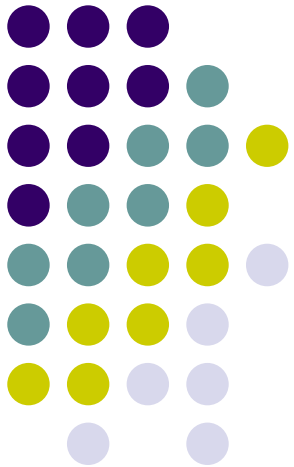
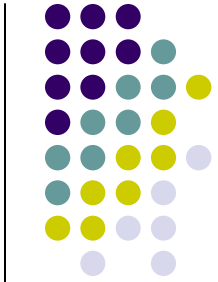
Laboratory and Data Management for Scientists

David L. Blum, Ph.D.
Research Assistant Professor
Department of Biochemistry

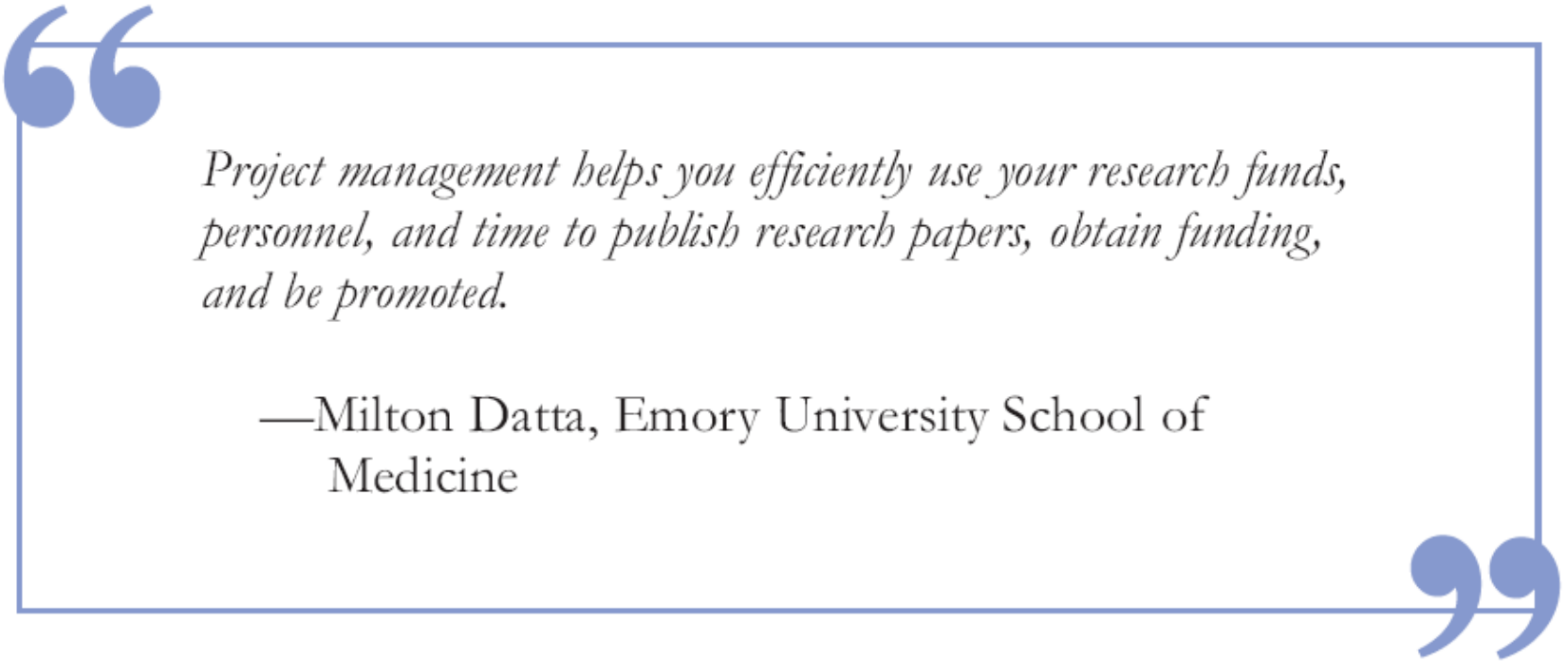


OUTLINE



- Project Management
  - Choosing the right project
  - Project Plans
  - Project Management tools
- Data Management
  - Record Keeping
  - Inventory
  - Number crunching

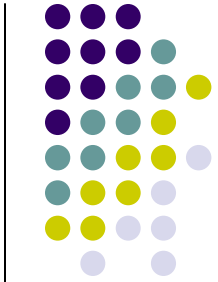
Project Management



Project management helps you efficiently use your research funds, personnel, and time to publish research papers, obtain funding, and be promoted.

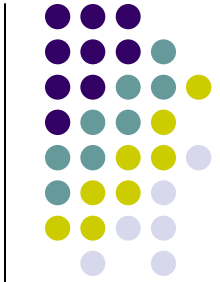
—Milton Datta, Emory University School of Medicine

Choosing the right project



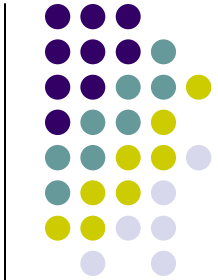
- Be publication oriented
- Keep goals/deliverables in mind
- Have a timeline, but be flexible
- Make sure key materials/resources are available
- Access to samples
- Capital equipment

Statement of Work



- Purpose
  - Background
  - Scope of Work
- Objectives
  - Statement
  - Measures
  - Specifications
- Constraints
  - Limitations
  - Needs
- Assumptions

Audience - People affecting the success of your project



- Drivers - you, collaborators, editors
- Supporters - lab personnel
- Observers - colleagues

Project Plans

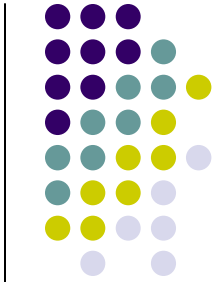
- To Gantt or not to Gantt?
- Critical Paths
- Deadlines (real or imaginary?)
  - Milestones
- Activities Plan
- Events Schedule
- Things not under your control
  - Plan for the worst hope for the best

GANTT charts

- Developed by Karol Adamiecki and published by Henry Gantt in 1910 (Harmonogram)*
- Allows users to map out project timelines and show dependency of tasks
- PERT (Program Evaluation and Review Technique) is another type of project management tool.
  - Activities represented by interconnected lines and nodes instead of horizontal lines (GANTT)

