

At the Cusp of the New Millennium





Computational Positivism

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



microphone

१. माइक्रोफ़ोन, एक यंत्र जिससे धीमी से धीमी आवाज भी ठीक सुनाई दे

(In itrans: 1. mAik{}rophona, eka ya.nt{}ra jisase dhimi se dhimi AvAja bhI ThIka sunAI de)

microphone Search

Exit

◀ ▶

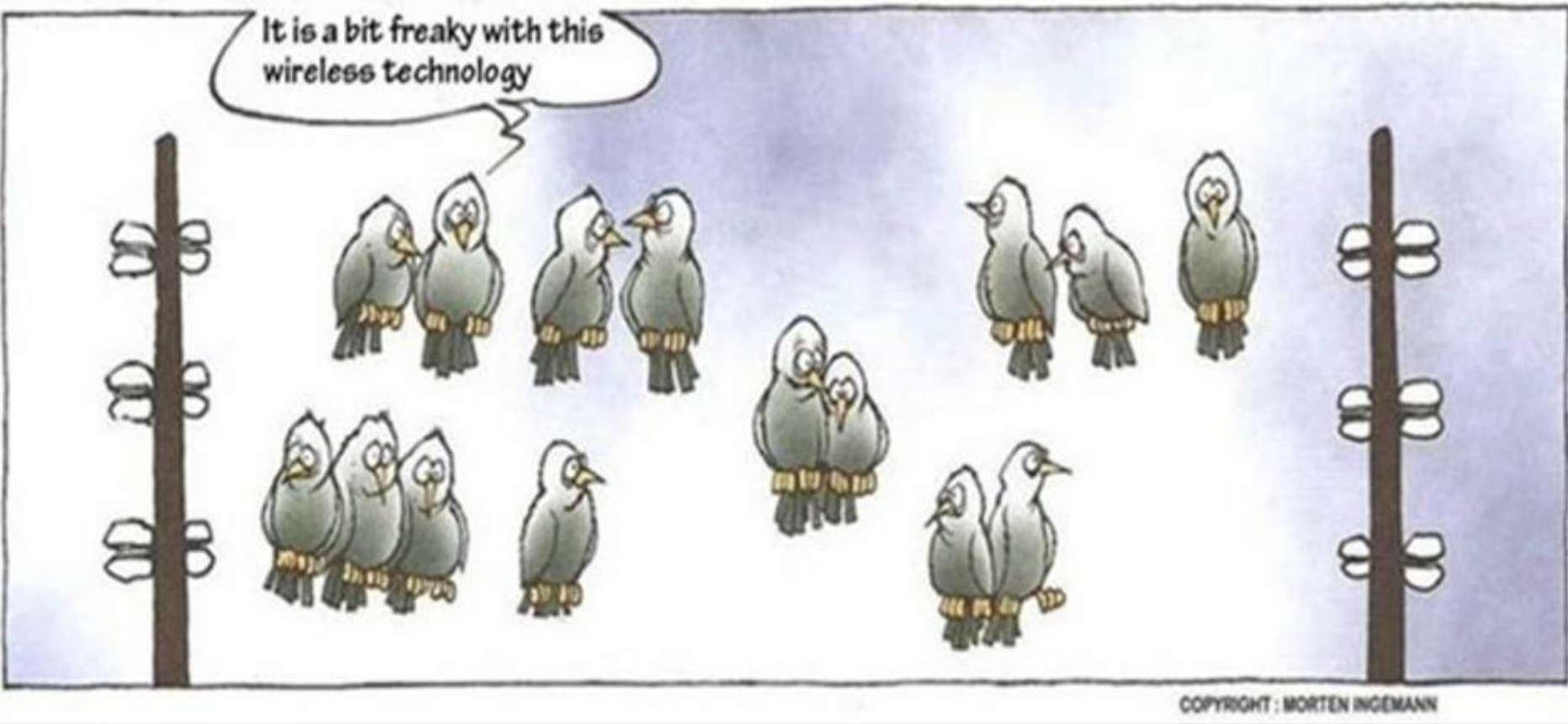




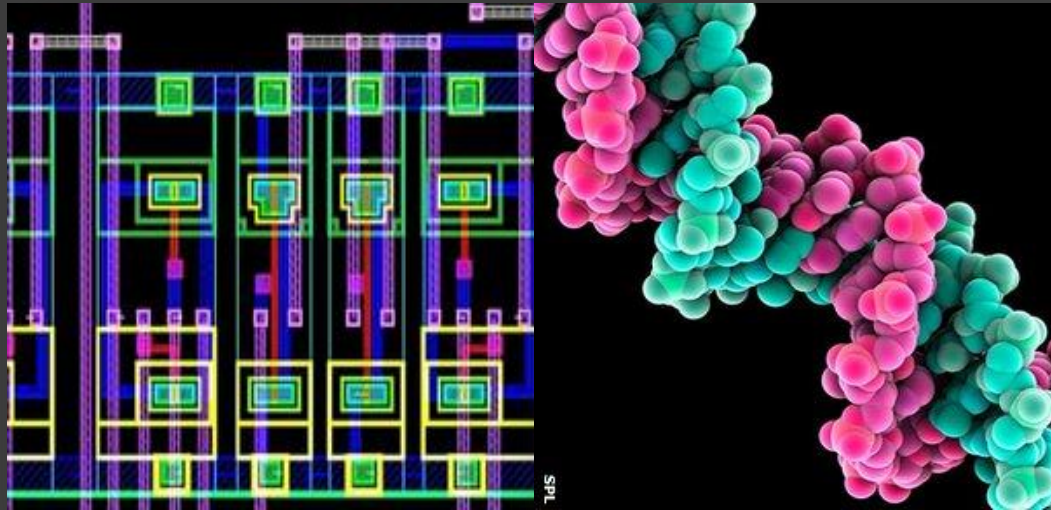
7/22/2013

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

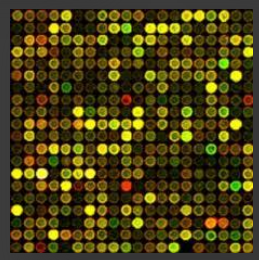
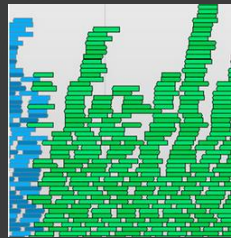
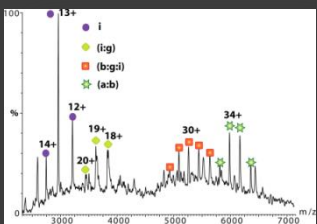
Strand Life Sciences: Investors



Burrill and Co., 2013

Strand Life Sciences: Businesses

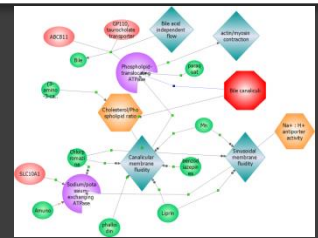
Software Products for Research Biology



