

## 1. **Pick up** Name Folder

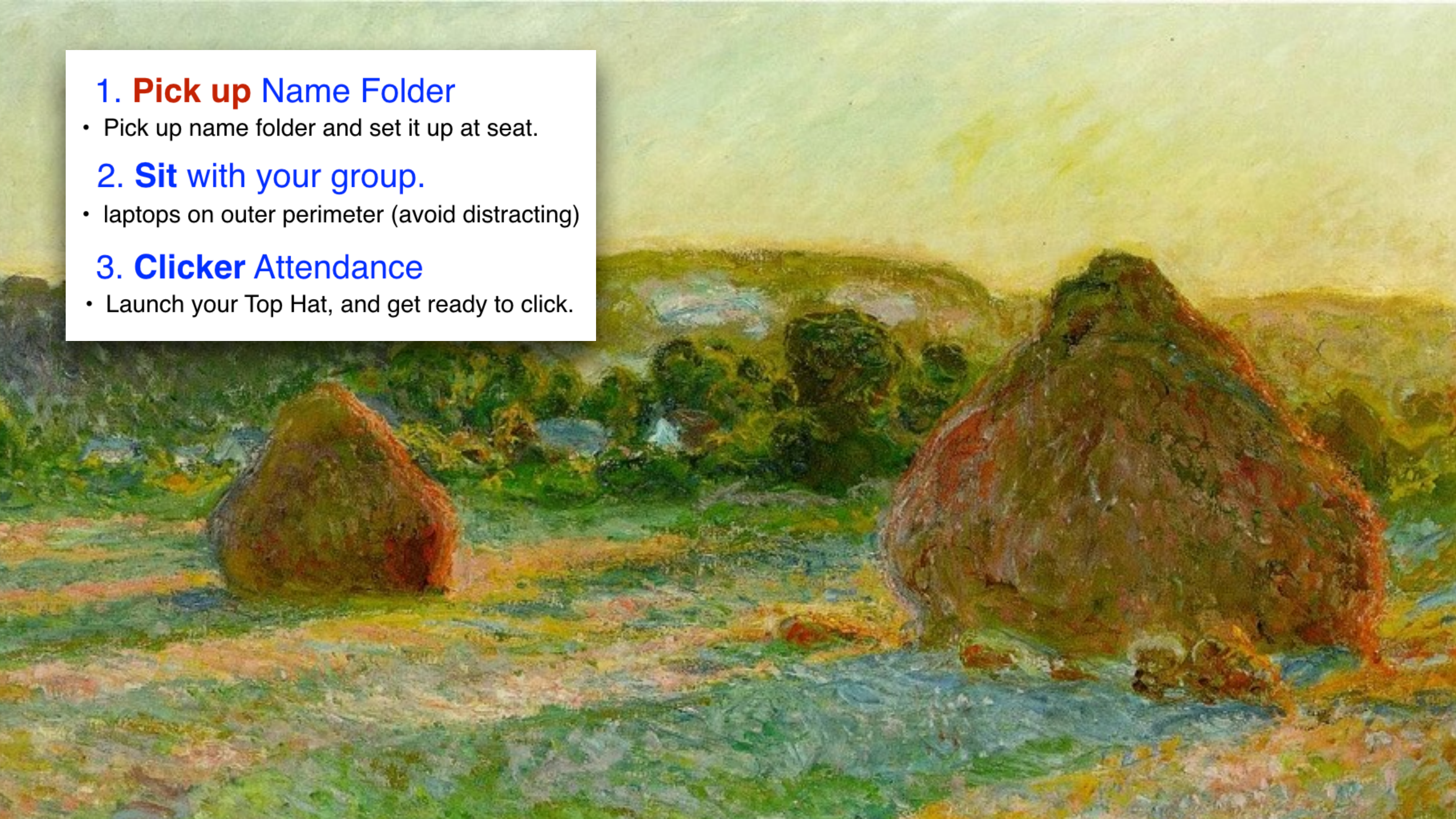
- Pick up name folder and set it up at seat.

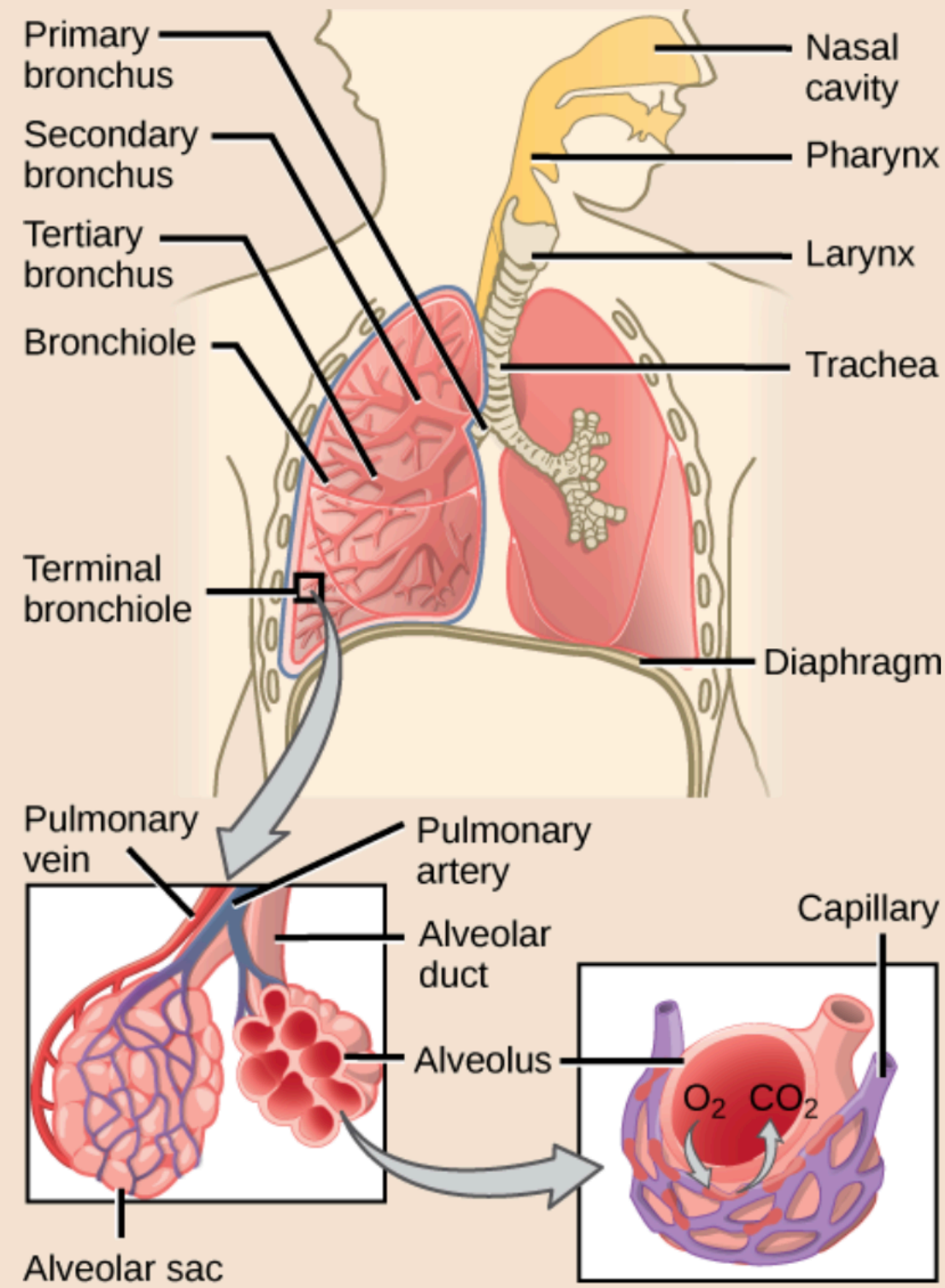
## 2. **Sit** with your group.

- laptops on outer perimeter (avoid distracting)

## 3. **Clicker** Attendance

- Launch your Top Hat, and get ready to click.





**Figure 6:** Air enters the respiratory system through the nasal cavity and pharynx, and then passes through the trachea and into the bronchi, which bring air into the lungs. (credit: modification of work by NCI)

**Link to Learning:**

Watch the following [video](#) to review the respiratory system.

**Week 11** M  
W

**Diabetes:** How do people get sick?  
Diabetes: How do you break down food?

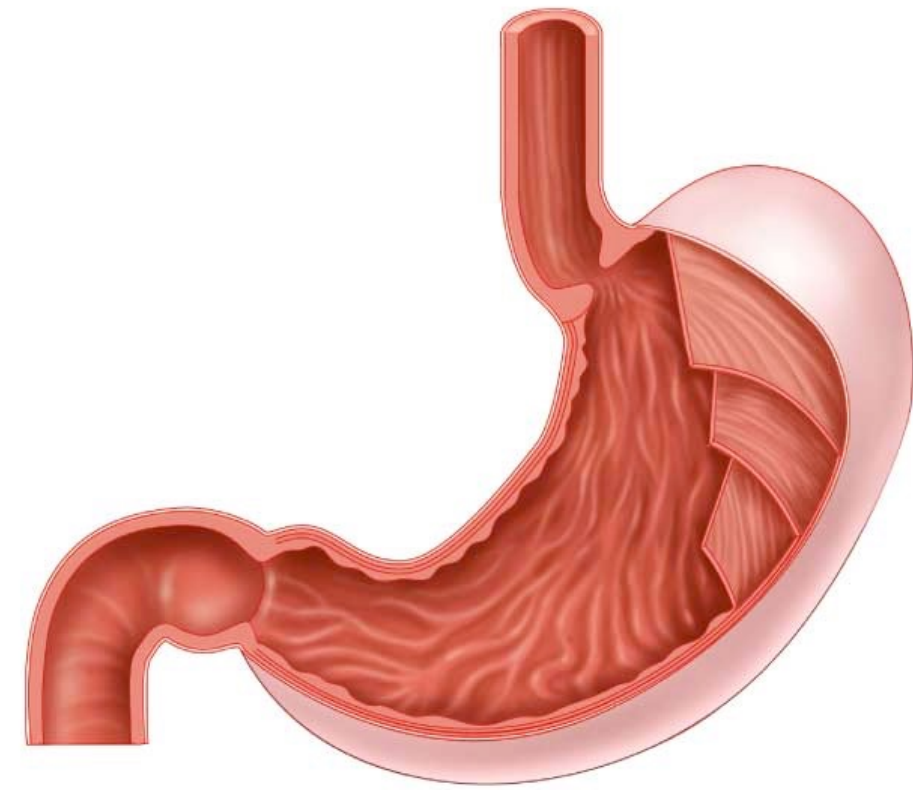
*Diabetes paper:* Polonsky *NEJM* 2012  
Ch.23-ICB: 23.1

**Week 12** M  
W

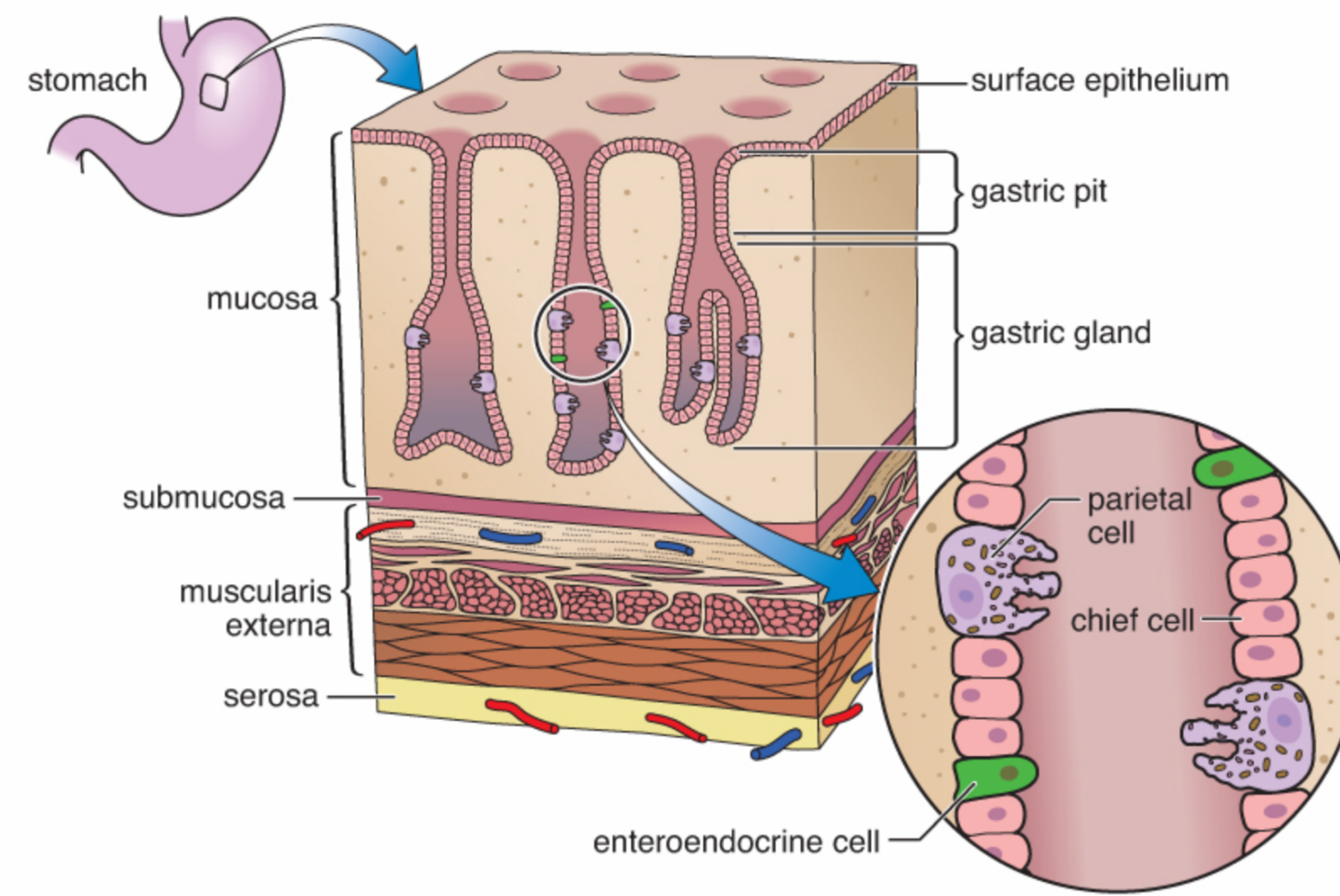
Diabetes: How does DNA shape affect (dogma)?  
Diabetes: How to make RNA (central dogma)

