Bio 111 Handout for Molecular Biology 1

This handout contains:
1. Today's iClicker Questions
2. Handout for today's lecture.
3. Take-home problem for next wednesday.

iClicker Question #24A - before lecture

Which of the following is/are not feature(s) of a gene?

(A) Genes can be copied.
(B) Genes encode proteins.
(C) Genes give rise to many of the physical traits of organisms.
(D) Genes cannot be altered.
(E) None of the above.

---

iClicker Question #24B - after lecture

Given our understanding of DNA structure, which of the following sets of DNA base compositions is impossible?

	%**A**	%**G**	%**C**	%**T**
(A)	30	20	20	30
(B)	10	10	40	40
(C)	10	10	10	10

(D) More than one is impossible.
(E) I don't know.

Beaming in your answers

1. Figure out your answer and select the appropriate letter (A-E).
2. Turn on your iClicker by pressing the "ON/OFF" button; the blue "POWER" light should come on. If the red "LOW BATTERY" light comes on, you should replace your batteries soon.
3. Transmit your answer as follows:
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Bio 111 DNA Experiments

Griffiths & *Streptococcus pneumonae*

• *S. pneumonae* - bacterium that causes pneumonia (potentially deadly infection)

• Grows in colonies on petri plates (like yeast) - 2 forms:

– R - rough colonies - harmless (inject into mice & has no effect)

– S - smooth & shiny colonies - virulent (inject into mice & they die)

23 types of S: S_1 through S_{23} (can be distinguished by tests)

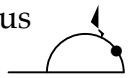
What was known before:

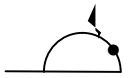
• loss of virulence: if you isolate S_3 from patients & grow it for a long time on petri plates, you find some rough colonies. They called them $R_{(3)}$.

• reversion: very rarely, $R_{(3)}$ will have some S_3 offspring (but never S_2 or S_{22} etc).

• heat killing: you can boil any S strain & this kills the bacteria. They burst open & you can get the "extract". This extract is harmless when injected in to mice.

Griffith's Experiments: Wanted to understand this type switching

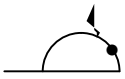
(1) mous  inject live $R_{(3)}$ →

(2)  inject live S_2 →

- isolate bacteria from dead mouse's blood & it is type S_2

(3)  inject extract of heat-killed S_2 →

- never find S_2 in the mouse's blood.

(4)  mix:
• live $R_{(3)}$
• extract of heat-killed S_2
⇒ inject →

– isolate bacteria from blood of dead mouse: if reversion, you'd expect S_3.
⇒ find S_2 - UNEXPECTED RESULT

Conclusion:

Chargaff & DNA Base Ratios

What was known before:
- DNA contained 4 bases: A, G, C, T
- DNA was a linear polymer
- it was believed (on very limited evidence) that DNA was just a repetating "tetranucleotide":

AGCTAGCTAGCTACGT.....

therefore: 25% A 25% G 25% C 25% T

Chargaff (1950 & 1951)
- Purified DNA from different organisms & measured the "base composition" %A %G %C %T

Some of his data:

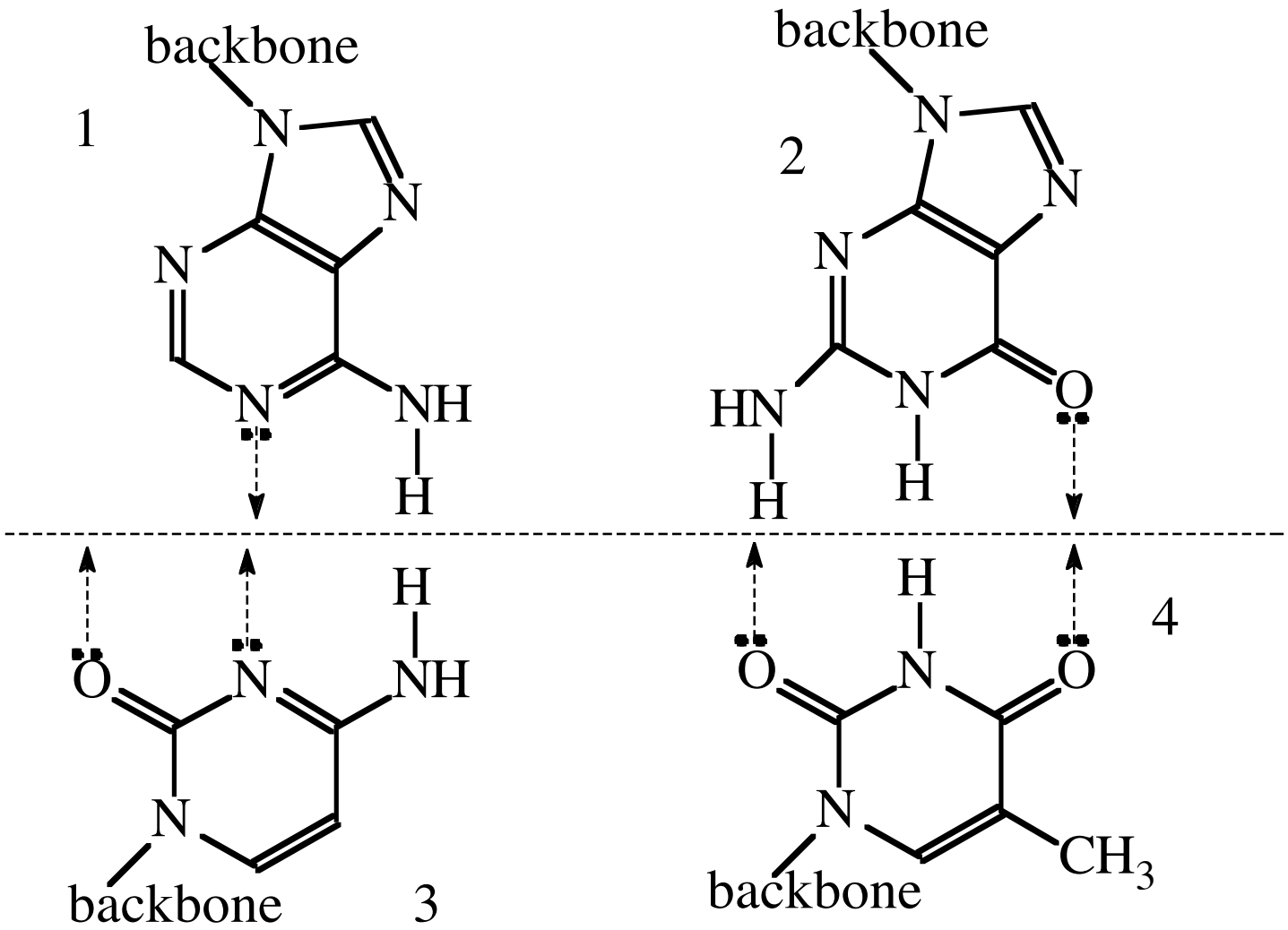
Organism	**%A**	**%G**	**%C**	**%T**	**total**
sea urchin*	32.8	17.7	16.3	32.1	98.9
human*	30.4	19.6	19.9	30.1	100.
bacterium*	15.1	34.9	35.4	14.6	100

*Base composition was the same in all cells of the same organism.

Conclusions:

Bio 111: Base-pairing Handout

Shown below are the four DNA bases:
(1) Tear in half along the dotted line.
(2) Make hydrogen bonds between lone pairs
('reaching out' for an H with the arrows ------➔
& H's attached to N's.
(3) Hint: each base on the top part matches with one on the bottom part.
(4) Note: you don't have to make all possible H-bonds between the bases.
(be sure to make at least 2)



Bio 111 Handout for Molecular Biology 2

This handout contains:
1. Today's iClicker Questions
2. Handout for today's lecture.

iClicker Question #25A - before lecture

Which mechanism of DNA replication actually occurs in all living cells?

(A) Conservative.
(B) Semi-conservative.
(C) Dispersive.
(D) None of the above.
(E) I don't know.

---

iClicker Question #25B - after lecture

Consider the following DNA molecule:

5′-CGAG-3′

If this strand were copied by DNA polymerase, the sequence of the new DNA strand would be:

(A) 5′-CGAG-3′
(B) 5′-GAGC-3′
(C) 5′-GCTC-3′
(D) 5′-CTCG-3′
(E) I don't know.

Beaming in your answers

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Bio 111 DNA Structure & Replication

(1) DNA Structure

[These structures can be viewed using the "Lecture Molecules Application".]

The big picture:

A chromosome

A gene.

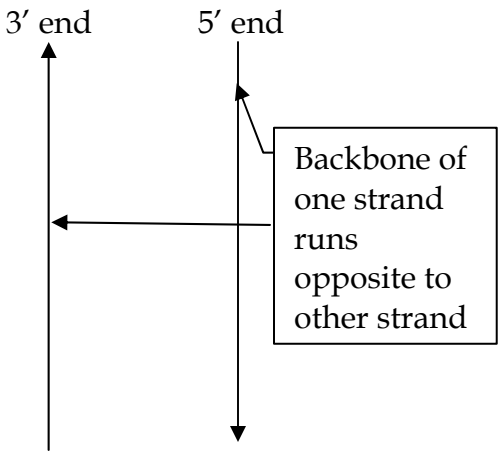
A close-up of part of the gene on the chromosome

DNA double-helix:
- each sphere is an atom
  - red = O
  - gray = C
  - blue = N
  - yellow = P
- 24 base-pairs are shown here (a typical gene is 10,000 or more.)