Clinical Diagnostics using Next-generation Sequencing

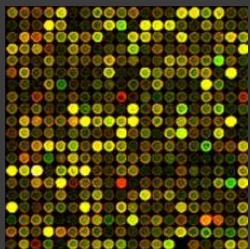
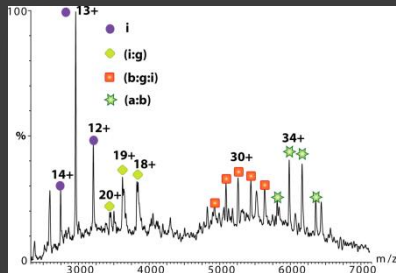


DILI Pharmacogenomics Custom Reports

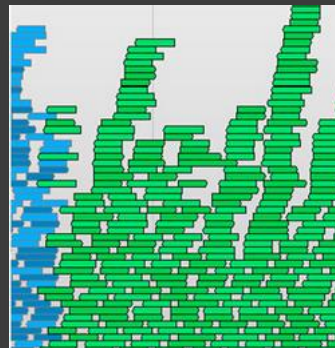


Strand Life Sciences: Products

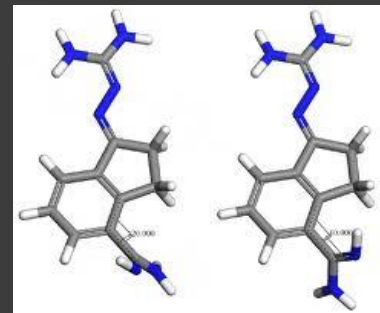
GeneSpring



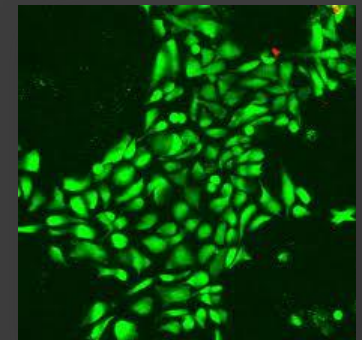
Avadis NGS



SArchitect



iManage

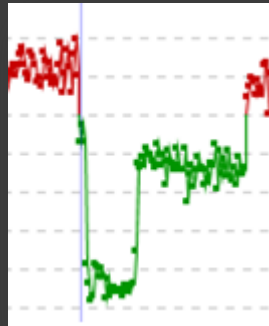


GeneSpring: Applications

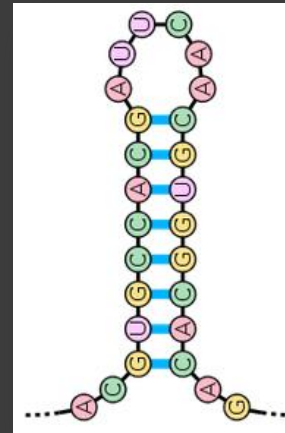
Gene Expression



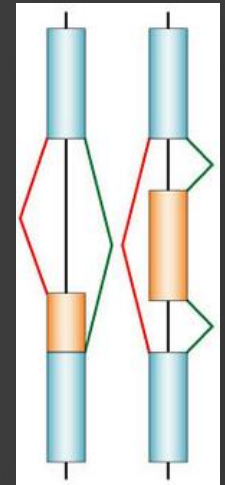
Genotyping



ncRNA Expression



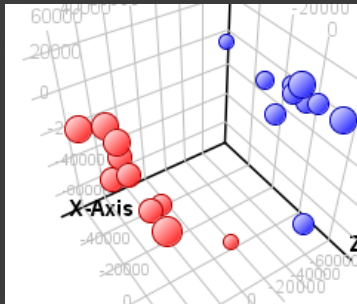
Exon Splicing



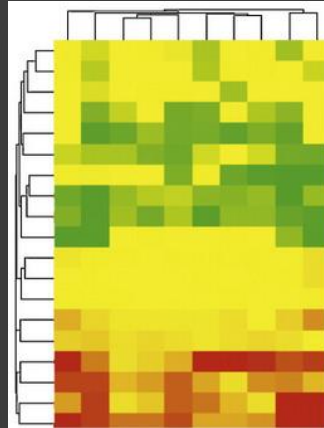
**GeneSpring is a trademark of Agilent Technologies;
GeneSpring is built in a partnership with Agilent**