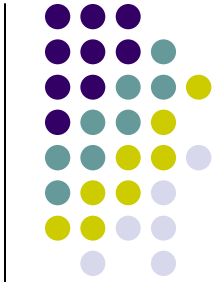
*http://en.wikipedia.org/wiki/Gantt

GANTT Chart Definitions

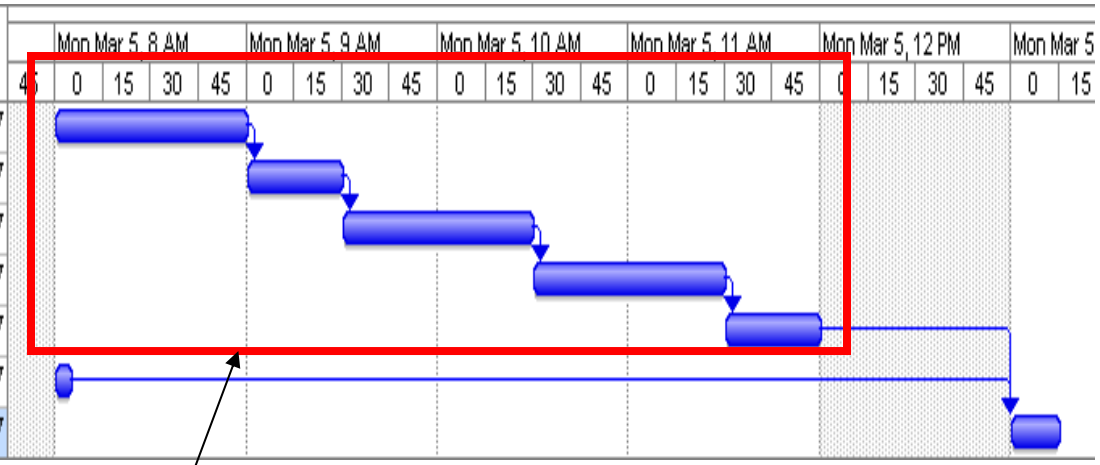


- Task - An action in a project plan
- Link - a way to visually show a connection between 2 adjacent tasks
- Critical Path - sequence of events denoted the minimum time to complete a project
- Milestone - event marking a significant change in development
- Finish to Start - Common way how 2 tasks are linked

Simple GANTT Chart

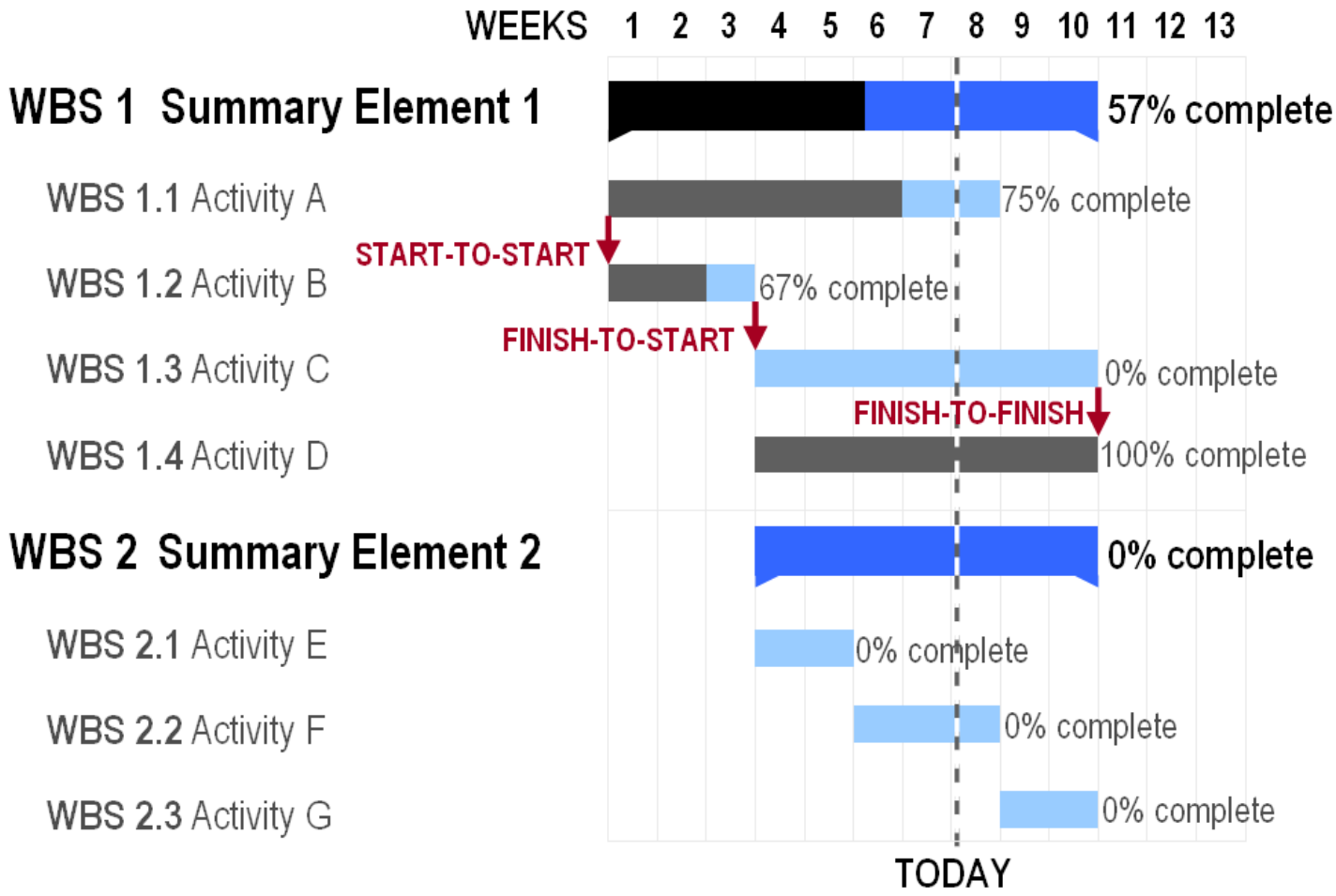


ID	Task Name	Duration	Start	Finish
1	find ingredients	1 hr	Mon 3/5/07	Mon 3/5/07
2	mix ingredients	30 mins	Mon 3/5/07	Mon 3/5/07
3	bake cake	1 hr	Mon 3/5/07	Mon 3/5/07
4	cool cake	1 hr	Mon 3/5/07	Mon 3/5/07
5	frost cake	30 mins	Mon 3/5/07	Mon 3/5/07
6	set table	5 mins	Mon 3/5/07	Mon 3/5/07
7	serve cake	15 mins	Mon 3/5/07	Mon 3/5/07