[load DNA]

The DNA in a chromosome consists of two DNA strands running **antiparallel** (parallel, but in opposite directions)

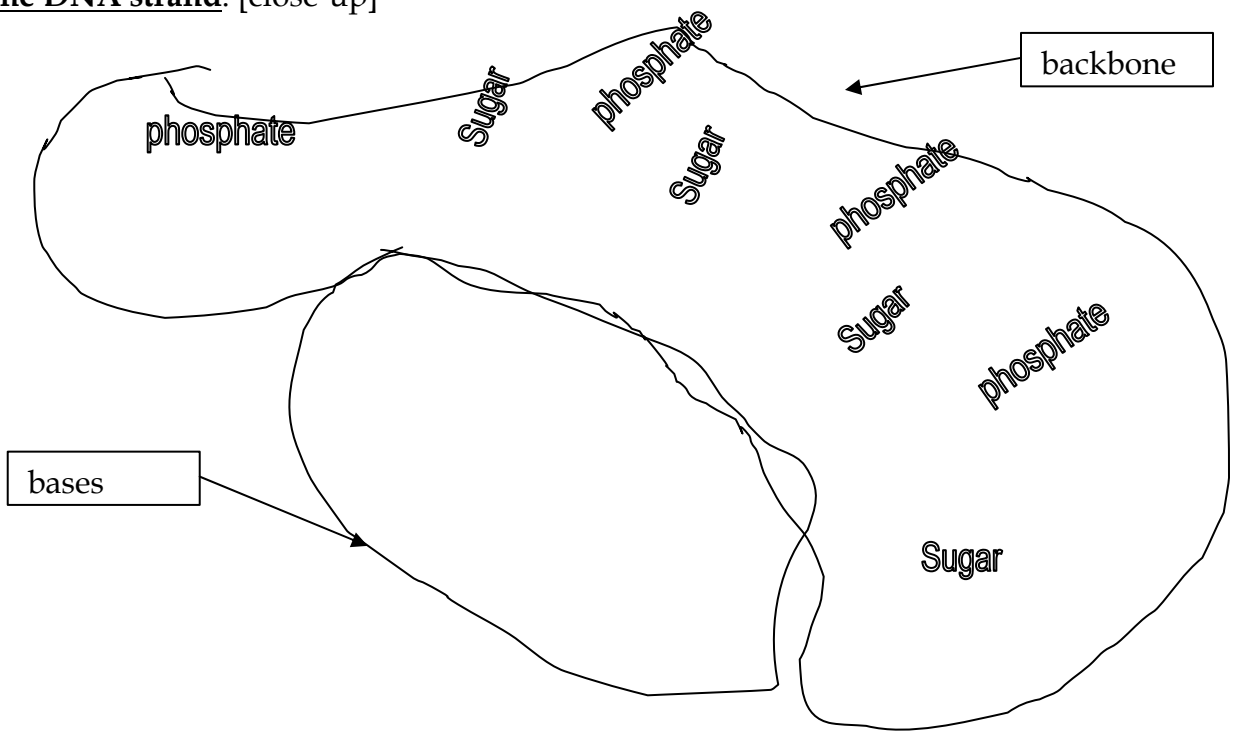
One strand in red; the other in green.



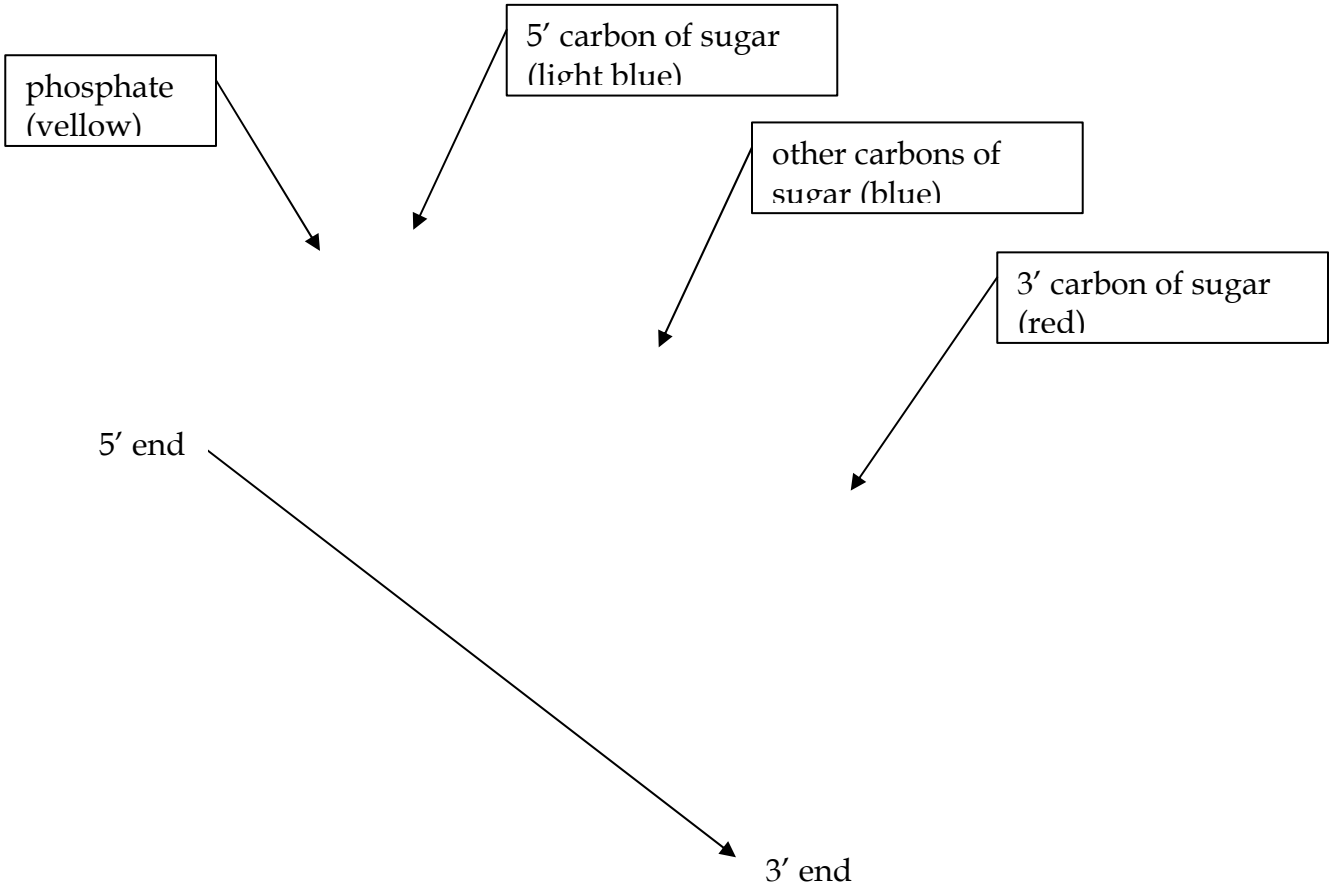
5′ end 3′ end

[2 chains]

<u>One DNA strand</u>: [close-up]



Close-up on sugar-phosphate backbone:



A base-pair: (same colors as previous page) [base-pair]

A

T

Hydrogen bonds between bases hold strands to each other.

The Whole Thing: [big picture]

One strand's backbone.
WHITE

The other strand's backbone.
YELLOW

Bases in between:
A = RED
T = LIGHT BLUE
G = GREEN
C = BLUE

A pairs with T
G pairs with C

(2) DNA Replication: Copying DNA. Must be done before the cell can divide (mitosis or meiosis).

[the views of DNA replication are available at the link: "DNA Replication animation"]
[the views of the chromosomes are available at the link: "Mitosis Animation"]

CHROMOSOMES **DNA**

Before Replication - the cell has one copy of each chromosome:

QuickTime™ and a
Animation decompressor
are needed to see this picture.