GeneSpring: Elements

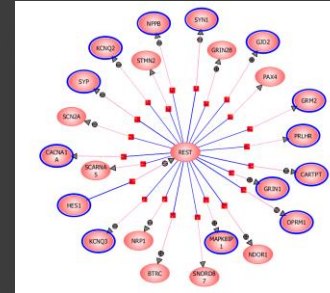
Visualization



Bioinformatics/
Algorithms



Literature



Workflows

Experiment Setup ⤴

Quality Control ⤴

Analysis ⤴

Class Prediction ⤴

Results Interpretations ⤴

Pathway Analysis ⤴

NLP Networks ⤴

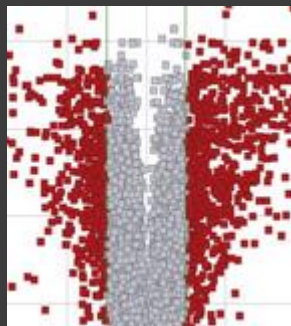
Utilities ⤴

GeneSpring Mass Profiler: Proteomics and Metabolomics

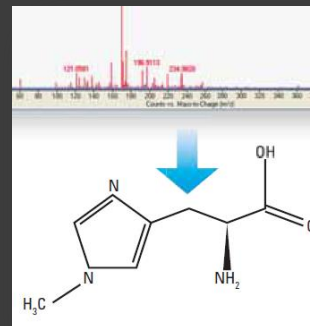
GC-MS, LC-MS and
ICP-MS data



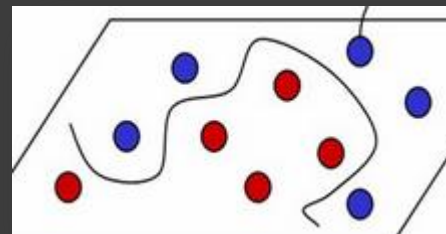
Feature Alignment,
Normalization,
Differential Statistics



Compound
Identification



Class Prediction



GeneSpring Impact

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

~2000 users

Prepublished online January 4, 2013;
doi:10.1182/blood-2012-09-457747

Gli3-mediated hedgehog inhibition in human pluripotent stem cells initiates and augments developmental programming of adult hematopoiesis

Brendan A.S. McIntyre, Veronica Ramos-Mejia, Shravanti Rampalli, Rami Mechael, Jong-Hee Lee, Cantas Alev, Guojun Sheng and Mickie Bhatia

Neurochemical Research

January 2013, Volume 38, Issue 1, pp 133-140

Functional Annotation of Genes Differentially Expressed Between Primary Motor and Prefrontal Association Cortices of Macaque Brain

Toshio Kojima, Noriyuki Higo, Akira Sato, Takao Oishi, Yukio Nishimura, Tatsuya Yamamoto, Yumi Murata, Kimika Yoshino-Saito, Hirotaaka Onoe, Tadashi Isa

A few recent publications

Nutrition and Cancer

Volume 65, Issue 2, 2013



Fatty Acid Synthase Inhibition Induces Differential Expression of Genes Involved in Apoptosis and Cell Proliferation in Ocular Cancer Cells

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

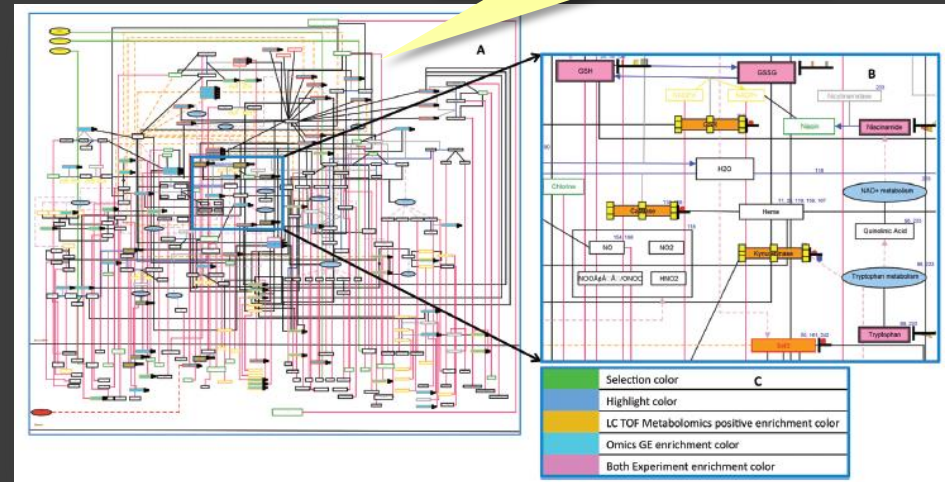
Machine Learning applied to the food industry

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

Integrative analysis via pathways

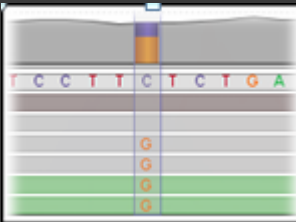


Transcriptomic and Proteomic Profiling of KEAP1 Disrupted and Sulforaphane Treated Human Breast Epithelial Cells Reveals Common Expression Profiles

[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

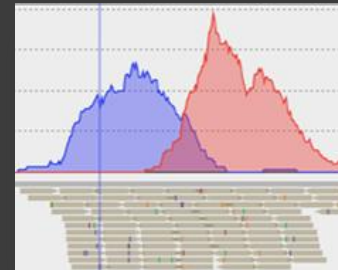
DNA Mutation
Detection



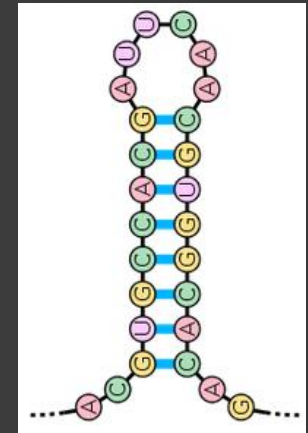
RNA-Seq



ChIP-Seq



Small RNA Expression





**Key challenge: handling billions
of reads on standard hardware**

Avadis NGS: Publications



Basic Science and Experimental Studies

A Global Transcriptome Analysis of a Dog Model of Congestive Heart Failure With the Human Genome as a Reference