Ch.1-ICB: 1.4, ELSI-1.1  
Genes and Proteins (OSB): 15.3, 15.5

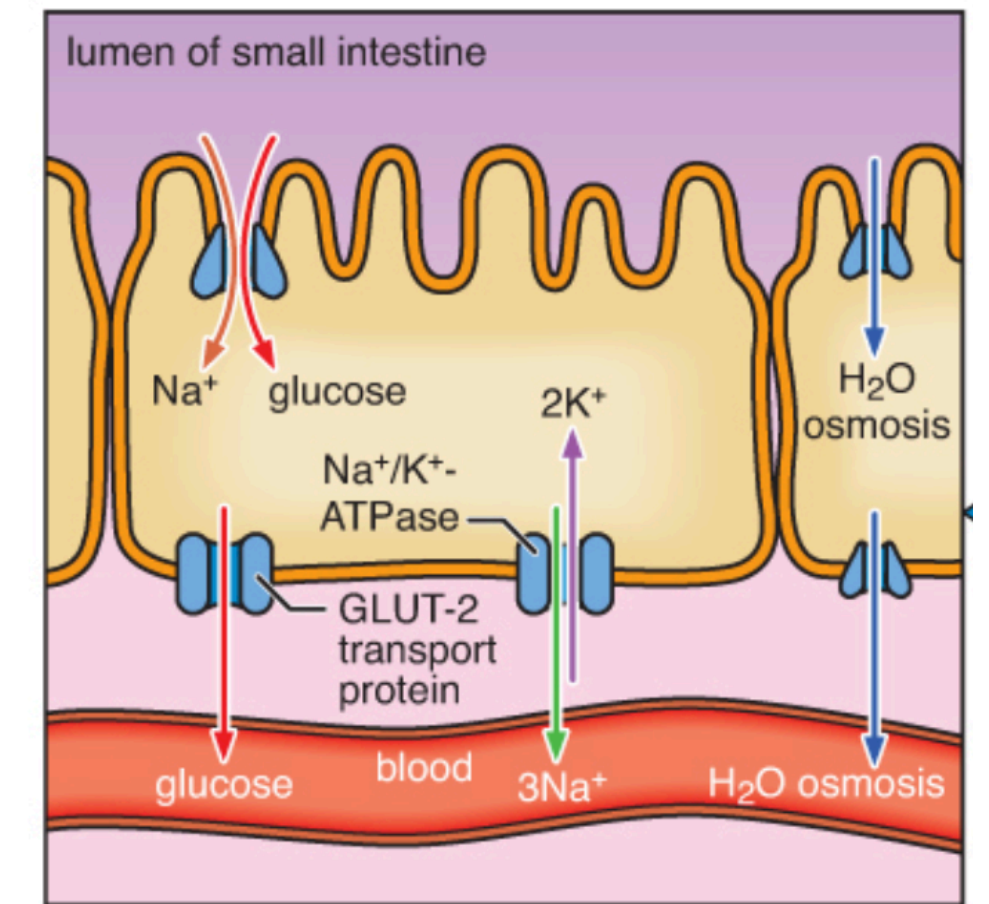




## Prout (Stomach)



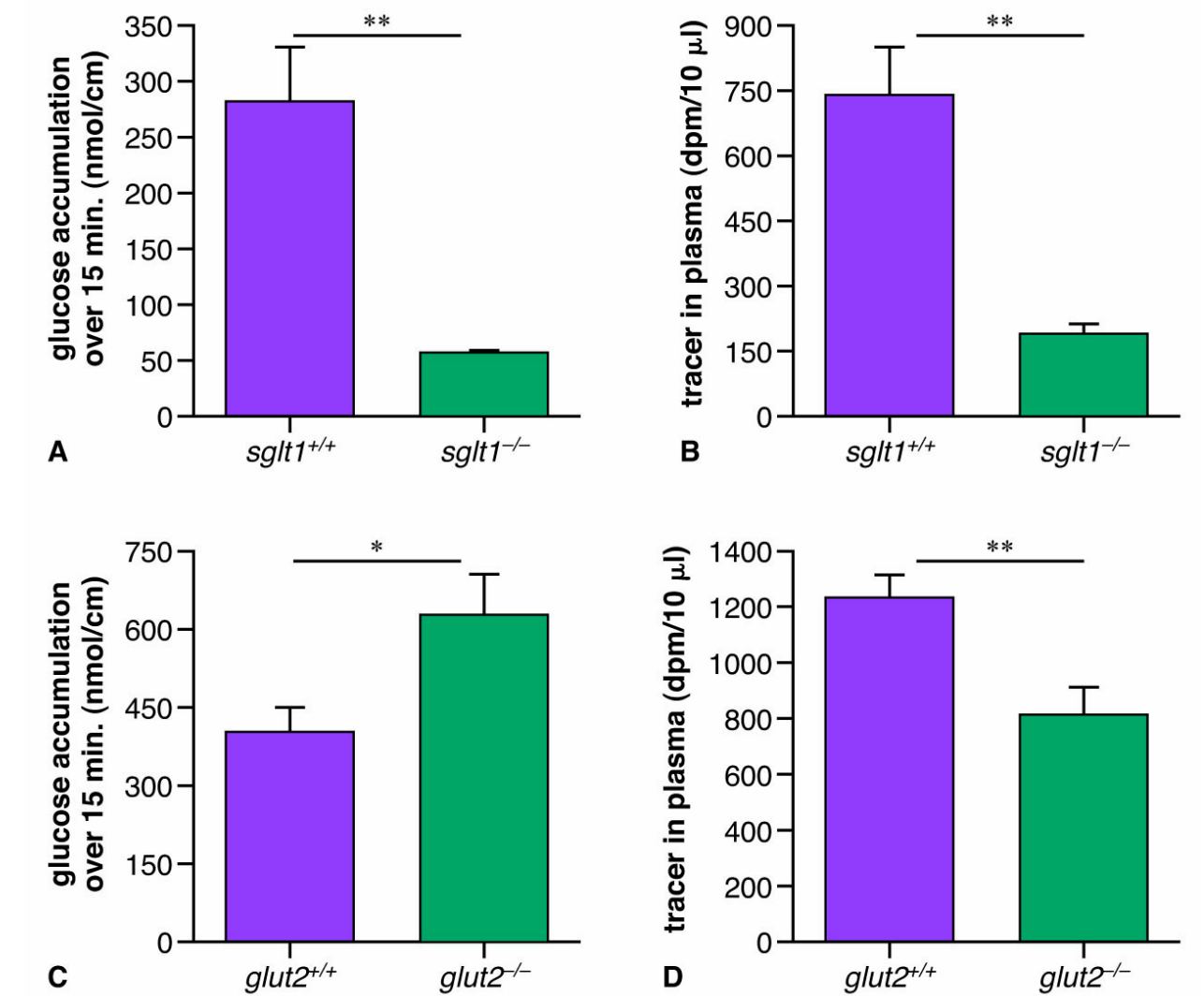
## Muallem (Parietal cell)



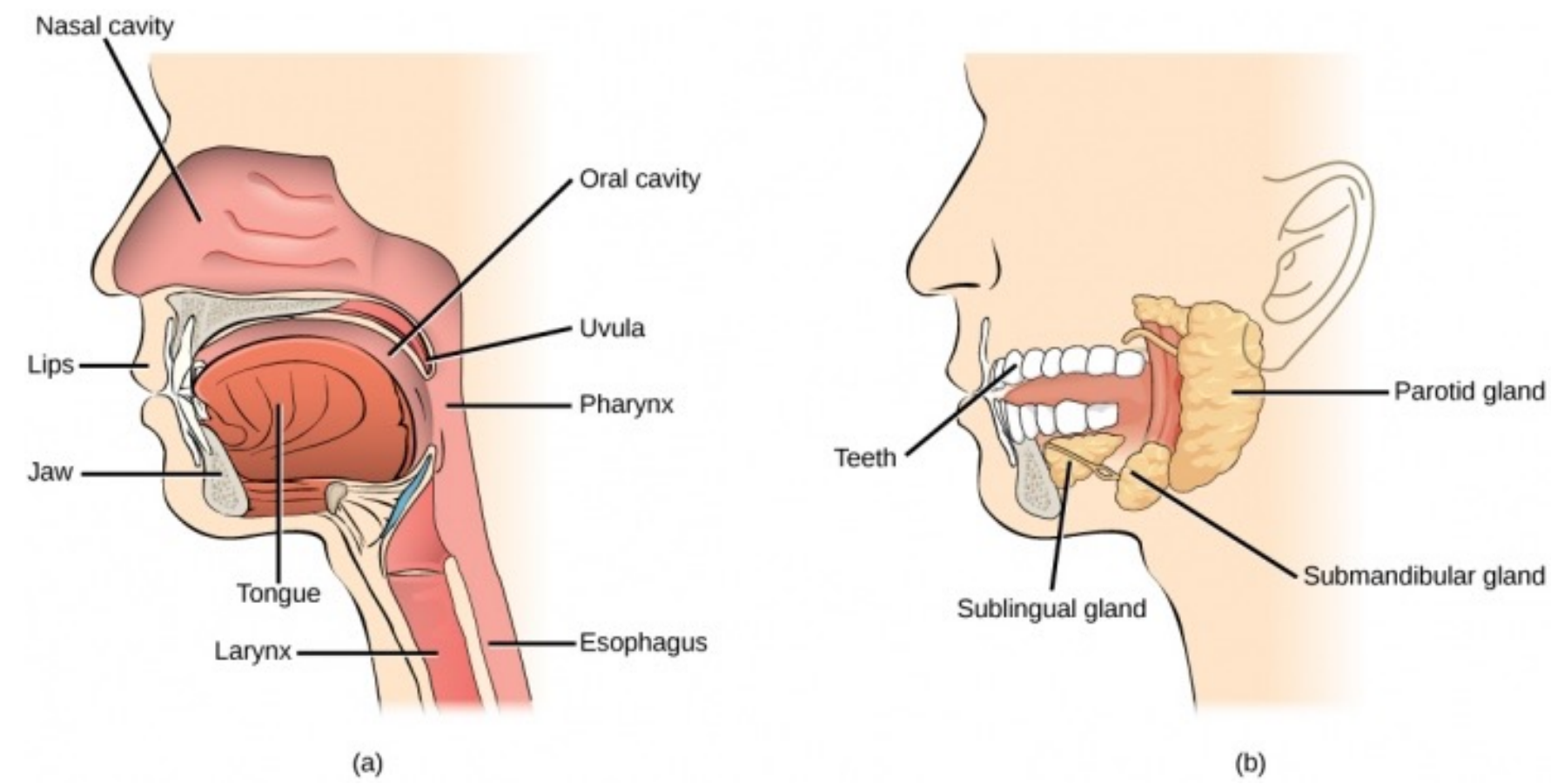
## Roder (Absorption)

fraction of solution	rabbit 1	rabbit 2	rabbit 3
chloride salts (first fraction) (g)	0.12	0.95	1.71
exact amount of base to neutralize acid (second fraction) (g)	1.56	0.76	0.40
chloride salts after neutralization (third fraction) (g)	1.59	2.22	2.72
total amount of chloride (g)	3.27	3.93	4.83
other acids (fourth fraction)	0	0	0

treatment	$\Delta\text{pH}$
no $\text{Na}^+$	-0.58
$\text{Na}^+$ added after exposed to no $\text{Na}^+$	0.56
$\text{Na}^+$ and $\text{Na}^+/\text{H}^+$ exchange inhibitor added after exposed to no $\text{Na}^+$	0
histamine	$0.130 \pm 0.038$



VF



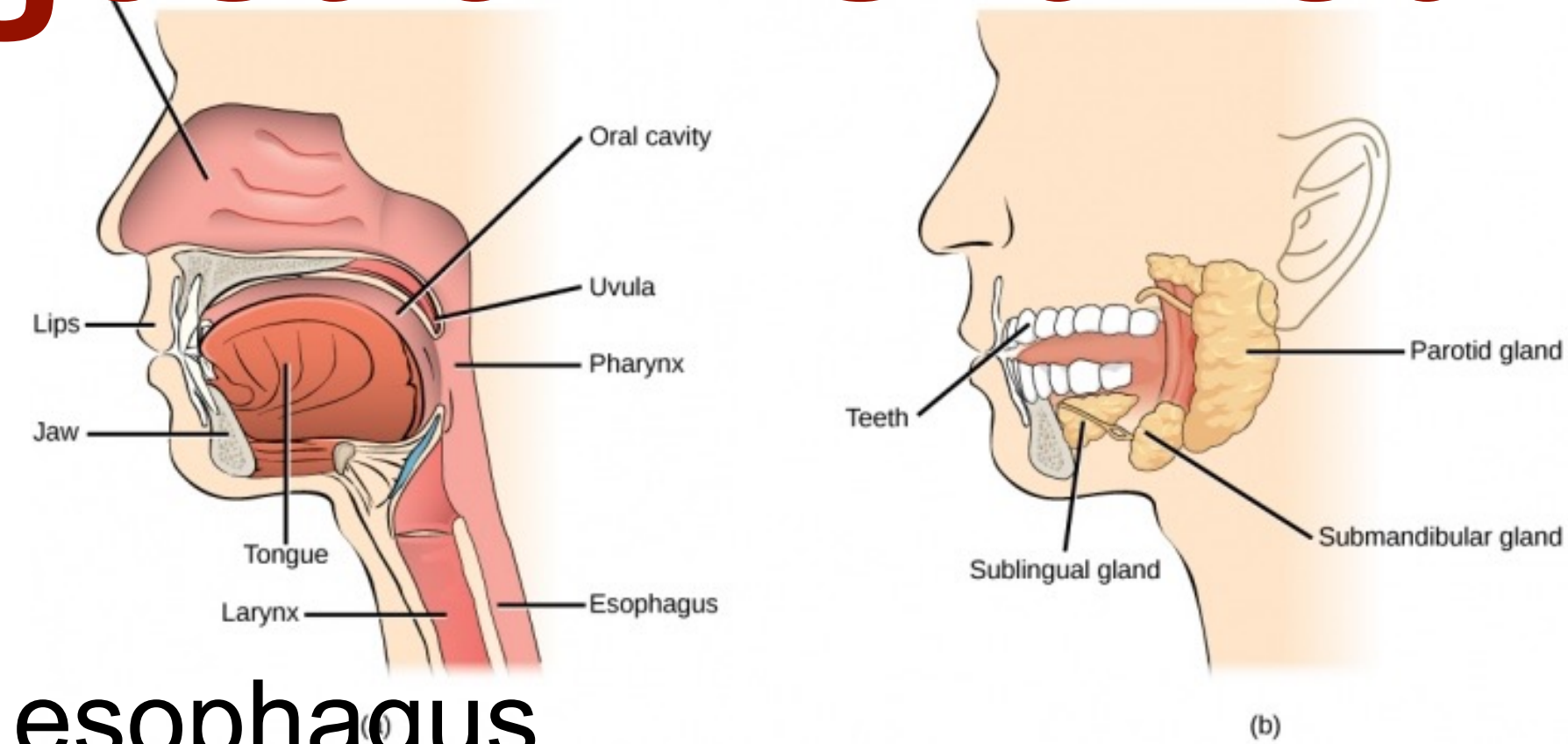
## Digestion: Oral Cavity

When you are eating a Krispy Kreme donut, describe the process of digestion in the Oral Cavity (mouth).

