BIOC 4004 (63.404)
Industrial Biochemistry

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Lectures / Workshops:

Mon	10:05-11:25	CO208 ???
Wed	10:05-11:25	CO208 ???
Fri	11:35-13:25	TB432

Office Hours:

- Immediately after lectures
- Contact by phone, e-mail,
- Come visit me at 100 Sussex Dr. (!?!)

About BIOC4004

The Goal:

"to expose students to some of the advances in the fields of chemistry, biochemistry, microbiology, and molecular biology that have shaped biotechnology and that have accelerated its growth."

COURSE ORGANIZATION

- Lectures (Mondays and Wednesdays)
- Workshops (Fridays)
  - Students group presentations
  - Guest lecturers
  - Problem Based Learning Exercise.

Student participation in workshops is mandatory, and will account for 10% of your final grade. Absenteeism will result in a lower Workshop Participation Mark.

EVALUATION

First Evaluation Exercise	20%
Seminar	20%
Research Proposal	20%
Participation	10%
Second Evaluation Exercise	20%
Assignment	10%
Total	**100%**

EVALUATION EXERCISES (2 x 20% = 40%)

Two Evaluation Exercises:

- written examination of two hours duration.
- These will be conducted during the Workshop Periods on Fridays.
- Questions will be drawn from the lectures, workshops and assigned readings.
- Selected questions from student seminars will also be used.

Tentative dates for the **Evaluation Exercises** :
February 27th, 2004 and April 2nd, 2004.

SEMINAR (20%)

Seminars will be evaluated by the instructor, by your groupmates, and by your classmates. The following mark distribution will be used:

Instructor's evaluation	10%
Audience evaluations	5%
Group members evaluations	5%
Total for Presentation	**20%**

RESEARCH PROPOSAL (20%)

- A proposal for new research that you think up

- The proposal topic must be approved by the instructor before you proceed
  - Ie. get cracking on potential topics!!!!

- You should focus on the molecular aspects of the process.
  - Ie. how biochemistry is applied to solve industrial problems,

- Should display effective academic writing skills
  - correct grammar
  - good analysis
  - construction of a logical and persuasive argument

PARTICIPATION (10%)

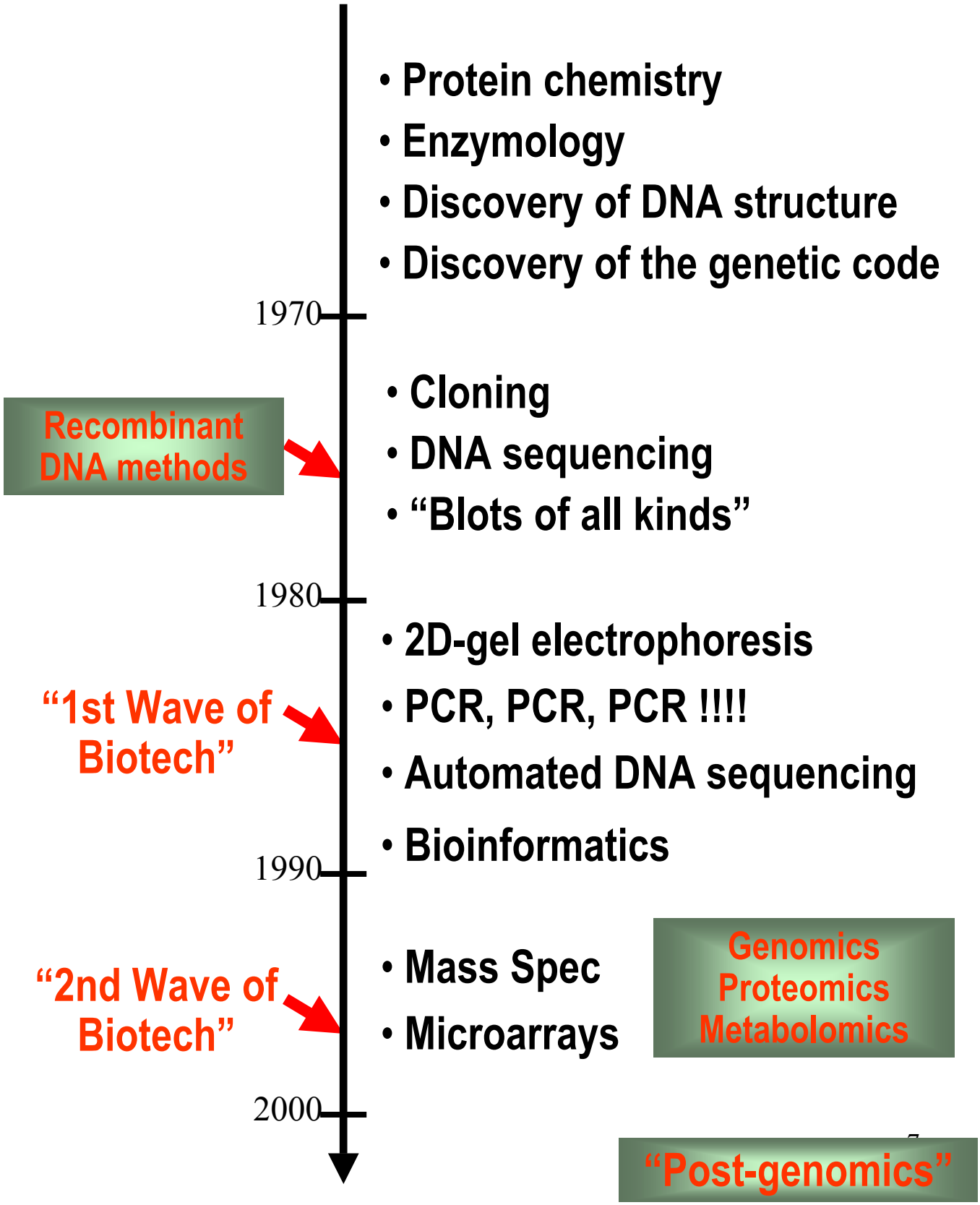
- Read the assigned papers
- Prepare questions and ideas for discussion during the workshops.

