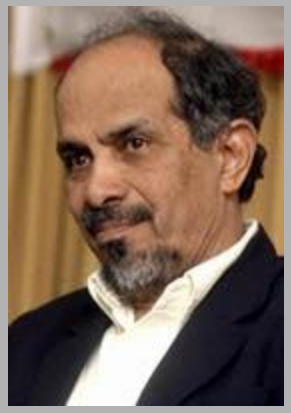
At the Cusp of the New Millennium



Computational Positivism

‘computational positivism’, which considers observation and computation as the only things that matter

dṛk to **gaṇitā** to **siddhā-antha**

To the Indians it was Newton who was the extraordinary epistemological revolutionary not Heisenberg or Gödel

Computational Positivism in Biology
The Story of Strand

Strand Life Sciences: Genesis

The first academic spin-off in India, from the Indian Institute of Science, Bangalore, in 2000

Academic Entrepreneurship

1. October 2000: IISc Council institutes faculty entrepreneurship.This is the first time a public university has a mechanism for faculty entrepreneurship in India.
2. November 2000: MetaString (holding company), StringLabs (Technology Incubator), Strand Genomics (Bioinformatics Enterprise) are launched.
3. May 2001: PicoPeta Simputers Pvt Ltd launched.

Simputer: Radical Simplicity for Universal Access

Listed in 7 hottest university startups worldwide (Technology Review, Sept 2001)

NY Times December 9, 2001 "The Year in Ideas"

The most significant innovation in computer technology in 2001 was not Apple's gleaming titanium Powerbook G4 or Microsoft's Windows XP. It was the Simputer, a Net-linked, radically simple portable computer, intended to bring the computer revolution to the third world.

…

This is computing as it would have looked if Gandhi had invented it …. India has already succeeded in localizing cinema, satellite communications,cable television and radio. The Simputer is meant to do the same for the Internet.

…

Bruce Sterling

People's Computer

"So, take heart: Simpler, more natural computer systems will enter our lives within the next 5 to 10 years. Let's speed up their arrival, as users by asking for them, and as technologists by daring to build them."

Michael Dertouzos, The People's Computer, Tech Review, May/June 2000

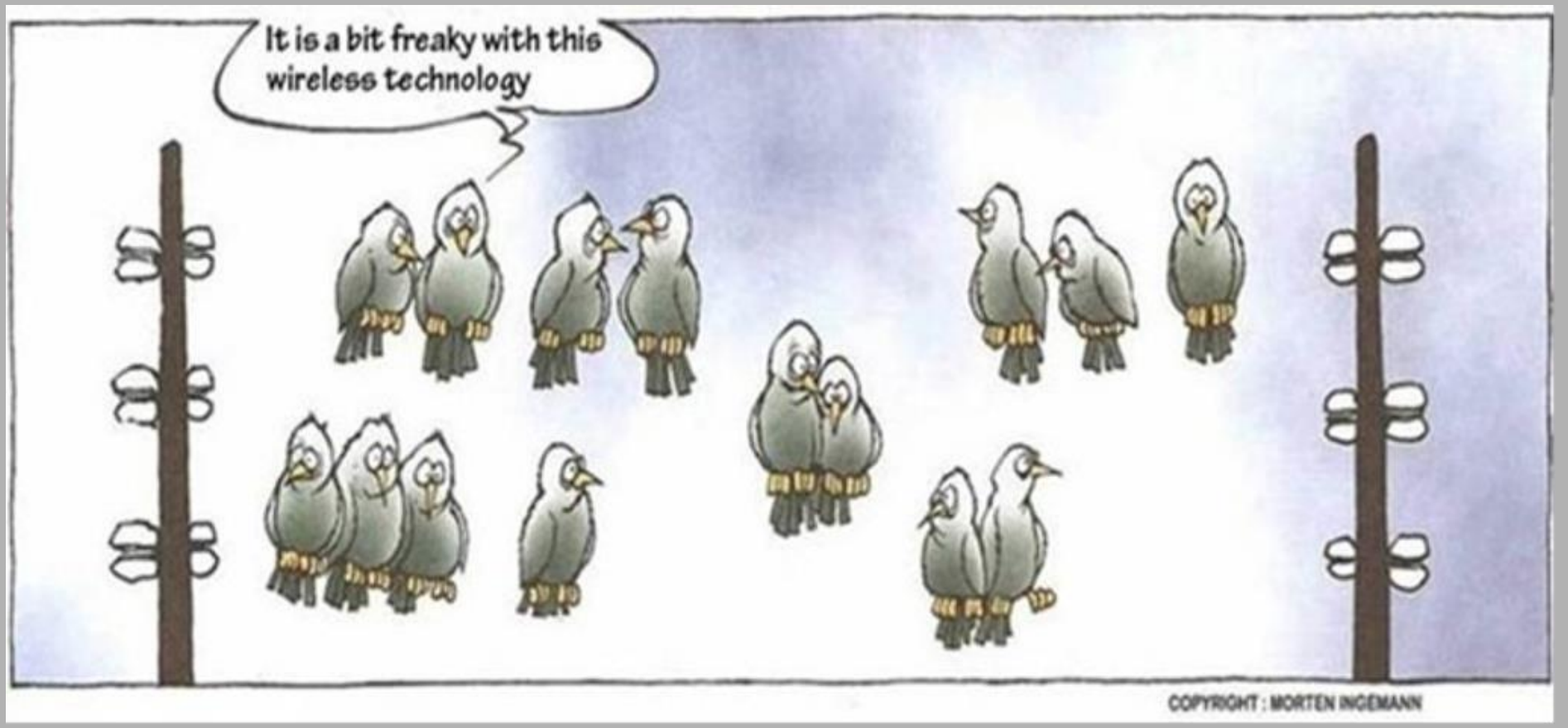
amida

amida

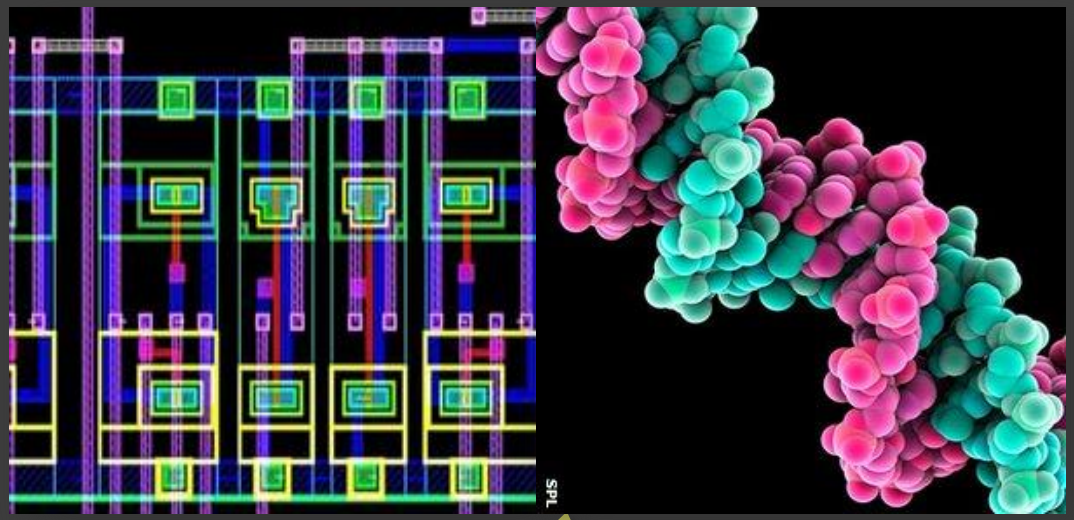
amida

email
amida
Introducing the Amida Simputer. It's time to Rewrite.

