygous** – the type of genotype that occurs when an organism receives two different versions of a gene or segment of DNA from each parent; in the basic symbols, AB would be considered heterozygous

- 21. homozygous** – the type of genotype that occurs when an organism receives the exact same version of a gene or segment of DNA from both parents; in basic symbols, AA and BB would be considered homozygous
- 22. Human Genome Project (HGP)** - begun in 1990, the U.S. Human Genome Project was 13-year effort coordinated by the Department of Energy and the National Institutes of Health. The goals of the project were to identify all the approximately 30,000 genes in human DNA, determine the sequences of the 3 billion chemical base pairs that make up human DNA, store this information in databases, improve tools for data analysis, transfer related technologies to the private sector, and address the ethical, legal, and social issues (ELSI) that may arise from the project; information gathered by the HGP has greatly improved and increased the use of GeneChip microarrays
- 23. hybridization** – the attraction between two nitrogen bases of DNA; A only hybridizes to T and C only hybridizes to G; no other combinations occur, making the coming together of two DNA strands very precise; hybridization between these bases allows the GeneChip microarray to work as it makes sure a specific probe will only bind to a specific target in the sample
- 24. insertion** – DNA mutation where an extra single base or section of bases is added into the DNA; this may occur in the non-coding areas of the DNA or inside of a gene; insertions that occur in genes have an extreme negative affect on the final protein it codes for
- 25. melanin** – protein produced by skin cells that adds pigmentation to the skin and protects the skin from damaging rays of the sun; darker skin has more melanin; the body produces more melanin when exposed to more sun than normal
- 26. mutation** – general term for any change to the DNA base sequence; different types of mutations include deletion, insertion, and point mutation (the change of a single base in the DNA); if the mutation occurs in a gene it can change the final protein that the gene codes for
- 27. phenotype** – the physical result of the combination of genes (genotype) an organism has; a genotype results in the phenotype – for example, a person may receive the blue eyed gene from mom and the brown eyed gene from dad, resulting in brown eyes
- 28. polymerase chain reaction (PCR)** – process that uses the manipulation of heat and the use of enzymes to build and amplifies a specific region or section of DNA
- 29. probe** – in GeneChip microarrays, the probes are small single-stranded pieces of DNA that are bound to the small sections of the chip known as features;

each feature contains thousands of the same probe; probes are used to detect for a specific target sequence in the sample

- 30. protein** – type of organic molecule made of a long folded chain of subunits known as amino acids; has multiple functions in the cell such as controlling specific reactions in the cell (enzymes), acting as structural components of the cell (cytoskeleton), and serving as communication molecules (hormones) of the cell.
- 31. resequencing microarray** – one of three types of GeneChip microarrays that functions to sequence unknown pieces of DNA in a sample; used to check for the presence of specific DNA in a sample as well as look for specific changes in the DNA (mutations)
- 32. restriction enzyme** – enzymes that function to cut up DNA into smaller pieces by breaking the DNA backbone at specific areas; can be used to fragment DNA and splice pieces back together to make recombinant DNA molecules
- 33. ribonucleic acid (RNA)** – secondary type of nucleic acid that functions as an intermediate molecule in protein synthesis; structurally, very similar to DNA except that instead of having a Thymine as one of the four bases, it has the base Uracil and is normally single stranded; three types of RNA exist: mRNA, which is a messenger molecule used to take the code out of the nucleus where it can guide the building of a protein, tRNA, which acts as a transfer agent, bringing in the amino acids used to build the protein, and rRNA, which is the site of protein synthesis
- 34. single nucleotide polymorphisms (SNP)** – DNA sequence variation of a single base pair at the exact same part of the DNA; difference of a single base pair when comparing two portions of the DNA; can be used as markers with certain disease genes or when making DNA comparisons
- 35. tagged RNA (or DNA)** – when using GeneChip microarrays to study the genomes of a cell or entire organism, the DNA or RNA in the sample must be chemically or tagged before it is applied to the chip; by tagging the DNA or RNA, it allows the scanner to pick up and visualize the areas of the chip where the DNA in the sample has hybridized with the DNA of the probes on the chip
- 36. target** – term for the DNA in the sample that is added to the GeneChip microarray and may or may not bind to the probes on the chip; called the target because it is being “targeted” by these probes
- 37. transcription** - first step in the synthesis of a protein where the code in the DNA is used to build a mRNA molecule which will take the code from the

DNA in the nucleus outside to the ribosome where it will be used for the second step (translation)

**38. translation** – second step in protein synthesis that occurs at the ribosome in the cell's cytoplasm; basically, is the process of using the mRNA to guide the building of a specific protein by determining which specific amino acid added to the growing strand or protein

**39. wash** – term used to describe the step when using GeneChip microarrays that involves adding a solution to the actual chip; “washing” means to bathe the chip in a solution, with the idea that the molecules in the solution will stick to the chip in some fashion