


Integrative analysis and visualization of clinical and molecular data for cancer precision medicine

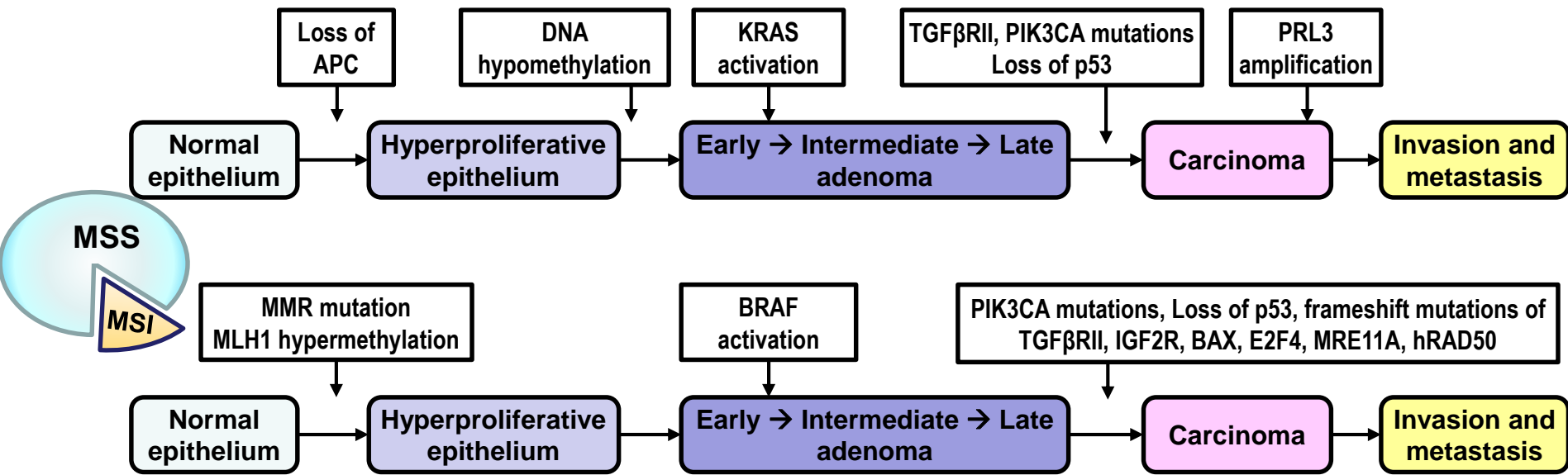
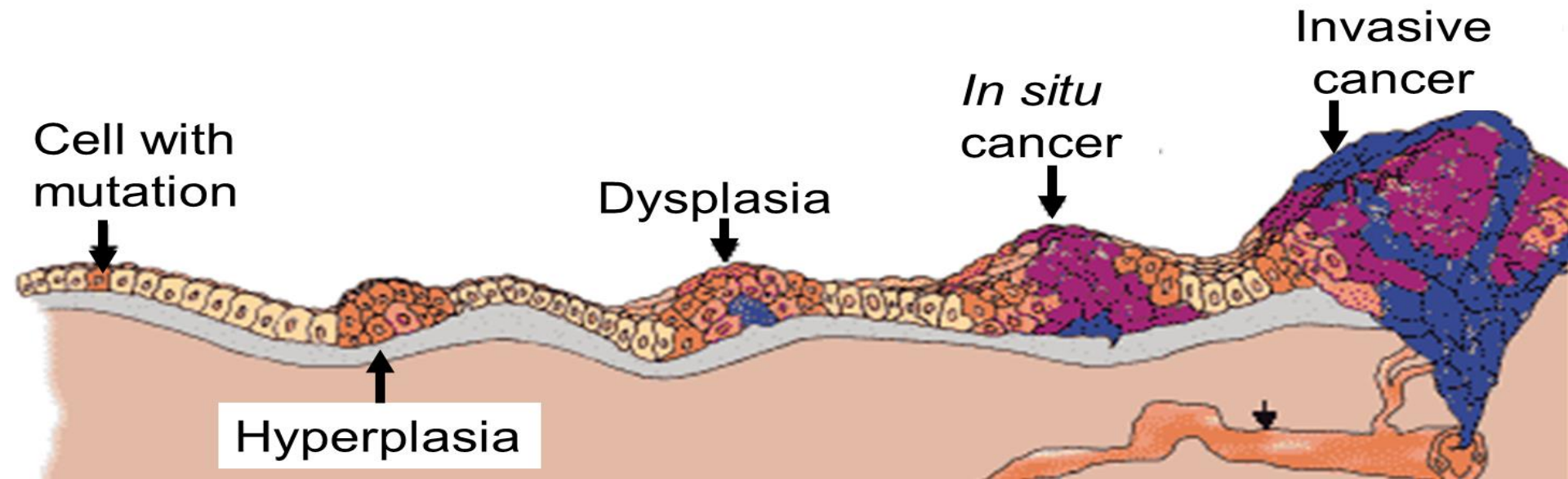