It’s a bit freaky with this sequencing technology



Strand Life Sciences: The Team



M:F
48:52

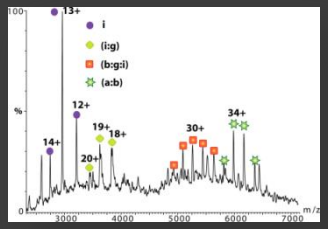
170 Computer and Life Scientists working together, a large fraction from premier Indian and US schools

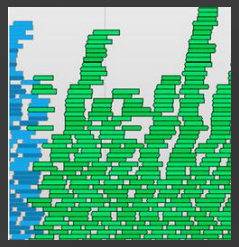
Strand Life Sciences: Investors

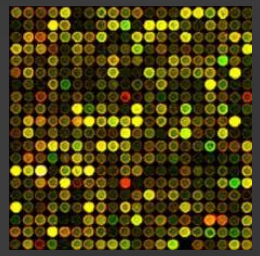
Burrill and Co., 2013

Strand Life Sciences: Businesses

Software Products for Research Biology

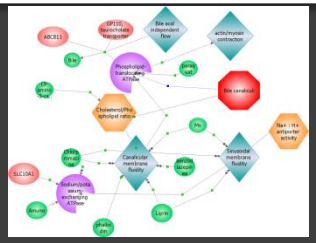






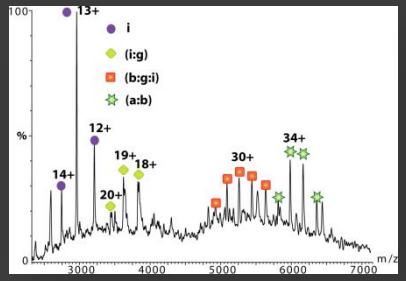
Clinical Diagnostics using Next-generation Sequencing

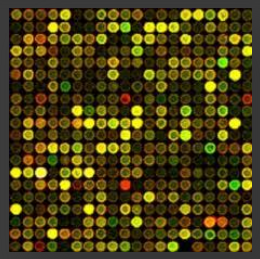
DILI Pharmacogenomics Custom Reports



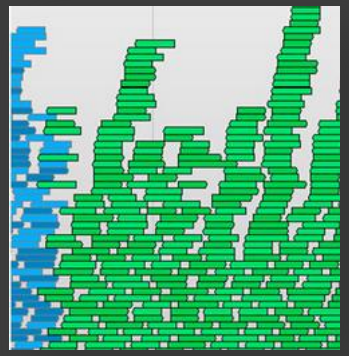
Strand Life Sciences: Products

GeneSpring

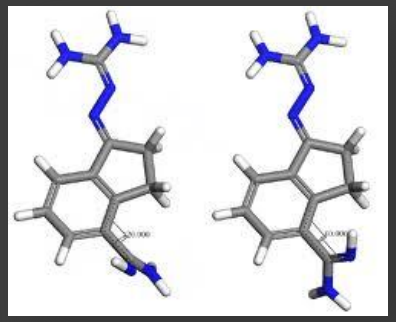




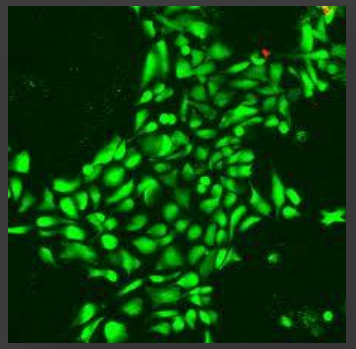
Avadis NGS



SArchitect



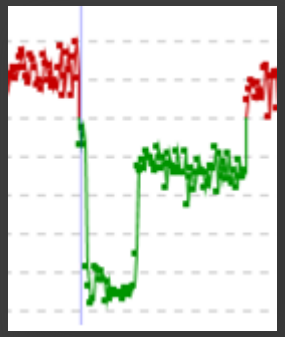
iManage



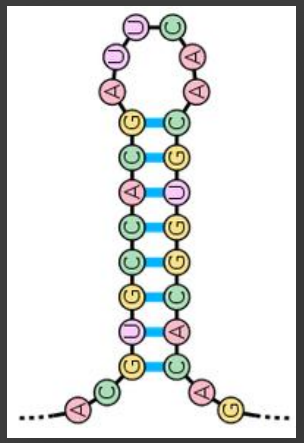
GeneSpring: Applications

Gene Expression

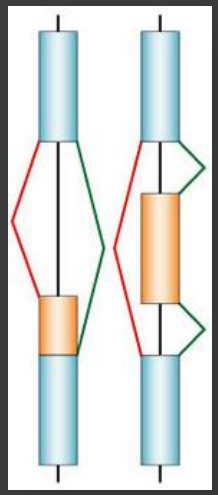
Genotyping



ncRNA Expression



Exon Splicing



GeneSpring is a trademark of Agilent Technologies;
GeneSpring is built in a partnership with Agilent

