HER2 BIOMARKER & THE GEO DATABASE

What is a Biomarker?

- A molecule that gives a snapshot of what is happening biologically within an organism.
- Can help indicate a biological response to treatment, the progression of disease or assist in diagnostics.

HER 2

- HER2, also known as ERBB2, stands for human epidermal growth factor receptor 2. It is a protein that can serve as a biomarker associated with breast cancer.
- When HER2 is over-expressed, it drives the proliferation of cancer cells and can send anti-apoptotic signals. HER2+ is the overexpression of HER2.

1 out of 5

BREAST CANCERS ARE HER2 POSITIVE

GENE EXPRESSION OMNIBUS

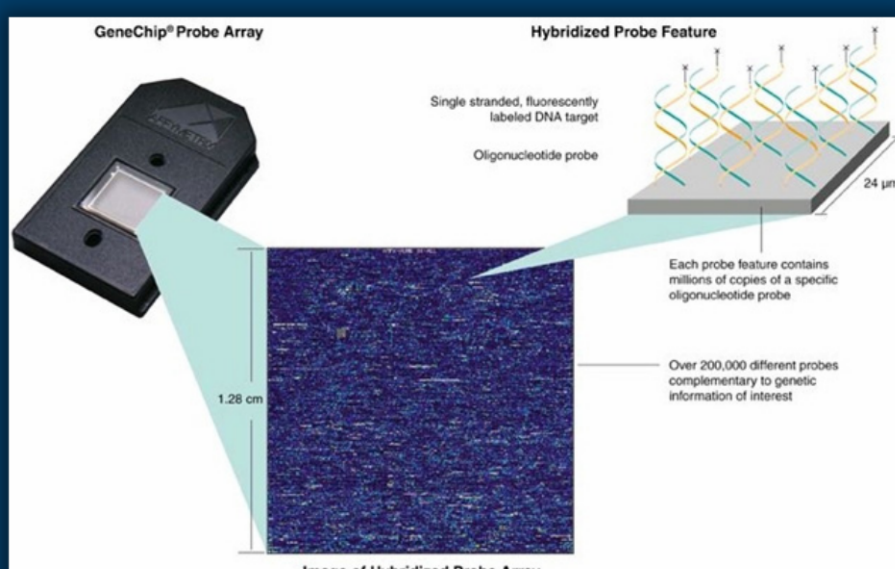

A database with...

4348 datasets reviewed by GEO staff

173314 series combining similarly processed samples

4997270 samples submitted by researchers

GENE CHIP TECHNOLOGY

On the surface, each chip contains thousands of short, synthetic, single-stranded DNA sequences, which together add up to the normal gene in question, and to variants (mutations) of that gene that have been found in the human population


GeneChip® Probe Array | Hybridized Probe Feature

Single stranded, fluorescently labeled DNA target

Oligonucleotide probe

24 μm

Each probe feature contains millions of copies of a specific oligonucleotide probe