What **hormones** -> stimulate which **cells** -> to secrete what **enzymes** (or perform what **mechanical** actions) -> to digest what **food** molecules?

VF

# Digestion: Oral Cavity



## ? The mouth and esophagus

- Salivary amylase begins the process of carbohydrate digestion (starch i.e. amylose).
- Lingual lipase initiates fat (i.e. lipid) digestion.
- Hormones: (kinda) neurotransmitter via nerves from brain
- other? Buffers, mucous, mechanical, antibacterial compounds
- A combination of smooth and skeletal muscle moves food down the esophagus by peristalsis.

VF



## Digestion: Stomach

When you are eating, describe the process of digestion in the Stomach.

What **hormones** -> stimulate which **cells** -> to secrete what **enzymes/other** (or perform what **mechanical** actions) -> to digest what **food** molecules?

# In-class exercise

(on paper)

Stomach

**enzymes? ->**

**hormones? ->**

**other ->**

VF

# Stomach

End of esophagus

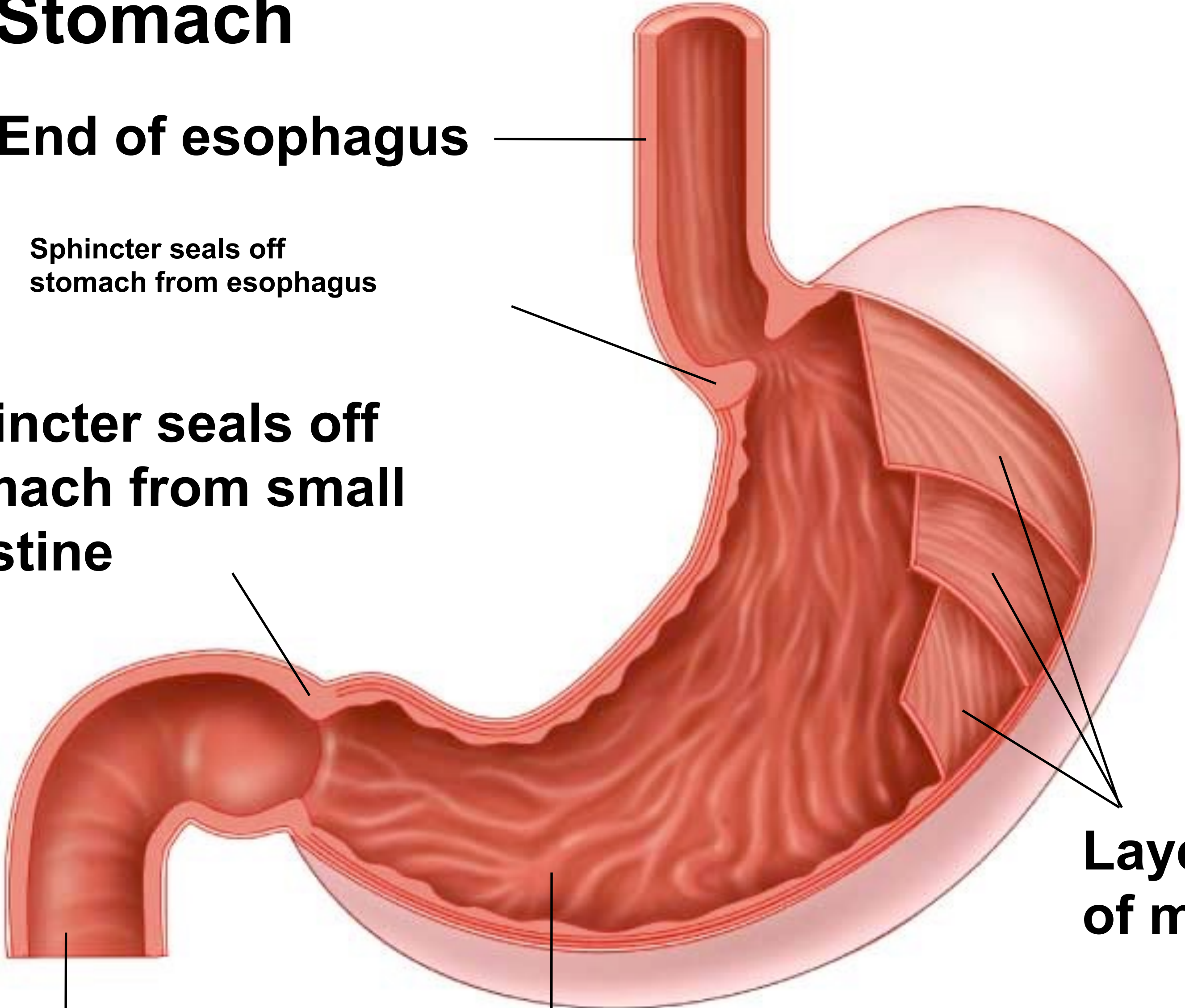
Sphincter seals off stomach from esophagus

Sphincter seals off stomach from small intestine

Beginning of small intestine

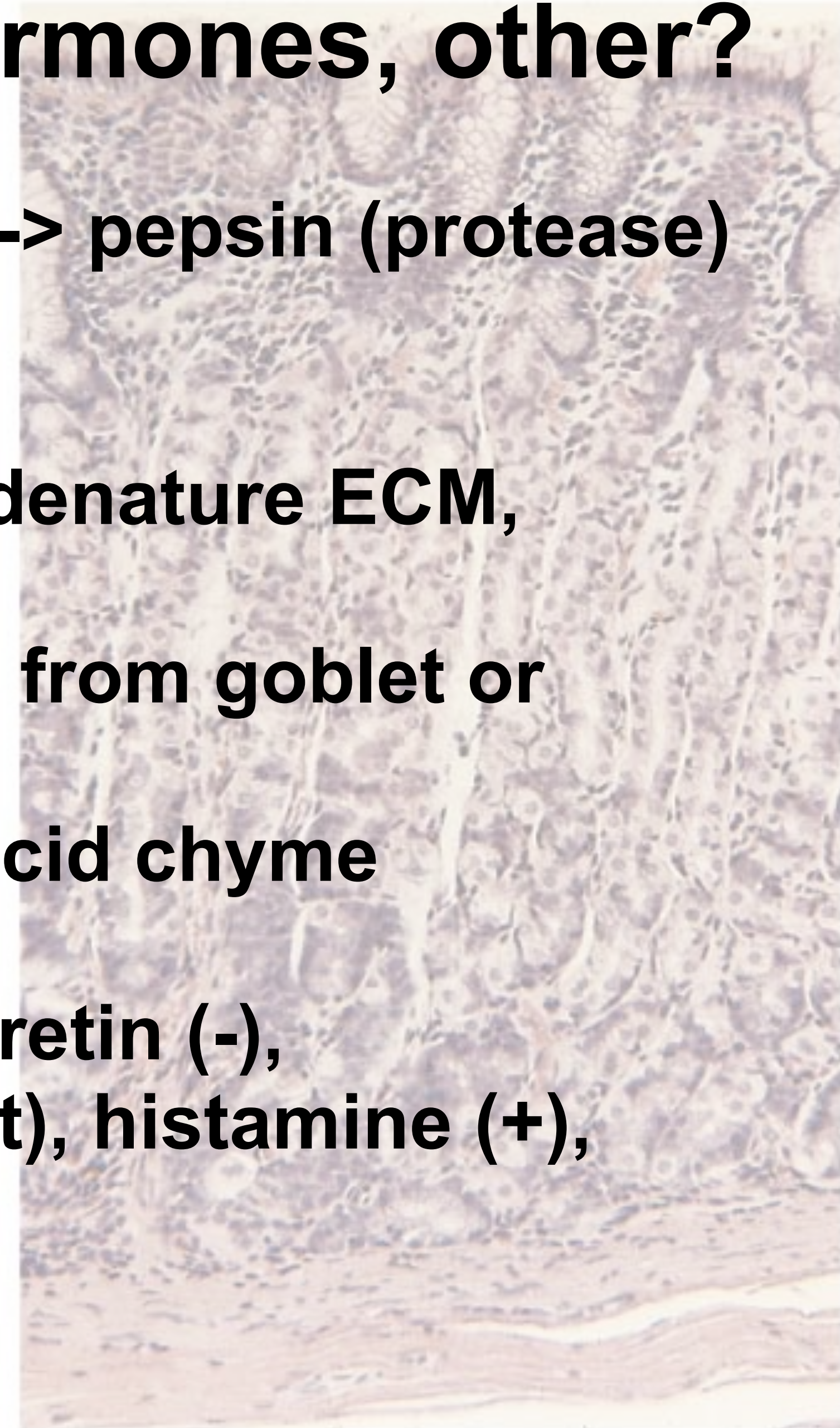
Lumen (interior)

Layers of muscle



# Stomach -Enzymes, Hormones, other?

- **Enzymes:** pepsinogen (inactive)-> pepsin (protease) from chief cells
- **Other:** HCl from parietal cells-> denature ECM, bacteria, activator of pepsin
- **Other:** Mucins/mucus protective from goblet or mucus cells
- **Other:** mechanical churning -> acid chyme
- **Hormones:** Gastrin (+), CCK/secretin (-), enterogastrone (-- pyloric sphinct), histamine (+), acetylcholine (+)



