Chromosome Abnormalities
Moderator: Angela E. Lin, Harvard Medical School, and MassGeneral Hospital for Children, Boston, MA

Chromosomes and Microarrays: Deciphering the Results
Angela Scheuerle, Tesserae Genetics and Texas Birth Defects Epidemiology and Surveillance, Dallas, TX

Chromosomes are the structures in every cell of the body (except red blood cells) that carry the genetic information. Each chromosome is a huge molecule of DNA. There are 6 feet of DNA in each cell of the body, coiled and re-coiled and coiled again so it all fits. The supercoiled structure is what we see under a microscope as a chromosome. There are standard ways to talk about the parts of chromosomes. Each chromosome has a ‘waist’ called the centromere. On one side of the centromere is the short arm – the p arm – and on the other is, logically enough, the long arm – the q arm. Each chromosome has a striping or banding pattern that appears when the slide is stained and the banding pattern is consistent from person to person: All #1s look alike, all #2s look alike, etc. Each arm of the chromosome is separated in a region – some correspond to bands and some don’t – and then there are subregions, etc.

Looking at the genome by looking the chromosomes under a microscope is like looking at the city from an airplane. You can see big stuff, but you can’t tell if your mailman has come. For a change to be visible under a regular microscope it has to be at least 4 million base pairs in size (4Mb). That’s a really huge change. So, having an extra chromosome is like adding a zip code or building an airport. A deleted portion that can be seen microscopically is like draining a lake. A chromosome report result, like 47,XX,+21, or 46,XY,del(21)(q11.2) is like telling you a zip code.

The next more detailed step is the cytogenetic microarray. This is like knowing what mailboxes have mail in them. It is the same general question - is there extra or missing genetic material – but at a much finer level of detail than a routine chromosome analysis. The general result is the same and is read the same, though there may be more numbers after the decimal point. In addition there is a pair of multi-digit numbers. We will talk about what these mean, but essentially they are saying “from the 700 block of Main street to the 1400 block of Main street, there is has been no mail delivery”.

We will not be talking about single gene mutations in this presentation, but to continue the analogy, testing a single gene for mutations is like going to a mailbox, pulling out an envelope and checking what is owed on the water bill. It is looking for a specific piece of information in a specific place.