Critical path

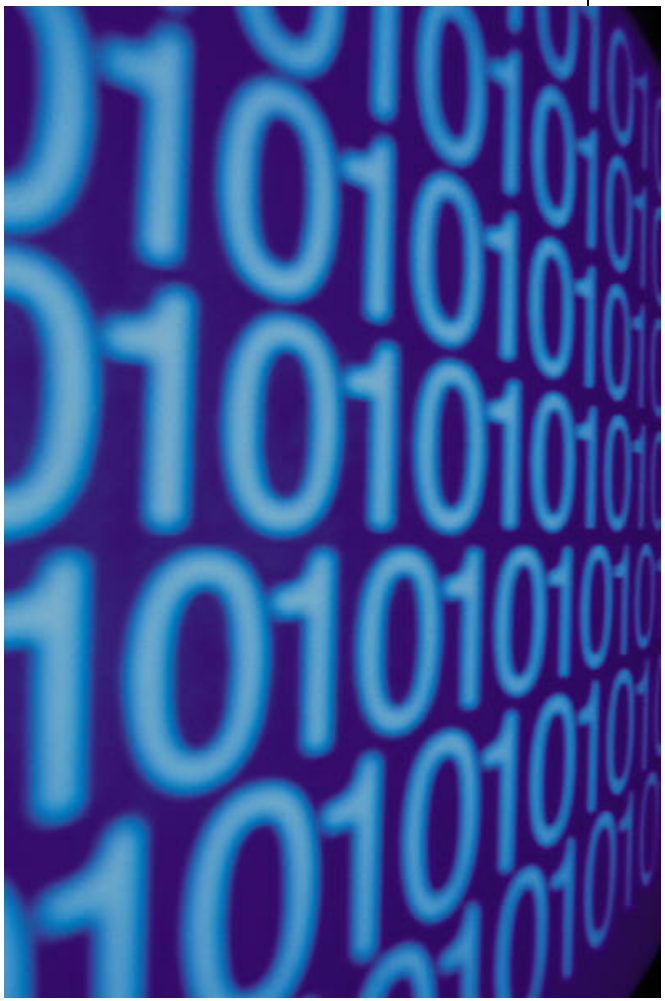
GANTT Chart



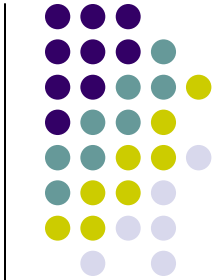
http://upload.wikimedia.org/wikipedia/en/e/e2/GanttChartAnatomy.png

Project Management Software

- Gantt Charts
  - MS Project
  - OmniPlan (Mac)
  - ProPlanning (Mac)
  - MS Excel et al.
- Calendar or event schedulers (many)



Data Management



Enter all your work in a notebook—even procedures that did not work.

—David Adams, Duke University Medical Center

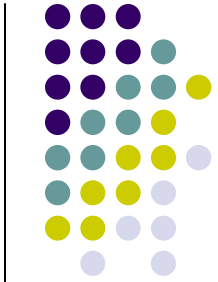
Reading notebooks is a nonconfrontational way to keep current with your students' and postdocs' work, and notebooks are critical when these lab members leave.

—Joseph Vinetz, University of Texas Medical Branch–Galveston

Record Keeping

- Notebooks
  - Electronic
  - Paper
  - Paper towel
- Journaling - The Lab Diary
- Protocols
- US Patents - first to invent
  - Cosigning of lab notebooks critical for establishing invention ownership

Electronic v. paper Notebooks



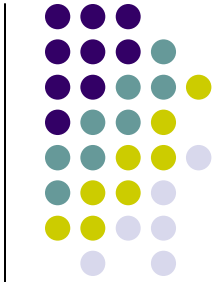
Electronic

- Initial software purchase
- Easy to search
- Can be shared remotely
- Resolves issues of poor handwriting
- Not all allow digital signing for patents
- Implementation and cost can be issue depending on the notebook

Paper

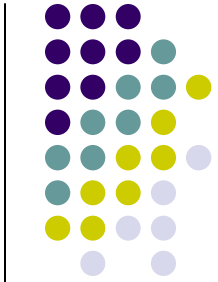
- Easy to use, but hard to search (requires TOC)
- Patent ready
- Scanned backups necessary in case of theft or damage
- Cost can be an issue depending on the notebook and number of projects

Lab notebook guidelines



- Use a permanently bound book and ink
- Use a table of contents
- Enter all observations and data directly into the notebook. Prettiness is not important.
- Each experiment should stand on its own
- Explain nonstandard abbreviations
- Periodically scan notebooks in case of loss or damage
- Cross through blank pages and large spaces

Notebook signing

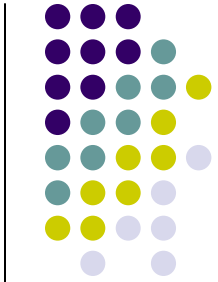


- U.S. patent assignment - First to invent (FTI)
- ROW - First to file

Notebook witnessing

- Industry - all pages signed and witnessed
- Academia - learn what to sign
- Find out what works best for your lab