Enzo Medico
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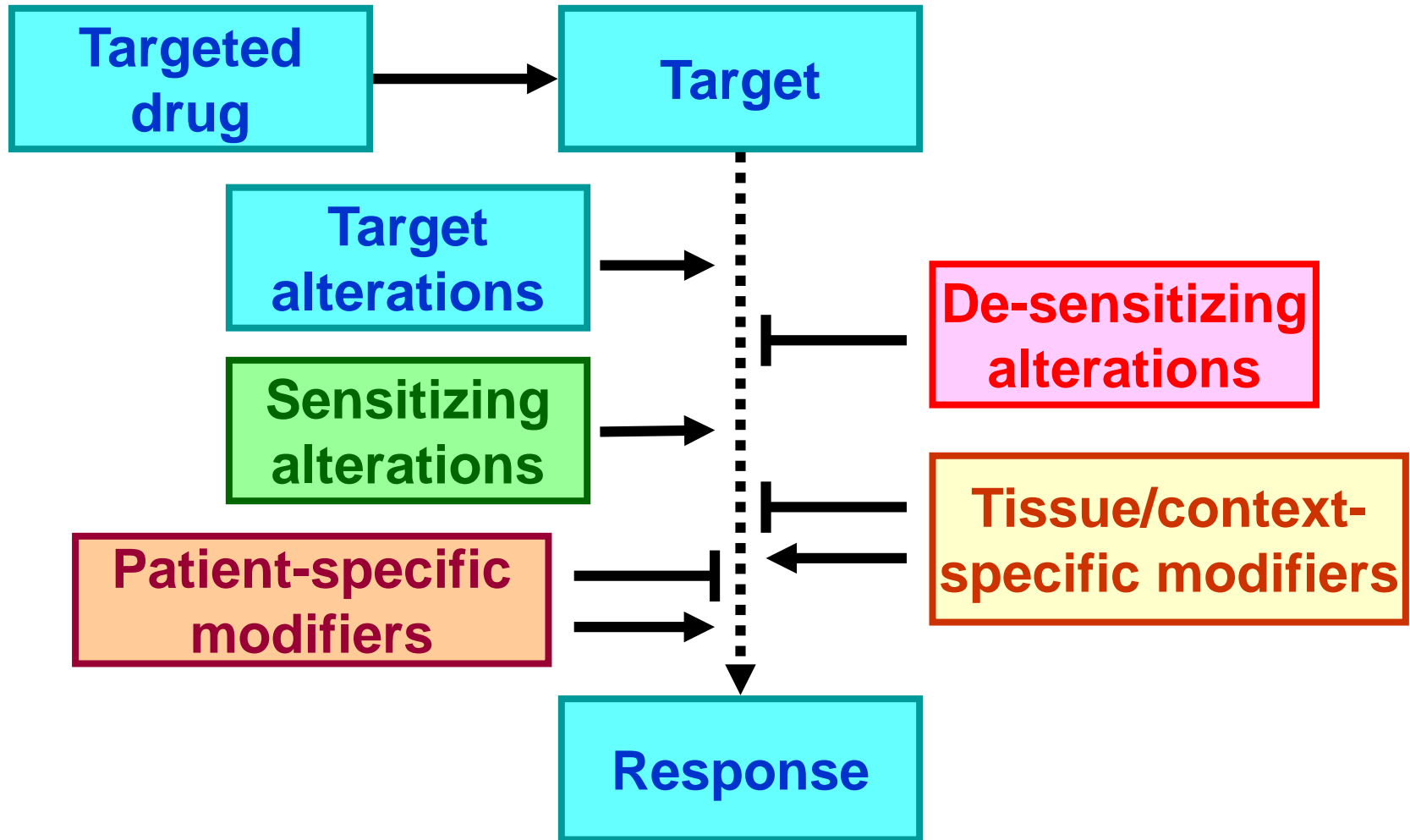
Candiolo Cancer Institute
Laboratory of Oncogenomics