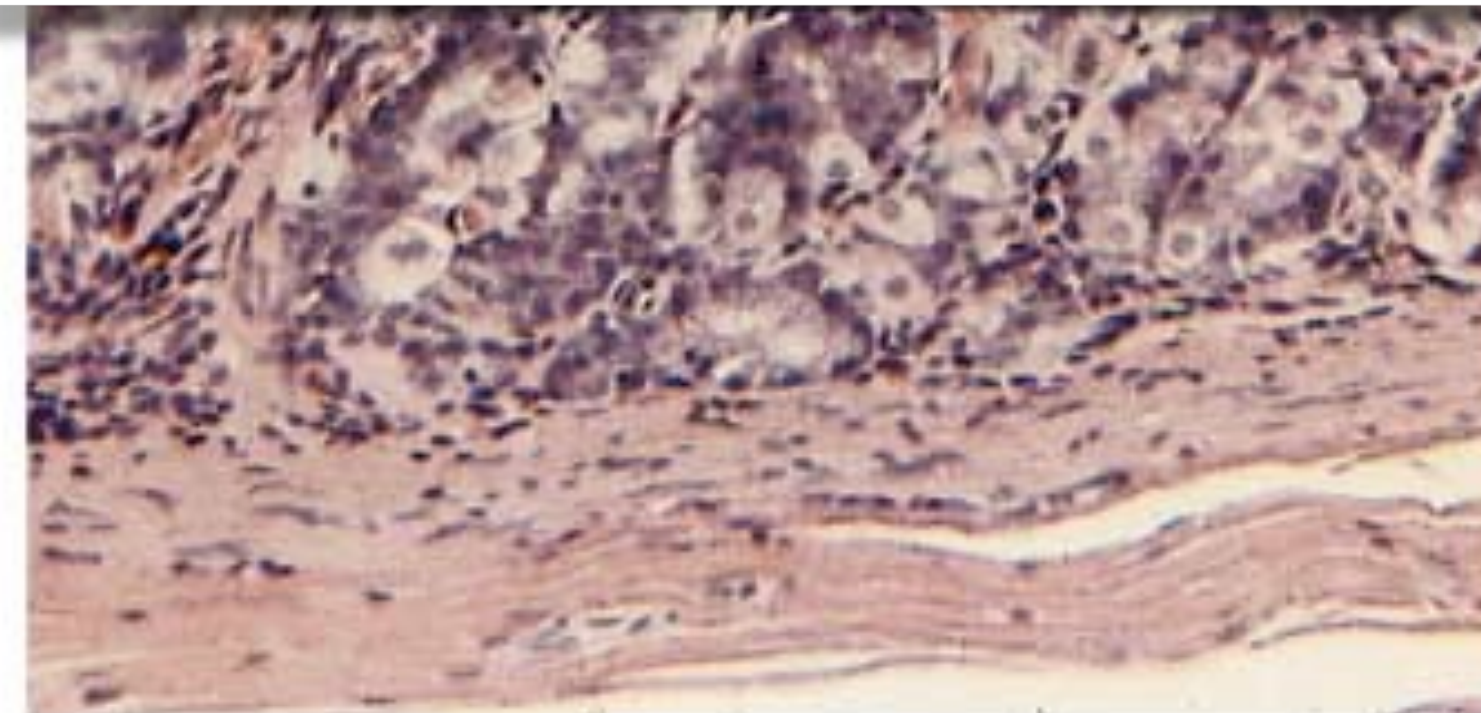
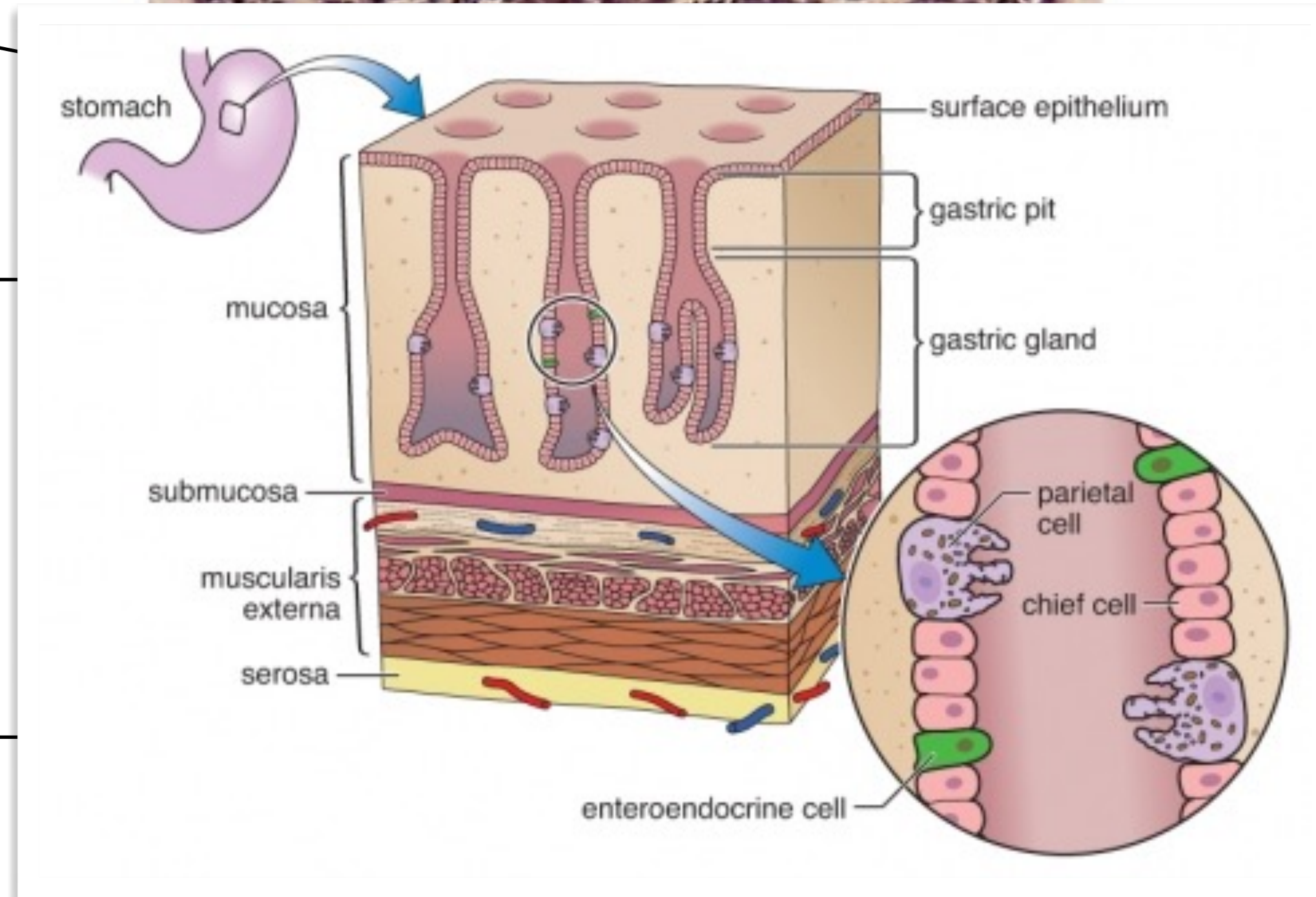
VF

