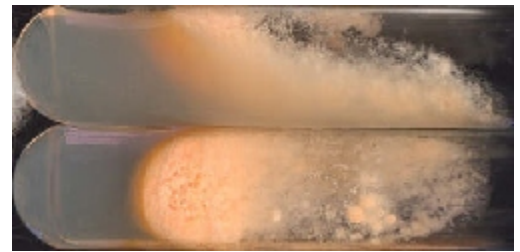


WHAT IS A GENE?

rvsd 2/15/93, rvsd 2/14/94, 2/16/96, 2/17/97, 14 Feb 00, 19 Feb 03, 20 Feb 04, 20 Feb 06, 18Feb09, 14Feb11
 SGML, P 282-, GMSLG p. 333-373, 7th: 268-283, 9th: 230-

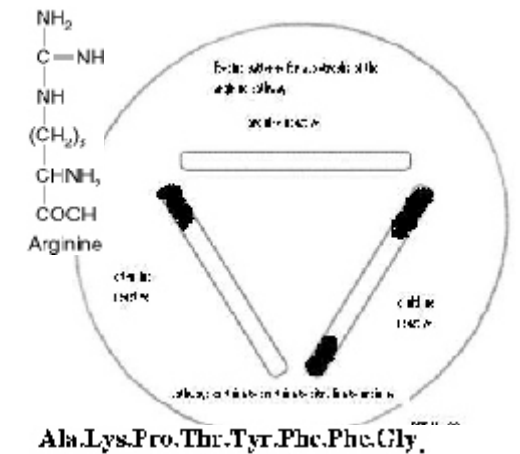
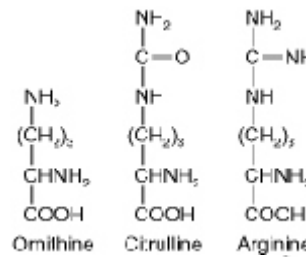


A GENE CODES FOR A PROTEIN:

Beadle and Tatum, 1940s (Nobel Prize), isolated *arg⁻* auxotrophs in *N. crassa*, found different growth patterns: **three classes of auxotrophs**: would grow on (P. 231) arginine, citrulline or ornithine Show feeding patterns:
 citrulline or arginine Based on excretion of
 only on arginine. precursor.

Concluded biochemical synthetic pathway:
 xanthine → ornithine → citrulline → arginine (p. 232)
 interpreted that enzymes were missing converting :
 X to O, O to C, or C to A.

Noted that each class mapped on unique chromosome,
 concluded that each gene coded for given enzyme:
one-gene, one enzyme hypothesis. (Genetic dissection of biochemical pathway)



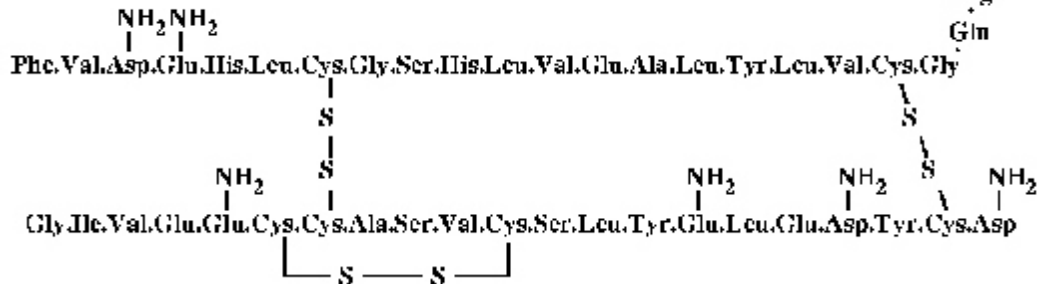
A PROTEIN IS DEFINED BY ITS AMINO ACID SEQUENCE:

(REVIEW PROTEIN STRUCTURE, 1°, 2°, 3°, and 4° structure)

Sanger (late 1040s to early 1950s)
 elucidated structure of insulin:

- 2D chromatography
- ninhydrin staining peptides (= fingerprint)
- Analyzed AA composition of spots.
- Overlap allows elucidation of sequence (p 277)

Concluded:
 insulin has **unique sequence of AA.**



A GENE MUTATION ALTERS AMINO SEQUENCE

Ingram 1957 studied Hb sequence
 (A chain = 141 AA, B = 146),
 found that sickle cell Hb has identical AA for all but #6 in B chain, (valine substituted for glutamic acid).
 Thus *single amino acid out of 287 caused sickle cell anemia* (pleotropic effects)

SEQUENCE OF MUTATIONS IS COLINEAR WITH SEQUENCE OF AMINO ACID ALTERATIONS

Charles Yanofsky ((p 325: 9th), 369) *E coli* tryptophan synthetase, mapped mutations with P1 phage, analyzed AA sequence.

Enzyme functioning (review): active site, altered configuration, impair function
 Explains TS mutations, dominance and recessiveness

DOMINANCE/RECESSIVENESS EXPLAINED BY COMPLEMENTATION (different genes can act trans):

heterokaryons (fusion on minimal medium) of *Neurospora*: *arg-1* plus *arg-2* becomes *arg+*.
cistron: genetic region within which no complementation occurs

A GENE IS LINEAR ARRAY OF SITES, MUTABLE AND SUBJECT TO RECOMBINATION

Genetic fine structure: **Benzer**, 1950s: (p 202):
 Used **rII system in T4 phage**. (rapid lysis mutants): see pp 202, 203
permissive: grow on coli B with large plaques compared to wild type.
restrictive: do not grow on K12(lambda)

Co-infect with two mutants of rII in *E. coli* B, look for small wild type plaques
 Good for mutations 1% or more apart
 Can test closer markers by plating on K, because *only* wt plate out.

DELETION MAPPING EASES FINE STRUCTURE MAPPING:

a battery of overlapping deletion mutations can be use to locate point mutations.
 Cross the mutant with transducing phage grown on the various deletion mutants.
 If the point mutation does not form wild type recombinants with the deletion, **it maps under the deletion.**
 Intragenic maps of linkages can be rapidly constructed
Handout deletion mapping exercise.

Name: _____ #: _____

Date: _____

PRACTICE ANALYZING DELETION MAPPING

D.B. Fankhauser, revised 18 Feb 2010

Strains 1 through 5 carry mutations in a gene and were mapped using deletion mapping by transduction. The mutants were crossed times the known mutants (a through g) carrying deletions as indicated (xxx means the material has been deleted). If wild type recombinants appear, it is scored +; if none are produced it is scored 0.

On the dotted lines below the deletions, indicate with an “H” bar the limits of the region in which the point mutation is located relative to the various deletion mutations. Be certain to line up the limits correctly with the deletion mutations above.

Mutants:						Del :
samp	1	2	3	4	5	
+	+	+	+	+	+	a XXXXXXXX-----
+	+	+	0	0	+	b -----XXXXXXXXXXXXXXXXXXXX
+	0	+	0	0	+	c -----XXXXXXXXXXXXXXXXXXXXXXXXXXXX
0	+	+	+	+	0	d -----XXXXXXXXXXXXXXXXXXXX-----
+	+	+	0	+	+	e -----XXXXXXXX-----
0	+	0	+	+	+	f XXXXXXXXXXXXXXX-----
0	0	0	0	+	0	g ---XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX-----

mutant: Draw your “H” bars here:

- Sample
- 1
 - 2
 - 3
 - 4
 - 5

Name: _____ #: _____

Date: _____

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