Takahiro Isono, PhD¹,  , Takehir Suzuki¹, Tokuhiro Chano, MD, PhD²

AJHG

Volume 90, Issue 4, 6 April 2012, Pages 685-688

Report

Mutations in the Glycosylphosphatidylinositol Gene *PIGL* Cause CHIME Syndrome



Bobby G. Ng¹, Karl Hackmann², Melanie A. Jones Bhide³, Vincent Cantagrel⁴, Joseph G. Gleeson⁴, Janice Zunich⁷, Madhuri R. Hegde³, Hudson H. Fr



Journal of the Neurological Sciences

Volume 315, Issues 1-2, 15 April 2012, Pages 15-19

A novel mutation in *SCN4A* causes severe myotonia and school-age-onset paralytic episodes

Harumi Yoshinaga^a,  , Shunichi Sakoda^b, Jean-Marc Good^c, Masanori P. Takahashi^f, Tomoya Kubota^c, Eri Arikawa-Hirasawa^d, Tomohiko Nakata^e, Kinji Ohno^e, Tetsuro Kitamura^f, Katsuhiro Kobayashi^g, Yoko Ohtsuka^a

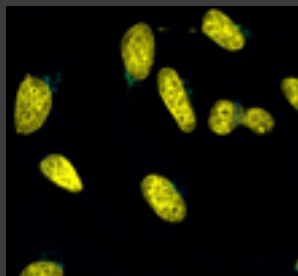
Recent publications

Avadis iManage: Elements

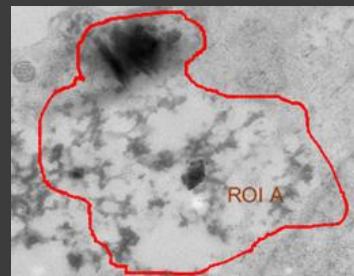
Jointly built with the
Institut Curie



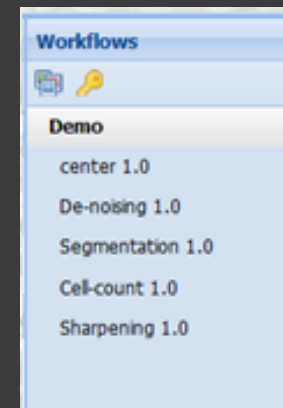
Image Management for
all microscopy images
and metadata



Visualization, Results
Annotation and
Collaboration



Pluggable architecture
for Image analysis
algorithms



The Avasis Platform: Access, Visualize, Analyze, Discover

The basis for our products

Ease of use and Customizability

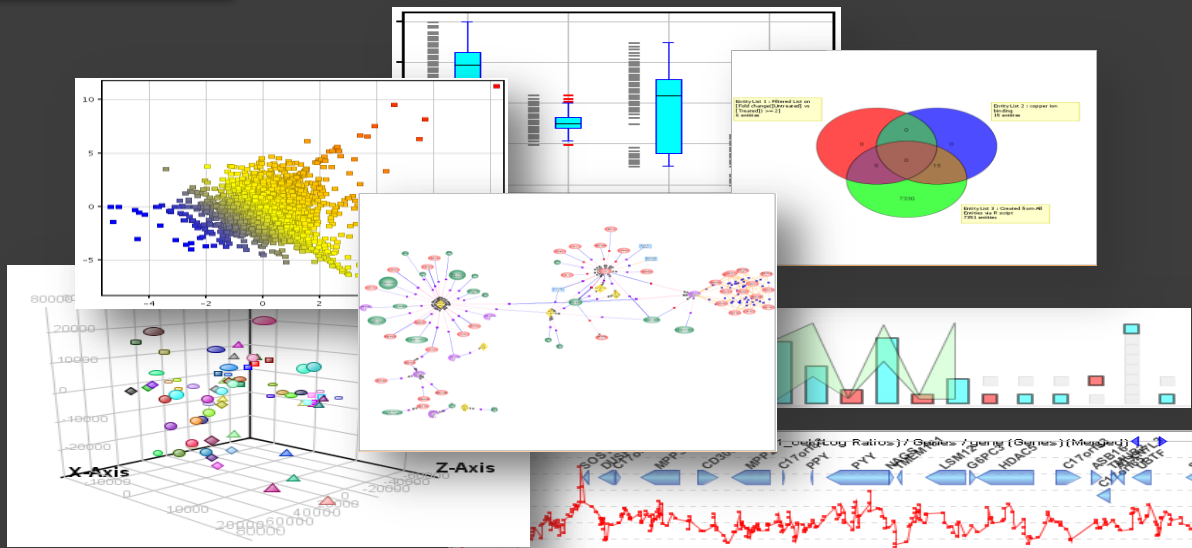
A Reusable Software Framework for Data Mining Applications

Dynamic Visualization

Pluggable Scripting and Workflows

Data Structures and Algorithms for Data Handling

Rapid product building



Workflow

- Experiment Setup**
 - Experiment Grouping
 - Create Interpretation
- Quality Inspection**
 - Pre-Alignment QC Plots
 - Base Quality by Tile
 - Alignment Quality by Tile
 - Alignment QC Plots
 - Fix Mate Status
 - Targeted Region QC
- Filter**
 - Filter by Tile Quality
 - Filter by Read Metrics
 - Filter by Read Status
 - Filter on Duplicates
 - Filter Samples
 - Filter by Region List
- Analysis**
 - SNP Detection
 - Find Significant SNPs
 - SNP Effect Analysis
 - Find Damaging Variants
 - Check for known Variants
 - SV Detection