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Cancer onset and progression



Towards precision cancer medicine



Further elements of complexity

- Intratumoral heterogeneity

De-sensitizing lesions only present in a fraction of the cancer cells may lead to early recurrence

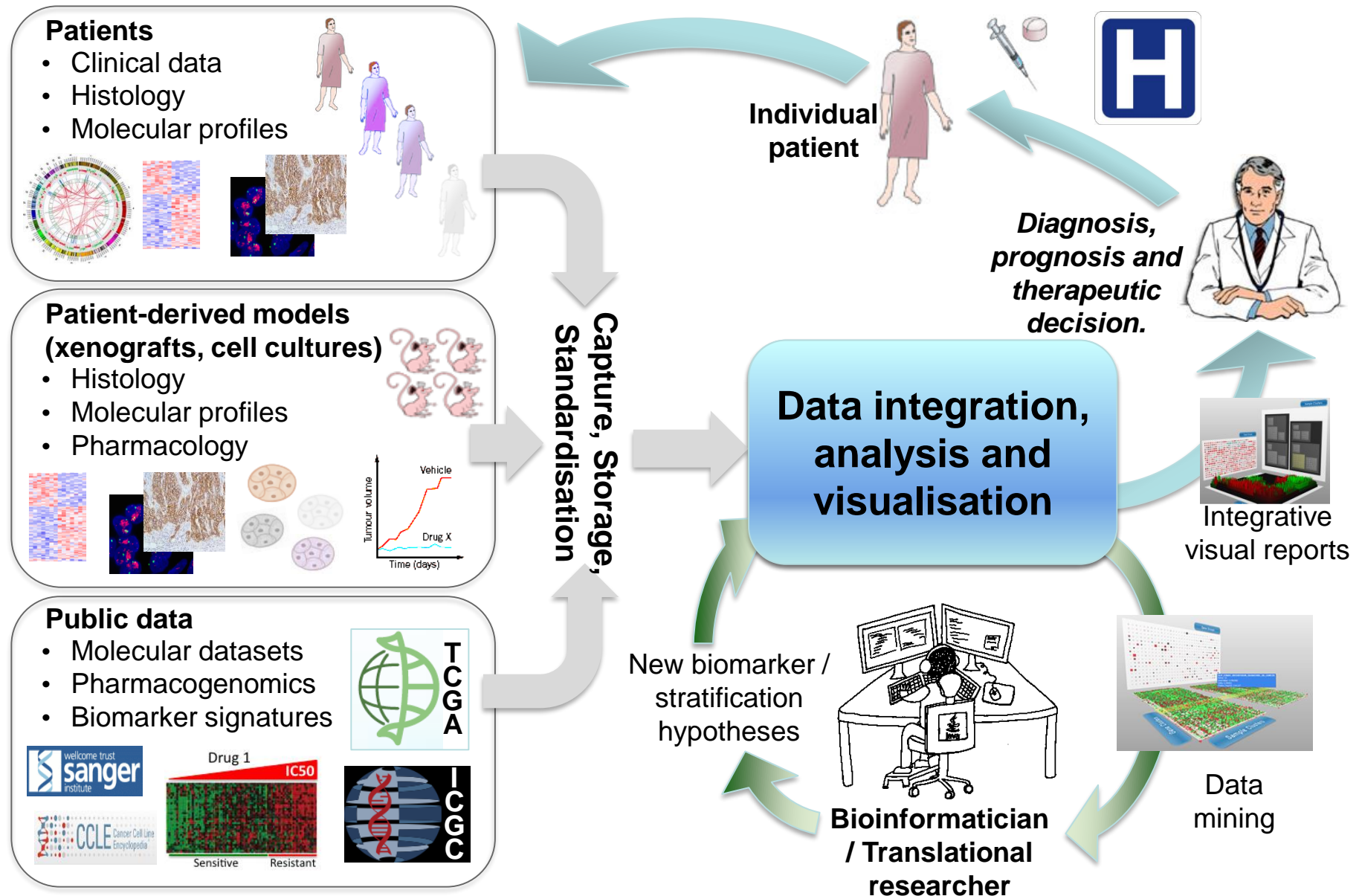
- Intracellular signaling is governed by networks

