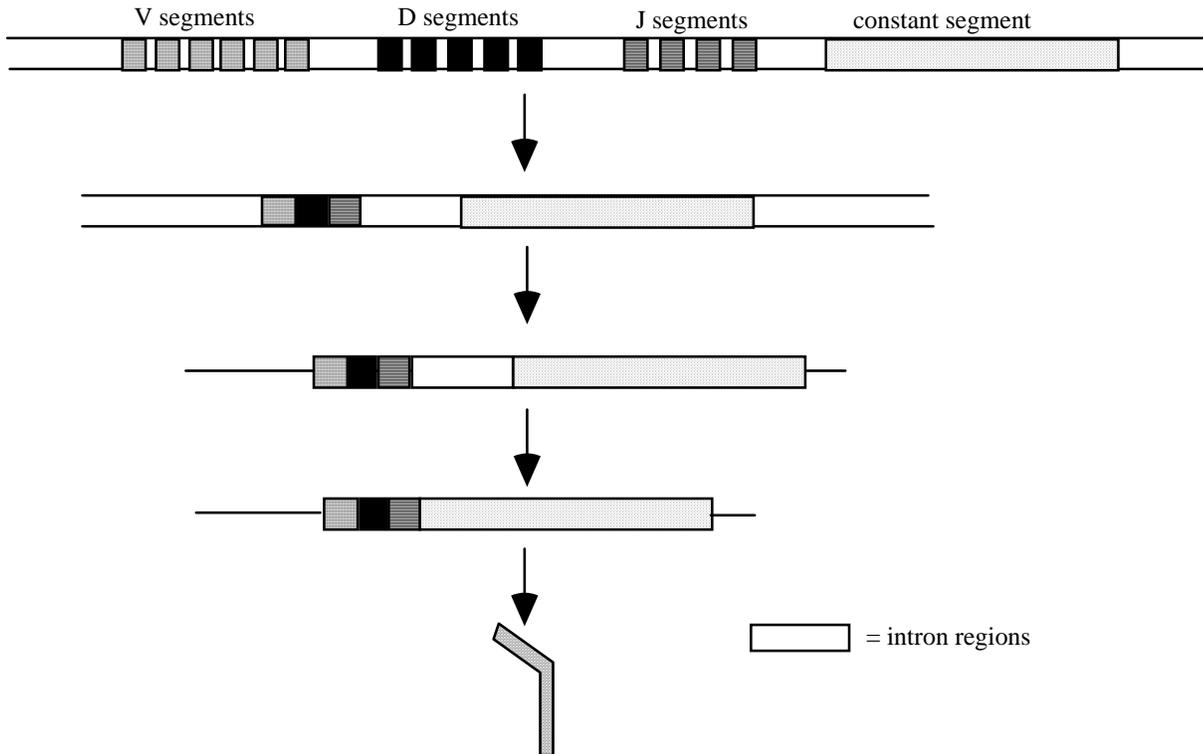


Immunology

A. Antibody production

Shown below is a schematic of the production of a heavy chain polypeptide for an antibody. At the top is the chromosomal arrangement found in an immature B cell, at the bottom is shown the heavy chain polypeptide.



1. Label the process indicated by each arrow. Choose the one best option for each from:
 - protein processing
 - transcription
 - translation
 - transduction
 - DNA ligation
 - DNA rearrangement
 - RNA splicing
 - RNA ligation

2. Indicate on the diagram below where you would expect to find each of the following components:
 - promoter
 - Transcription terminator
 - start codon
 - stop codon

3. Indicate on the diagram below the variable and the constant region of the heavy chain polypeptide.

An activated B cell undergoes cell division and produces many daughter cells. Some daughter cells will function as B cells, some will function as plasma cells and other will become memory cells.

4. Assume that an activated B cell undergoes somatic mutation and produces two different B cells each with a slightly altered version of the antibody. This event occurs early in the immune response (*i.e.* when antigen was present in the organism). Mutation A makes the antibody-antigen interaction stronger, mutation B makes the antibody-antigen interaction much weaker.
- i) Would you expect memory cells derived from the original activated B cell? _____
 - ii) Would you expect memory cells derived from the daughter B cell with mutation A (antibody-antigen interaction stronger)? _____
 - iii) Would you expect memory cells derived from the daughter B cell with mutation B (antibody-antigen interaction much weaker)? _____

Explain your answers.