## Stomach lining

Canal empties to lumen

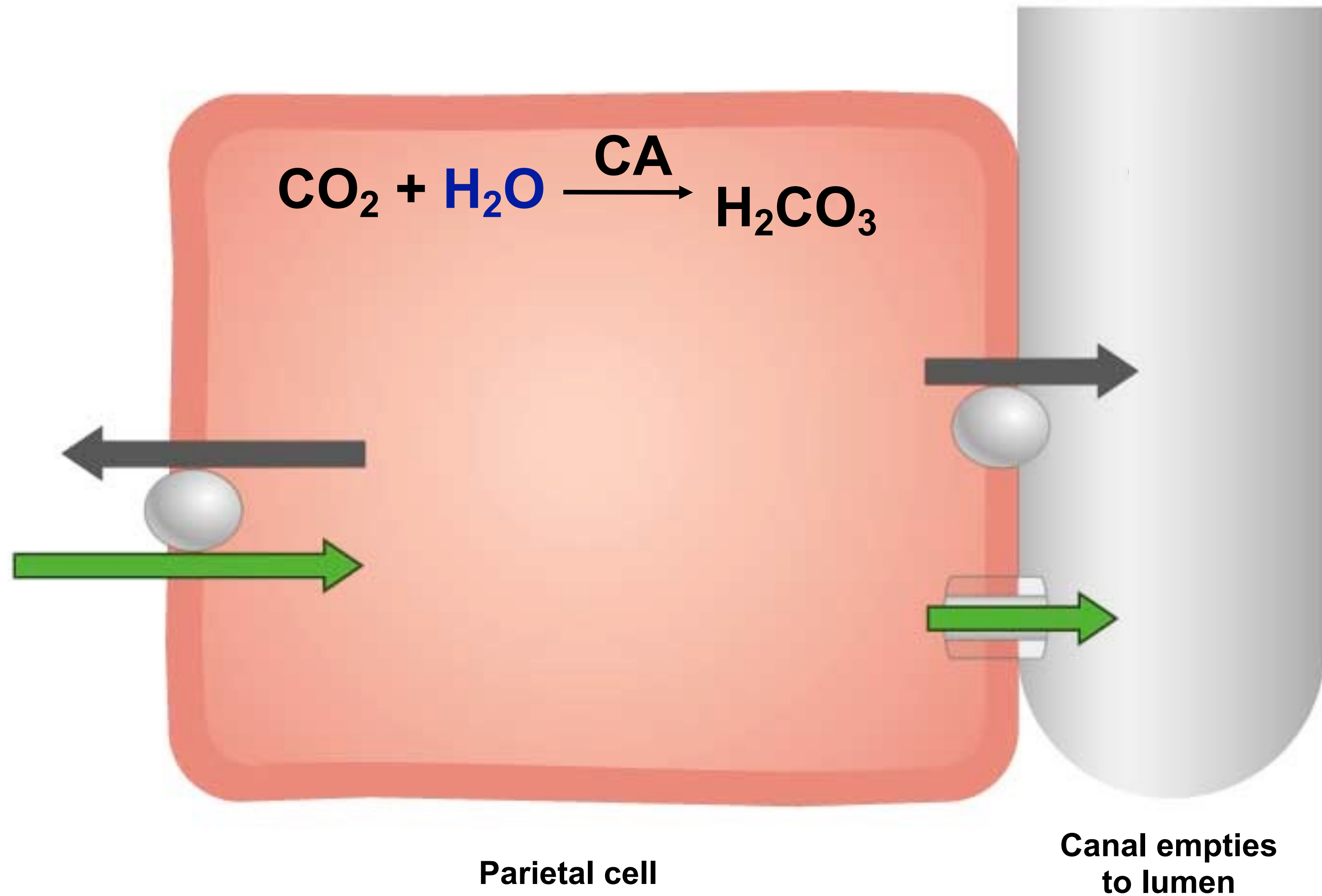
**Parietal cells  
(secrete HCl)**

**Chief cells  
(secrete pepsinogen)**



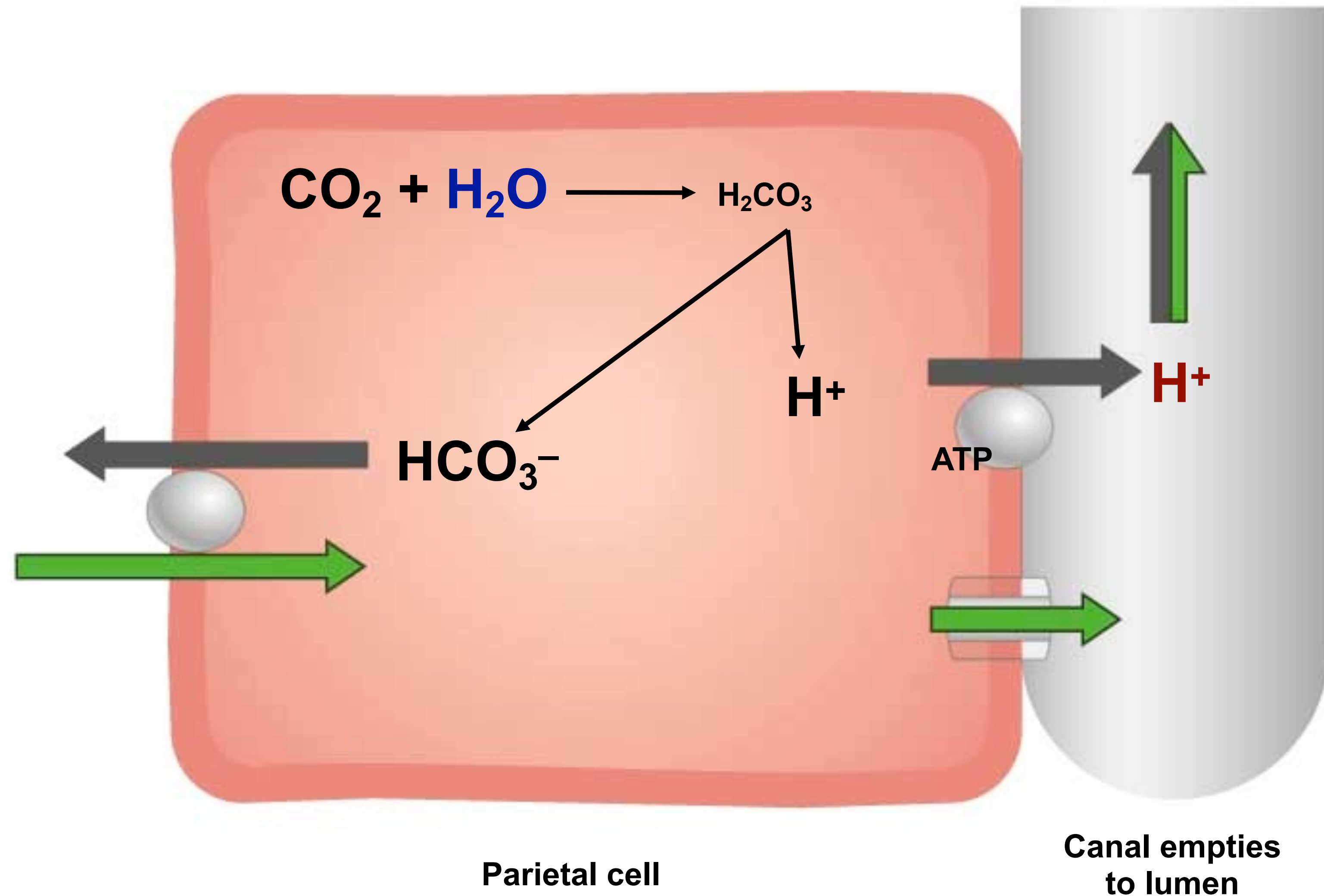
VF

# Secretion of HCl by parietal cells



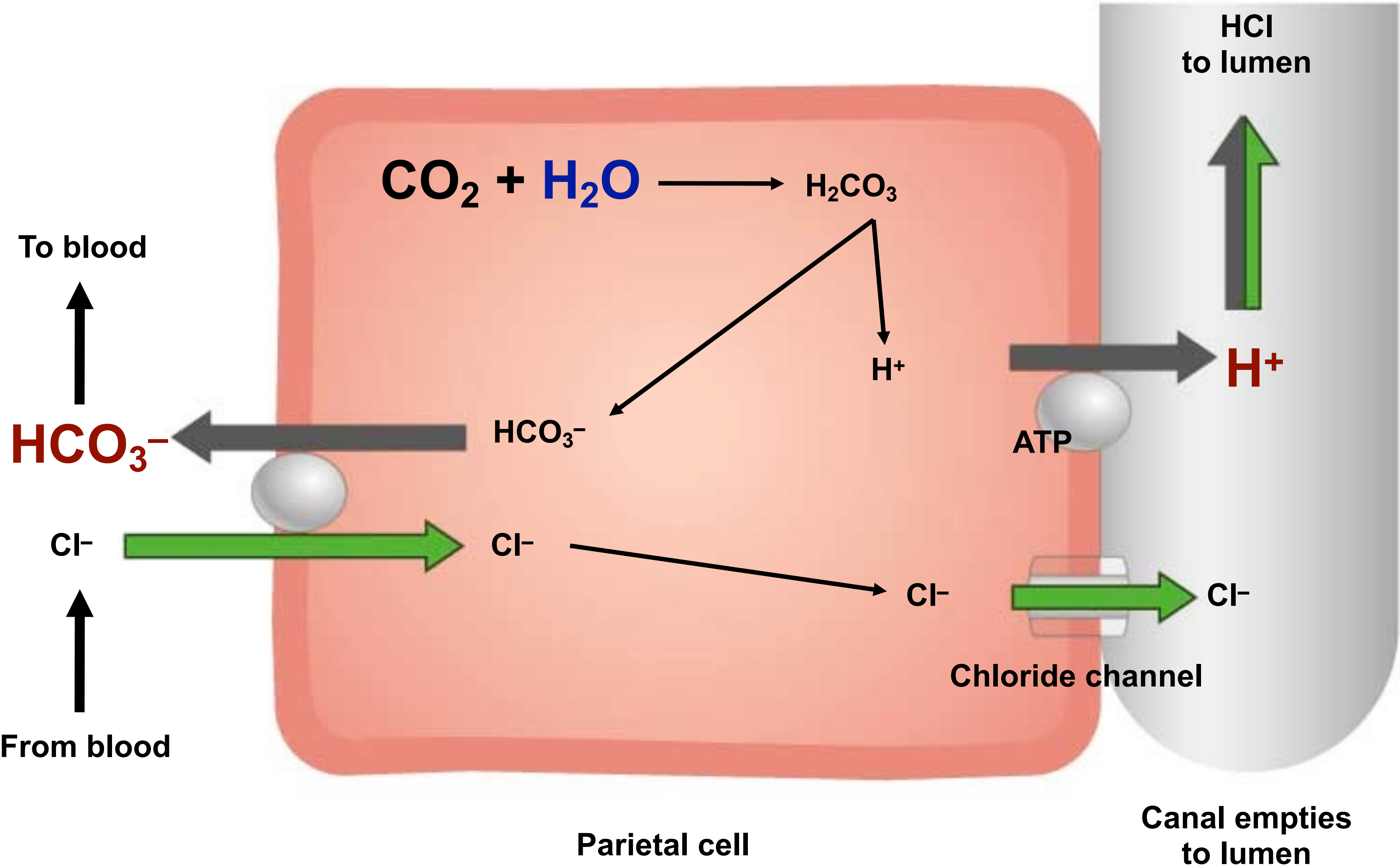
VF

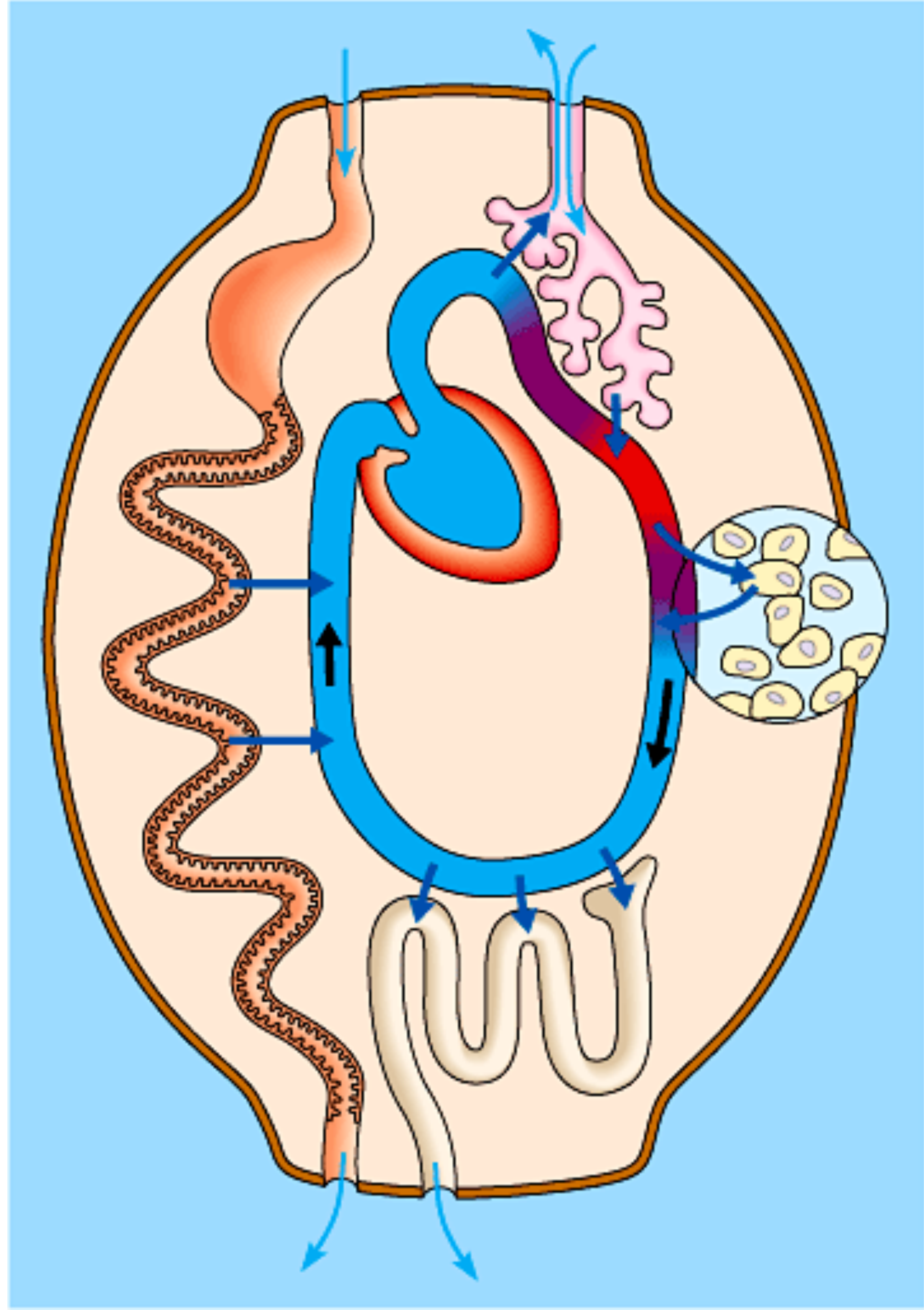
# Secretion of HCl by parietal cells



VF

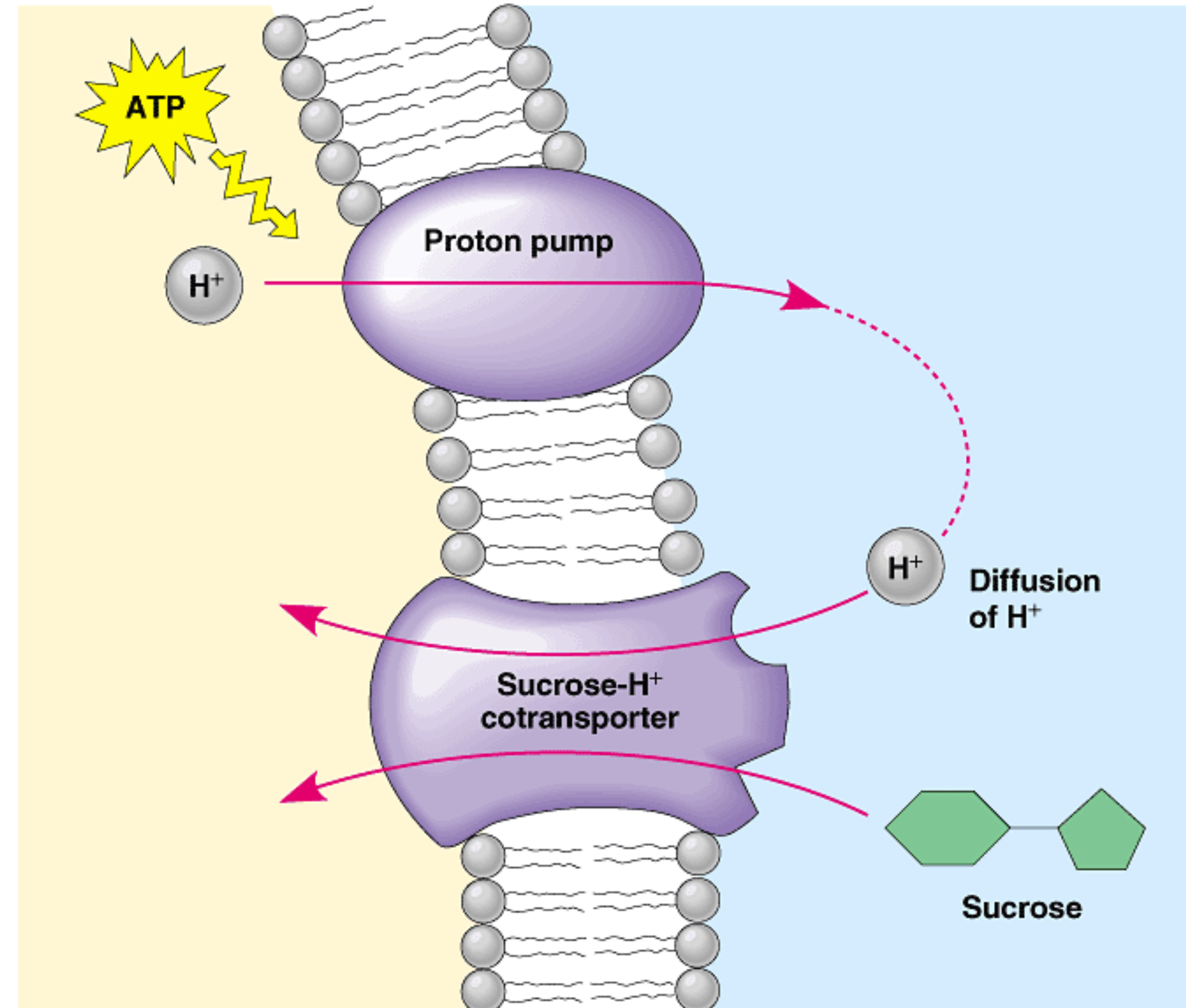
# Secretion of HCl by parietal cells





VF

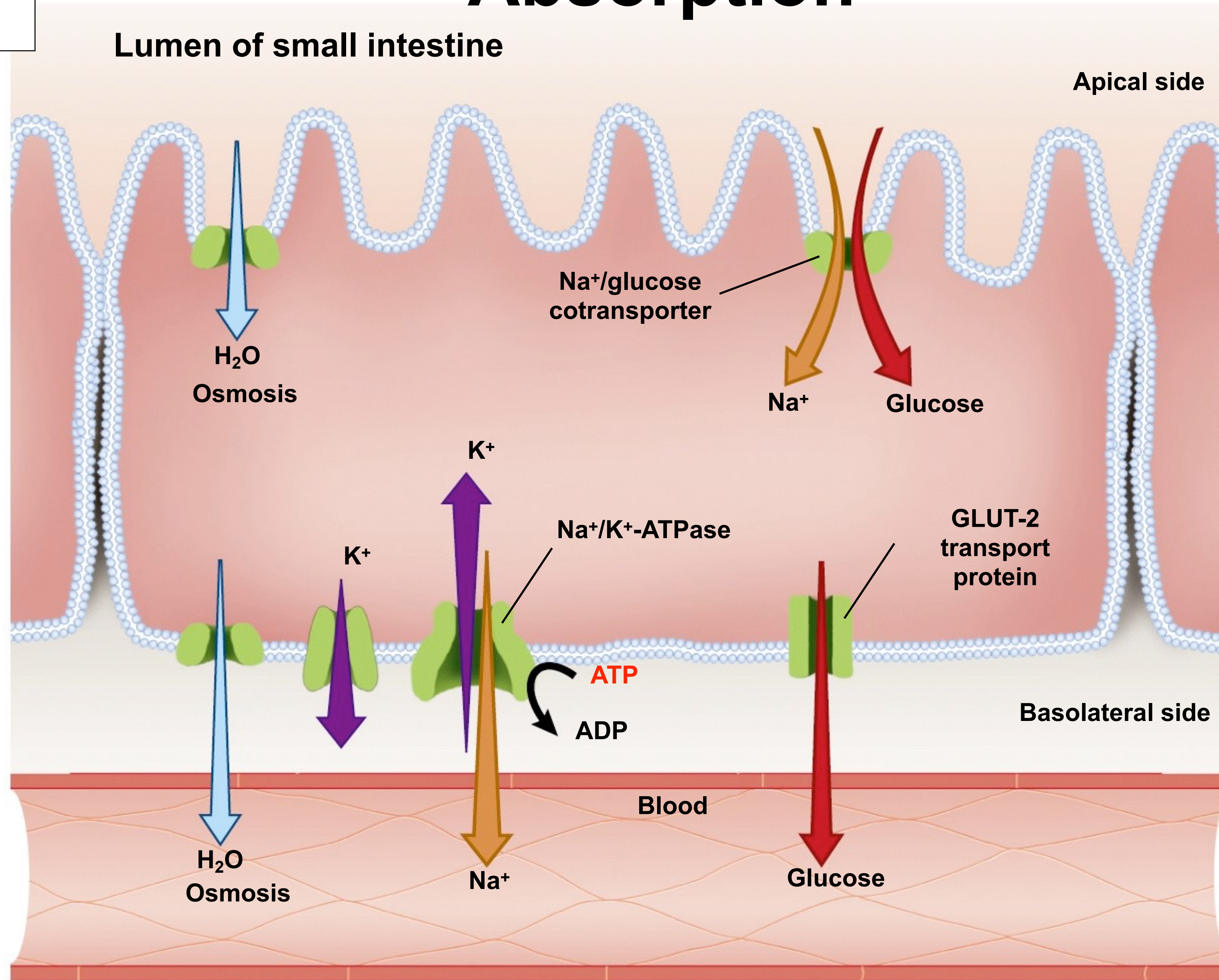
# Absorption



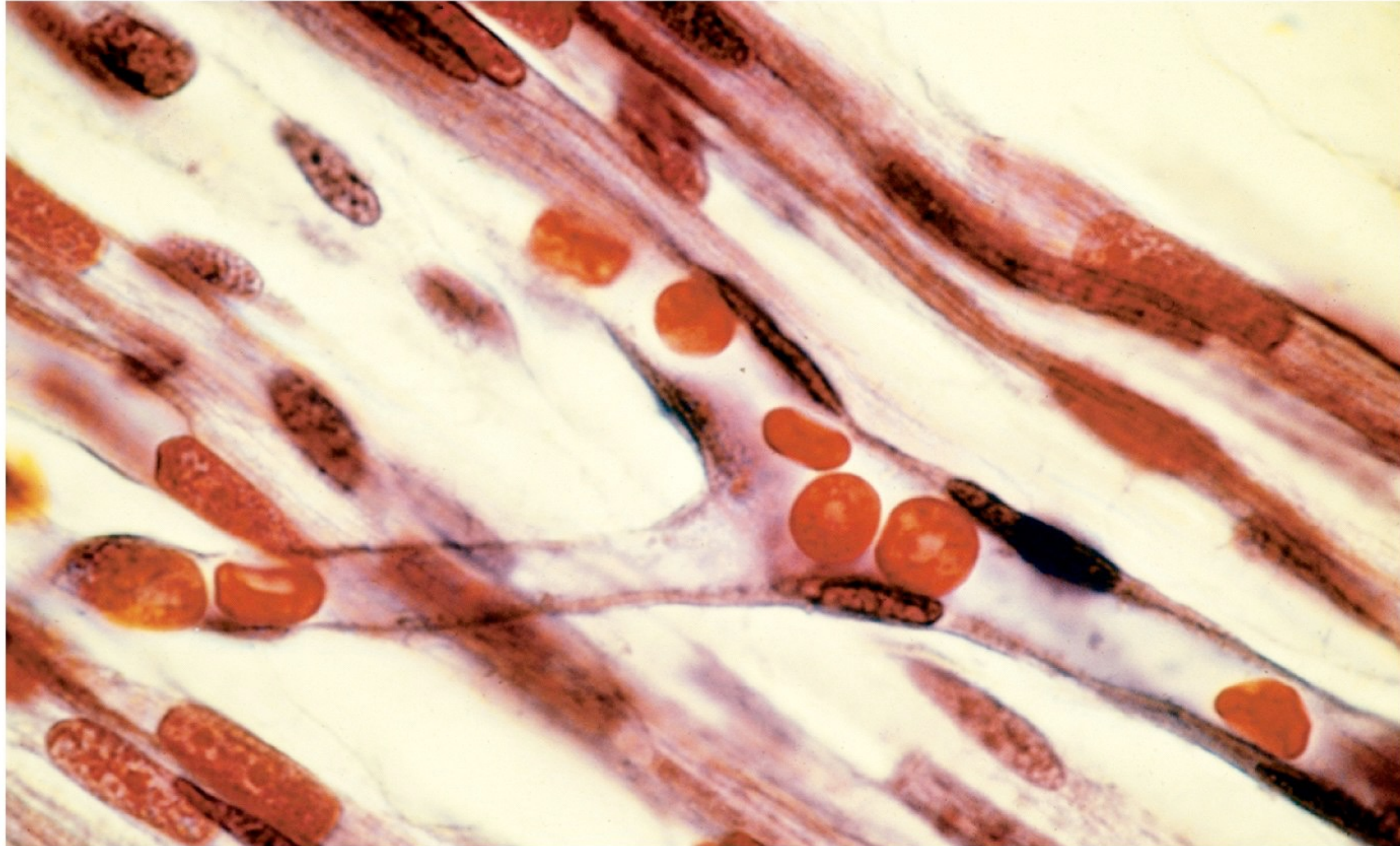
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# Absorption

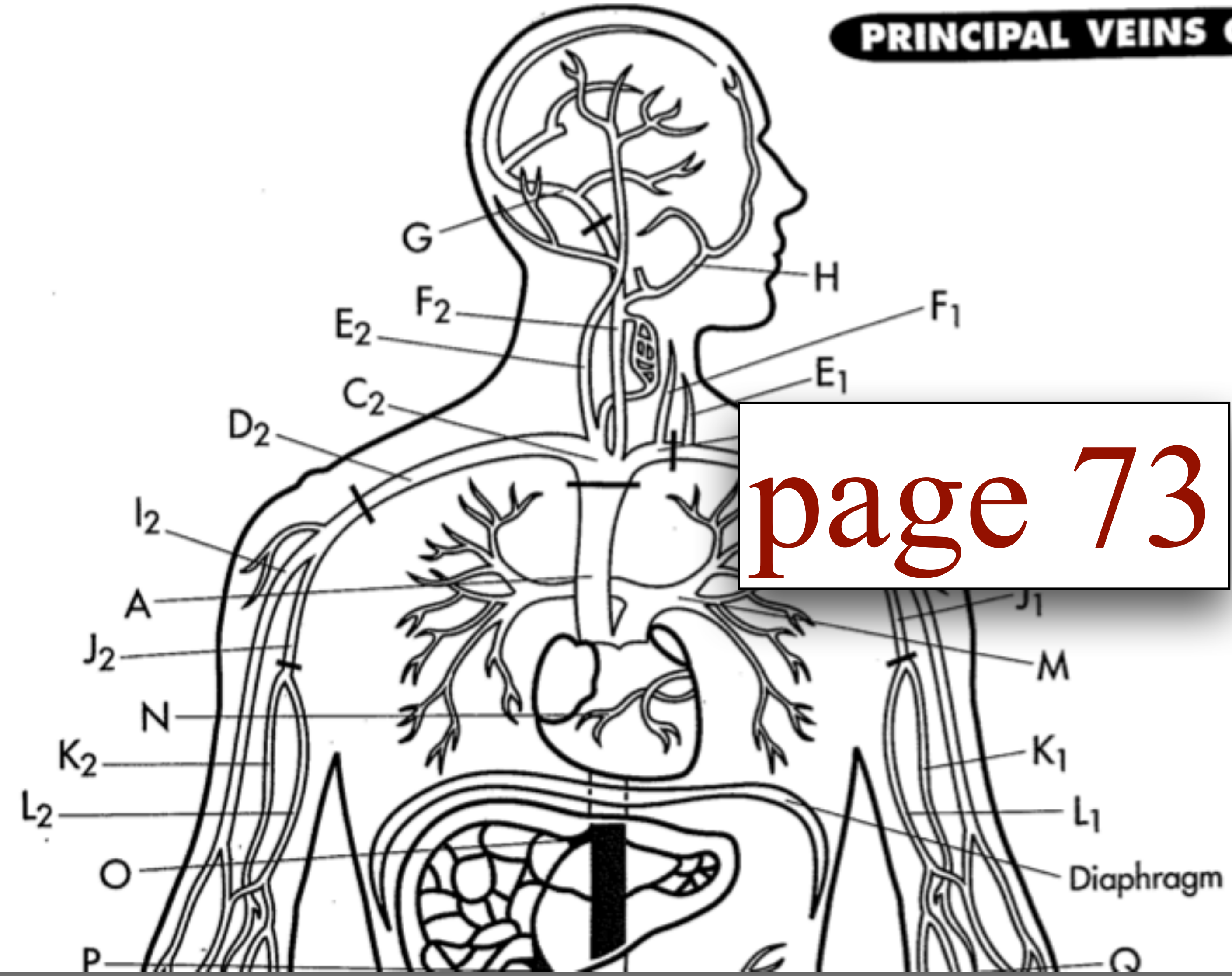
VF



**Capillaries are small and extremely thin walled.**



**PRINCIPAL VEINS OF THE BODY**



page 73

## Week 12

(Preparing for) **Monday's lecture:**

**Budgeting homework time (60 min):** Read ELSI 1.1 and the first 2/3 of section 1.4 in "Chapter 1: Heritable Material." While this is about 3700 words in both the readings combined, only the 2700 words in section 1.4 need careful reading and notetaking. Also, there are no traditional Trifectas to prepare for, just three simple questions posed below to be ready to answer aloud in class.