Patent dispute settlements

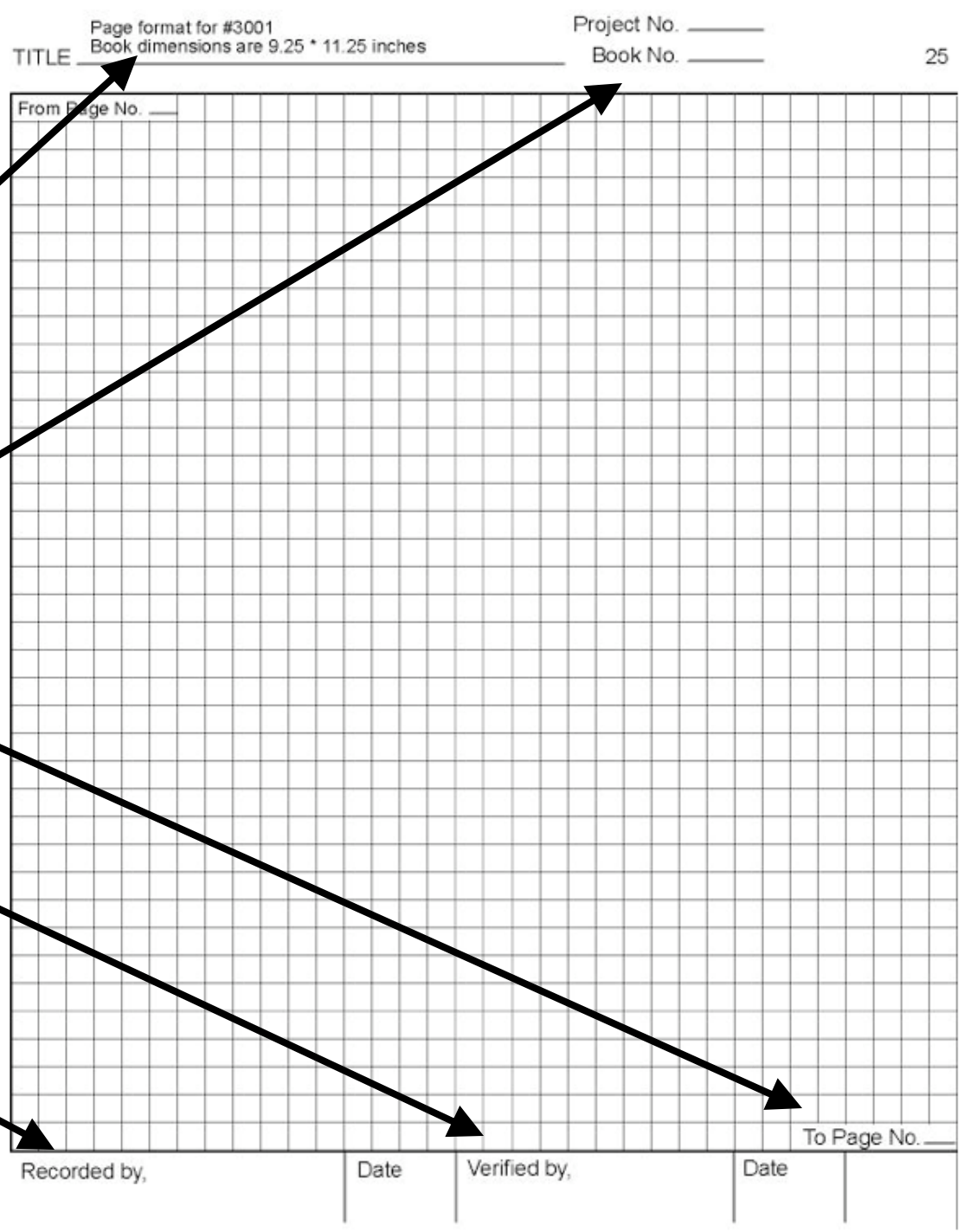


- Monsanto v. UC - UC awarded $100 million
  - Bovine Somatotropin
- Genentech v. UC - UC awarded $200 million
  - Human Growth Hormone
- Many Others
  - Inventorship timing based on when your notebook was cosigned not when you signed it!

Anatomy of a "Good" Lab Notebook

- Title for TOC
- Projects kept in separate notebooks
- Link to pages
- Verified (cosign)
  - Person not on same project
- Recorded by and date (FTI)

http://www.snco.com/



ELN software

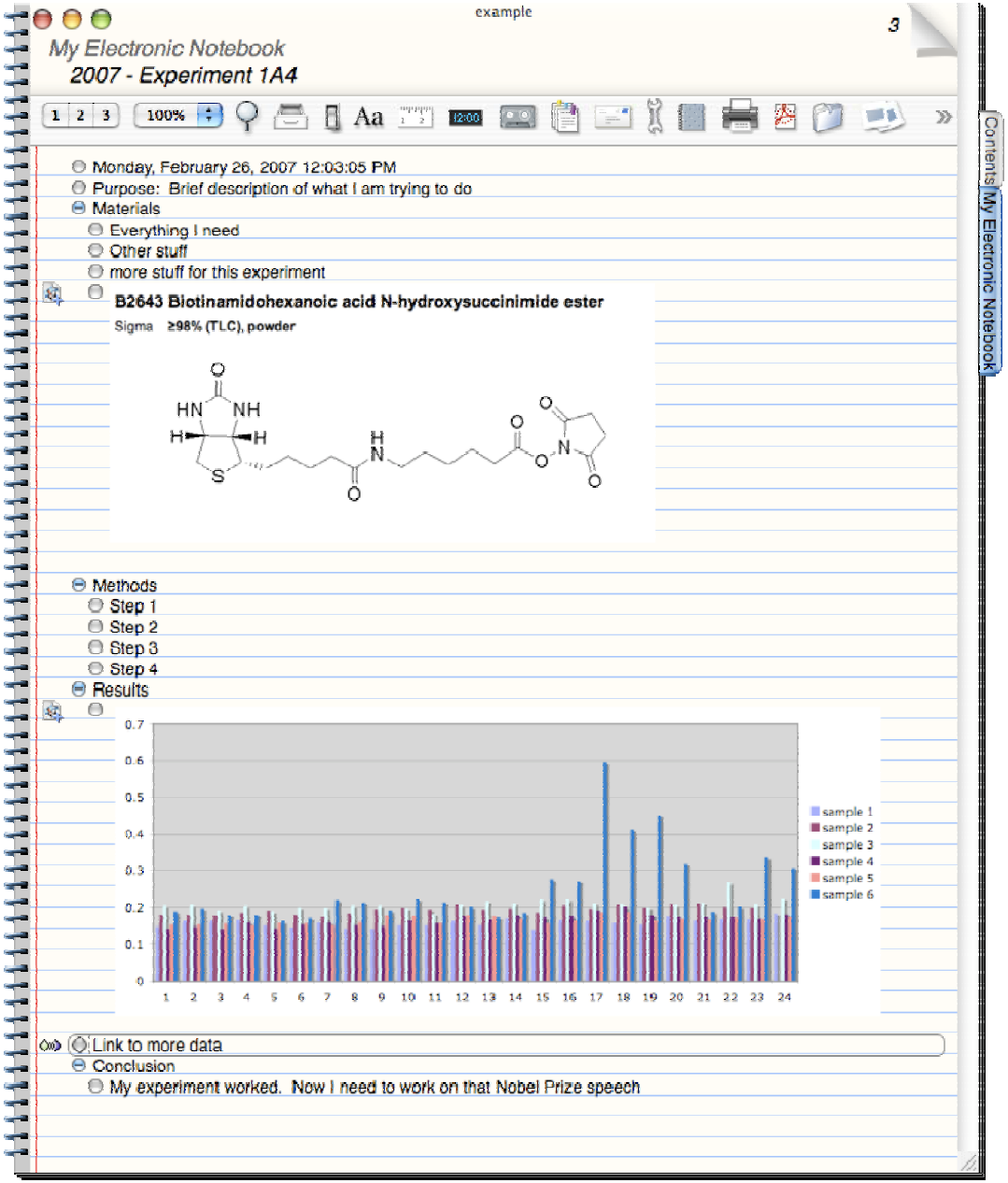
Dedicated ELN software

- Kalabie
- SmartTea
- Contur
- ACS
- NeuroSys

Note taking programs

- MS OneNote
- MS Word/Excel
- NoteTaker/NoteShare

NoteTaker/NoteShare Software



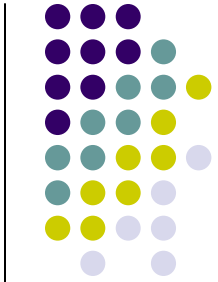
Information Management

Track collaborators, samples, chemicals, etc.