Dynamic adaptation to altered signaling.

- Tumor-host interactions

Tumor growth and response also depends on stroma, vasculature, inflammation and immune response

Cancer genomics and "Precision Oncology"



Towards *clinomics*

MULTI-DIMENSIONAL MOLECULAR PROFILING (primary samples, xenopatiens, cells)

Sequencing

mRNA
profiling

Genotyping &
Array-CGH

microRNA
profiling

Epigenomics

Proteomics

DATA INTEGRATION

STANDARDIZATION – STORAGE
PROCESSING – ANNOTATION
ANALYSIS – VISUALIZATION

Anamnestic data

Clinical history

Imaging

Pathology

Treatment(s)

Follow-up

**CLINICAL AND
PATHOLOGIC
DATA**

Sequence/expression
databases

Functional databases

Gene sets (MSigDB)

Published signatures

Genome and
transcriptome

miRNA targets

Promoters

protein interactions

DATA MINING

Treatments and
responses in
Xenografts

Treatments and
responses in cells

Functional/drug
screenings in
cells

**EXPERIMENTAL
DATA**

PRECISION MEDICINE

Predictions of individual treatment
response/resistance, risk stratification,
definition of clinical decision trees

CANDIDATE PRIORITIZATION

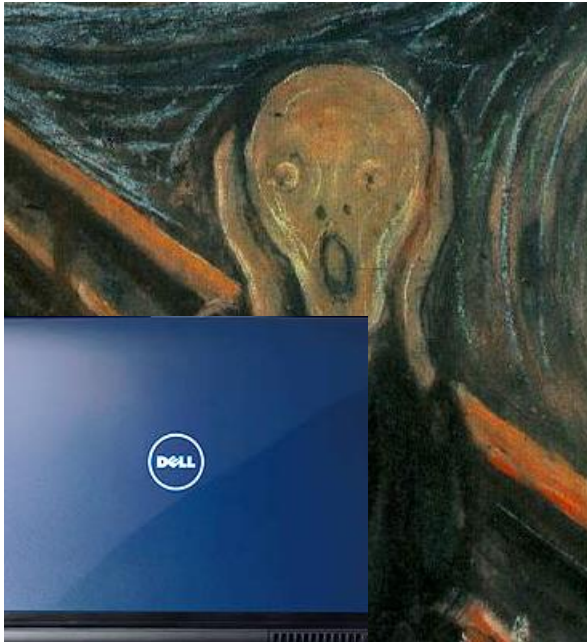
Coding/non-coding sequences whose
gain/loss-of-function is likely to affect
response to treatments

The Genomic Data Flood



Typical reactions - I

Despair



Succumb



Refuse

Typical reactions - II

Ignore



Adapt



...but what if...