B. Immunology and Immunizations

The varicella zoster virus (VZV) is the infectious agent that results in chickenpox, a common childhood illness that causes itchy red spots on the skin. Contracting VZV as a child is relatively benign, but can present serious health issues when contracted as an adult.

1. How does a VZV infected cell signal the immune system? How are the infected cells specifically eliminated from the body?

2. Over the course of a lifetime, the average person is exposed to VZV many times, yet usually only displays symptoms once. What is the immune system mechanism that results in lifetime resistance?

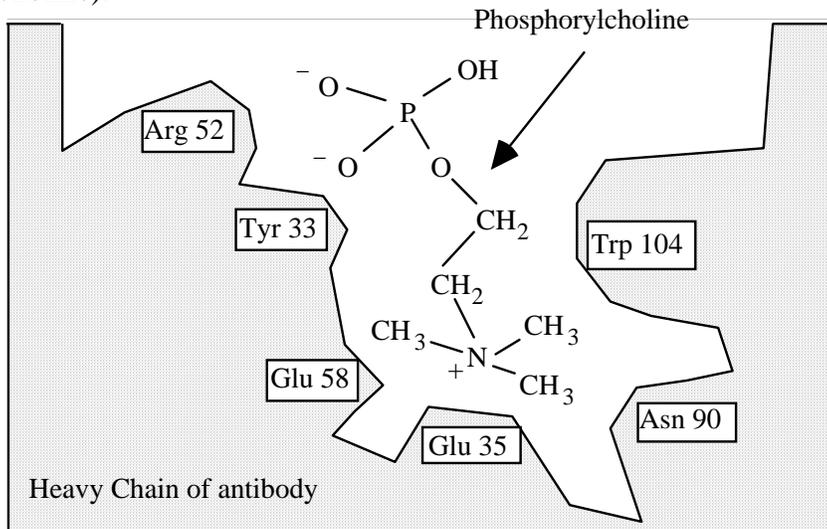
As of September 1999 any child entering kindergarten must have had chickenpox or received a new vaccine against VZV.

3. Present an argument in support of this vaccination campaign.

4. Present an argument opposed to this vaccination campaign.

C. Immunology and Central Dogma

Shown below is a diagram of the interaction of an antibody molecule with an antigen (phosphorylcholine).



1. Indicate the strongest type of interaction that occurs between the amino acids listed and the Phosphorylcholine molecule.
 - Phosphorylcholine and Arg 52
 - Phosphorylcholine and Tyr 33
 - Phosphorylcholine and Glu 35
 - Phosphorylcholine and Trp 104

2. Each of the following mutations alters the binding of the antigen to the antibody. Explain in terms of the change in interactions why the binding of the Phosphorylcholine to the antibody has remained the same, been made stronger, or been made weaker.

	mutation in antibody	binding of antibody to phosphorylcholine
1	Trp 104 -----> Leu 104	same
2	Arg 52 -----> Lys 52	stronger
3	Glu 35 -----> Gln 35	weaker
4	Tyr 33 -----> Phe 33	weaker

3. Can any of these mutations be due to a single base pair substitution?
If so, give one possibility.

The Genetic Code

	U	C	A	G	
U	UUU phe	UCU ser	UAU tyr	UGU cys	U
	UUC phe	UCC ser	UAC tyr	UGC cys	C
	UUA leu	UCA ser	UAA STOP	UGA STOP	A
	UUG leu	UCG ser	UAG STOP	UGG trp	G
C	CUU leu	CCU pro	CAU his	CGU arg	U
	CUC leu	CCC pro	CAC his	CGC arg	C
	CUA leu	CCA pro	CAA gln	CGA arg	A
	CUG leu	CCG pro	CAG gln	CGG arg	G
A	AUU ile	ACU thr	AAU asn	AGU ser	U
	AUC ile	ACC thr	AAC asn	AGC ser	C
	AUA ile	ACA thr	AAA lys	AGA arg	A
	AUG met	ACG thr	AAG lys	AGG arg	G
G	GUU val	GCU ala	GAU asp	GGU gly	U
	GUC val	GCC ala	GAC asp	GGC gly	C
	GUA val	GCA ala	GAA glu	GGA gly	A
	GUG val	GCG ala	GAG glu	GGG gly	G

STRUCTURES OF AMINO ACIDS at pH 7.0