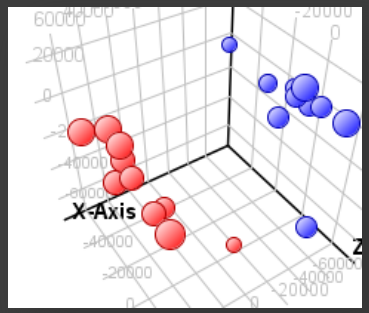
GeneSpring: Elements

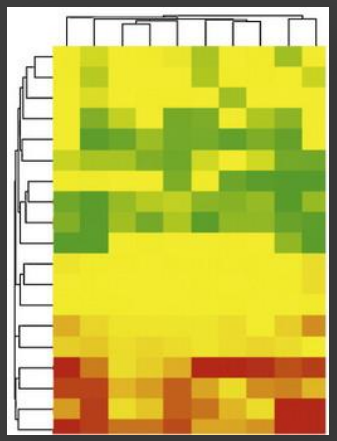
Visualization

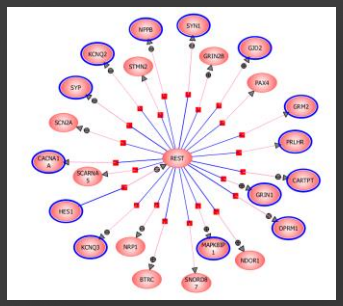
Bioinformatics/
Algorithms

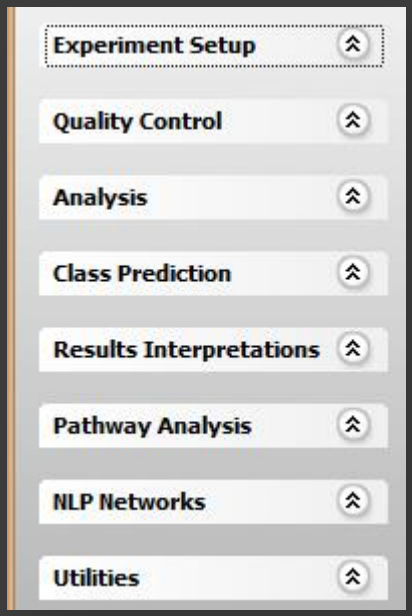
Literature

Workflows





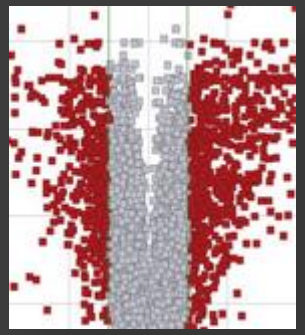




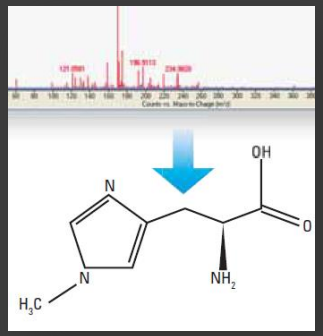
GeneSpring Mass Profiler: Proteomics and Metabolomics

GC-MS, LC-MS and ICP-MS data

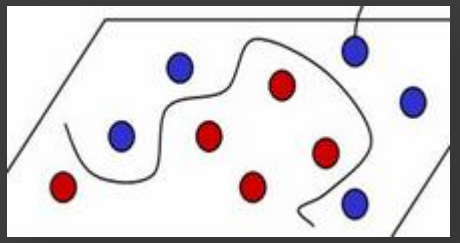
Feature Alignment, Normalization, Differential Statistics



Compound Identification



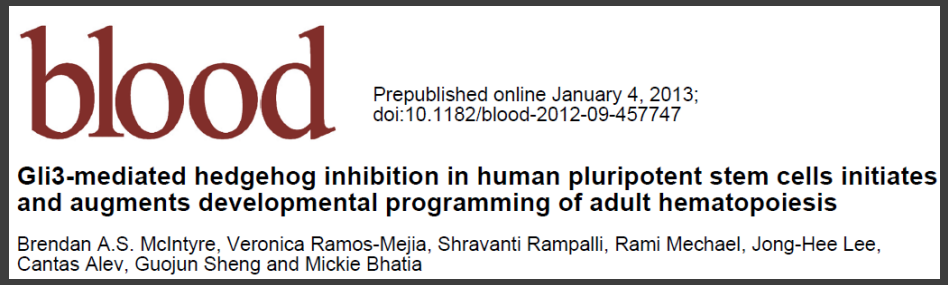
Class Prediction



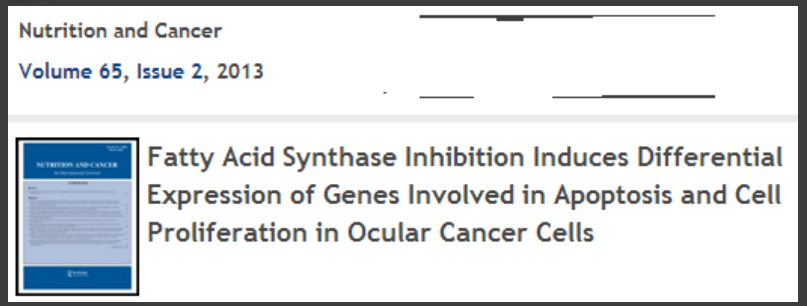
GeneSpring Impact

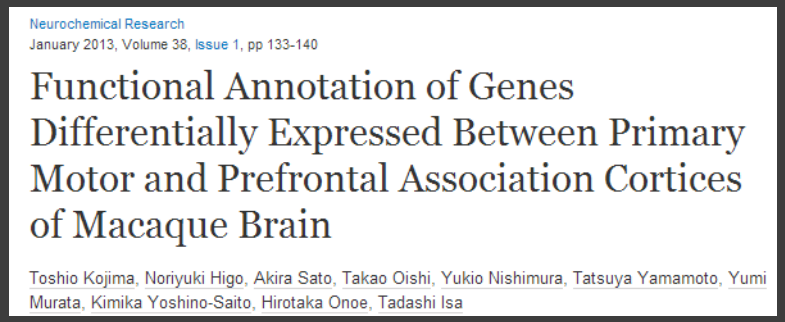
~7000 hits on Google Scholar from 2009 onwards, ~15000 on the whole

~2000 users



A few recent publications





GeneSpring Class Prediction Applications

A Prediction Model for Determining Wine Variety using the Agilent LC/MS Q-TOF and Mass Profiler Professional

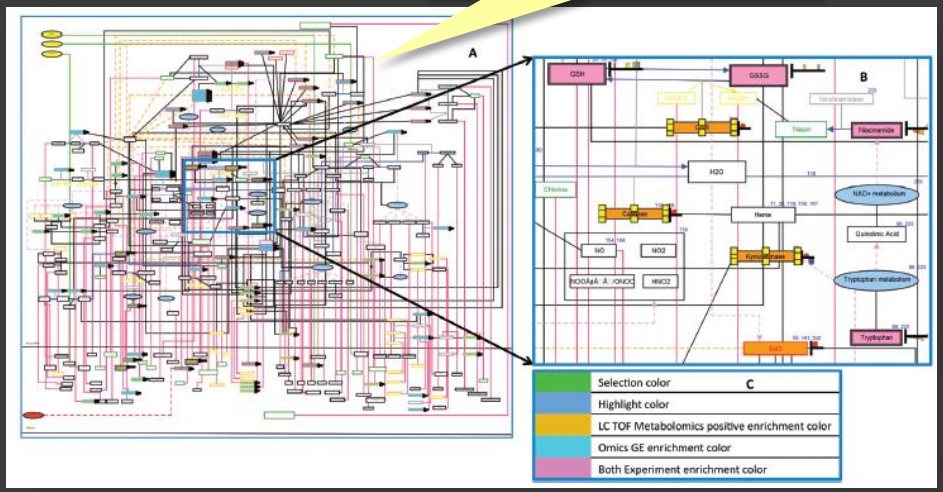
Olive Oil Characterization using Agilent GC/Q-TOF MS and Mass Profiler Professional Software