Over 200,000 different probes complementary to genetic information of interest

1.28 cm

Image of Hybridized Probe Array

AFFYMETRIX HUMAN GENOME U133 PLUS 2.0 ARRAY
Gene chip used in experiments that comprised the dataset
Covers U133 Set plus 6,500 additional genes
Analyzes over 47,000 transcripts
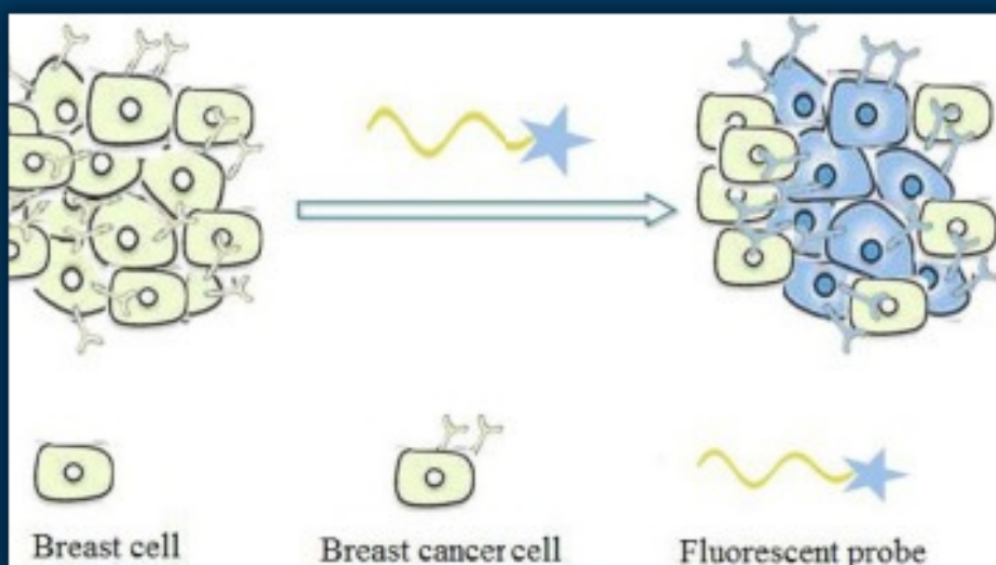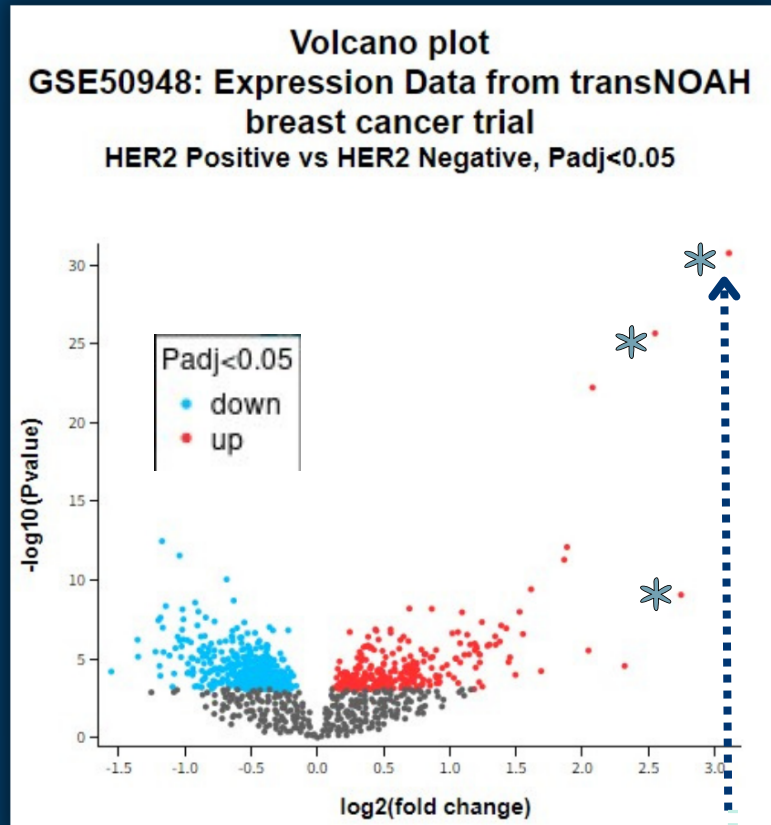
HER2 IN HUMAN TISSUE SAMPLES
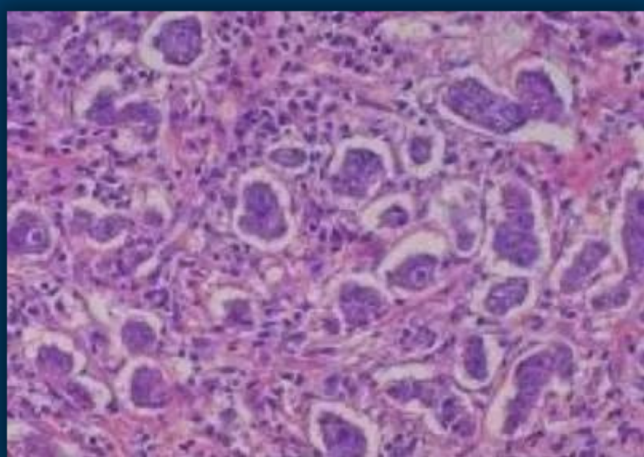
- Our selected GEO dataset was comprised of 156 samples taken from a human's primary tumor biopsy
  - GDS5027
    - 114 HER2 Positive samples
    - 42 HER2 Negative samples

Volcano Plot

Helps researchers visualize which genes vary the most between groups and are worth studying by analyzing gene expression from different probes.

- 54,675 probes total
  - 3 detected HER2 (ERBB2)

Volcano plot
GSE50948: Expression Data from transNOAH breast cancer trial
HER2 Positive vs HER2 Negative, Padj<0.05

Padj<0.05
- down
- up

-log10(Pvalue)

log2(fold change)

Breast cell   Breast cancer cell   Fluorescent probe

Probe: 210930_s_at

Probe 210930_s_at

- Confirmed HER2+ tumors show a higher gene expression than HER2- tumors
- Statistically significant P-value of 3.91×10^{-17} ($\alpha = .05$)

HER2+   HER2-