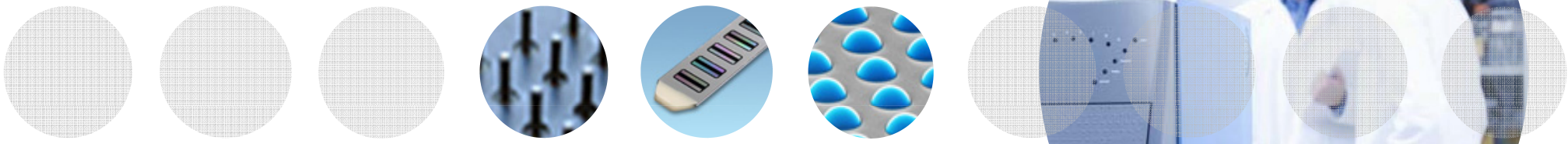
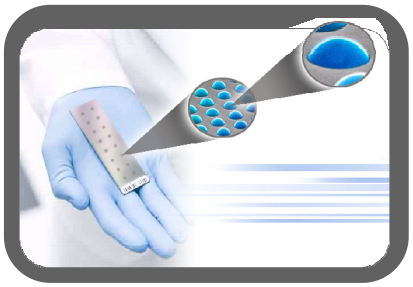
illumina®
making sense out of life



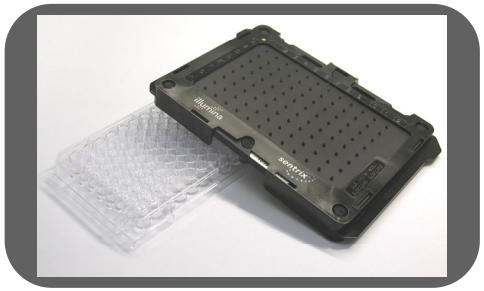
SDSU ACSESS Forum

March 27, 2009
Bob Kain
VP Engineering
Illumina

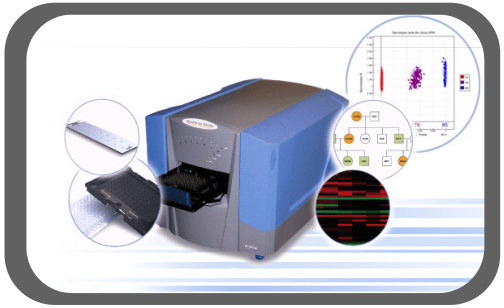
Illumina's mission is to develop next-generation tools for the large-scale analysis of genetic variation and function, the results of which will pave the way for personalized medicine



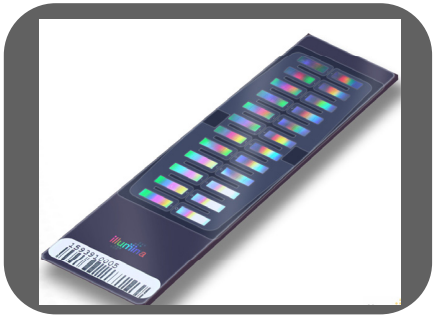
1998 - ILMN founded based on Bead Sensor technology