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

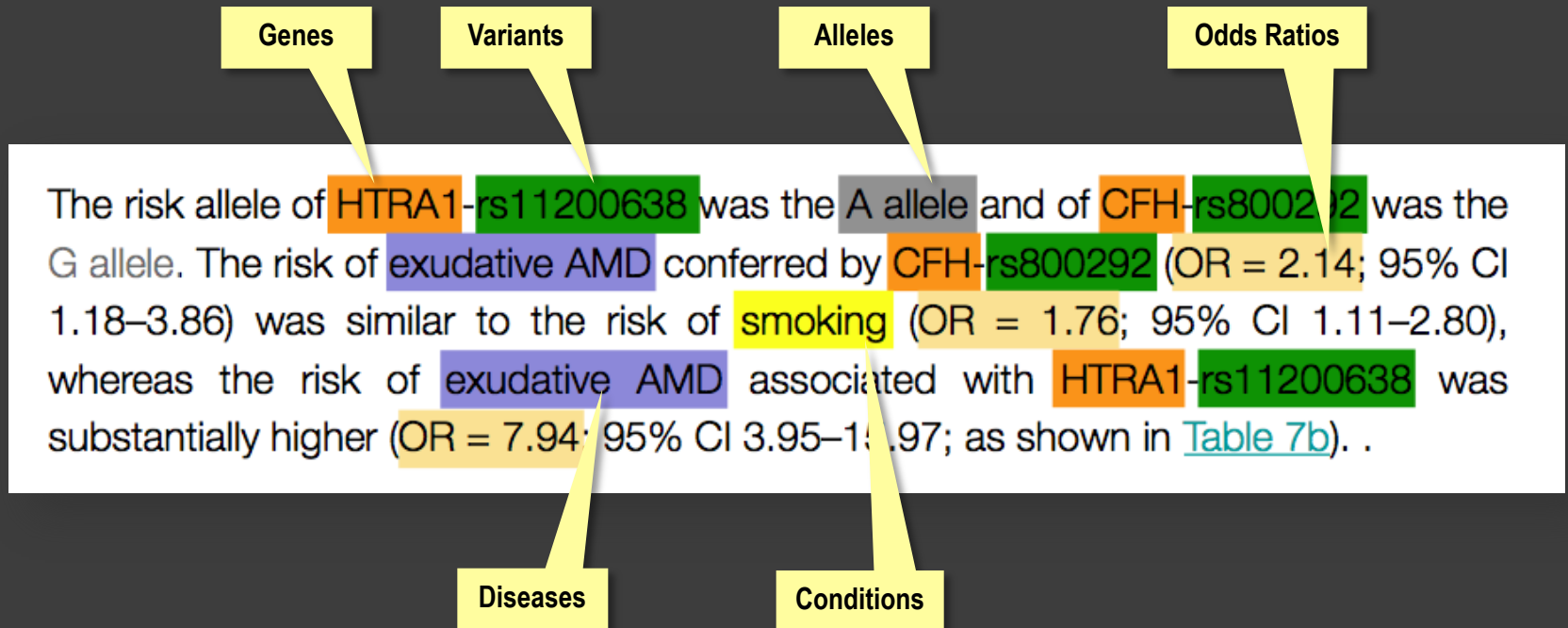
SEMANTIC INFERRENCING

Understanding meaning from parsing output

FACT EXTRACTION

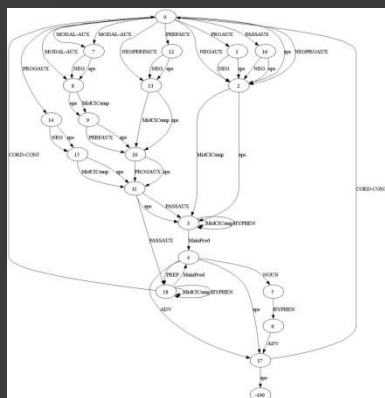
Extracting associations between entities via shallow parsing