During Replication

Old DNA paired with new DNA

This is not an accurate representation; the original and new chromosomes are intertwined

Old DNA

Old DNA paired with new DNA

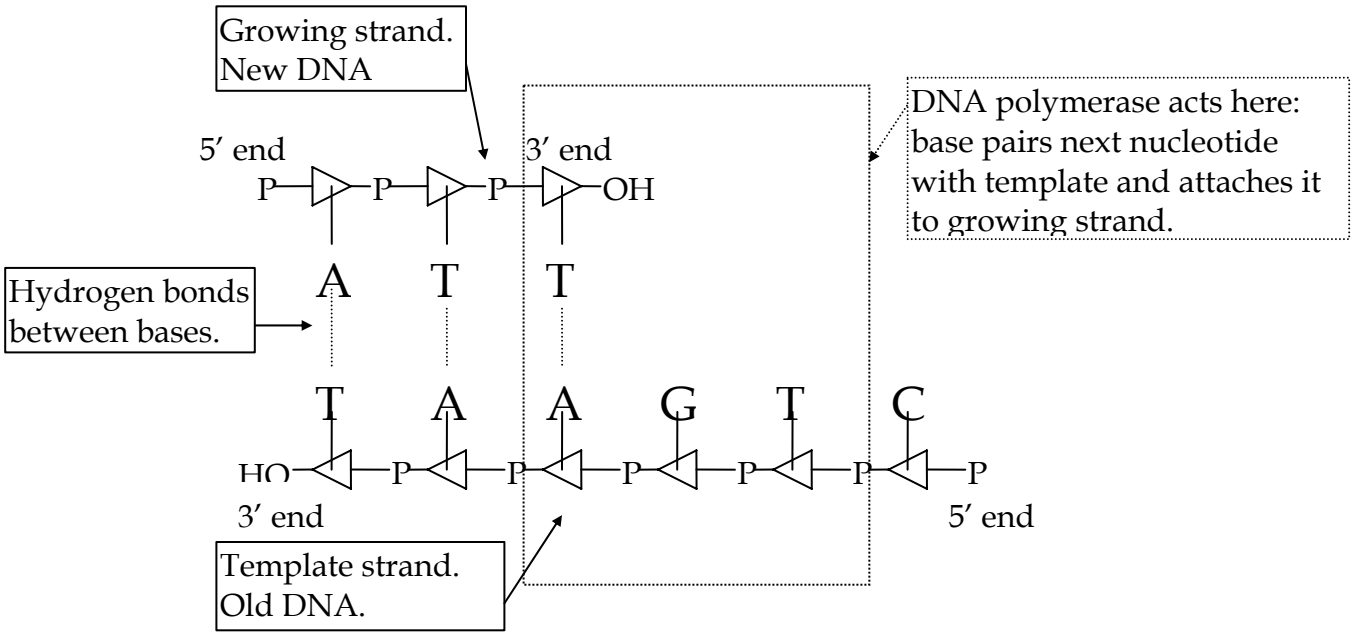
After Replication - the cell now has 2 copies of this chromosome:

Although this implies that the old and new chromosomes are separate, both are actually hybrids of old & new DNA

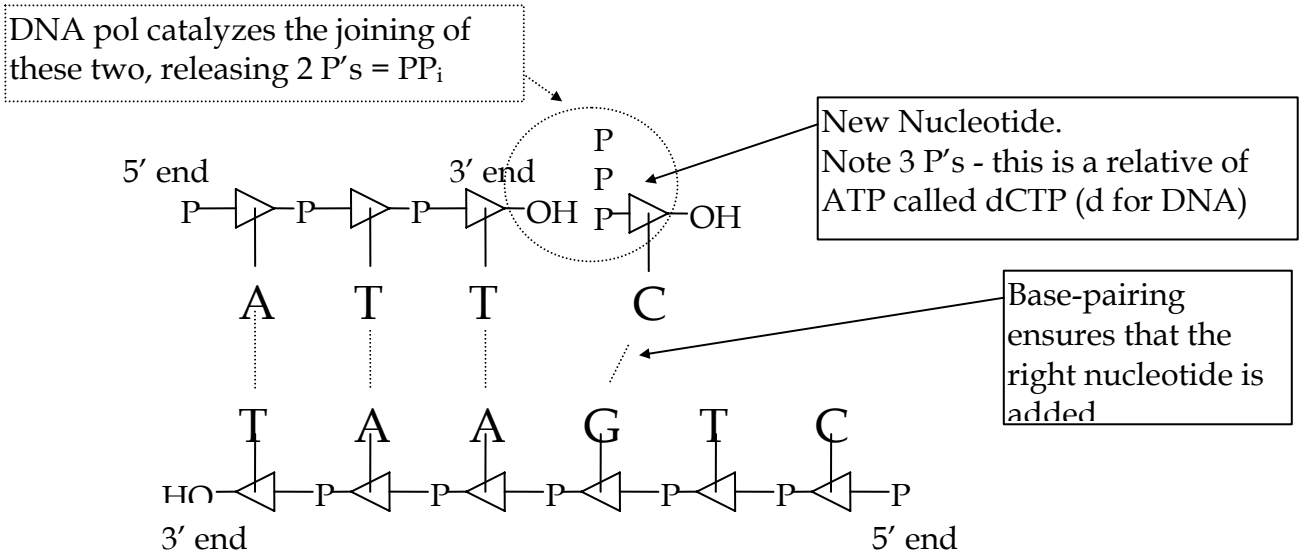
old:new hybrid	new:old hybrid

DNA Replication: Details:

• DNA replication is one by enzyme DNA polymerase (DNA pol). It adds nucleotides to the 3′ end of a DNA chain in the order specified by base-pairing to a template strand.

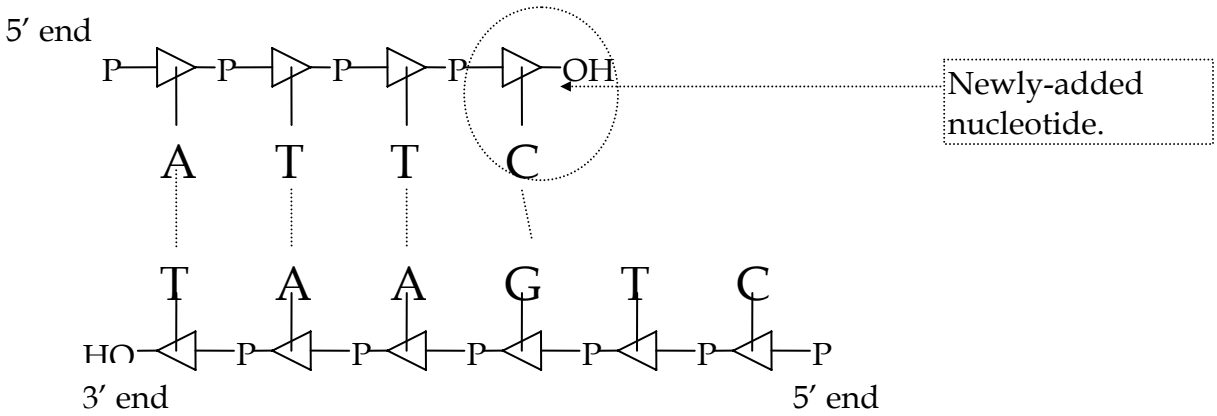


Step (1): DNA pol base-pairs new nucleotide with template, RESULTING IN:



Step (2): DNA pol joins the new nucleotide to the growing chain, RESULTING IN:

NEW 3′ end



Later steps: repeat (1) then (2)

Bio 111 Handout for Molecular Biology 3

This handout contains:
1. Today's iClicker Questions
2. Handout for today's lecture.

iClicker Question #26A - before lecture

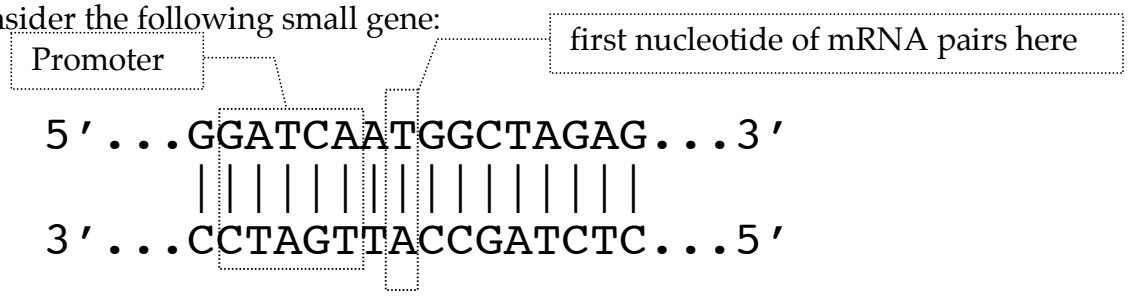
Which of the following statements is/are true?

(A) A chromosome contains many genes.
(B) DNA replication copies both DNA strands of entire chromosomes.
(C) Transcription only copies one strand of particular parts of chromosomes.
(D) All of the above.
(E) None of the above.

---

iClicker Question #26B - after lecture

Consider the following small gene:



What is the sequence of the first 6 nucleotides of the mRNA produced by this gene?

(A) 5′-ACCGAT....-3′
(B) 5′-ACCGAU....-3′
(C) 5′-TGGCTA....-3′
(D) 5′-UGGCUA...-3′
(E) I don't know.

Beaming in your answers

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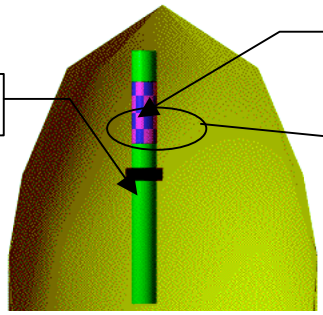
Bio 111 The 'Central Dogma' & Transcription

How do genes make proteins?