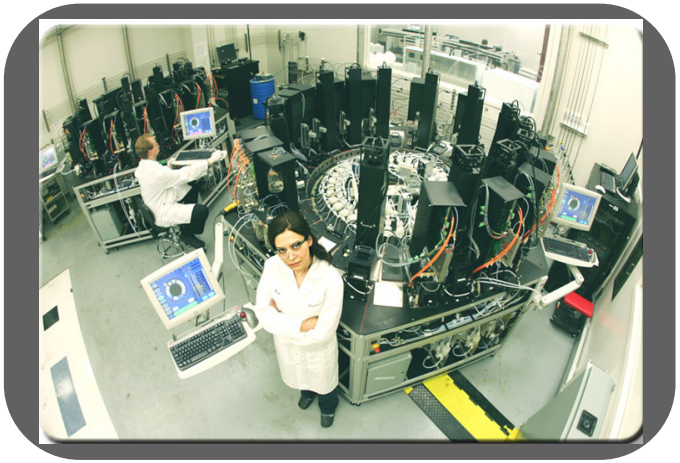
2003 – Array Matrix
155 K tests



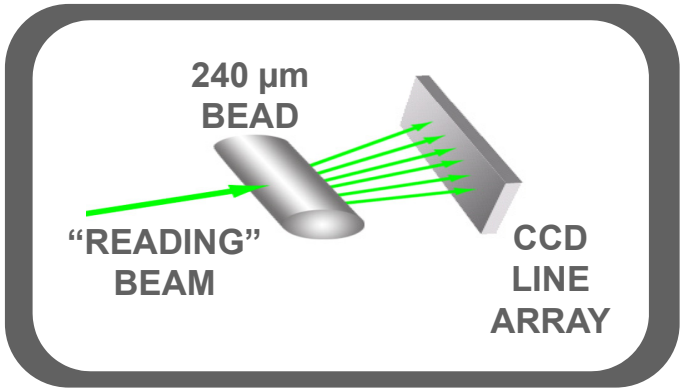
2003 - Assays, SW, LIMS, & Instrument
75K answers/hour



2005 - 100K Beadchip
2008 – duo 1M BeadChip
1M tests/ slide
1M answers/hour



2001 – 1st Gen DNA Synthesizer
2005 - 3rd Gen DNA Synthesizer
1 Million DNA bases/day



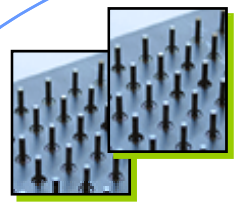
2005 - Acquisition
Holographic bead encoding
Low cost diagnostic products

2006 - Acquisition
DNA Sequencing instrument
1 Gigabase/run

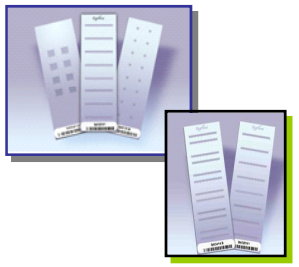
Technology/Product synergies help focus & leverage innovation

Broadened Markets

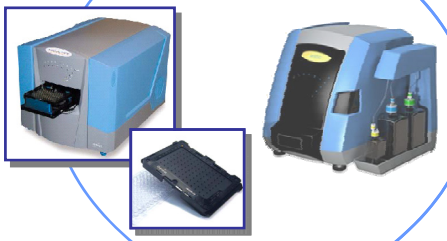
Discovery Research → *Focused Research* → *High Throughput Applications* → *Med-Low Density GE assays* → *Protein Expression* → *Mol Dx & Emerging Markets*