Avadis NLP: Entity Tagging

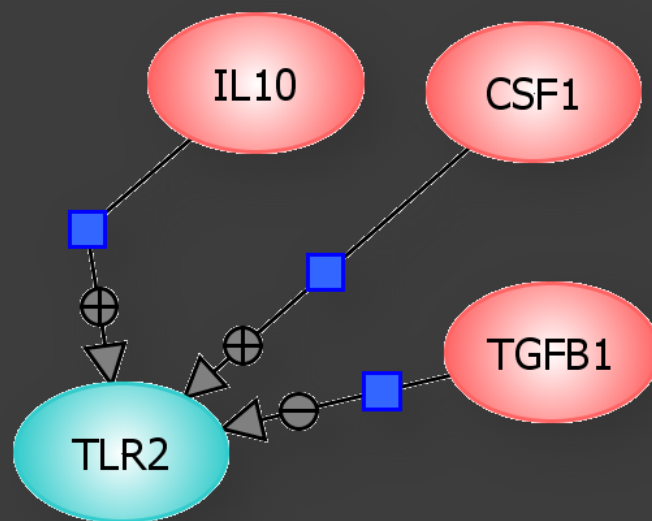


Avadis NLP: Fact Extraction via Deep Parsing

“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

Proof of concepts in progress
with Amgen, Pfizer etc

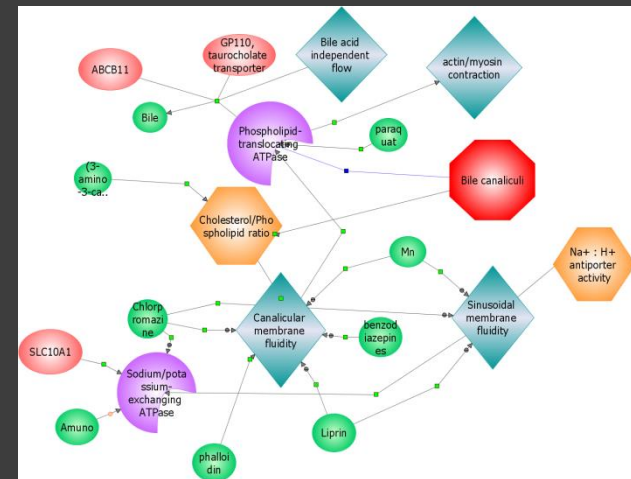
Identify Pathways

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



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

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

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

Insilico to Wet Biology

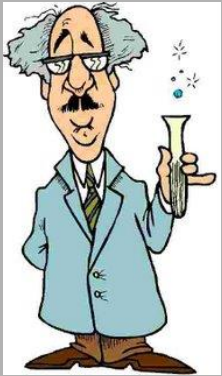


Ganit Labs

StrandX Clinical Labs

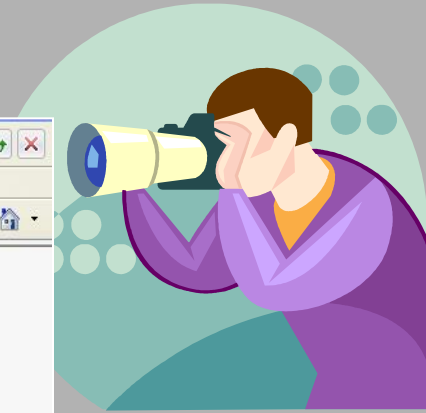


Researchers



CSR

Amateur Naturalists









http://thewesternghats.in/

File Edit View Favorites Tools Help

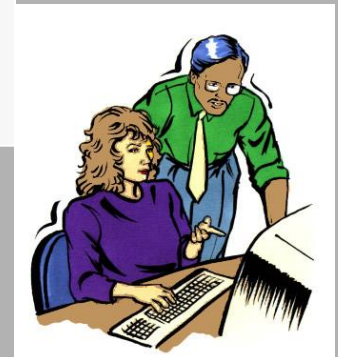
★ Favorites Western Ghats Portal

western Ghats beta

 Species	 Maps	 Checklists	Number of MAP LAYERS 96 Number of CHECKLISTS 291 Number of SPECIES PAGES 1129
 Observations	 Themes	 About	