1. \_\_\_\_\_ **For Monday's lecture**, revisit **Chapter 1: Heritable Material** and read section ELSI 1.1: "Who Owns Your DNA?" (975 words), and then read the first 2/3's of section 1.4 "How does DNA's shape affect its function?" Take notes on section 1.4 all the way up until it switches to the new light blue box topic of "DNA Replication" (2700 words). Read on, don't need to take notes.
2. \_\_\_\_\_ Try to answer some **Integrating Questions** and **Review Questions**.
3. \_\_\_\_\_ (Tip): **Prepare to explain (aloud) in class:** 1. What's difference between the chemical structure of DNA vs RNA, 2. What's incorrect in Figure 1.10?, 3. What's incorrect in Figure 1.13?

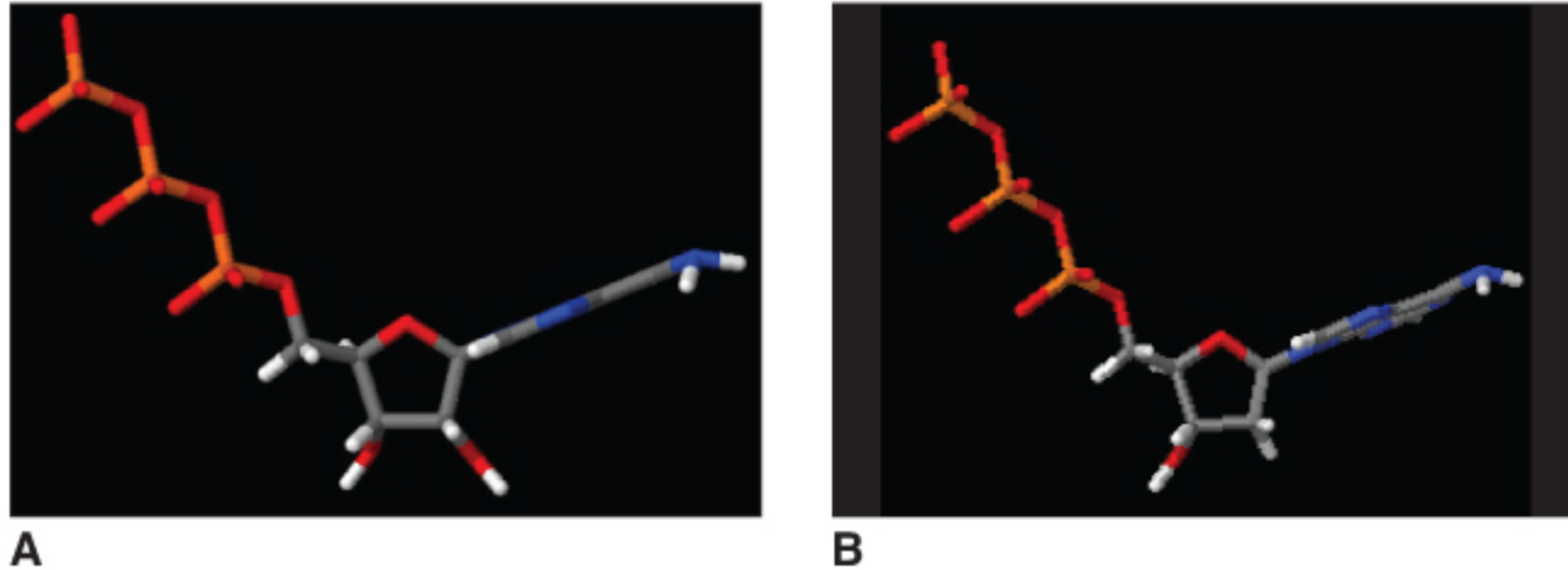


## 1.4 How does DNA's shape affect its function?

### **Biology Learning Objectives**

- Draw the structure of DNA showing the double helix and base pairings.
- Evaluate experimental design and analyze data from research on DNA as molecular information.

# Nucleotide Structures



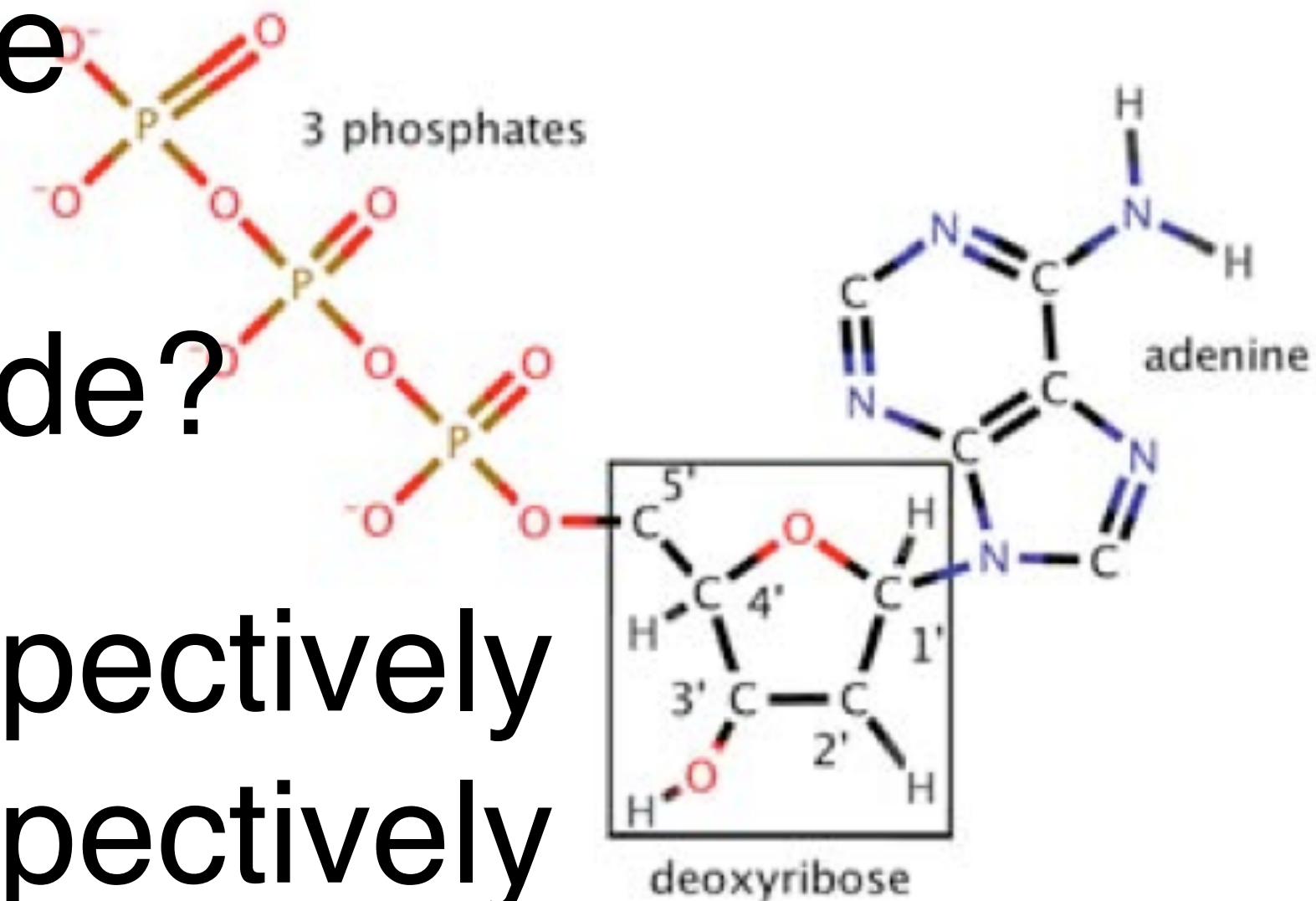
1. Draw dATP and use letter “A” for adenine
2. show C, O, H, P atoms on ribose & phosphate
3. number all carbons in deoxyribose