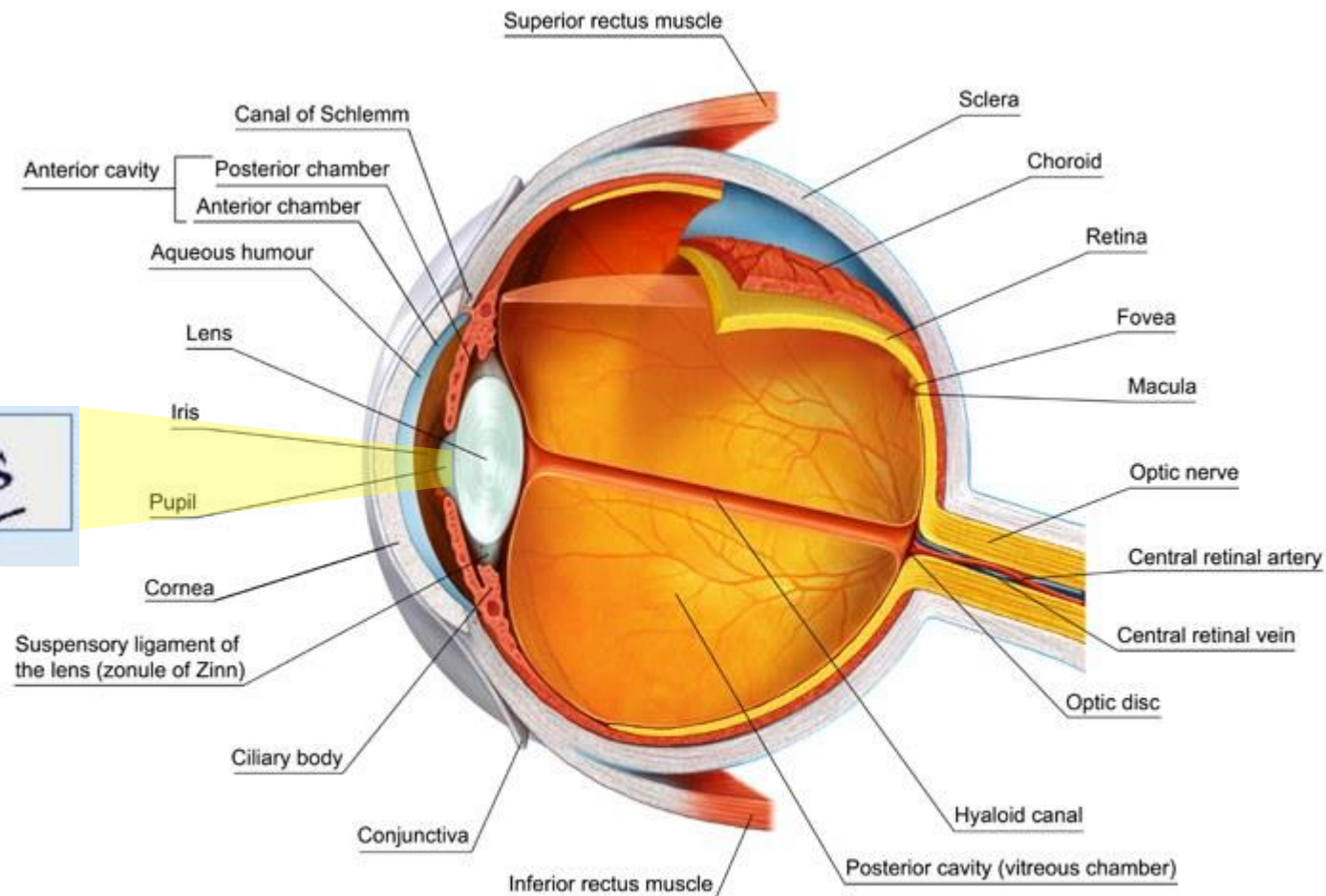
- Choose the best data analysis tool on earth
- Process and organize data for the tool
- Keep in mind the end-user(s)