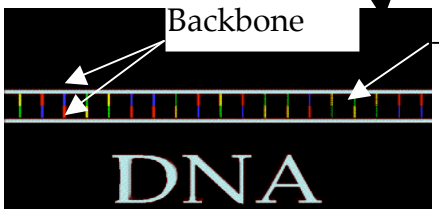
• or: how to get from DNA to protein? DNA ⇒ mRNA ⇒ protein

The big picture:



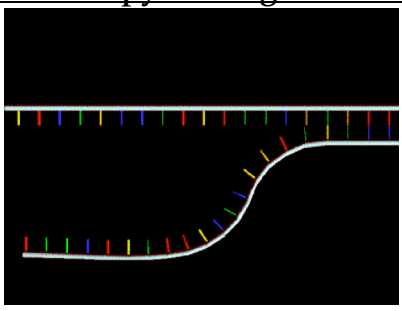
The gene = a stretch of double-stranded DNA.

One double-stranded DNA molecule.

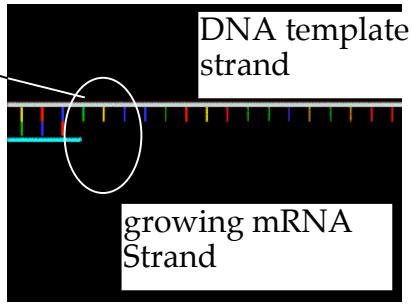


(1) Transcription: DNA ⇒ RNA (making an mRNA copy of the gene's DNA)

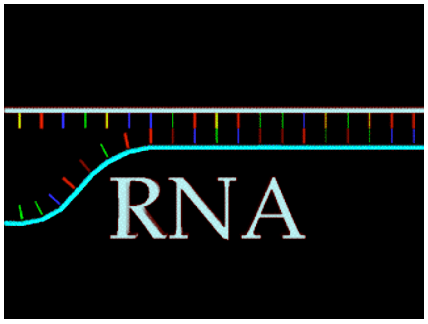
(a) Start by separating the DNA strands (break the H-bonds between bases) in the part of the DNA corresponding to the gene.



(b) **RNA polymerase** enzyme base-pairs RNA nucleotides with one DNA strand and then polymerizes these nucleotides (similar mechanism to DNA polymerase). The mRNA grows 5′ to 3′.

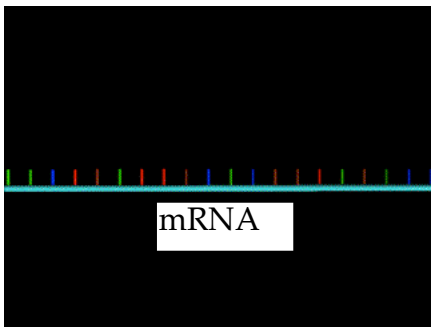


(c) As mRNA is made, it peels off of the DNA (H-bonds between bases break). The two DNA strands then re-bond.

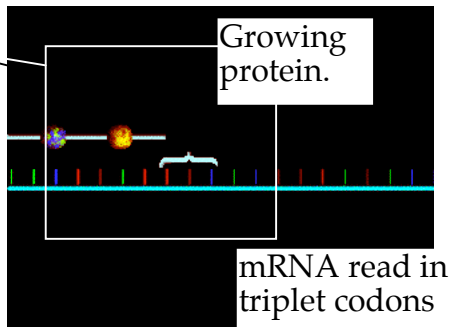


(2) Translation: mRNA ⇒ protein (reading the mRNA & making protein)

(a) • In **prokaryotes**, the mRNA is immediately translated to protein.
• In **eukaryotes**, the mRNA is first processed (more info later), then moves from the nucleus to the cytoplasm, and is translated there.



(b) The **ribosome** (a multi-enzyme complex) reads the mRNA in groups of 3 nucleotides (called codons). Each codon specifies one amino acid. The amino acids are added starting at the amino terminus.



(c) When the protein is finished, it is released from the ribosome and is functional. Most proteins fold into their 3-dimensional form as they are made on the ribosome.

Bio 111 Handout for Molecular Biology 4

This handout contains:
- Today's iClicker Questions
- Handout for today's lecture.

iClicker Question #27A - before lecture

Which words make this statement correct?

"Promoter is to terminator as (X) is to (Y)"

	(X)	(Y)
(A)	stop codon	start codon
(B)	start codon	stop codon

(C) None of the above.

---

iClicker Question #27B - after lecture

Given the genetic code table in this handout, what will be the amino acid sequence of the protein produced by the following mRNA?

5'AAUGCUUAAUUAGGGA3'

(A) H_3N^+-asn-ala-COO^-
(B) H_3N^+-met-leu-asn-stop-gly-COO^-
(C) H_3N^+-met-leu-asn-COO^-
(D) None of the above
(F) I don't know.

Beaming in your answers

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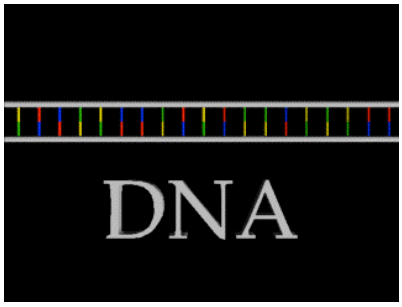
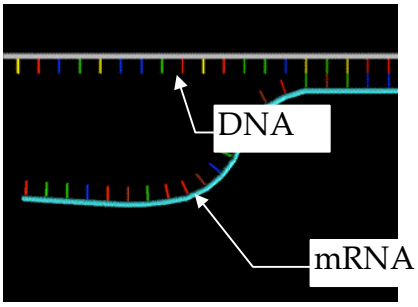
Bio 111 The 'Central Dogma': Translation

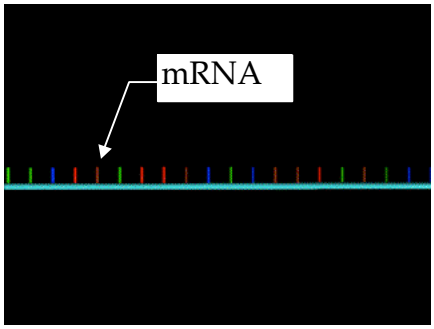
• or: how to get from mRNA to protein?



Transcription

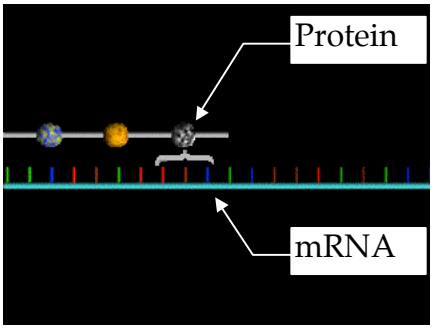
• done by: **RNA pol**
⇒ starts at **promoter**
≠ stops at **terminator**





Translation

• done by: **ribosome**
⇒ starts at **start codon**
≠ stops at **stop codon**

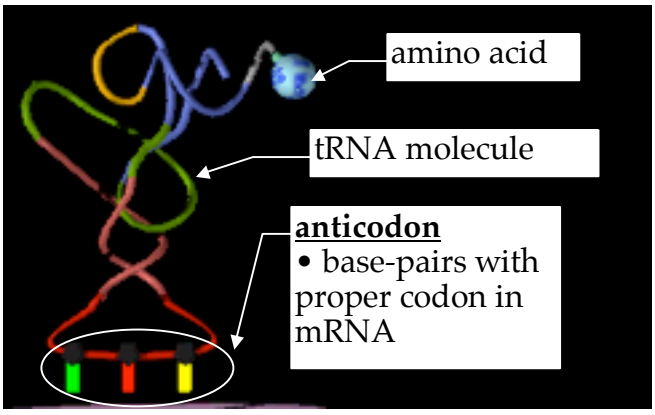


Translation:

Codon = group of 3 nucleotides.

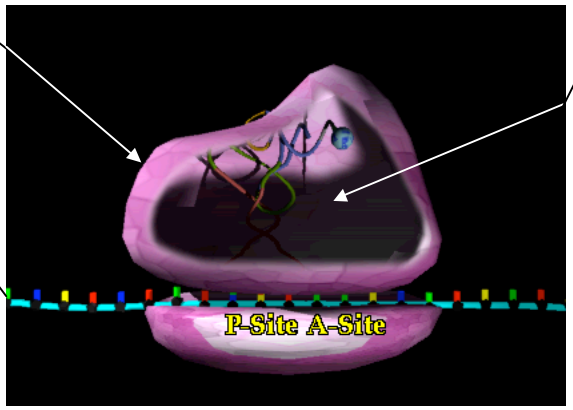
• Starting at start codon, read mRNA in codons, one amino acid per codon until you reach stop codon.
• Since amino acids can't base-pair with mRNA - need an adapter:
– something that can base-pair at one end and hold an amino acid at the other = **tRNA**

tRNA: a small RNA molecule - a different one for each codon.