Machine Learning applied to the food industry

Detecting Contamination in Shochu Using the Agilent GC/MSD, Mass Profiler Professional, and Sample Class Prediction Models

GeneSpring: Integrated Biology

Integrated Analysis of Transcriptomic, Metabolomic and Proteomic Data

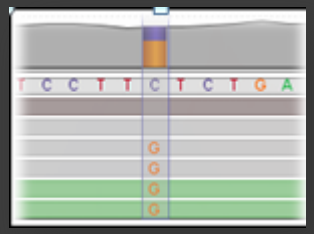


Transcriptomic and Proteomic Profiling of KEAP1 Disrupted and Sulforaphane Treated Human Breast Epithelial Cells Reveals Common Expression Profiles

Abena S. Agyeman,[1] Raghothama Chaerkady,[4,5] Patrick G. Shaw,[1,2] Nancy E. Davidson,[6,7] Kala Visvanathan,[3] Akhilesh Pandey,[4,5] and Thomas W. Kensler[1,2,6,7]

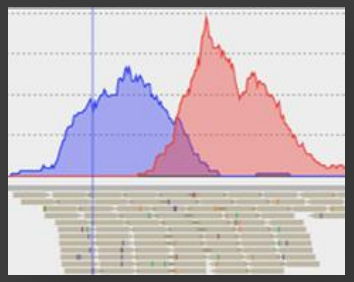
Avadis NGS: Applications

DNA Mutation Detection

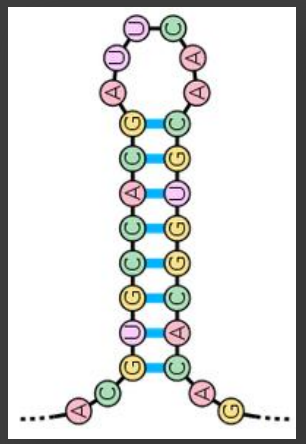


RNA-Seq

ChIP-Seq



Small RNA Expression



Key challenge: handling billions of reads on standard hardware

Avadis NGS: Publications

Avadis iManage: Elements

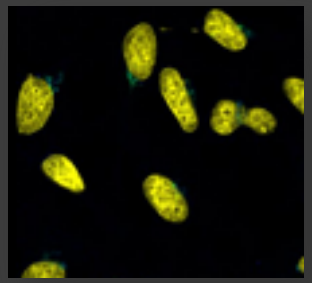
Jointly built with the Institut Curie

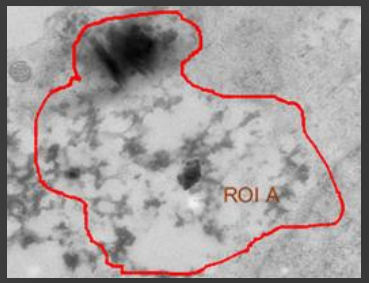
Image Management for all microscopy images and metadata

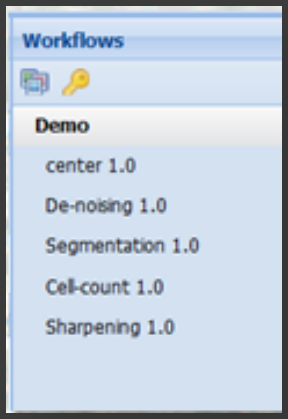
Visualization, Results Annotation and Collaboration

Pluggable architecture for Image analysis algorithms

institutCurie
Ensemble, prenons le cancer de vitesse.







The Avadis Platform: Access, Visualize, Analyze, Discover

The basis for our products

Ease of use and Customizability

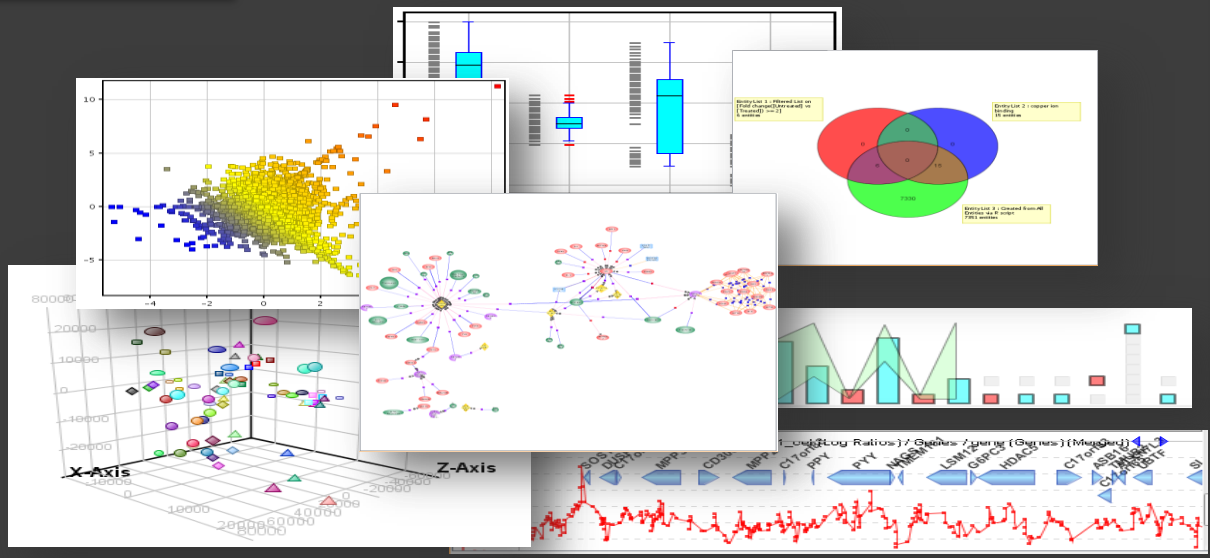
A Reusable Software Framework for Data Mining Applications

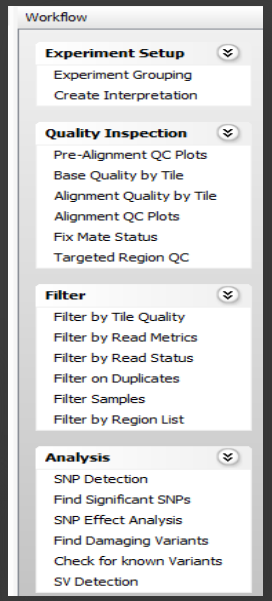
Dynamic Visualization

Pluggable Scripting and Workflows

Data Structures and Algorithms for Data Handling

Rapid product building





Avadis Natural Language Processing (Grammatica): Elements

DICTIONARY BUILDING
Building comprehensive dictionaries for relevant document search