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**

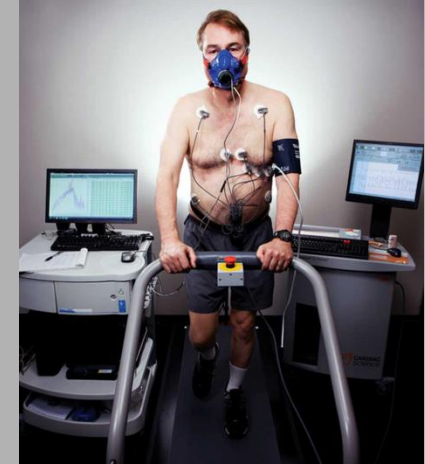
Wisconsin Medical

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

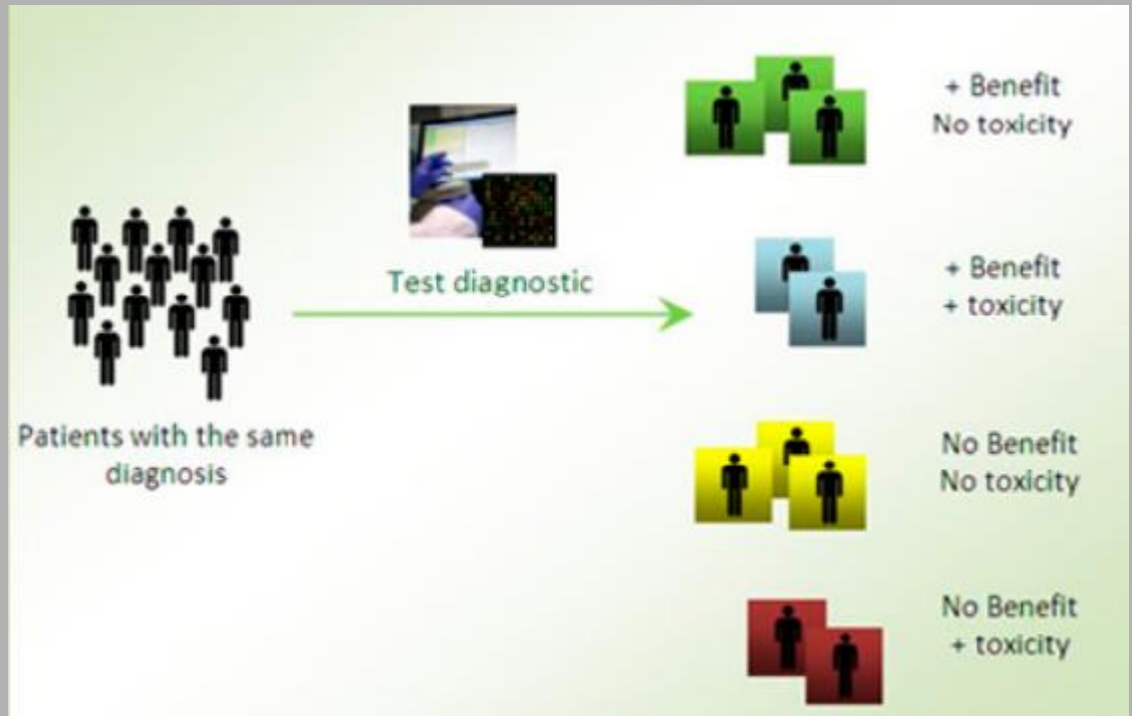
Diagnostics for Precision Medicine

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



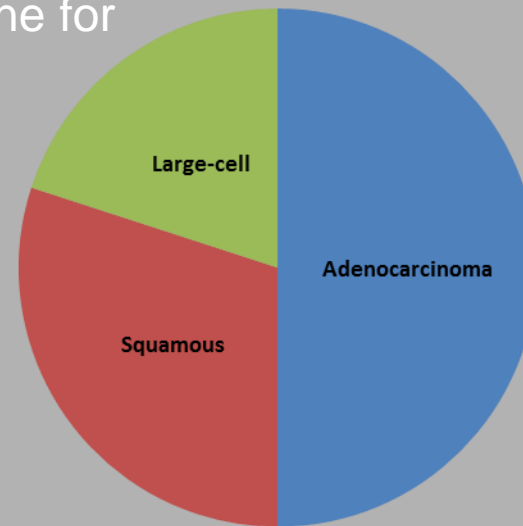
Right Drug
Right Disease
Right Time
Right Dosage