Enzymes recognize the anticodon and other parts of the tRNA and attach the appropriate amino acid.

• done by **ribosome** (complex of many proteins and rNA)



mRNA is read 5′ to 3′

The ribosome has two places for tRNA to bind.
• one holds the tRNA with the next amino acids to be added
• the other holds the tRNA with the growing protein on it.

• The process continues until the stop codon is reached & then the protein is released.

Q: Which codons correspond to which amino acids?
A: See the table of the Genetic code below:
(this is essentially univerasal for all life on earth)

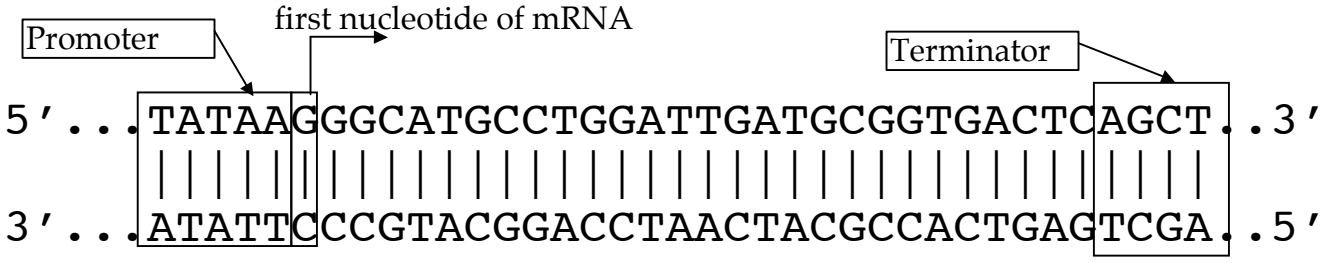
The Genetic Code

	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

* START CODON

Putting it together, a sample problem:

Here is a small section of a chromosome containing a small hypothetical gene.



Given that info, which is the mRNA produced by this gene?

a) 5′–GGGCAUGCCUGGAUUGAUGCGGUGACUC–3′

or:

b) 5′–CCCGUACGGACCUAACUACGCCACUGAG–3′

What is the amino acid sequence of the resulting protein?

Bio 111 Handout for Molecular Biology 5

This handout contains:
- Today's iClicker Questions
- Information on Exam 3
- Solutions Fall 2000 Exam 3

iClicker Question #28A - before lecture

Which of the following statements are true?

(A) Introns are found in prokaryotes and eukaryotes.
(B) Introns are removed from DNA during replication.
(C) Introns are removed from mRNA following transcription.
(D) Exons are removed from mRNA following transcription.
(E) None of the above are true.

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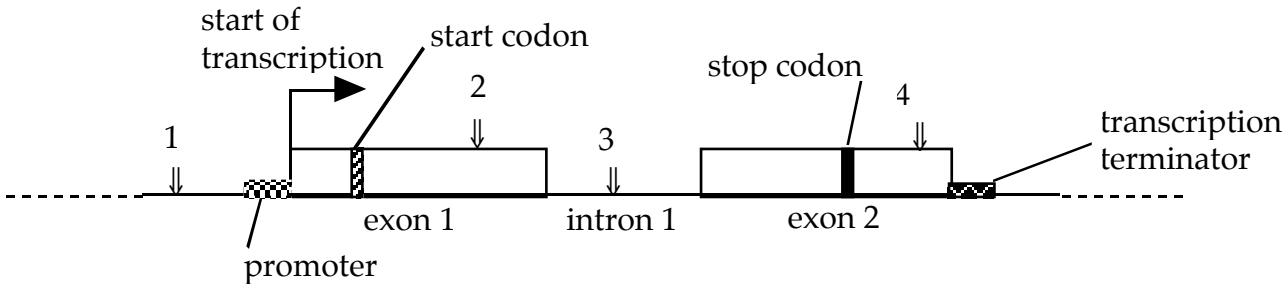
iClicker Question #28B - after lecture

Shown below is a diagram of a typical eukaryotic gene which encodes a protein:



Changing one base pair at which of the numbered locations above is likely to result in a mutant gene that is unable to produce a functional protein?

(A) Location 1
(B) Location 2
(C) Location 3
(D) Location 4
(E) More than one location.

Beaming in your answers

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Bio 111: Information for Exam III

Basic Facts

- The exam will be held in Lipke on {see syllabus for date} from 12:30 to 1:20.
- The exam will cover from Cell Biology 1 through Molecular Biology 10

- The exam will consist of approximately 4 questions. These will not be multiple choice; they will be problem-solving. A typical problem starts with a simple question, and then gets harder.
  - For a rough idea of what the exam might be like, you should work through all the problems assigned in APAIB **except**: Ch 3: 1.all, and 4.1.5 (although these are good practice). You should also work through:
    Fall 2000 Exam II Question 5 [Lab Manual]
    Fall 2000 Exam III - see lab manual.
  - You need to know:
    - the parts & differences between prokaryotic, plant, & animal cells from lecture
    - the functions of Transpeptidase, peptidoglycan, penicillin, and β-lactamase
    - DNA/RNA structure (not the specific structures, but be able to recognize the following parts: 5', 3', bases, sugars, phosphates and know their roles in structure and polymerization)
    - Chargaff's ratios (%A %G %C %T) - the principle, not any specific set of ratios
    - DNA/RNA rules
    - DNA replication & leading & lagging strand
    - Transcription & which strand is made
    - mRNA splicing & processing (introns & exons)
    - Translation & start codon & stop codon & reading frame
    - Mutations - types from lecture
    - Parts of a gene (differences between prokaryotic genes & eukaryotic genes)
    - the viral life cycle in general & the life-cycle of HIV at the level of detail presented in lecture.
    - how to explain the effect of an anti-AIDS drug given how it works
  - You **do not** need to know:
    - the structures of the base-pairs
    - Enzymes & details of DNA replication other than DNA polymerase
    - tRNA & other details of translation
    - the structure of any particular gene
    - the specific effects of any anti-AIDS drug
  - You will be given:
    - structures of any relevant molecules
    - a table of the genetic code

- You may bring in a single sheet of (8 1/2 x 11 inch) paper with any notes you want. You may write on both sides.

Bio 111 Fall 2000 Solutions to Exam III

1) a) 5′ UACAA 3′
b) H_3N^+-met-tyr-asp-COO^-
c) H_3N^+-met-met-thr-asn-COO^-
d) frameshift

2) i) YES Adding 3bp here will add one amino acid to the protein chain. This could disrupt the function by changing the shape of the protein. It could also insert a stop codon, causing premature termination of translation. Note that this CANNOT cause a frame-shift because the reading frame will not be shifted.
ii) NO The intron is not part of the mRNA so changing it will not change the protein.
iii) Many possible here (promoter, anywhere in exon between start & stop codons, etc.)
iv) The 3bp could be ATG, thus producing a new start codon. This new, earlier start codon would add more amino acids to he N-terminus of the protein which could inactivate it. Alternatively, the ATG might cause the mRNA to be read in a different frame, resulting in a completely different (and likely non-functional) protein.

3) a) LEFT TO RIGHT top row: 5′; middle row: 3′, 3′; bottom row 3′
b) bottom
c) top

4) a) (3) Reverse Transcriptase makes a single-stranded DNA copy of the viral RNA.
(9) The viral mRNA is translated.
b) i) top row: YES YES; bottom row: NO YES
ii) Drug Y This drug would stop the replication of the virus (thus helping the patient) without killing the patient.
c) i) (left to right) Replication; Transcription; Translation
ii) RNA ⇒ DNA

Bio 111 Handout for Molecular Biology 6

This handout contains:
1. Today's iClicker Questions
2. Handout for today's lecture

iClicker Question #29A - before lecture

Which of the following statements about mutation are true?

(A) Mutations are alterations to DNA.
(B) Mutations can lead to changes in mRNA.
(C) Mutations can lead to changes in proteins.
(D) All of the above.
(E) None of the above.

---

iClicker Question #29B - after lecture

Which of the following mutations would be likely to have the largest effect on the protein involved?

(A) A missense mutation of the last amino acid of the protein.
(B) A nonsense mutation of the 10^{th} amino acid (assuming the protein is more than 100 amino acids long).
(C) A single base-pair change in an intron.
(D) A single base-pair change after the stop codon.
(E) I don't know.

Beaming in your answers

1. Figure out your answer and select the appropriate letter (A-E).
2. Turn on your iClicker by pressing the "ON/OFF" button; the blue "POWER" light should come on. If the red "LOW BATTERY" light comes on, you should replace your batteries soon.
3. Transmit your answer as follows:
   a. Press the button corresponding to the answer you've selected (A thru E).
   b. The "STATUS" light will flash green to indicate that your answer has been received. If the "STATUS" light flashed red, your answer was not received; you should re-send it until you get a green "STATUS" light.

Bio 111 Selected β-globin Mutations

Changes shown in outline type.