TEXT READING
Format handling, sentence splitting, tokenization, POS tagging, phrase extraction

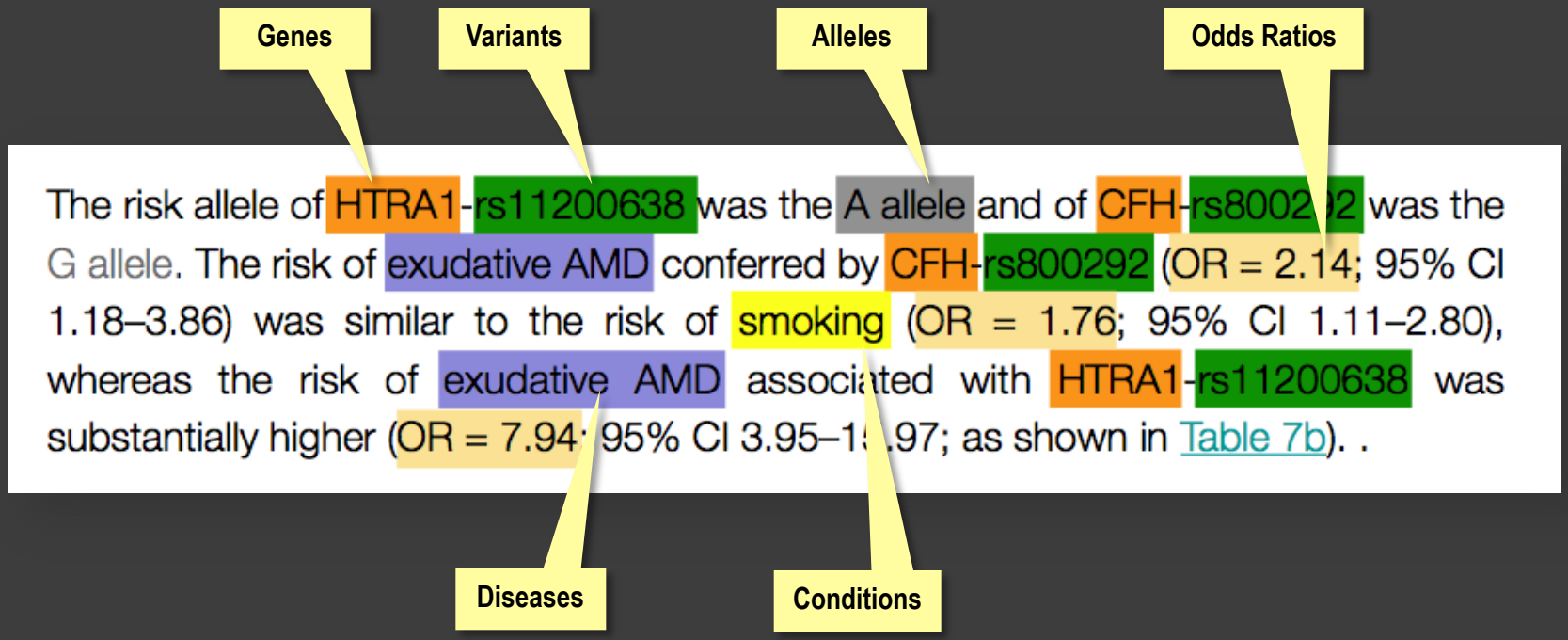
ENTITY RECOGNITION
Dictionary-driven robust identification of entities

SYNTAX PARSING
Grammar-driven deep parsing of sentences

SEMANTIC INFERENCING
Understanding meaning from parsing output

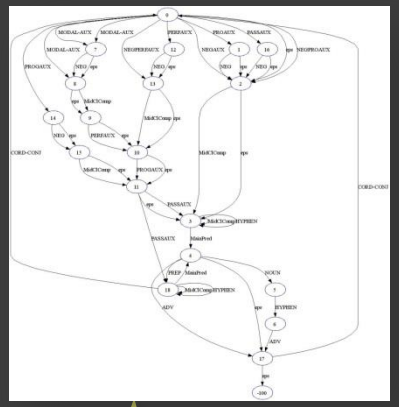
FACT EXTRACTION
Extracting associations between entities via shallow parsing

Avadis NLP: Entity Tagging

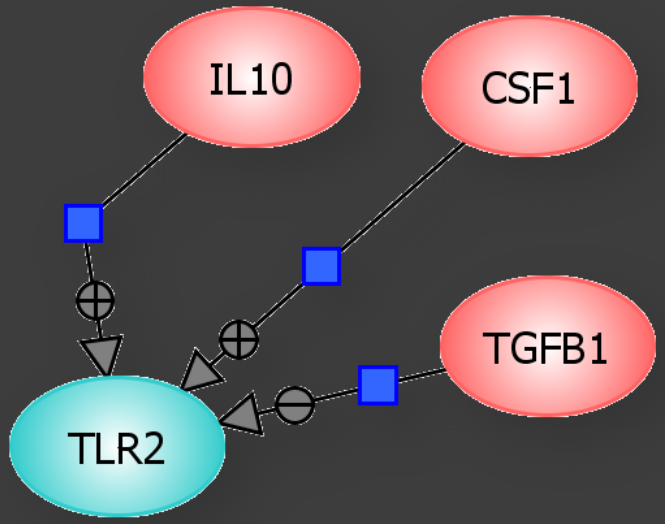


Avadis NLP: Fact Extraction via Deep Parsing

“TLR-2 expression on monocytes was enhanced by macrophage colony-stimulating factor (M-CSF) and interleukin-10 (IL-10), but was reduced by transforming growth factor beta1.”



The Grammar for a verb!!



SLS HepTox: Prediction of Drug Induced Liver Injury

Identify Pathways

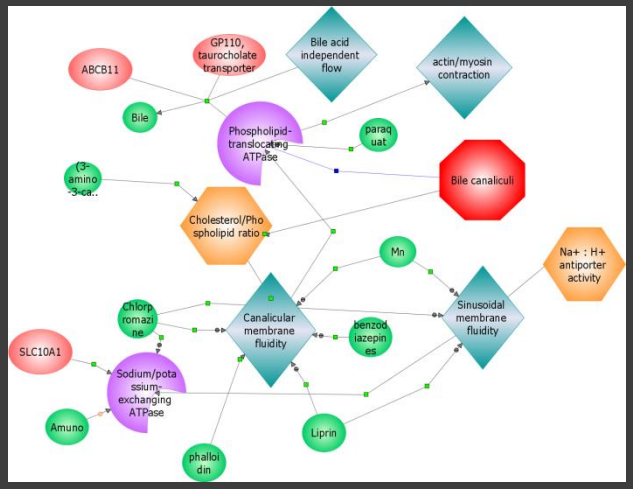
Curate pathway parameters from literature