Fig.1.9

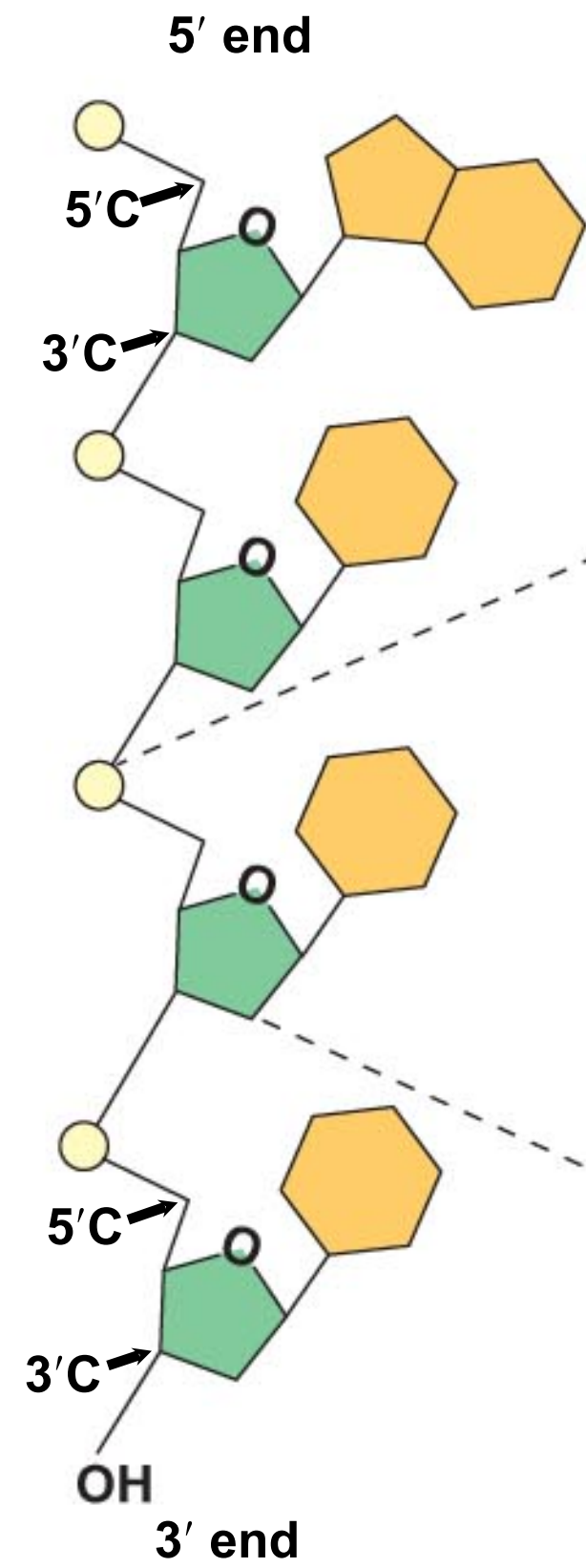
1. Draw dATP and use letter “A” for adenine
2. show C, O, H, P atoms on ribose & phosphate
3. number all carbons in deoxyribose

# Integrating Questions

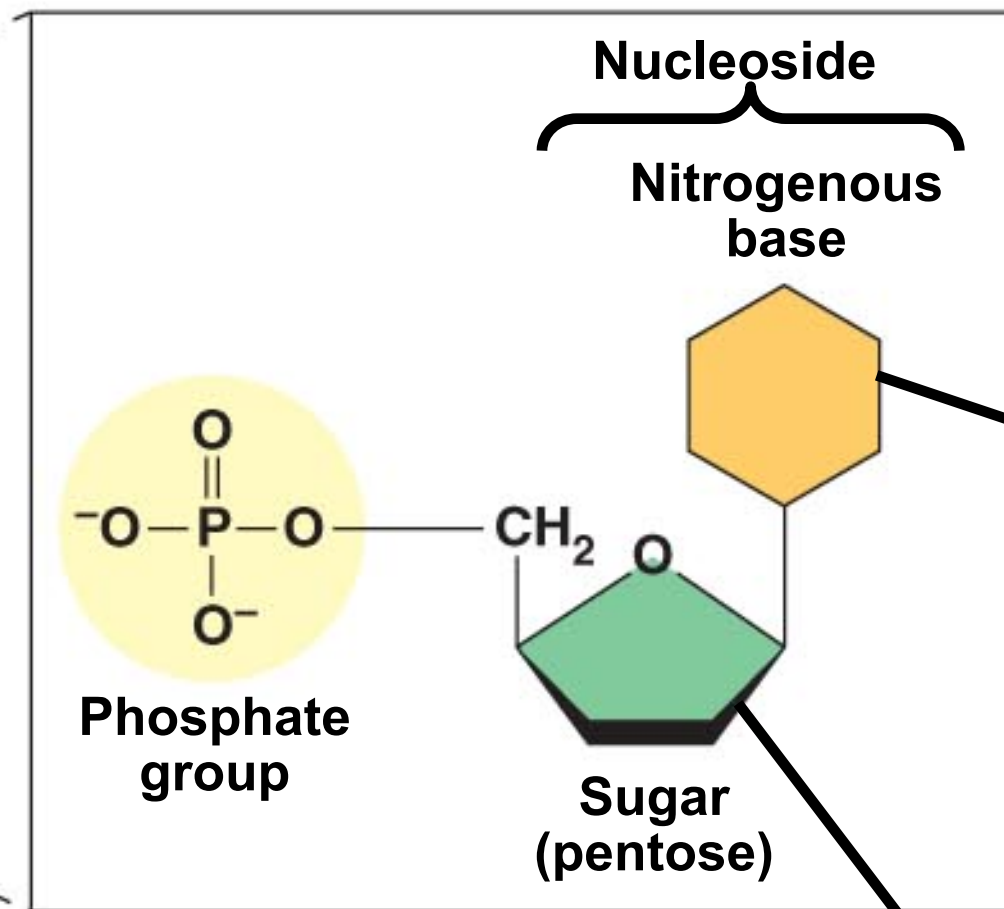
1. Which carbon in this deoxy nucleotide (dATP) is missing the oxygen? Which carbon in the deoxyribose sugar will be attached to another nucleotide?



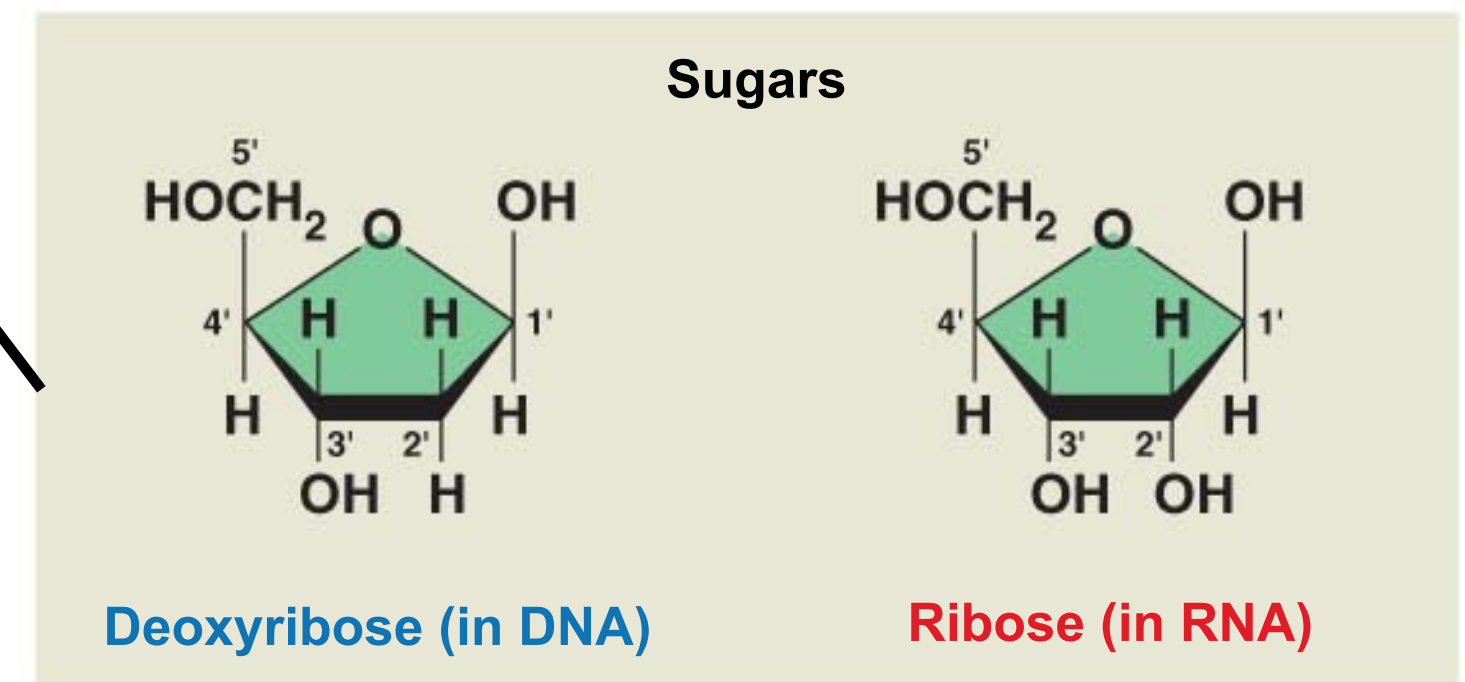
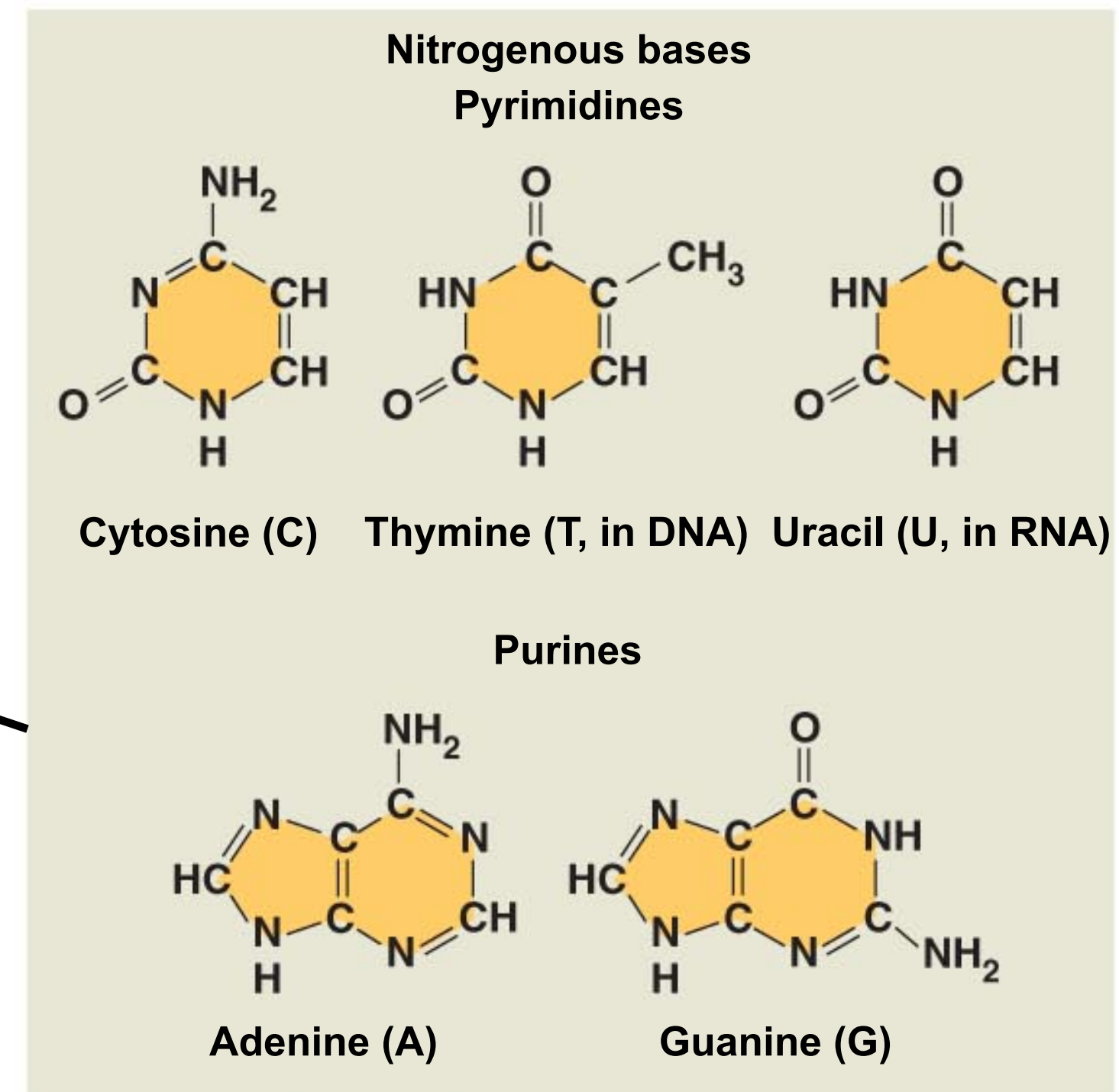
- A. Carbons # 3' and 5' respectively
- B. Carbons # 2' and 3' respectively
- C. Carbons # 2' and 5' respectively
- D. Carbons #2 and 3 respectively
- E. None of the above



