Mendel Lecture

Molecular Genetics: the present position

Honoured

Initially above title

Two aspects of molecular genetics:

from the genetic role

The gene experiment which need a fairly detailed knowledge of molecular basis to interpret correctly.

(example: genetic recombination, intragenic complementation)

from the molecular biology role

can to explain sides (e.g. fundamente processes)
in molecular terms.

Thus is needed as a tool,

example: co-linearity of gene, protein —

why tool is needed:

1. NA is difficult to study (e.g., sequences etc.)
   
   by biochemistry

2. in vitro system: other molecules; algae cells in complex.

Note on the other hand that gene expression now always seem include a chain cells; may be better to copy cells, and see all the "fam product" - proteins.
Revised Lecture
Molecular Genetics: The present position

Difficult to name title.
Too broad. Thus will omit.

1. Recombination: breakage repair, not copy choice repair mechanism.
   Can recombine bases adjacent bases.
   Restricted type of mutation.

2. Control mechanism: can involve groups of gene, (i.e., rate of gene action)
   Group is polar (open).
   Also polar mutants exist.

3. Recombination complicated, especially in
   New view of protein synthesis involved in rRNA produced.
   Little known about RNA destruction.

What are the basic problems of molecular genetics?

1. What are genes made of?
2. How are they joined together? Chromosome structure.
3. How are genes copied? What do mutations occur.
4. What are mutations? And how are they produced?
5. How do genes act? What is the gene product?
   [6. How control their rate of action?]
   [7. What is mechanism of genetic recombination?]
Second Pertichki
15 micro-organisms.
partly because a major part of our knowledge comes from
micro-organisms.

advantages because:
1. ease of preparation + selection techniques.
2. rapid growth - quick experiments
3. growth requirements simple.

Also, because they are actually simpler
- "chromosome" is simpler.
more like "enzyme in a bag" than higher cells,
re. less interaction species interaction.

two side references to higher organisms

Plan of Lecture

General survey: in broad terms.

Her critical comments
Mendel Lecture

Title too wide: full coverage impossible.

Thus unit-reconstruction and control also replication also mainly apply to microorganisms. Our are the special mechanisms of microorganisms.

Plan:

General survey first to give picture of outline
Then critical evaluation.

Importance of microorganisms:

1. Large populations + selective techniques make for fine genetic mapping

2. Rapid growth makes experiments quick

3. Defined medium helps in planning experiments

(Not fully easy to grow or their proteins.)
General Survey

DNA \rightarrow RNA \rightarrow protein
RNA \rightarrow protein

Genetic material is nucleic acid.

- Usually DNA, but RNA in some viruses.
- Usually double-stranded, but occasionally single-stranded for some RNA viruses.
- Length may be complex with many strands.

Replication of genetic material

- For single-stranded, simpler double-stranded replication intermediates

Expression of genetic material

- By making an RNA copy of one strand (unnecessary for RNA viruses).
- Usually this RNA used as a messenger for protein synthesis. Thus, main function of genes is to control an sequence of proteins.
Protein synthesis involves complicated biochemical machinery.
(c.e. ribosomes, activate enzymes, tRNA etc.)
translate by means of a non-overlapping, triplet code, most triplets stand for amino acids, probably universal.

Protein folding

attempt to hold up itself (by and large)
3-d structure for its specificity etc for enzyme action or for use in a structural component.

mean, protein, an aggregate of related subunits.

[allusion: idea that a unrelated small molecule can influence the configuration and thus the
very of a enzyme action]

Certain mechanisms poorly understood.

Clean flow for rise of con action can be controlled
by small control molecule, not by means of c. molecule.

that goes on after controlled in scope.

polar effects
General remarks

2) Character of NA and protein.
   NA - very limited function, but ideal for replication.
   Protein - very versatile, but no easy replication mechanism.

3) Basic plan
   1D genetic information
   -> 1D amino acids and sequence
   -> 3D protein structure.

4) Nature of genetic material - not flexible.
Detailed mammalian

1. DNA is the genetic material
   a. Not crystal-clear what genetic material means.
   b. Mean material most simply replicated.
   c. Centrin (core) information needed to make cell
      need to known information, which is then paid back.
      But must be self-consistent.

2. Cytoplasmic factors: probably due to special DNA
   e.g., mitochondrial and chloroplast.
   Those to exist, but nothing known about what
   they do.

3. Other factors e.g., nuclear factors
   Probably exist, nor clear how stable they
   an alternative would be, nor how many
   of them.
(d) In all NA "Genetic" i.e., it is all copied.

no. no evidence that RNA is copied in non-normal cells (but in virus-infected cells)

medical replication

(ii) does all DNA code for protein

no, some clearly code for tRNA and rRNA

may be other examples.

however regulatory sense prob. produce protein

(may be nucleoprotein)

but ALL DNA:

ex. DNA of eg. amphibian newt of crab, species AT DNA.

important because would like to estimate

the number of genes, etc. other facts

might be important.
(2) Nature of the chromosome

E. coli: one big piece NA, often circular
sometimes circularly permuted

E. coli: one very long piece DNA, a ton of a circle.

Hyper organisms
obscure: probably several circles, probably several per chromosome.
Arrangement unclear.
Role of protein (histones) still obscure

Mc Dermott.
DNA replication

Evidence for semi-conservation fairly good

As in some cases, can show chains come apart.

But no replication of exogenous DNA in vivo like

by bacterial enzyme.

Also problem of direction of replication.

Is it a repair enzyme?

If so, what is the true enzyme like?

Is it specially located in the cell?

Enzyming problem still very unsatisfactory.

With NA was NA replication

only one can in which increase of

enzymological activity is then mechanism controversial.

Also detailed action of enzyme is thus panic, not so established.
making RNA for DNA

reasonable evidence that only one checchi is copied.

but does know signal for start

--

stop

[only rather vague idea about control of rate]

don't really know if particular ribosome (i.e. protein synthetin) play a role in proper reading.

don't know details of mechanism (e. g. there is running loop? or is double helix never unraveled.

but evidence does suggest complementary synthesis (because will work a high strand)

so far no simple mutants (ie a protein)

delicate which appear to give start or stop signals)
Protein synthesis

Genetic code

- [punctuate marks need further study]
- [what are minor tRNA's for?]
- [is there ambiguity?]
- [is there redundancy (escape from punctuate mark effect)?]
- [is it really universal?]

Structure of code -- covalent

(Origin of code?)

Extra facial suppressors and error protein synthesis.
General conclusions

We see that for most of the genes, fall into two classes,

1. Gene structure
   Gene replication
   Gene action
   Nature of mutation

2. Gene control

Future development

To extend to larger structures and higher organisms,

E.g. Alzheimer's disease.

To study physical chemistry in more detail

E.g. Reflection, protein, base pairing.