    - contribute to the discussion of PBL topics during workshops or in the CHAT group
    - ask questions at student seminars
    - contribute to the discussion of the assignment problems
    - make postings to the Industrial Biochemistry CHAT group
    - create a webpage related to a topic in Industrial Biochemistry
    - ask questions in class
    - make submissions to the glossary
    - reply to postings on the CHAT group

ASSIGNMENT (10%)

- bioinformatics assignment
- molecular sequence analysis
    - contig assembly
    - gene prediction
    - assignment of functions, etc
- You will be expected to take advantage of bioinformatics resources available on the WWW to perform your analysis.

Milestones in the evolution of Biotechnology...



New approaches to "The Scientific Method"

- HDS has been the norm in scientific research

- The beginning of the Genomics "revolution" swung the pendulum all the way towards DDS:

- We'll get there faster (but sometimes we won't know where we're going)

- It's been great, but "too much of a good thing…."

"The Scientific Method" fights back

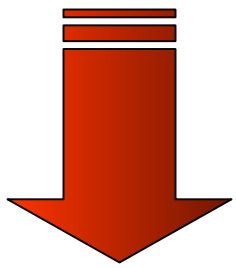
The post-genomics hangover:

"too much data, not enough questions"

The field is trying to strike a balance:

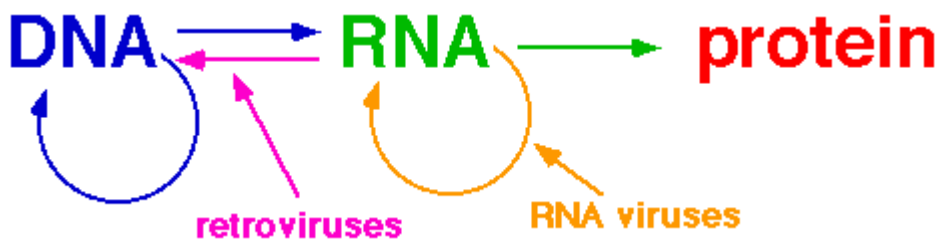
- use the tools of genomics

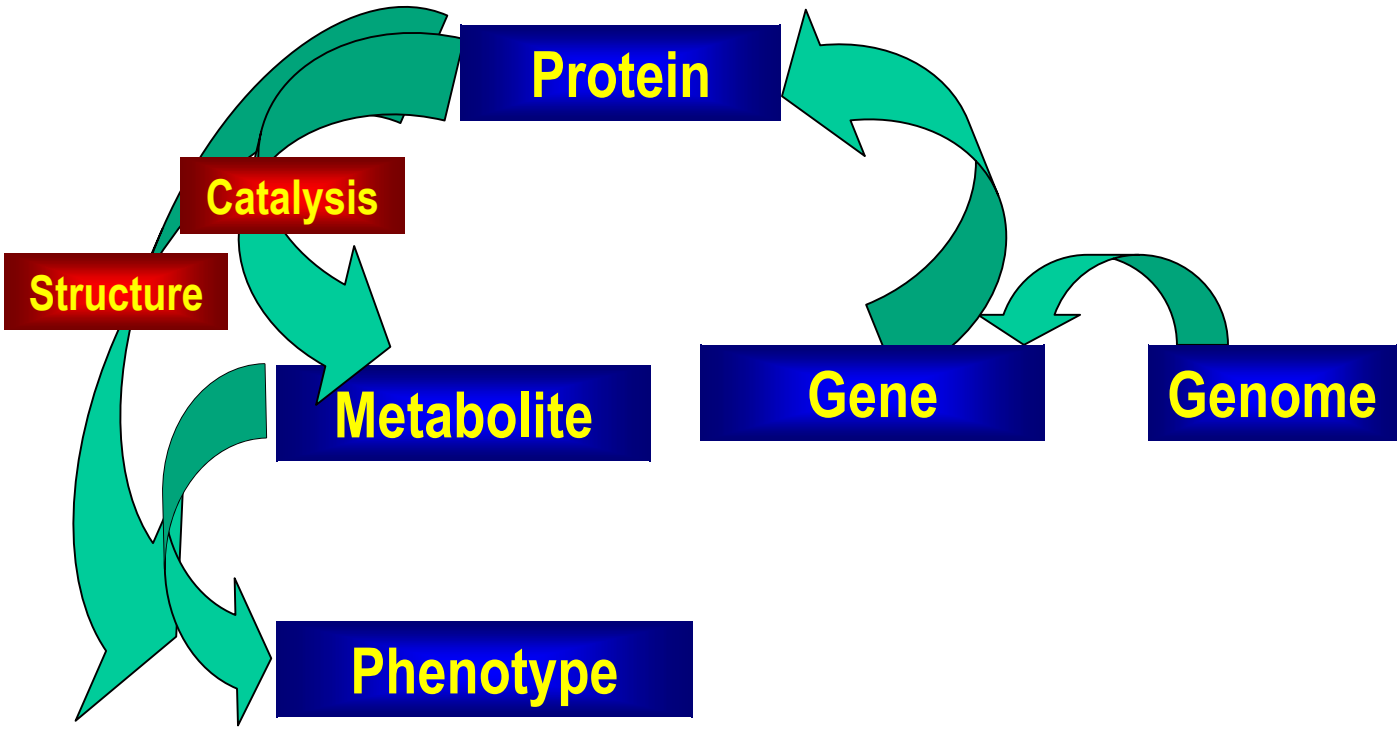
- use the methodology of HDS



- **Use HDS to define testable hypotheses**
- **Use High Throughput metholodogies**
- **"Old School" Target Validation**
  - **ie. get thyself to a lab bench and get to work!!!**