In Cancer Research,
Big Data Needs to
Be Smart Too

Dr. Durie's Blog

by Brian G. M. Durie, MD

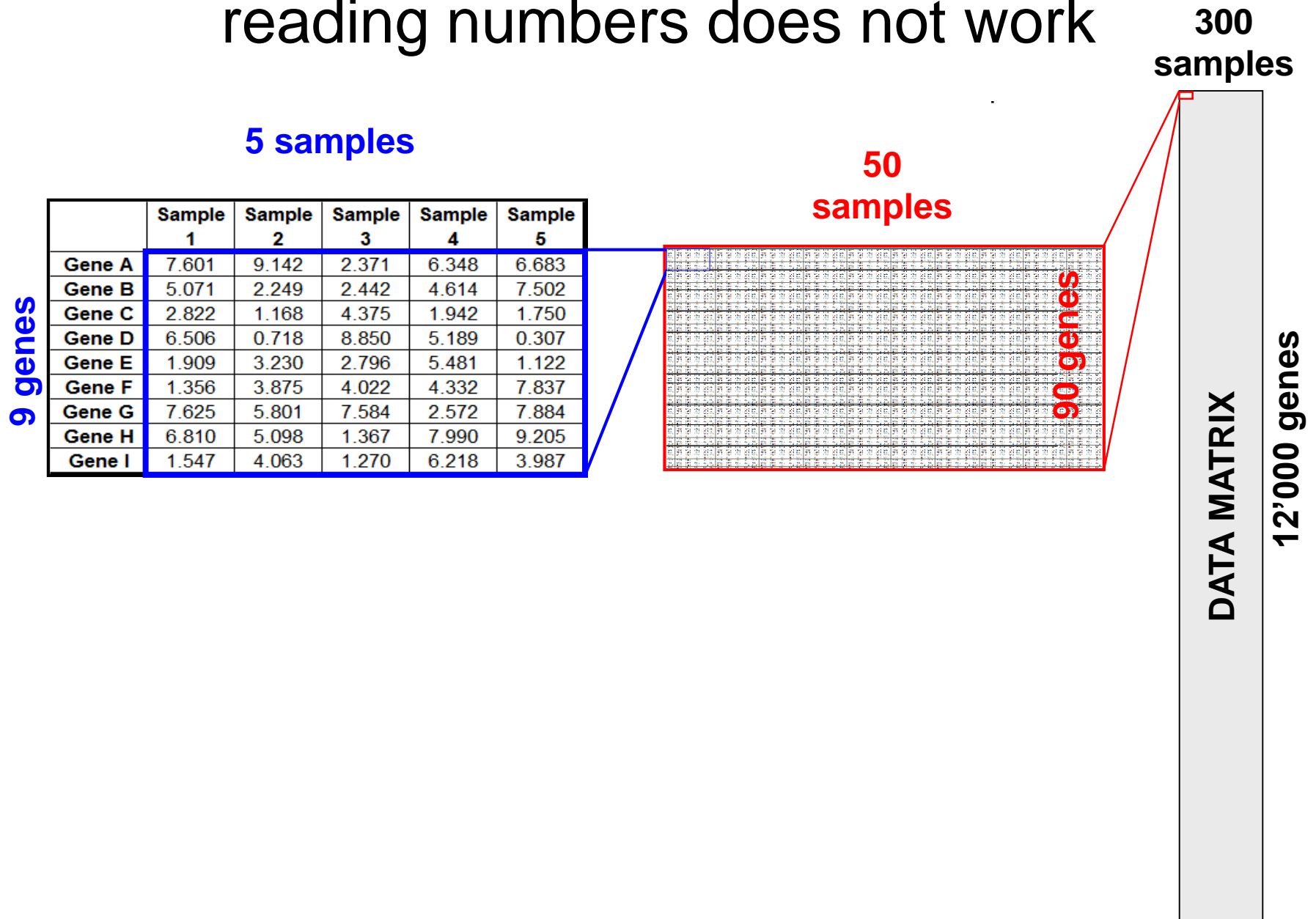
The most efficient pattern-finding tool available on earth