- Excel Spreadsheet
- Databases
  - Filemaker Pro (Mac&PC)
  - Access (PC only)
  - Alpha Five (PC only)
  - Paradox (PC only)
- Find out what works for you (benefit per time & effort)

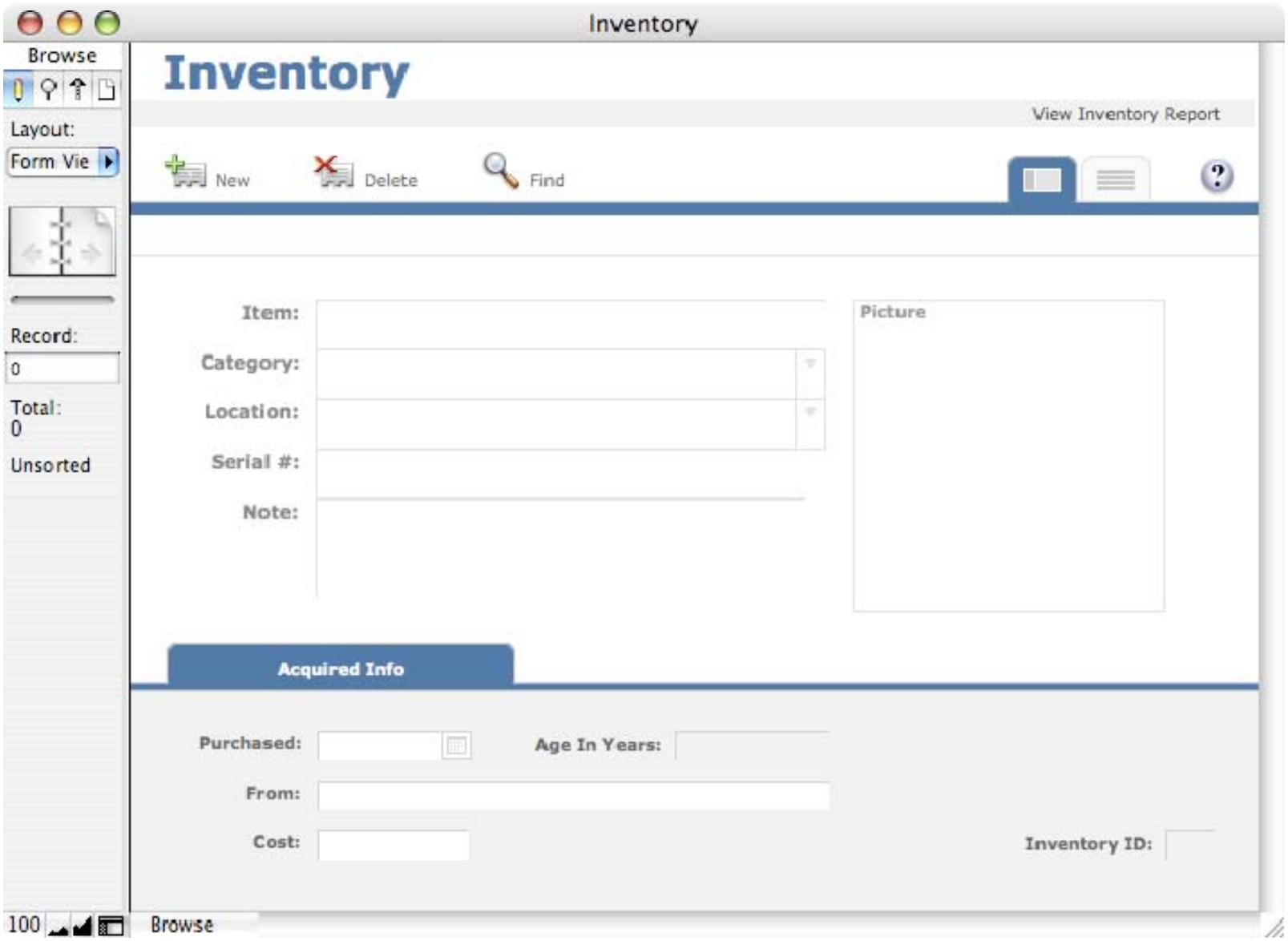
"We can't be out of mustard. I'm showing two bottles in the pantry, top shelf, on the left."