Model and identify sensitive entities to measure

Design appropriate assays to measure entities

Feed measurements back to model and simulate for prediction

Proof of concepts in progress with Amgen, Pfizer etc



$$d[\gamma\text{-}GC]/dt = V_{GCS} - V_{GS}$$

$$V_{GCS} = K^*[\gamma\text{-}GC]^A*[ATP]^B*[Cys]^C*[GSH]^D$$

It delivers what it promises.
It may not be Truth, but it is honest!
Nagarjuna - prapakatva

Insilico to Wet Biology

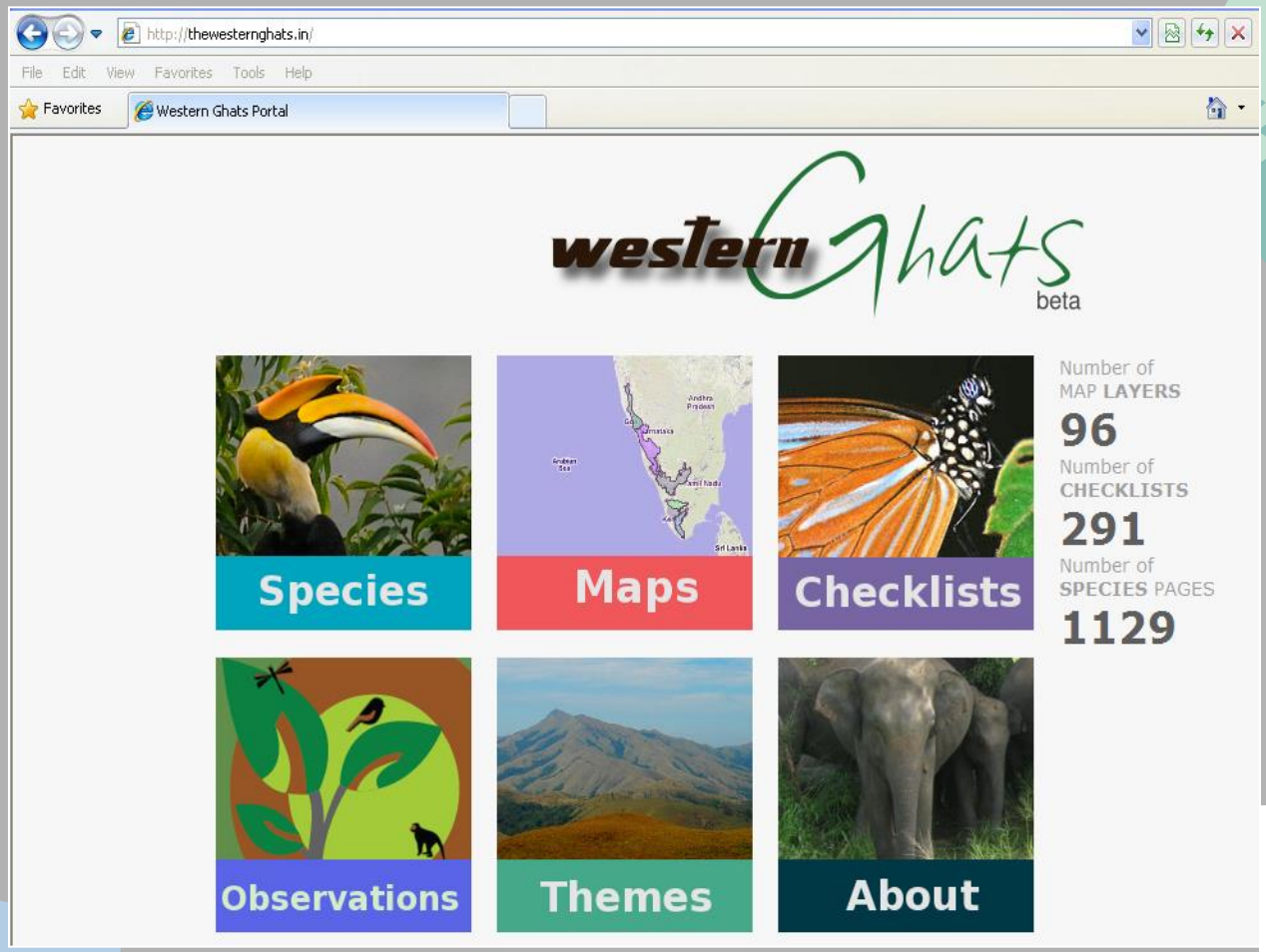
Ganit Labs

StrandX Clinical Labs

Researchers

CSR

Amateur Naturalists



Public

Decision Makers

Plant Genomics & Ganit Labs

www.ganitlabs.in a PPP of IBAB, GoK, GoI, Strand Life Sciences

1. Neem (Azadirachta indica) genome and transcriptome sequencing

Krishnan, N.M. et al. De novo sequencing and assembly of Azadirachta indica fruit transcriptome. *Current Science* (IASc) 101, 9 (2011).

Krishnan, N.M. et al. A Draft of the Genome and Four Transcriptomes of a Medicinal and Pesticidal Angiosperm Azadirachta indica. *BMC genomics* 13, 464 (2012)

2. Grain amaranth (*Amaranthus hypochondriacus*)

Understanding the lysine biosynthesis pathway of the plant

Heralding Clinical Genomics

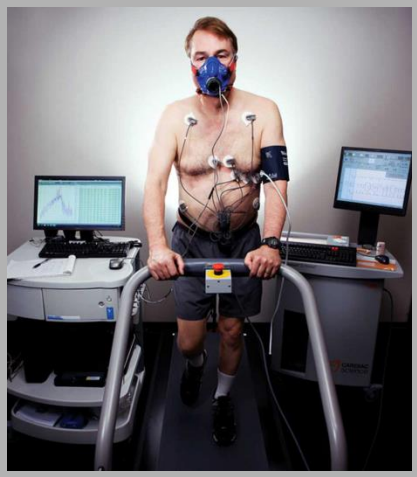
Nicholas Volker

Wisconsonsin Medical

One in a Billion

Sequence helped to identify XLP and Gut Disorder. Cord blood transplant worked..

- **Neuromuscular disorder**
  - Schwarz-Jampel Syndrome or Sodium Channelopathy?
- Sequence relevant genes to rule out Schwartz-Jampel.