High Density SNPS & GE Arrays



Custom Microarrays



High Throughput Flexible Custom Assays

Custom Soln Phase Assays

IVD Screening

Mol Dx

Protein Assays

Bead Array Technology | **Digital Bead Technology**

Broadened Technology Foundation

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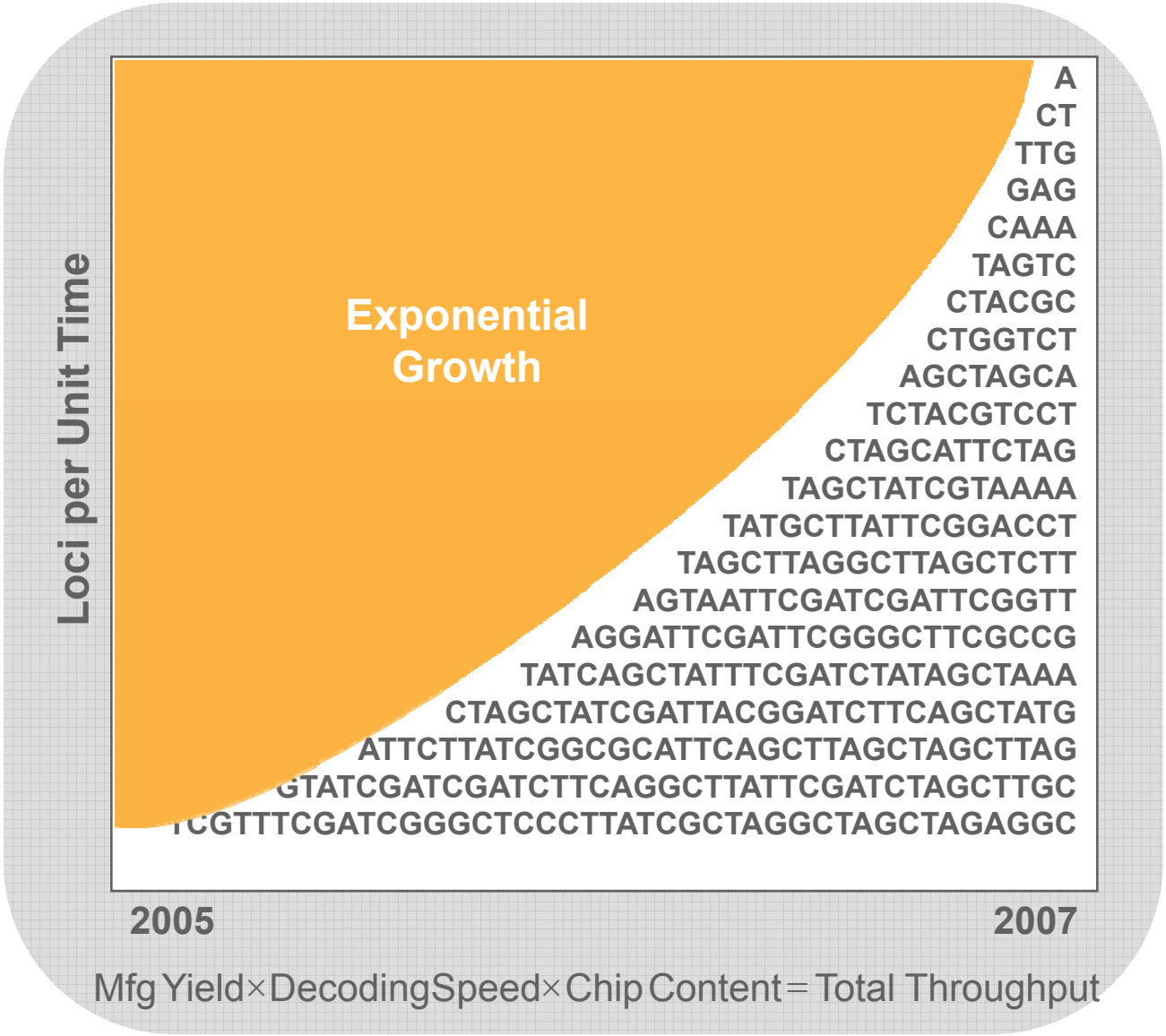
Higher Manufacturing Efficiency