1) Sickle-cell anemia (missense mutation: one amino acid changed to another)

	normal allele	mutant allele	
DNA:	5′...GAG...3′ 3′...CTC...5′	5′...GTG...3′ 3′ CAC...5′	all others unchanged
mRNA:	5′...GAG...3′	5′...GUG...3′	all others unchanged
protein:	H_3N^+-...glutamic acid...COO^- #6	H_3N^+-...valine...COO^- #6	all others unchanged

---

2) Nonsense mutation (one amino acid codon changed to a stop codon)

	normal allele	mutant allele	
DNA:	5′...TGG...3′ 3′...ACC...5′	5′...TAG...3′ 3′ ATC...5′	all others unchanged
mRNA:	5′...UGG...3′	5′...UAG...3′	all others unchanged
protein:	H_3N^+-...leu-trp-(132 more)-COO^- #14 15	H_3N^+-...leu-COO^- #14	all others missing

3) Frame-shift mutation (add or delete 1 or more base pairs ⇒ change reading frame)

	normal allele	mutant allele
		⇓
	5′...CCTGAGGAGAAGTCT...3′	5′...CCTGGGAGAAGTCT...3′
DNA:	|||||||||||||||	||||||||||||||| all others unchanged
	3′...GGACTCCTCTTCAGA...5′	3′ GGACCCTCTTCAGA...5′
		⇓
mRNA:	5′..,CCU,GAG,GAG,AAG,UCU,..3′	5′..,CCU,GGG,AGA,AGU,CU..3′
		all others unchanged
protein:		
	H_3N^+-...pro-glu-glu-lys-ser.....-COO^-	H_3N^+-...pro-gly-arg-ser-leu...-COO–
	#5 6 7 8 9	#5 6 7 8 9
		all others wrong

---

4) Promoter mutation - change DNA sequence so RNA pol no-longer recognizes it as well

	normal allele	mutant allele
	5′...ATAAA...3′	5′...AGAAA...3′
DNA:	|||||	||||| all others unchanged
	3′...TATTT...5′	3′ TCTTT...5′
mRNA:	normal	normal sequence but lower amount
protein:	normal	normal sequence but lower amount

Bio 111 Handout for Molecular Biology 7

This handout contains:

- Today's iClicker Questions
- Handout for today's lecture.

iClicker Question #30A - before lecture

When a virus infects a cell, which of the following components does the virus bring to the cell?

A. ribosomes
B. small molecules (monomers)
C. genetic material
D. more than one of the above
E. I don't know.

---

iClicker Question #30B - after lecture

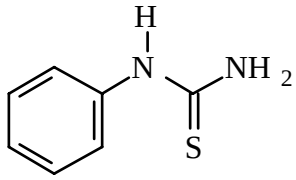
Suppose you wanted to choose a drug that would inhibit HIV but not inhibit human cells. Which of the following drugs would you choose?

(A) Drug A, which inhibits ribosomes.
(B) Drug B, which inhibits RNA polymerase.
(C) Drug C, which inhibits DNA polymerase.
(D) All of the above.
(E) None of the above.

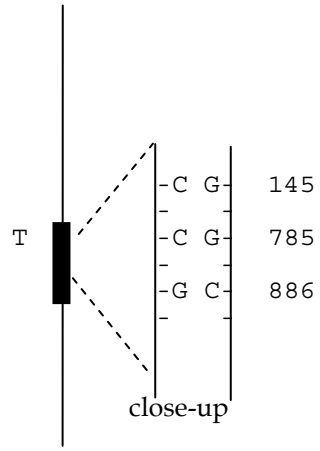
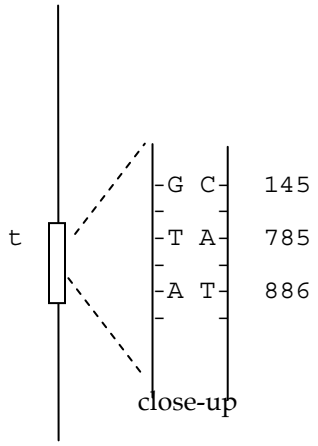
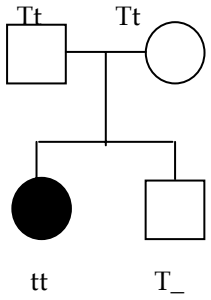
Beaming in your answers

1. Figure out your answer and select the appropriate letter (A-E).
2. Turn on your iClicker by pressing the "ON/OFF" button; the blue "POWER" light should come on. If the red "LOW BATTERY" light comes on, you should replace your batteries soon.
3. Transmit your answer as follows:
   a. Press the button corresponding to the answer you've selected (A thru E).
   b. The "STATUS" light will flash green to indicate that your answer has been received. If the "STATUS" light flashed red, your answer was not received; you should re-send it until you get a green "STATUS" light.

Bio 111: Putting it All Together - tasting PTC

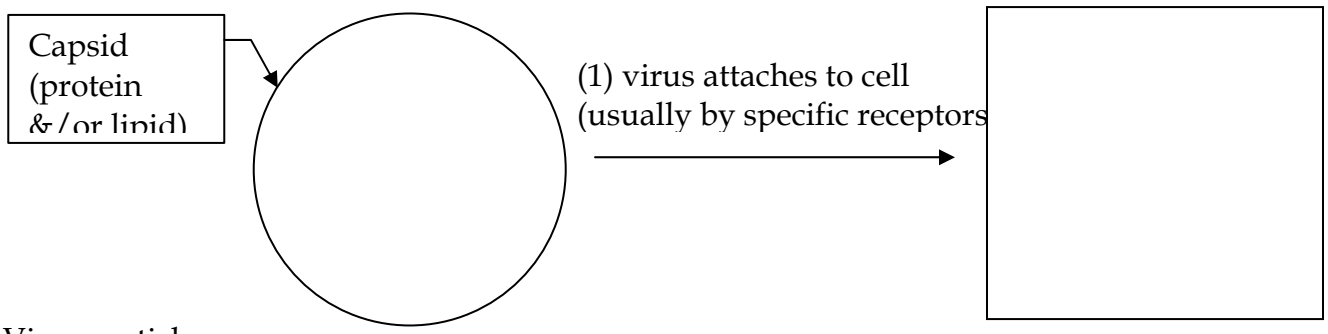


- Phenyl-thio-carbamide (PTC) is a molecule with the structure shown at the right:
- Some people find that PTC has a strong bitter taste; others find that it has no taste at all.
- The DNA sequence of the gene that codes for the ability to taste PTC has recently been determined. This gene is found on chromosome 7. The researchers found three different alleles; two of these are the most common in most human populations. These two alleles differ at three different amino acids; all the other amino acids are the same in both alleles.
- The gene encodes a protein 333 amino acids long; this protein's sequence is very similar to that of another protein that is known to be a taste receptor protein. Taste receptor proteins allow sensory cells in the tongue to detect and respond to particular molecules. It is therefore likely that this gene encodes a taste receptor protein.

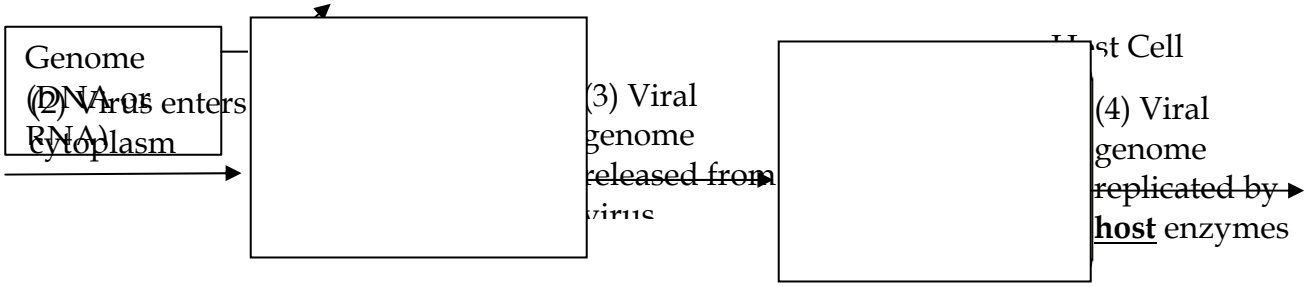
Type of analysis	**B allele**	**b allele**	**Notes**
Genetics: contribution to phenotype	Can taste PTC (dominant) "taster"	Cannot taste PTC (recessive) "non-taster"	TT - taster tt - non-taster Tt - taster
Biochemistry: protein structure & function	Produces functional taste receptor protein: H_3N^+-met$_1$-leu$_2$-...-pro$_{49}$-... -ala$_{262}$-...-val$_{296}$-...cys$_{333}$-COO$^-$ (...pro$_{49}$...ala$_{262}$...val$_{296}$...)	Produces **non**-functional taste receptor protein: H_3N^+-met$_1$-leu$_2$-...-ala$_{49}$-... -val$_{262}$-...-ile$_{296}$-...cys$_{333}$-COO$^-$ (...ala$_{49}$...val$_{262}$...ile$_{296}$...)	TT - 100% normal receptor tt - 0% normal receptor Tt - 50% normal receptor: enough to be able to taste PTC
Molecular Biology: DNA	⇓ ⇓ ⇓ 5'..CCA..GCT..GTC..3' 3'..GGT..CGA..CAG..5'	⇓ ⇓ ⇓ 5'..GCA..GTT..ATC..3' 3'..CGT..CAA..TAG..5'	
Genetics & Molecular Biology	 Chromosome 7	 Chromosome 7	