Larry Smarr

UCSD, Calit2

Predictive, Preventive, Personalized, Participatory

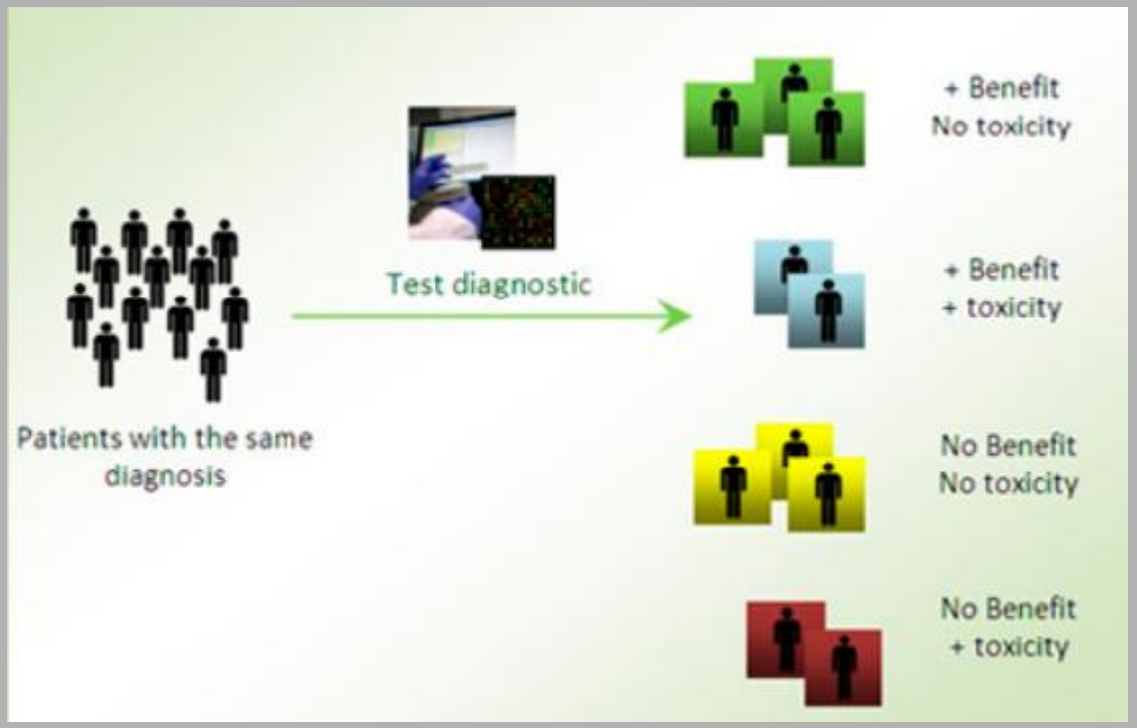
P4 Medicine

Diagnostics for Precision Medicine

Vision: Bring insights from sequencing to bear on disease, treatment & wellness

Right Drug
Right Disease
Right Time
Right Dosage

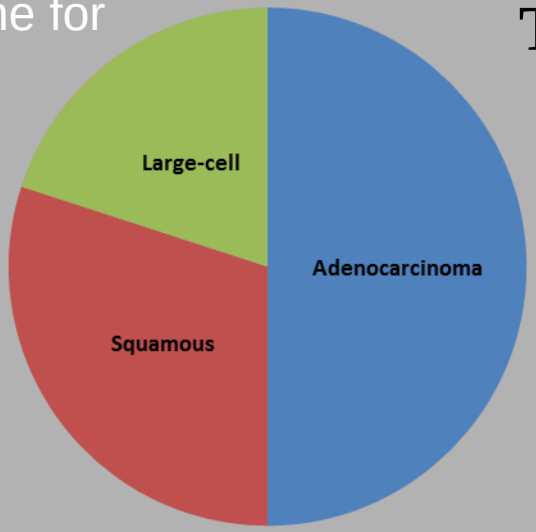
Precision Medicine



Rapidly Changing Standards of Care

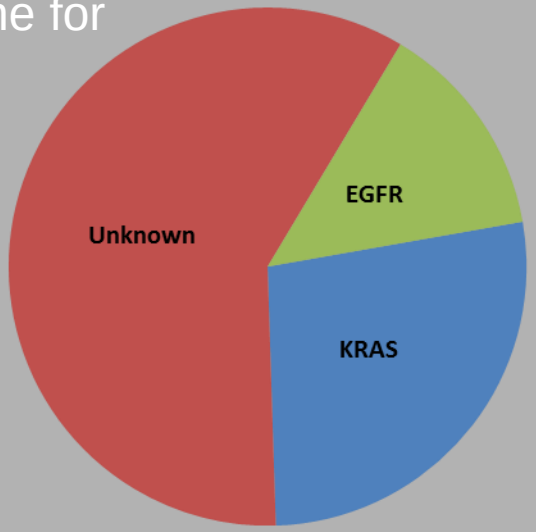
- Precision Medicine for Lung Cancer

Traditional



Rapidly Changing Standards of Care

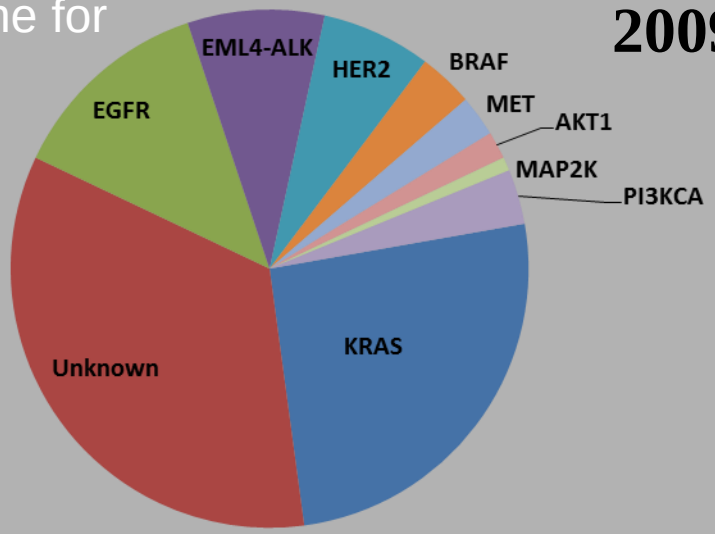
- Precision Medicine for Lung Cancer



2004

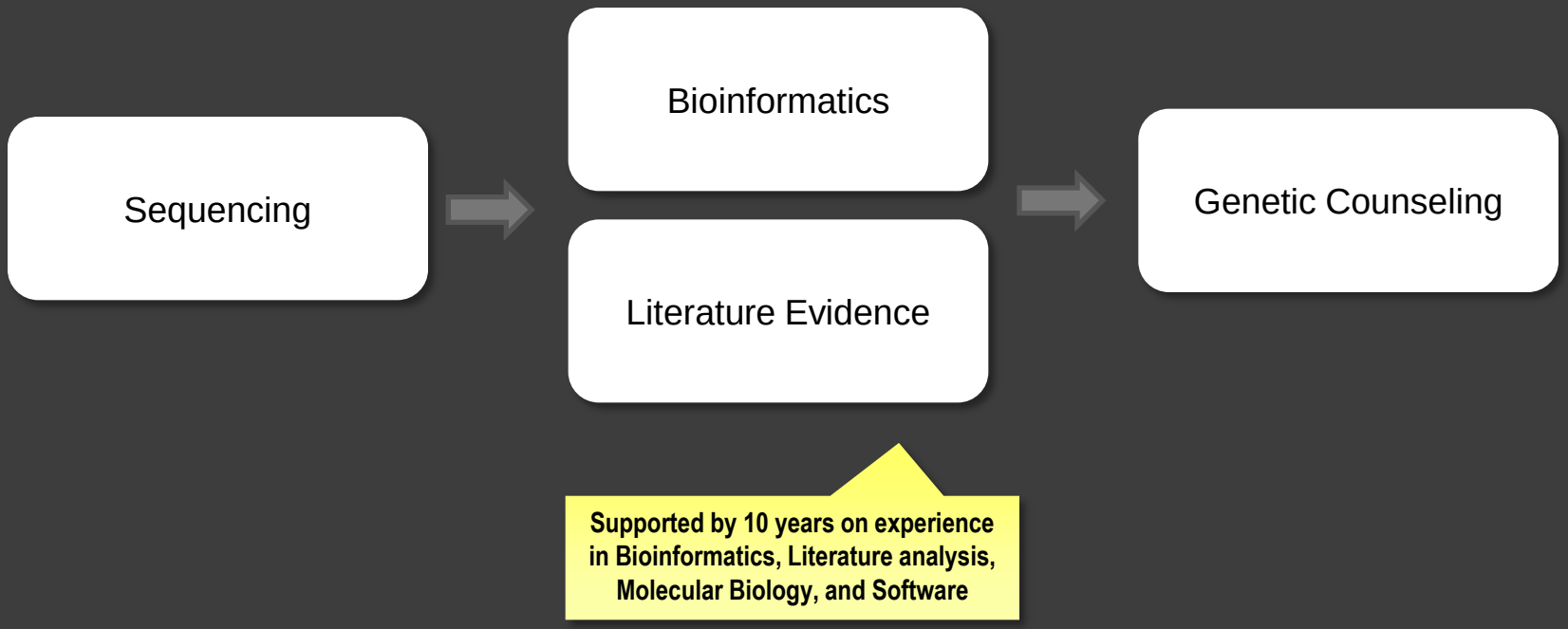
Rapidly Changing Standards of Care

- Precision Medicine for Lung Cancer