Relational Databases

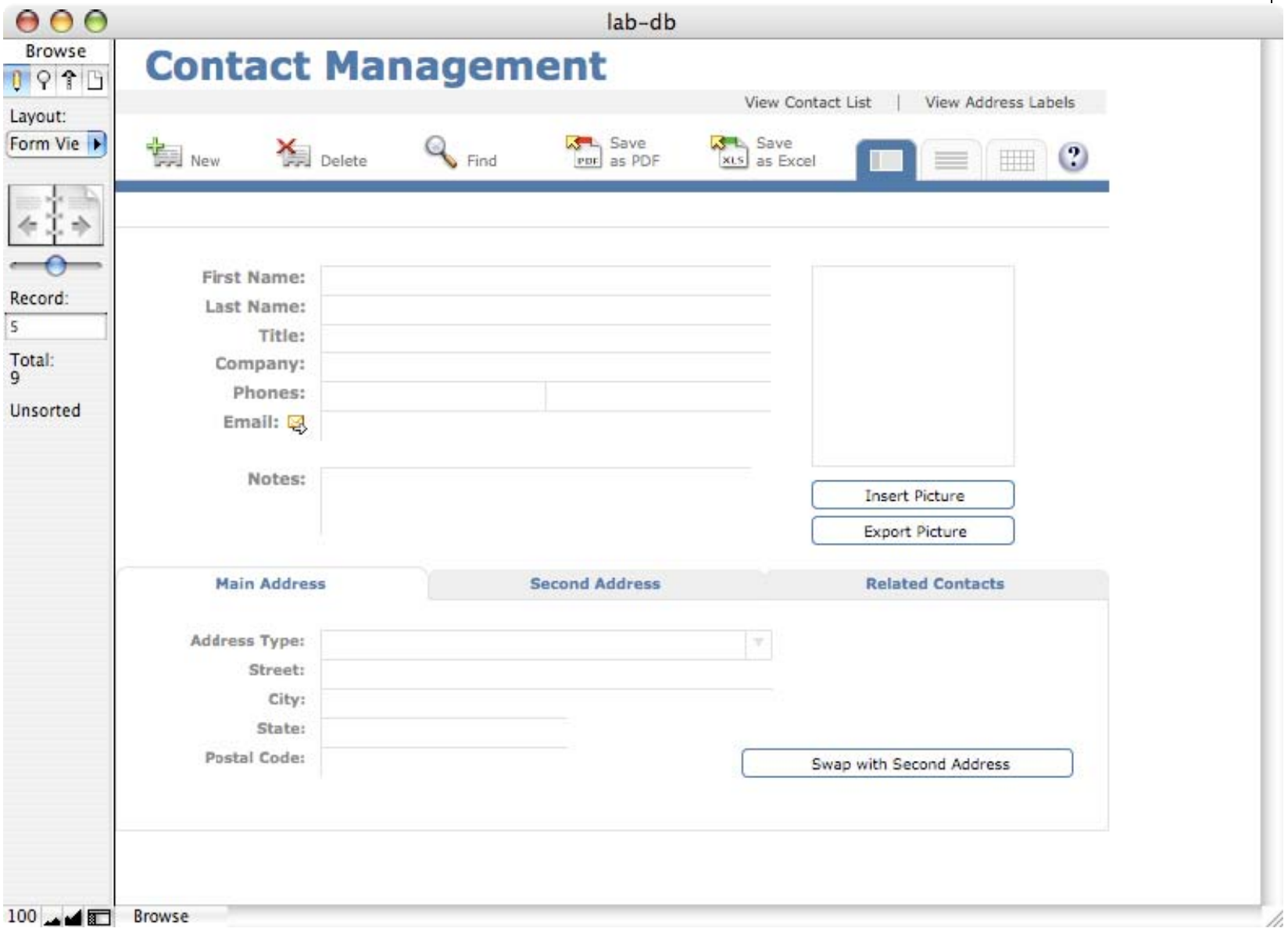


- Collection of “related” tables
- Queries (searches) used to combine data from different tables
- Large tables (Excel has limits)
- Customizable forms for data entry
- Calculations
- Retail databases can be used for LIMS
- Only as good as the information in them
  - Be persistent
  - Make data entry part of lab culture