Precision Medicine



Rapidly Changing Standards of Care

- Precision Medicine for Lung Cancer

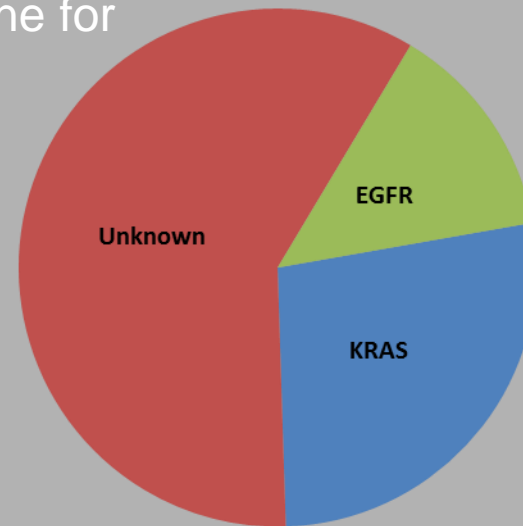


Traditional

Rapidly Changing Standards of Care

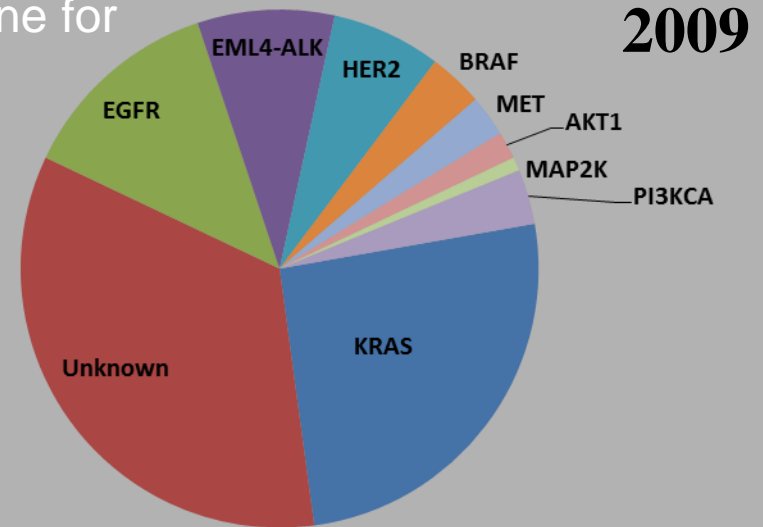
- Precision Medicine for Lung Cancer

2004



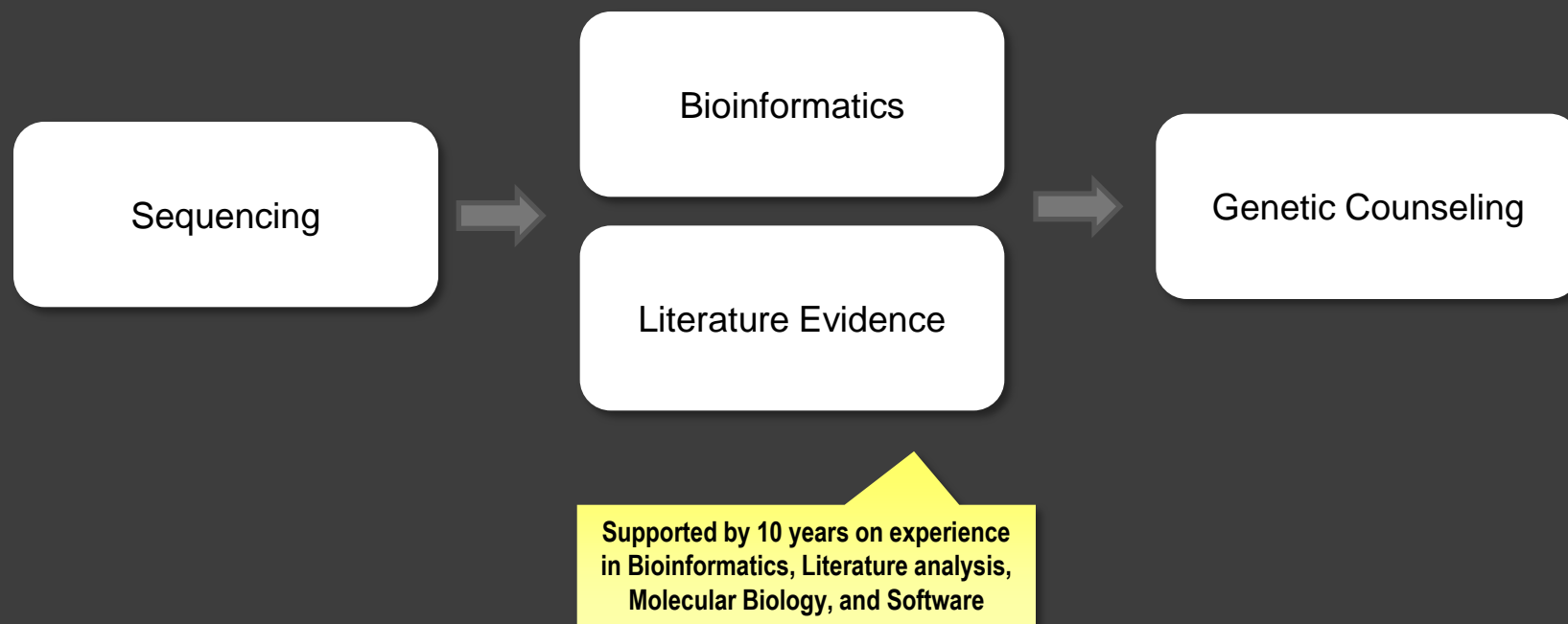
Rapidly Changing Standards of Care

- 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

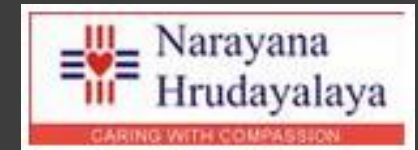
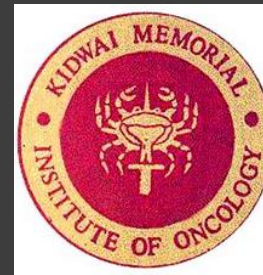
Rare Diseases

Cardiology

Oncology

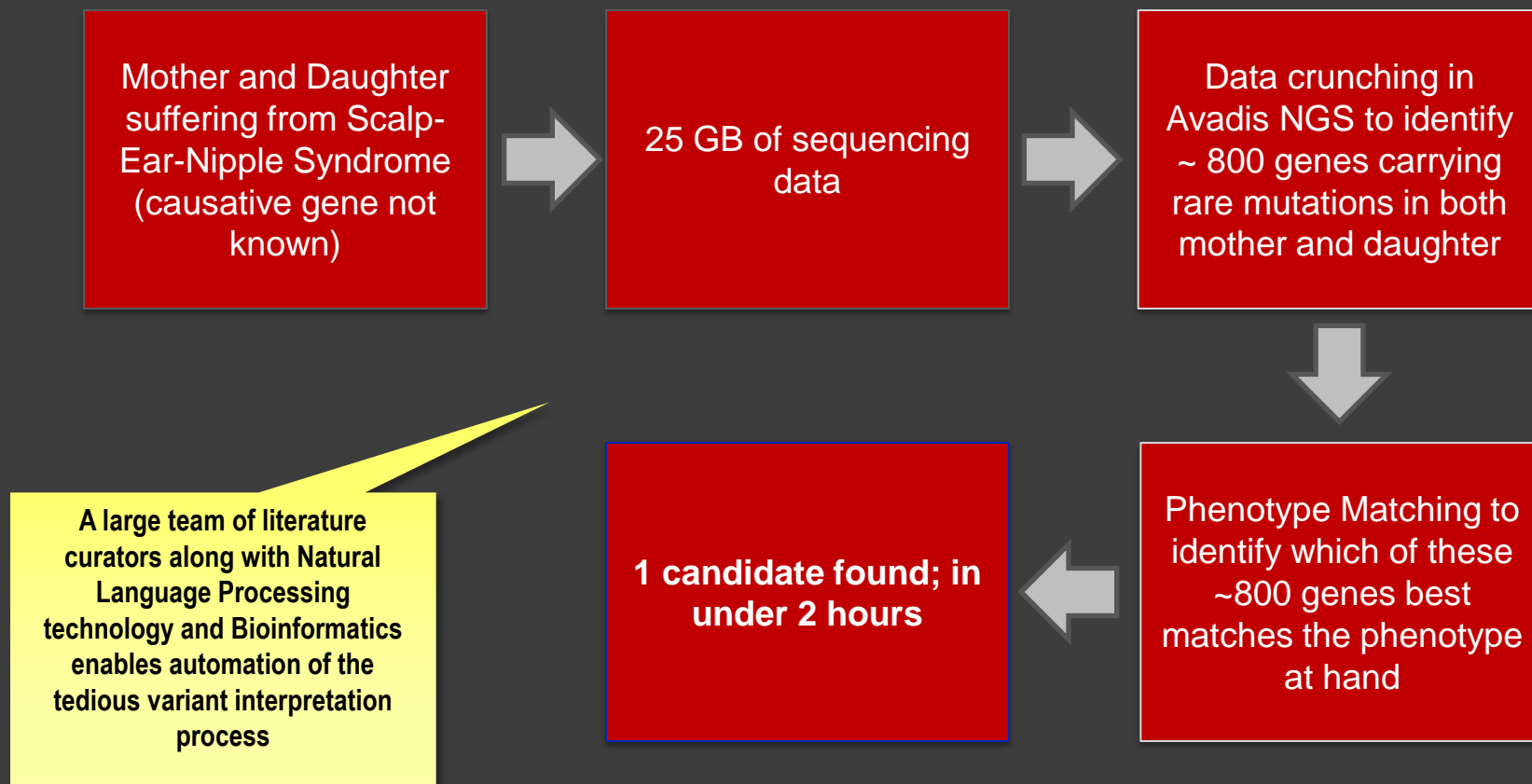
Metabolic Diseases

Ophthalmology



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

Anthra-Prerna

Self Motivated