Driving Higher Throughput per Modular Manufacturing Unit



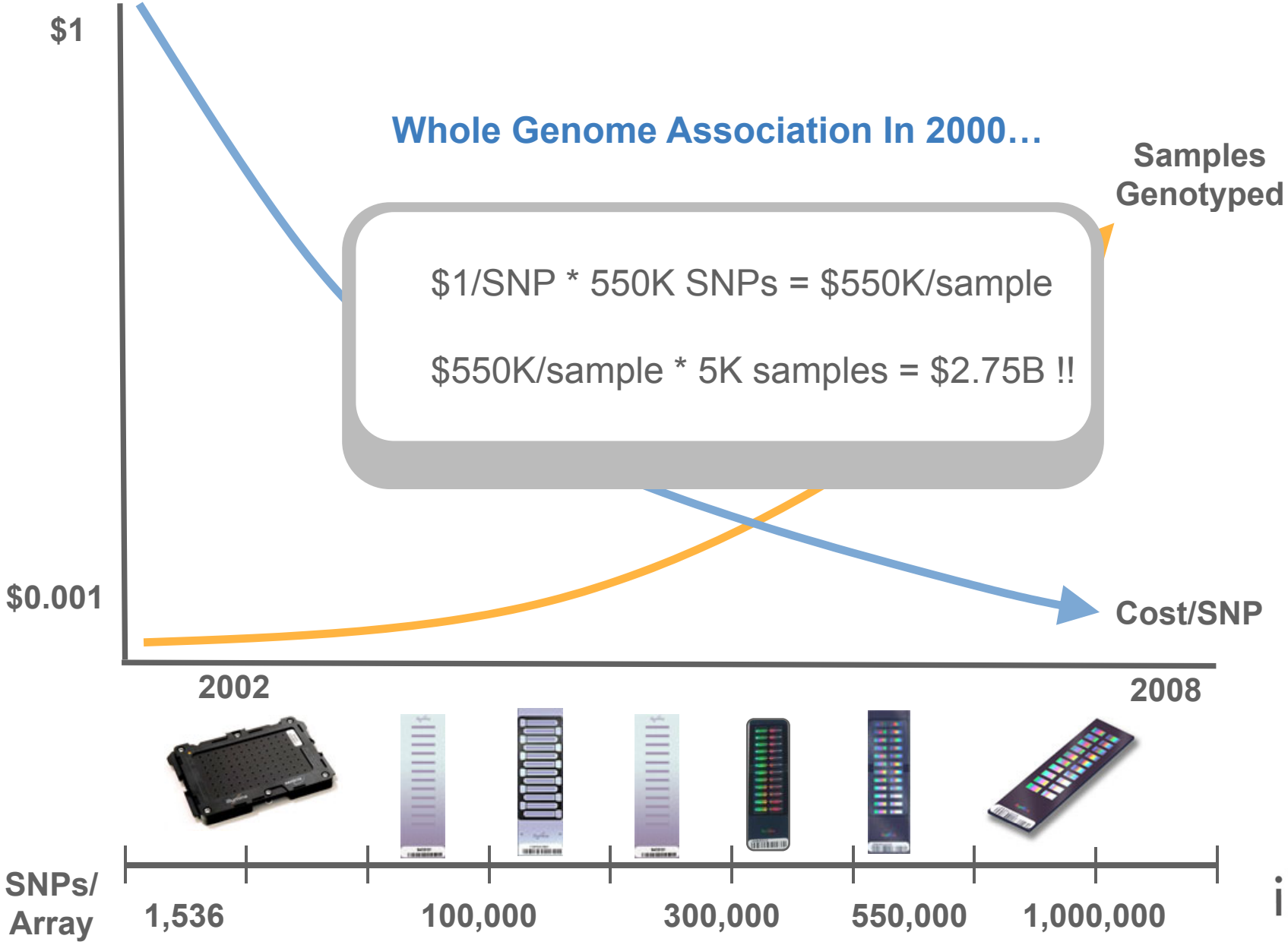
Drivers

- SNPs per Chip
- Decoding time
- Manufacturing yield

2005 - 2007
21x Improvement in Manufacturing Efficiency and Still Gaining

Innovating to Drive Down Costs

SNP Genotyping is a Highly Elastic Market



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What skills to grad students lack when they come on board and are essential to develop

- Cross functional and cross-business team experiment
- Understanding of the nature of R&D vs. product development
- How to “Engineer”
- Leadership: technical and project
- Organizational Savvy – how do people get things done in an organization
- Ability to function as part of a high performance team
- Understanding of Manufacturability and Serviceability and role in product success

What skills and/or knowledge should academia include in future curriculum

- Integrated system knowledge – different combinations of:
  - 1980s and 1990s : Electronics, optics, SW, mechanics
  - 2000:to now: Biology, chemistry, molecular biology, bioinformatics, computational analysis, laboratory automation, genetics
  - 2010: All of the above plus manufacturing process development
- Appreciation of how companies work
  - Focus on team results vs. individual results
  - Understanding of the path from idea to product hand-off to operations
  - Understanding of the organizational roles and structure

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Hiring at Illumina

- Five year outlook
  - Hardware engineering, process engineering, chemistry, biology, informatics, software, laboratory automation, computational biology, …
- Degrees we look for
  - BS, MS, Ph.D.
- What else do we look for
  - Technology breadth
  - Cultural fit
  - Ability to function on teams
  - Passion for results
  - Competence
  - Interest in or passion for the “system”

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