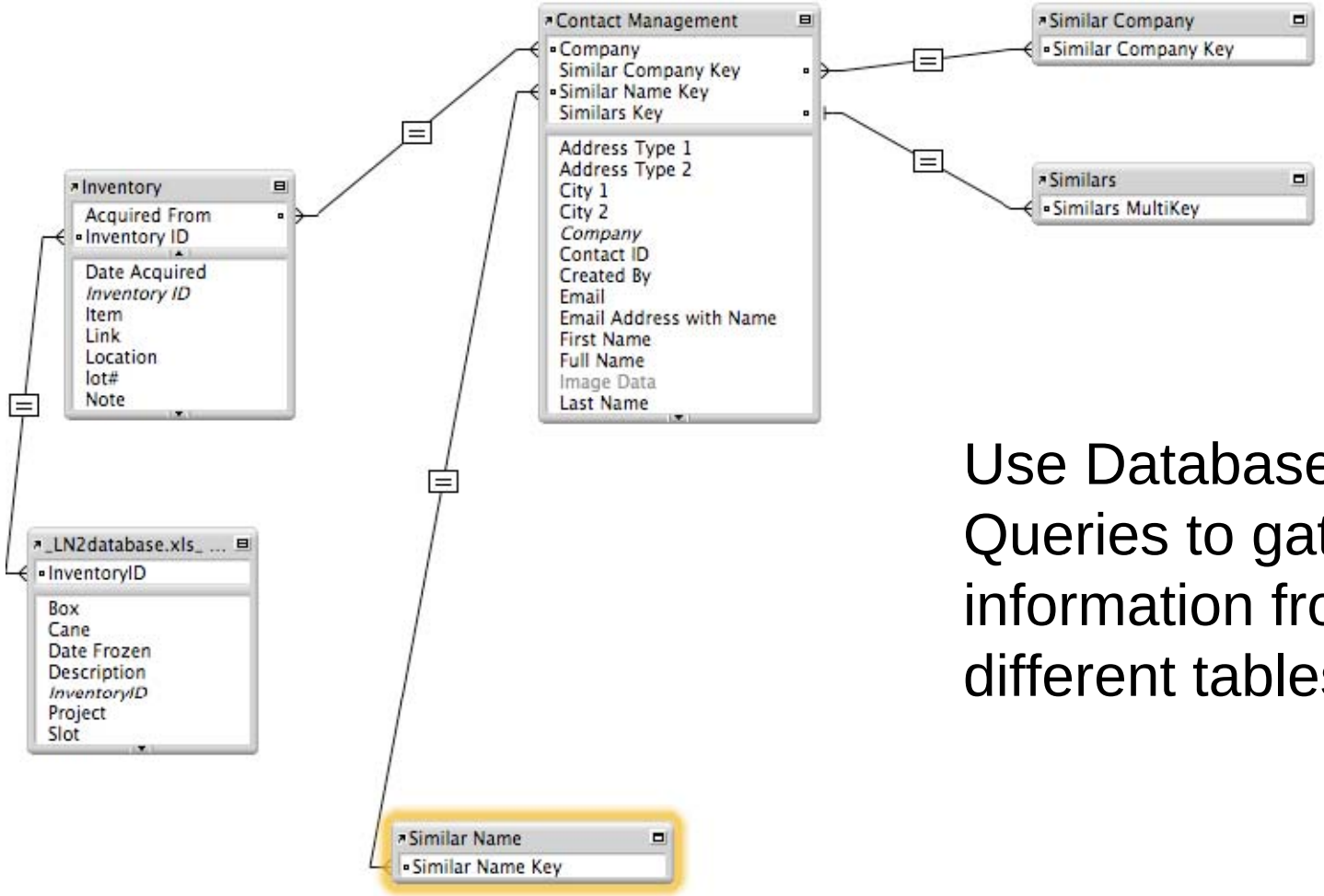
Database - Forms with Flair



Database - Forms with Flair

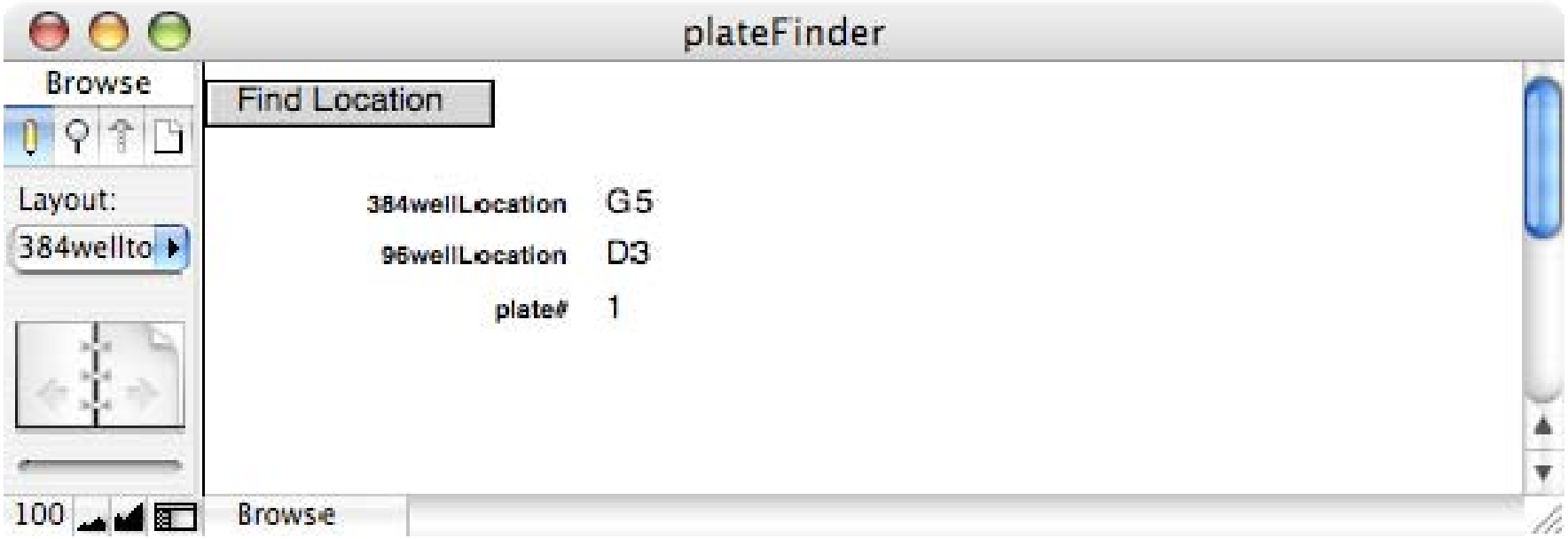


Database - Collection of related spreadsheets



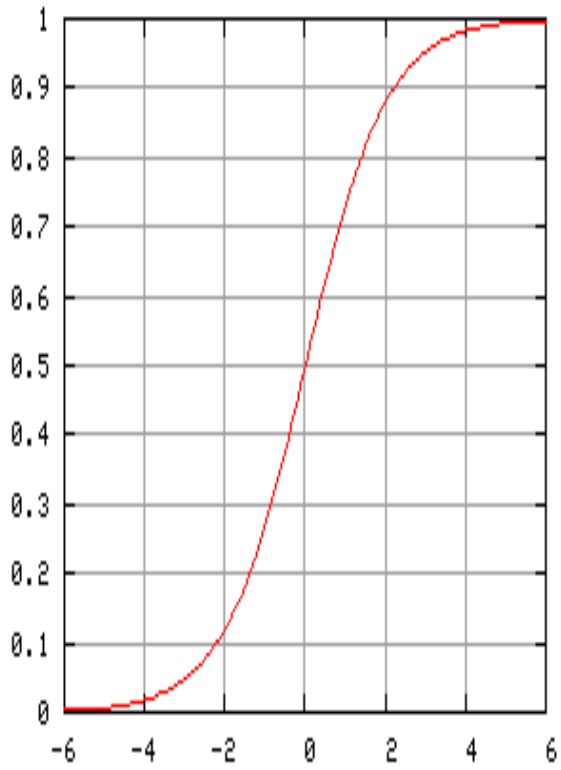
Use Database Queries to gather information from different tables

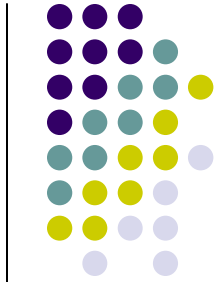
A Simple Database



Number Crunching

- Use Excel to make “templates” for analyzing the same type of experiment
  - Protein assays
  - ELISAs
- Use Prism (GraphPad) or SigmaPlot if you have sophisticated kinetics or other data patterns that don’t fit a linear regression
  - Binding curves
  - Kinetics