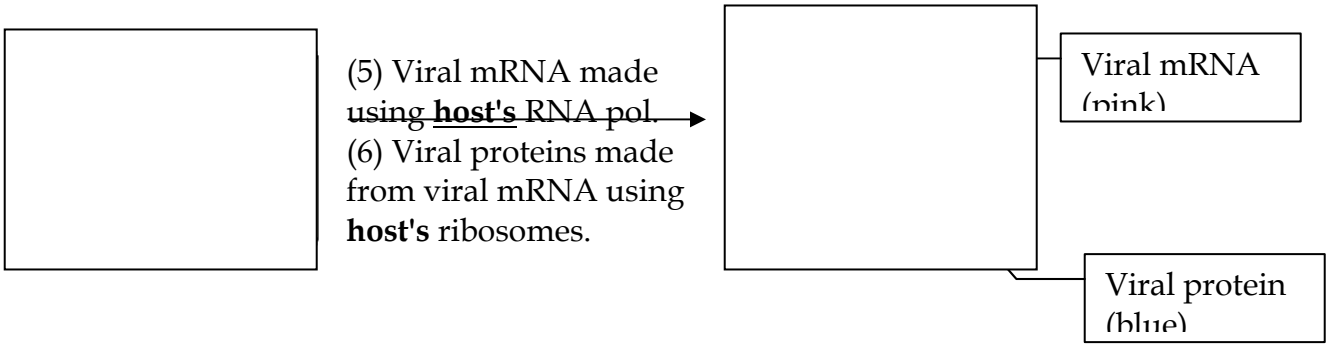
Bio 111 Viruses & HIV

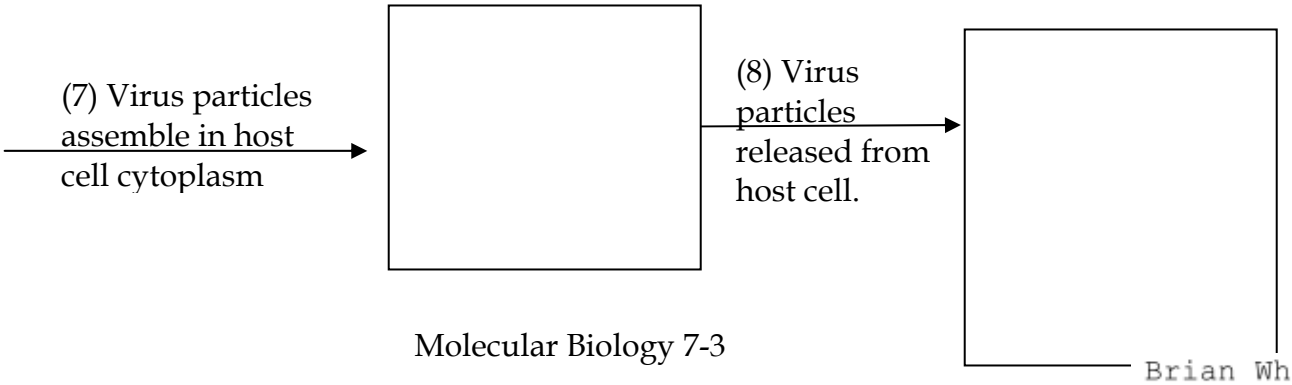
1) Generalized Viral Life cycle (Campbell CD-ROM activity 18.1 - first one in list)



Virus particle:

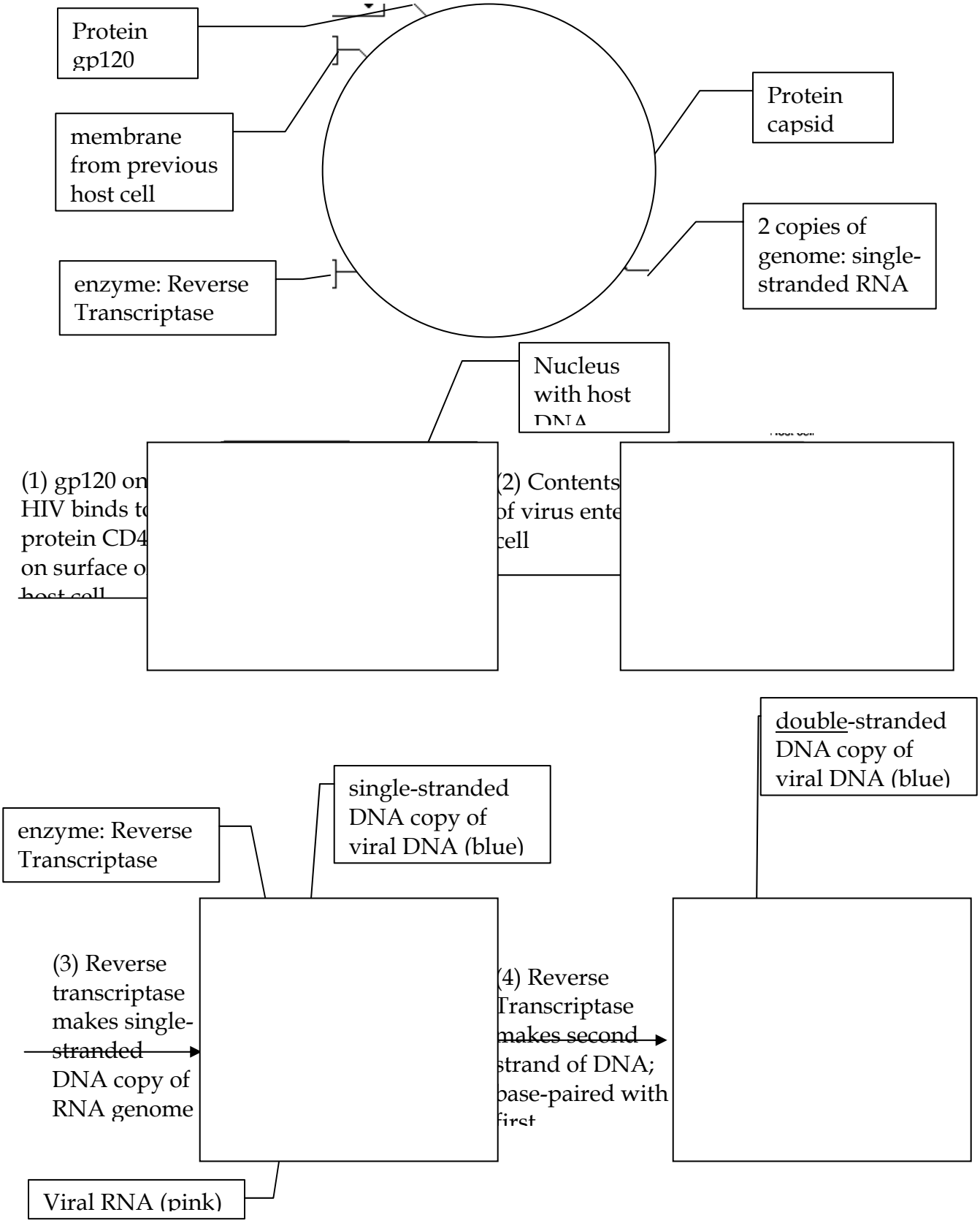


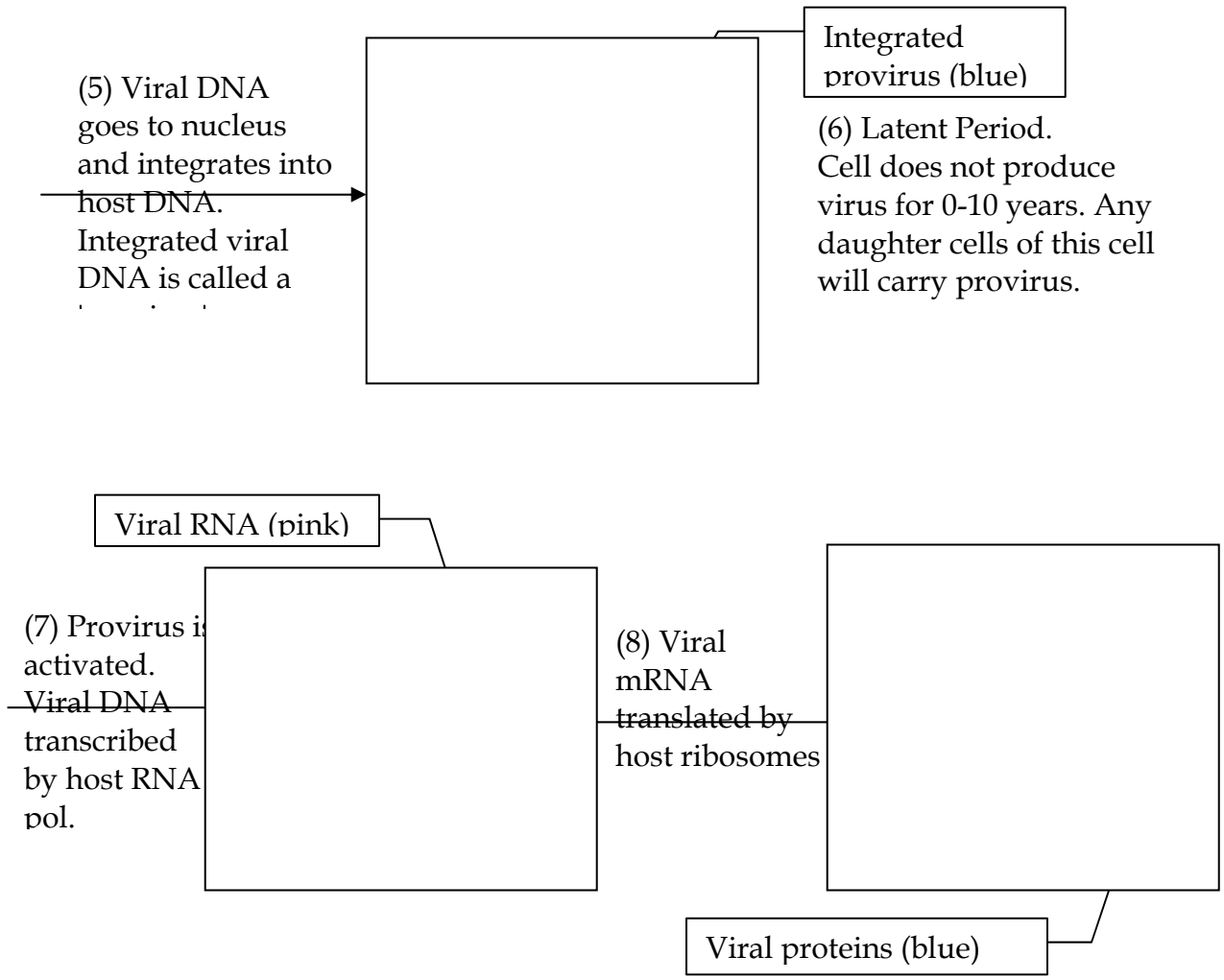




2) HIV (a retrovirus) Life cycle (Campbell CD-ROM activity 18.1 - fourth one in list)

• an HIV particle:





(11) Virus particle must mature before it can infect cells. Enzyme encoded by viral RNA, HIV protease, must process viral proteins to make the particle active.

Bio 111 Handout for Molecular Biology 8

This handout contains:
- Today's iClicker Questions
- Handout for today's lecture.

iClicker Question #31A - before lecture

Suppose you wanted to choose a drug that would inhibit HIV but not inhibit human cells. Which of the following drugs would you choose?

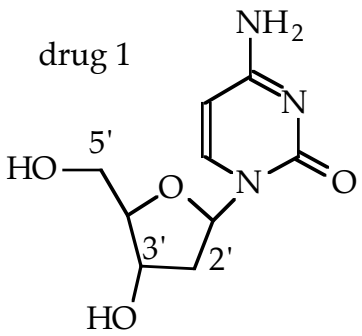
(A) Drug A, which inhibits reverse transcriptase.
(B) Drug B, which the enzyme that integrates HIV DNA into the host cell's DNA.
(C) Drug C, which prevents CD-4 from binding to GP-120.
(D) All of the above.
(E) None of the above.

---

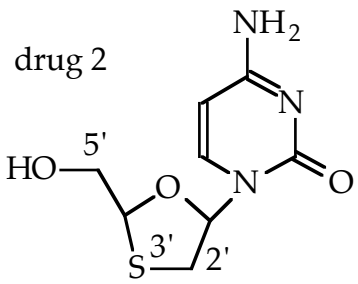
iClicker Question #31B - after lecture

Consider the following drugs. Which of these would be likely to inhibit reverse transcriptase?

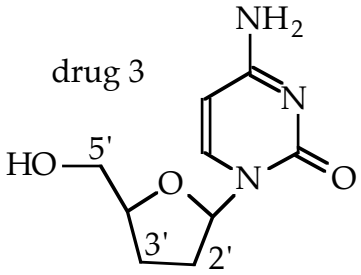
drug 1



drug 2



drug 3



(A) drug 1 only
(B) drug 2 only
(C) drug 3 only
(D) drug 2 and drug 3
(E) I don't know.

Beaming in your answers

1. Figure out your answer and select the appropriate letter (A-E).
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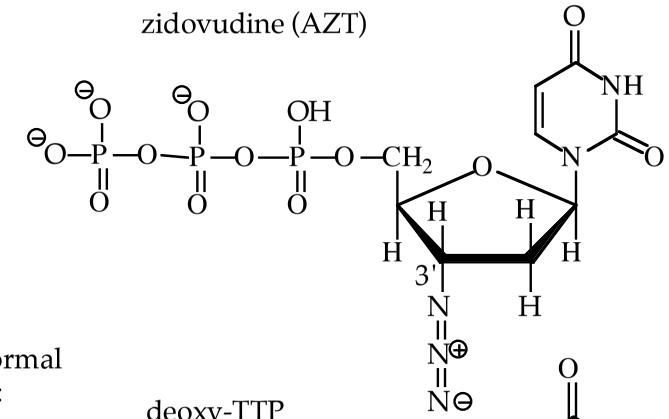
Bio 111 Anti-HIV drugs

1) Nucleotide analogs

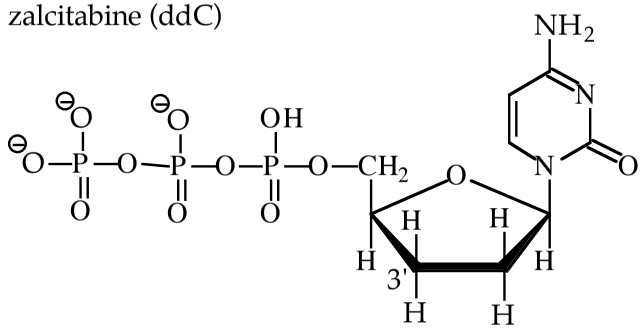
Note that these drugs are administered in a different form than the active form shown here. The drug as administered lacks any phosphate groups. The phosphate groups are added by the cell.

Drug name: zidovudine (AZT)

Structure of active form:

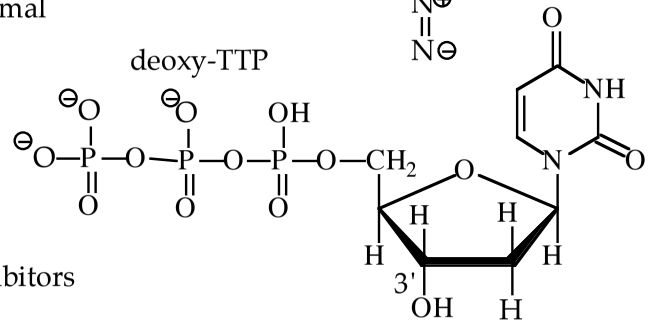


zalcitabine (ddC)

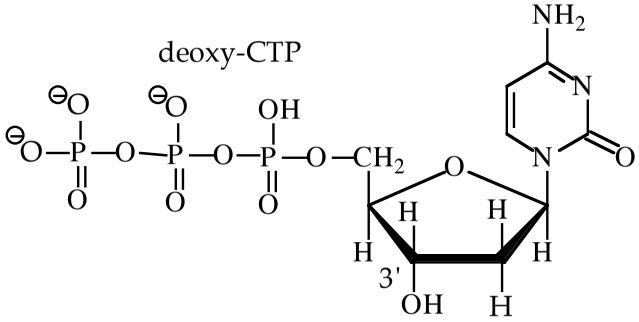


Structure of normal cellular analog:

deoxy-TTP



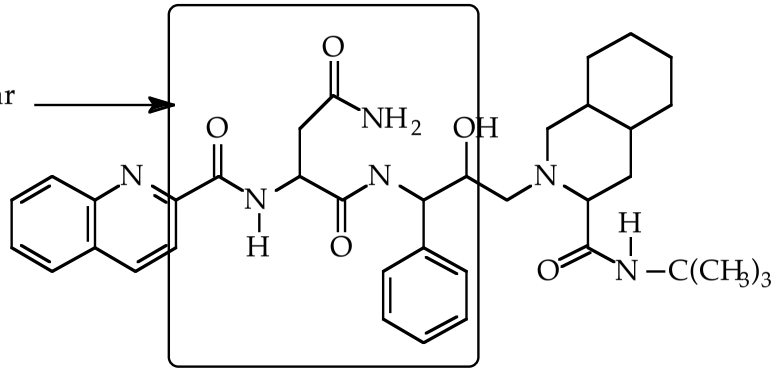
deoxy-CTP



2) Protease Inhibitors

Saquinivir

boxed region is very similar to the short protein: asn-phe



Molecular Biology 8-2