The Molecular Biology of Higher Organisms

Choice of topics: Mechanism common to "all" plants or "all" animals

- personal selection
- make a few GENERAL suggestions


- Firm theoretical substratum: chemistry, physical chemistry, physics
- Lucky to have a broad theoretical framework. family early
  DNA \rightarrow RNA \rightarrow protein \rightarrow mRNAX

- choice of simple systems in spite of obvious disadvantage
  e.g. B. E coli, T-even phage, etc.

- use of modern physico-chemical techniques,
  some simple, some requiring complex instrumentation
  e.g. chromatography, ultracentrifuge, radioactive tracer, etc.

- use of Genetics as a tool (to be discussed later)

- use of cell-free systems: partly time problem, partly for ease of addition. Genetic
  combined with studies on intact systems. Biochemistry for the kill, code

- General approach: reformulate problems, often in terms cellular, or more often
  molecular elements to define sub-problems

- for these "classic" systems may be the best
  Thus, we have the choice of the organs - chosen later.
Summary of some of its problems

For each element have to consider:
1. Its Structure
2. Its Function
3. Its Synthesis

Start with Chromosomes:
- Larger than prokaryotes: probably one chromosome per molecule of DNA.
- More complex than prokaryotes: an example
  1. DNA more varied: simple sequence, repetitive, unique
  2. Contains proteins, histones, 5 snaii types, other incert
  3. Non-histone (acid) proteins
  4. rRNA?

Also: individual genes (= complementation group) rather big

Drosophila: e 20,000-30,000 sp.

Problem of structure:
- bands: interbands
- X-ray diff.

Function of RNA: large, stable, rapidly, deletion, rapid turnover.
- Controls: little known, acidic proteins: speculation.
- Replication: little known at molecular level: many starting points
  (Rca in xeropus)
  (unproven)
  (understood)
- Mitosis: folding & unfolding: movement (late): centromere
- Recombination: almost certainly breaks & repair: mechanism? fungi?

Definition of field:
- Overcrowded: many simultaneous
- Underpopulated: not repeated
- Prime: one discovery can expand whole viewpoint: origin of life.
Nucleoplasm: prob. no protein synthesis.

Small RNA in nucleoplasm: several type, rare,picric.

hnRNA: some of it possibly prob. a mRNA precursor.

Where is mRNA, found?

other type of hnRNA: spectrum of turnover?

Regulation at the level?

Antisense with proteins: Messenger's informer?

General idea: unusual for mRNA to be naked.

"enigmatic": tRNA: allele DNA?

Secondary structure of RNA important

DNA & tRNA, RNA.

also true for mRNA (in endosome)? hnRNA?

RNA? change of pitch with base-ratio (Penz)

- helix: stable in wound structure?

-poly A

Export: how is cytoplasm?

Protein synthesis (body) many problem same as in prokaryote, eukaryote, stall, cell, cell.

Control at translational level: naked mRNA.

Structure of ribosome, of tRNA: "factor".

Attachment to the endoplasmic reticulum: secretin

Secretion (to tight membrane): part of ribosome, headpiece in polypeptide chain?

Role of polysaccharide?

Why rule our prokaryote?

eg. structure of ribosome,

may be reasons to special in sequence available (e.g., E. coli)

what affect at molecular level.
Membranes now an agreed model

- phospholipid bilayer has not "structured" proteins; partly true for all lipid membranes.

- cell surface gets membrane: instead "globular" proteins: inside, outside, middle through.

- lipid diffusion: do in one layer: flip-flop: different lipids in each half?

- protein diffusion: slow by comparison to individual protein: (outside only?)

- "chumps" - pericytoms. mechanism of this?

- also receive pericytoms - also relationship to other membranes: cell, endoplasmic reticulum, nuclear.

- Synthesis: are the basic: synthesis in different place: membrane.

Function of pericytoms

- "structural" of cell-cell recognition: antibody recognition.

- per Transport proteins: eg. "pumps".

- [leave any protein Jones, until membrane be isolated in native form]

- on inside: is there a subcortical gel? in special case?

Fibrillar elements in cells

- microfibrillar (several type)

- actin, myosin +

- intermediate filaments.

- characteristic of protein elements (combined acts, three different)

- interaction?

- lectins: membrane bound: here

- how do they get lectins?
Formation of tissues

- Cell-cell interaction
- Surface proteins: polysaccharides?

Junctions: e.g., tight junctions.

- By secretion system: large cell, small cell.

- By exocytosis: amoeboid system.

Protein interaction - products - enzymes: source and sink.

Solid structures: e.g., cells walls in plants

E.g., collagen in bone in animals: many special examples.

Signal

- Hormones: signal role: to act on cell (e.g., CAMP)
- Lysosome: signal role: e.g., signal to activate: protein synthesis.

- Action?:
  - Animal: e.g., hormone, lysosomal polysaccharides.
  - Plant: e.g., acetylcholine, etc.

- How secreted (vesicles?): how do they act?

MIS:
- Protein interaction
- Micronuclei involve

General rule: signal molecules are usually not same as "herable" molecule (though often chemically related)
For Techniques

- Obviously new new techniques
- often can save a need (e.g., cell which have recently fired a lot)
- but still v. difficult to predict.

- New techniques can be simple
- instrumentation: can be grew e.g., high resolution e.g.,
  - or high dose X-ray beam.

- or can involve automation either for old methods e.g., pipetting
  - or new problem e.g., nanomaterial

- Type of
depth, partly, or engineers skill available in one place
  - e.g., fine mechanical devices
  - modern electronics

- In all we include programming standard computers
Choice of systems

Value of multiple system is apparent < problem
eg. Bode human HB

PMV E.coli.

Some desirable properties:
- how big can pipes be put in
- how many are needed?
- can it all be done in the lab or use single cells?
- can you get a lot of it, radioactive labelling?
- can nucleic acids etc. be easily extracted

how "simple" is it? need for better classification of systems 1.

is it genetically easy? eg. haploid, diploid, etc.

Overall scientists are human - like to enjoy their work
Typically they would prefer - significance
- no very long interval (usually)
- technique available or easily developed ("")
- irreversibility "certain"
- no one else working ("a less crowded"")

impossible! very difficult to select in advance

only multiple systems appear to solve a problem
eg. Green code