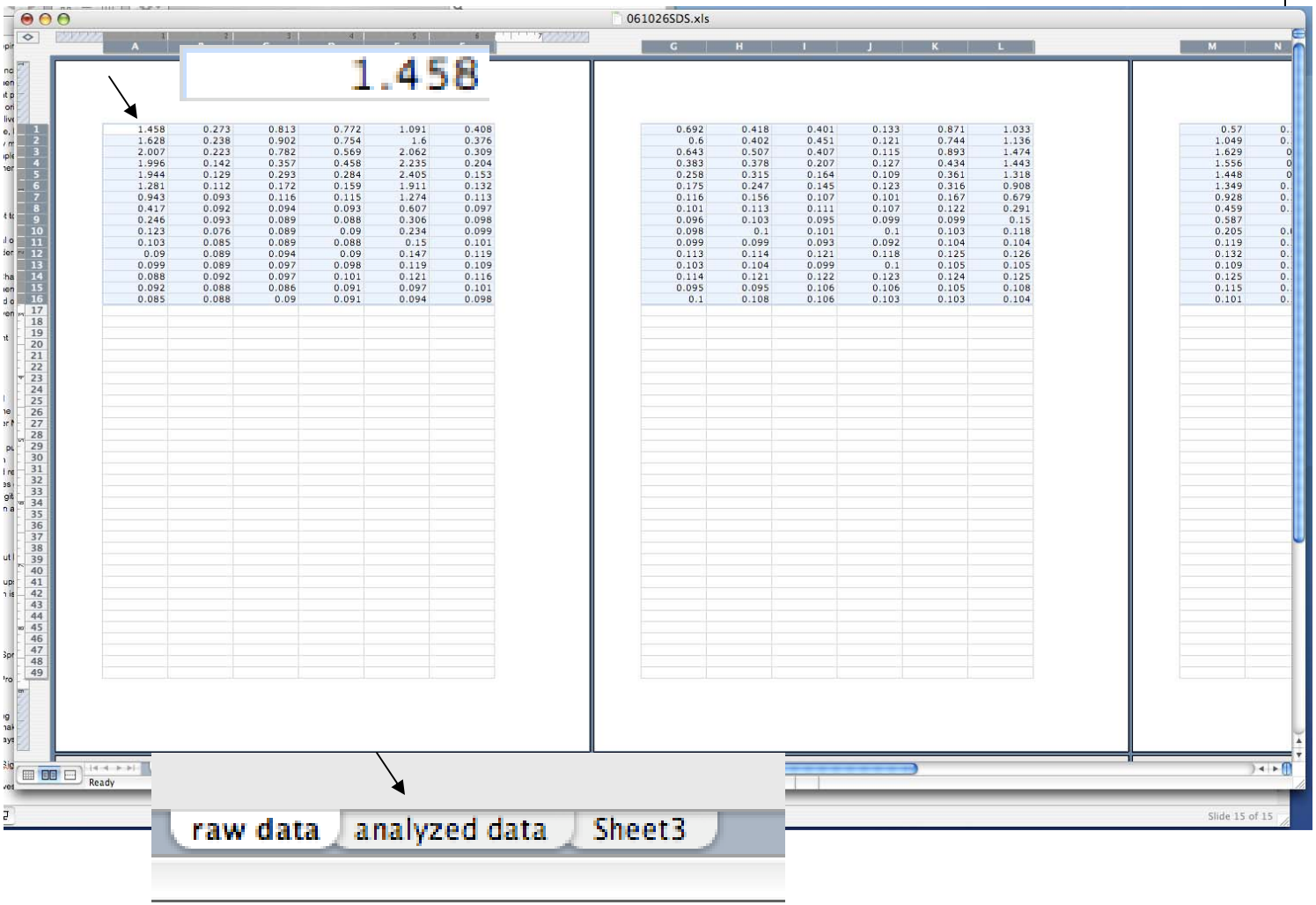




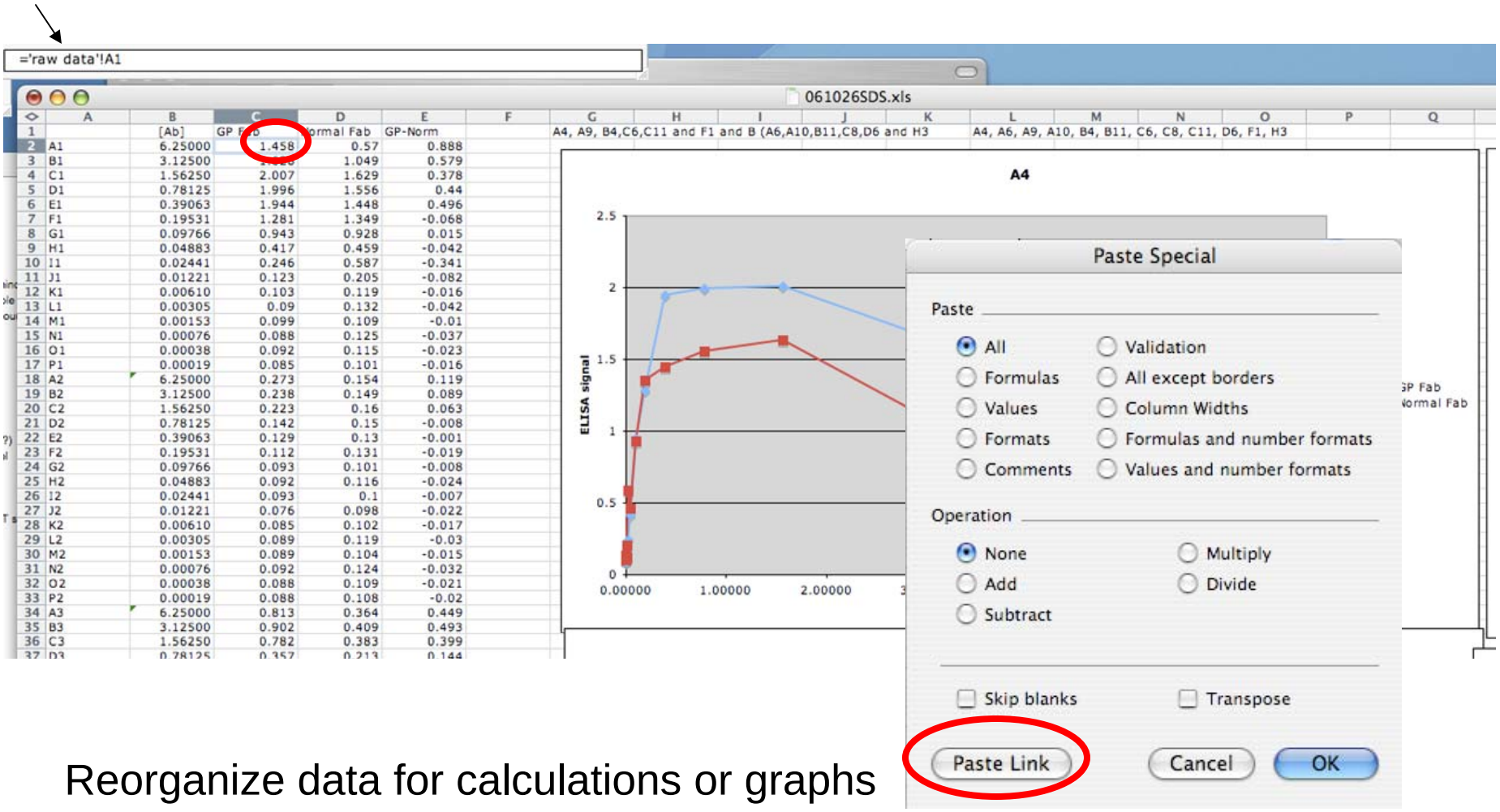
Making templates for repetitive tasks

- Use “paste link” function to copy data from 1 sheet to another
- Pasted data can be manipulated using graphs, formulas, etc.
- New data can be pasted without recreating graphs or formulas

Making templates for repetitive tasks



Using “Paste Link”



Reorganize data for calculations or graphs

Subsequent data can be formatted without having to create a new graph

Acknowledgment

- Ray Mernaugh, Ph.D.
- Vanderbilt Institute of Chemical Biology