The Meaning of Life: the central dogma

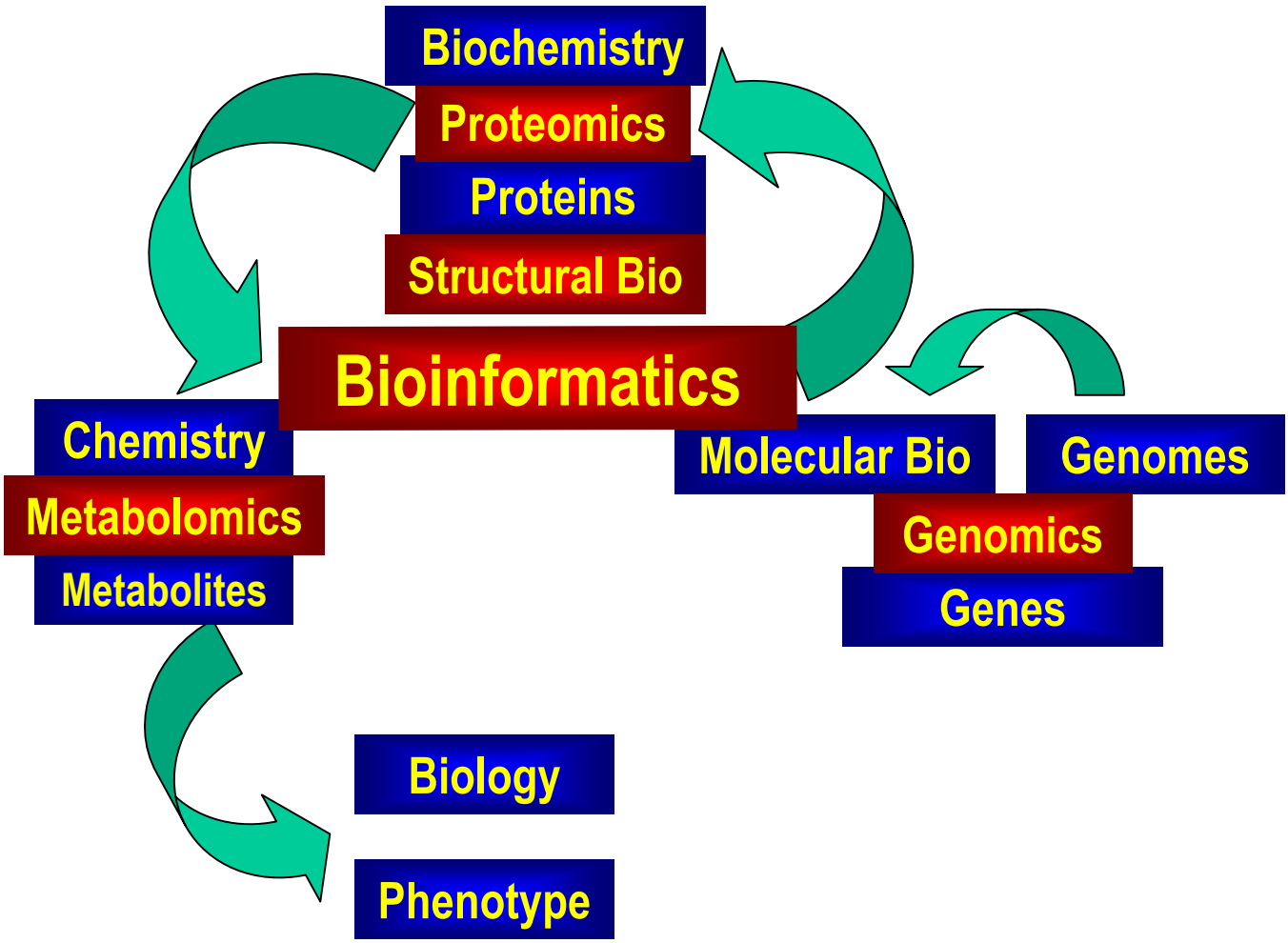




Phenotype dictated by . . .

- potential contained within the genome
- gene expression → protein
- protein activity → metabolites
  - FEEDBACK LOOP → LIFE

The Meaning of BIOC4004



Topics of Discussion:

- **Of Genes and Proteins**
  - Eukaryotic vs. prokaryotic gene structure
  - Introns, Exons, Promoters, gene regulation
  - Transcription, Translation, degeneracy of the genetic code

- **Recombinant DNA technology:**
  - Manipulation of DNA using restriction/modification enzymes
  - Cloning vectors, Cloning strategies
  - Southern, Western, Northern blots
  - DNA sequencing
  - The Polymerase Chain Reaction (PCR)
  - Novel applications of PCR

Topics of Discussion: (cont')

- **Expression and purification of recombinant proteins**
  - Protein structure (primary, secondary, tertiary)
  - Protein engineering
    - site-directed mutagenesis, "synthetic genes"
  - Monoclonal and polyclonal antibodies
  - Enzyme assays

- **The "OMICS" Sciences**
  - Genomics
    - genome sequencing projects, bioinformatics, DNA chips
  - Proteomics (2D-gels, Mass-Spec)
  - Metabolomics
  - Structural Biology

- **"Big Pharma"**
  - Development of pharmaceuticals and vaccines
  - High-thoughput screening
  - "The microarray concept"
  - Combinatorial chemistry

Topics of Discussion: (cont')

- **Biotech and medical research**
  - Gene therapy
  - Diagnostics (antibody-based, DNA-based…)
  - Stem-cell research

- **Agrifood and biotech**
  - Transgenic plants and animals (GMOs), cloning of animals
  - "Pathway engineering"

- **Issues with biotechnology**
  - Ethical
  - Legal
  - Social
  - Economic
  - Ecological.