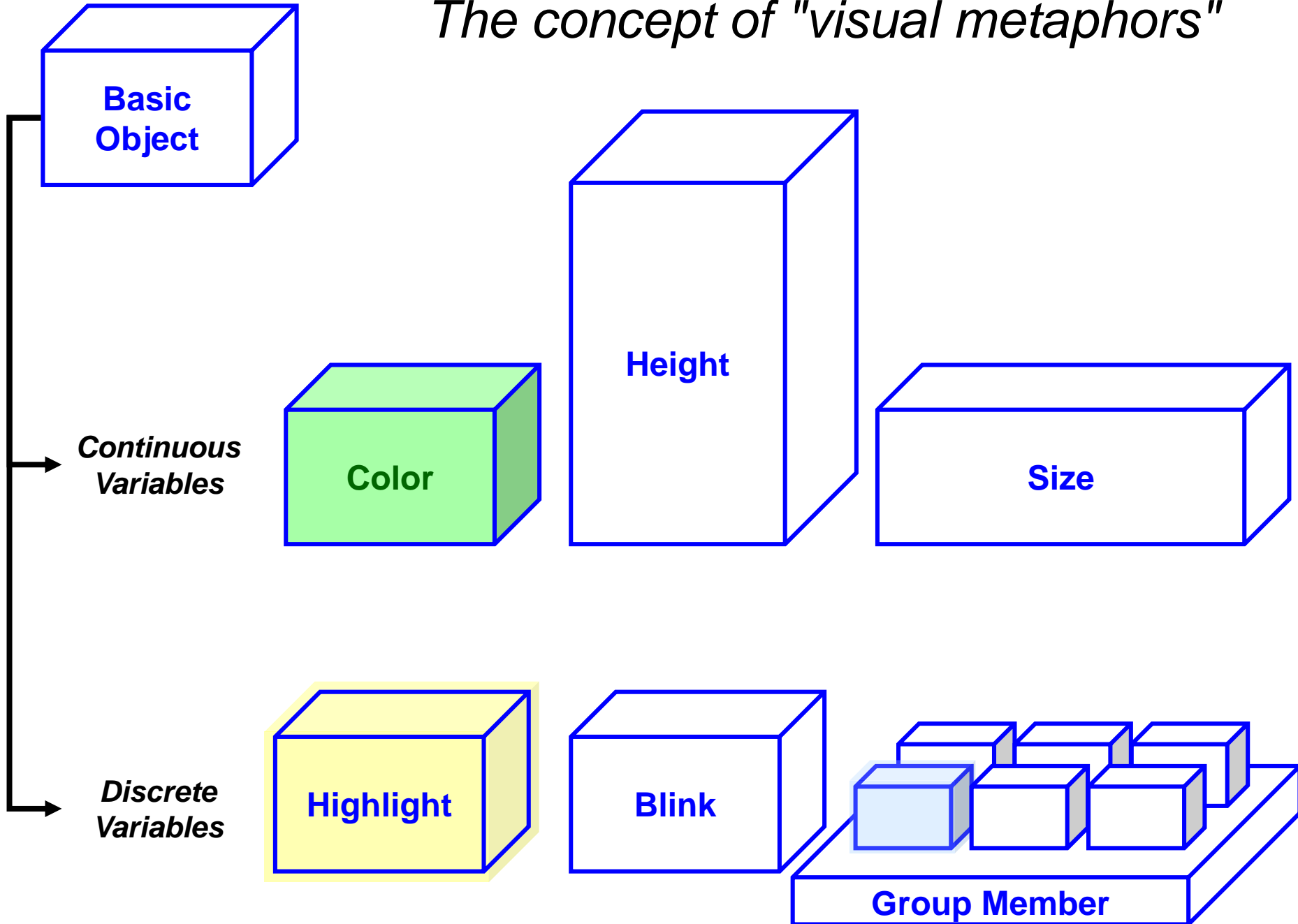


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The visualization problem: reading numbers does not work



The concept of "visual metaphors"





GenomeCruzer:

a tri-dimensional environment in which different types of information, such as gene expression, dosage, methylation and clinical data can be concomitantly visualized and analyzed.

www.kairos3d.it



Navigating colorectal cancer omics



DEMO

Summary

- Multiple levels of molecular alteration are functionally involved in cancer initiation, progression, and response to treatment.
- Reliable prediction of tumor aggressiveness and therapy response requires integrative analysis of all data.
- Particular attention should be dedicated to interactive visual environments, where end-users could easily navigate and analyze the integrated information, at the genome, gene or patient level.

GenomeCruzer playlist on Youtube:

<https://www.youtube.com/watch?v=buKx67CjcwY&list=PLuVag8CXc5J7wGiohs8Satz7TfUQYRaG2>

Acknowledgments

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