Strand Life Sciences Clinic: Mission

SLS Clinic (founded 2012) is an end-to-end service that offers Next Generation Sequencing diagnostics to hospitals in India



The Diagnostic “StrandX” Tests

- Diabetes
- Rare Diseases
- Cardiology
- Oncology
- Metabolic Diseases
- Ophthalmology

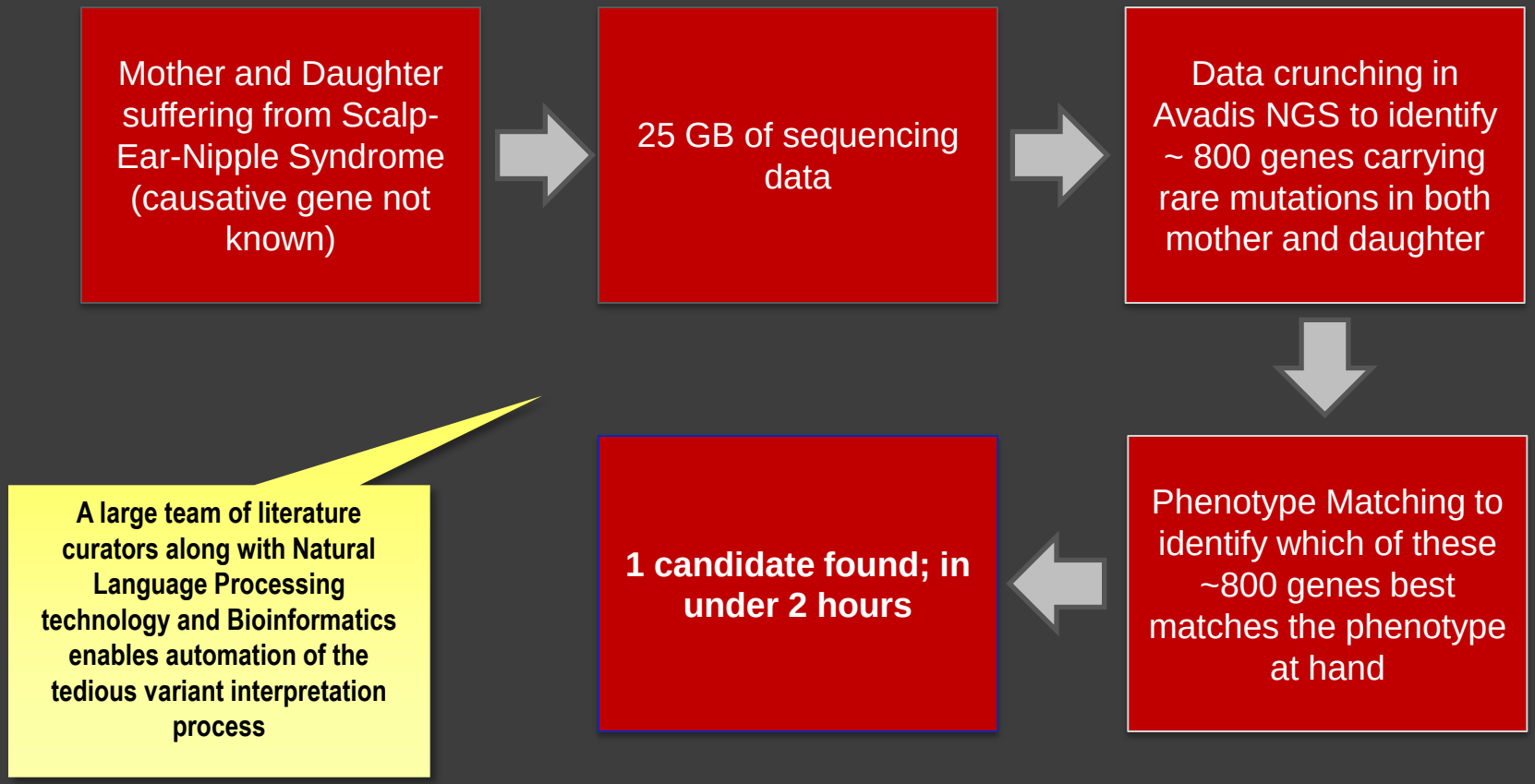
MAX HEALTHCARE
Caring for you... for life

KIDWAI MEMORIAL INSTITUTE OF ONCOLOGY

Narayana Hrudayalaya
CARING WITH COMPASSION

Hospital Partners

SLS Clinic: Driven by Phenotype Matching Algorithms



Vision

Be the repository of clinical genomic information in the era of large scale sequencing.

Be the clinicians interface to genomic medicine

Antha-Prerna

Self Motivated