(a) Polynucleotide, or nucleic acid



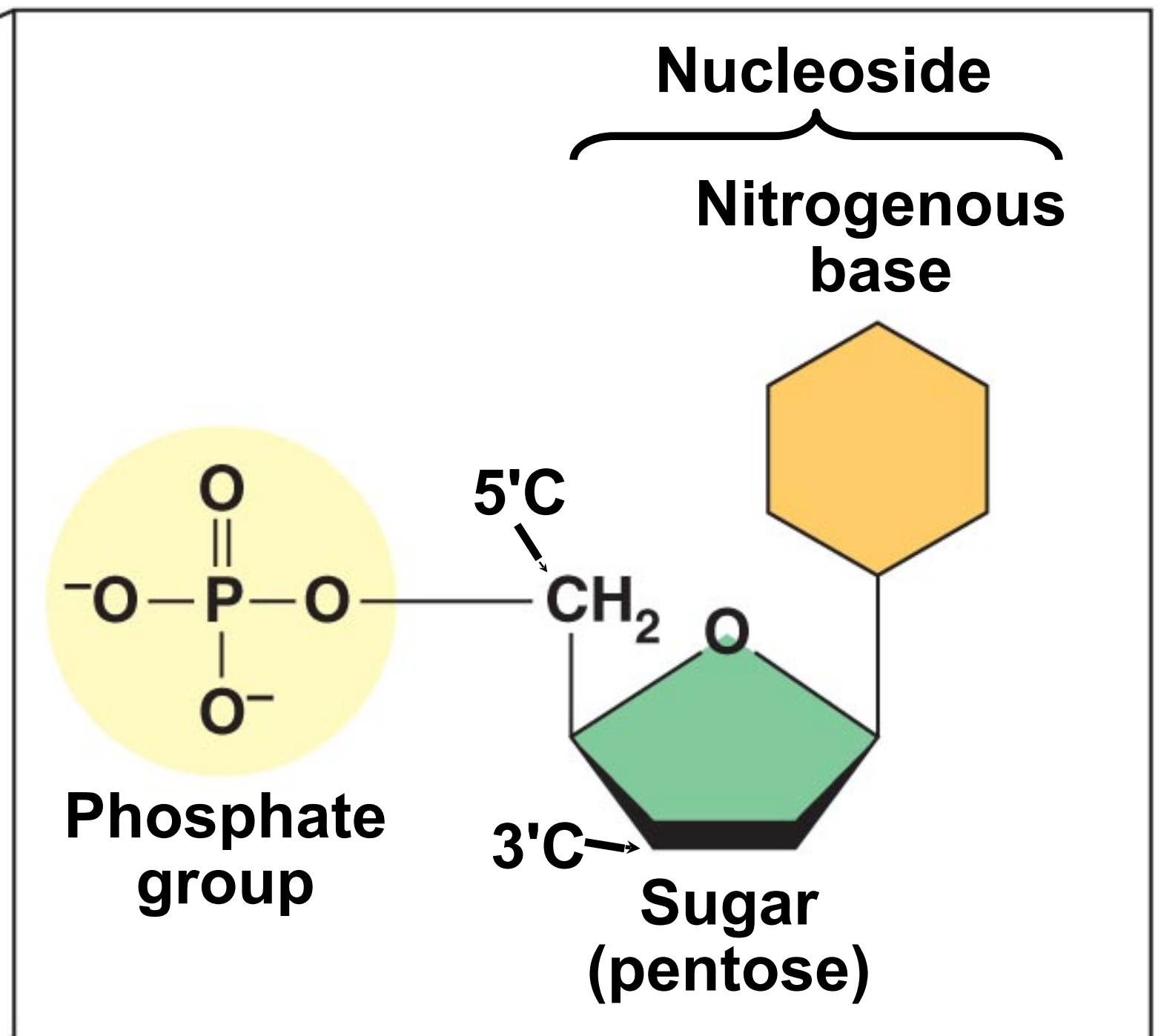
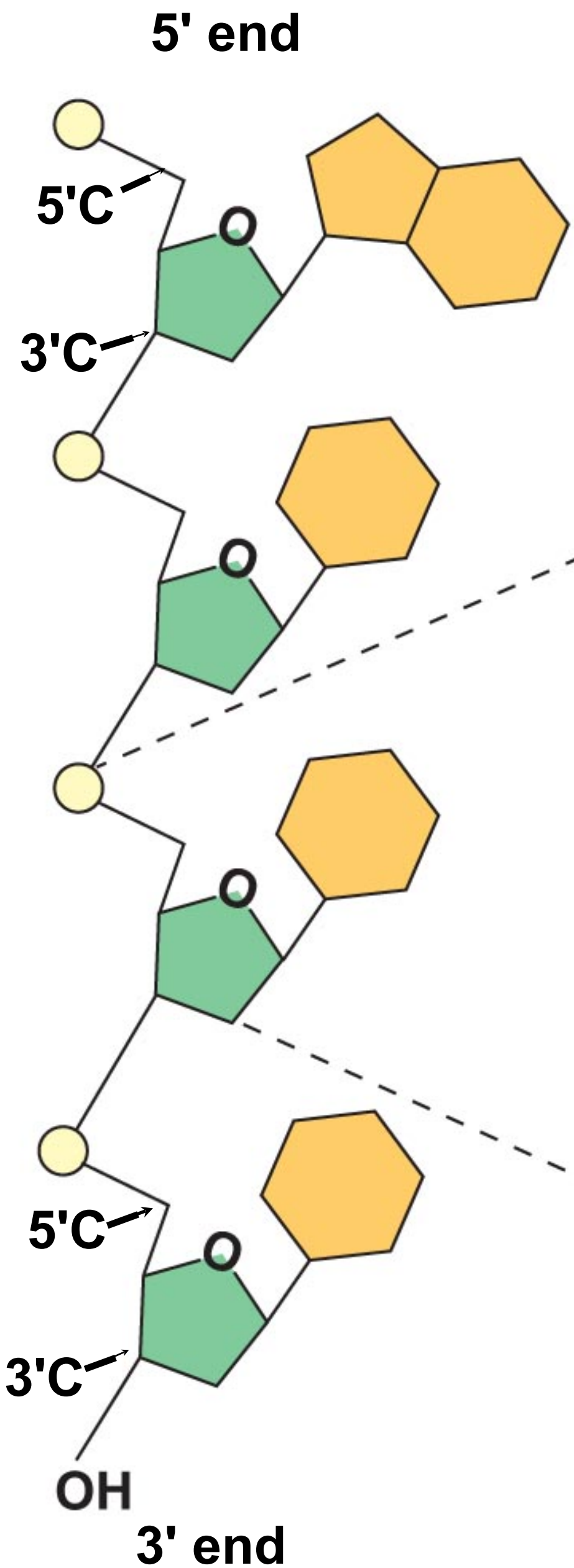
(b) Nucleotide



(c) Nucleoside components: sugars

# Structure

# Is this DNA or RNA?



(b) Nucleotide

(a) Polynucleotide, or nucleic acid

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# Nucleotide Structures

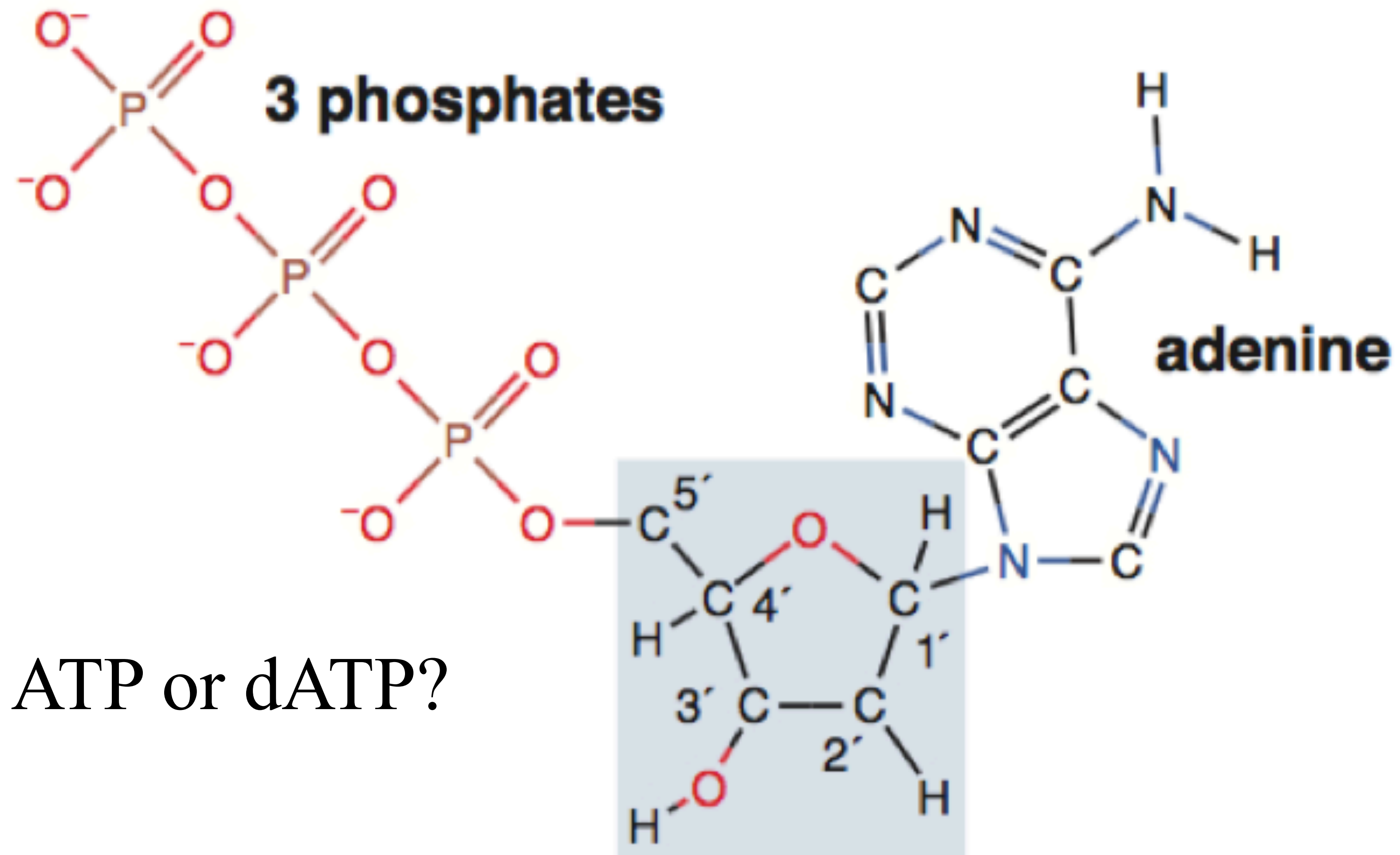


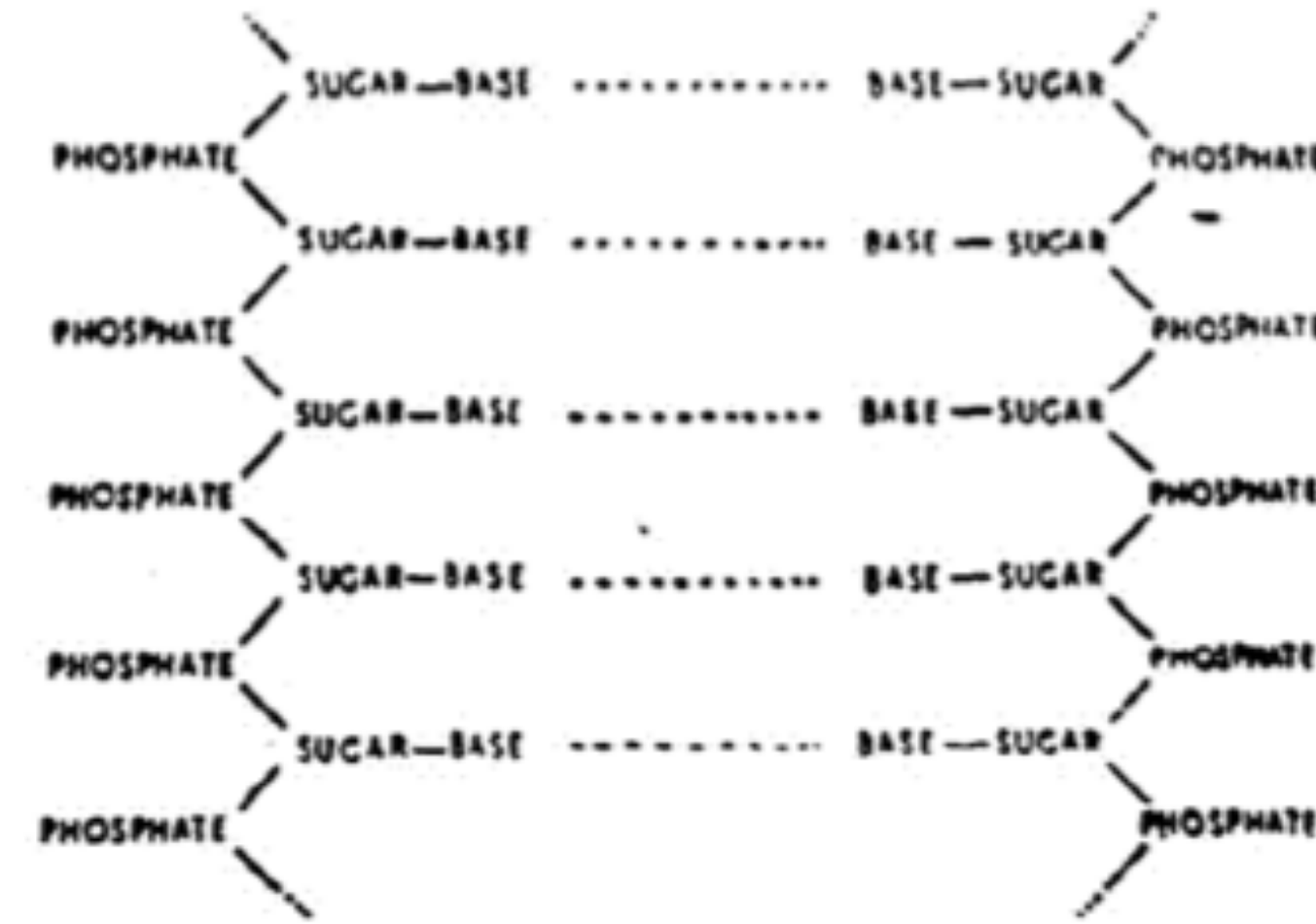
Fig. 1.9



“It has not escaped our notice that the specific base pairing we have postulated immediately suggests a possible copying mechanism for the genetic material.”

## Integrating Questions

2. If the DNA had a uniform diameter of 20 Å, why did the bases have to pair one A for each T, and one G for each C base?

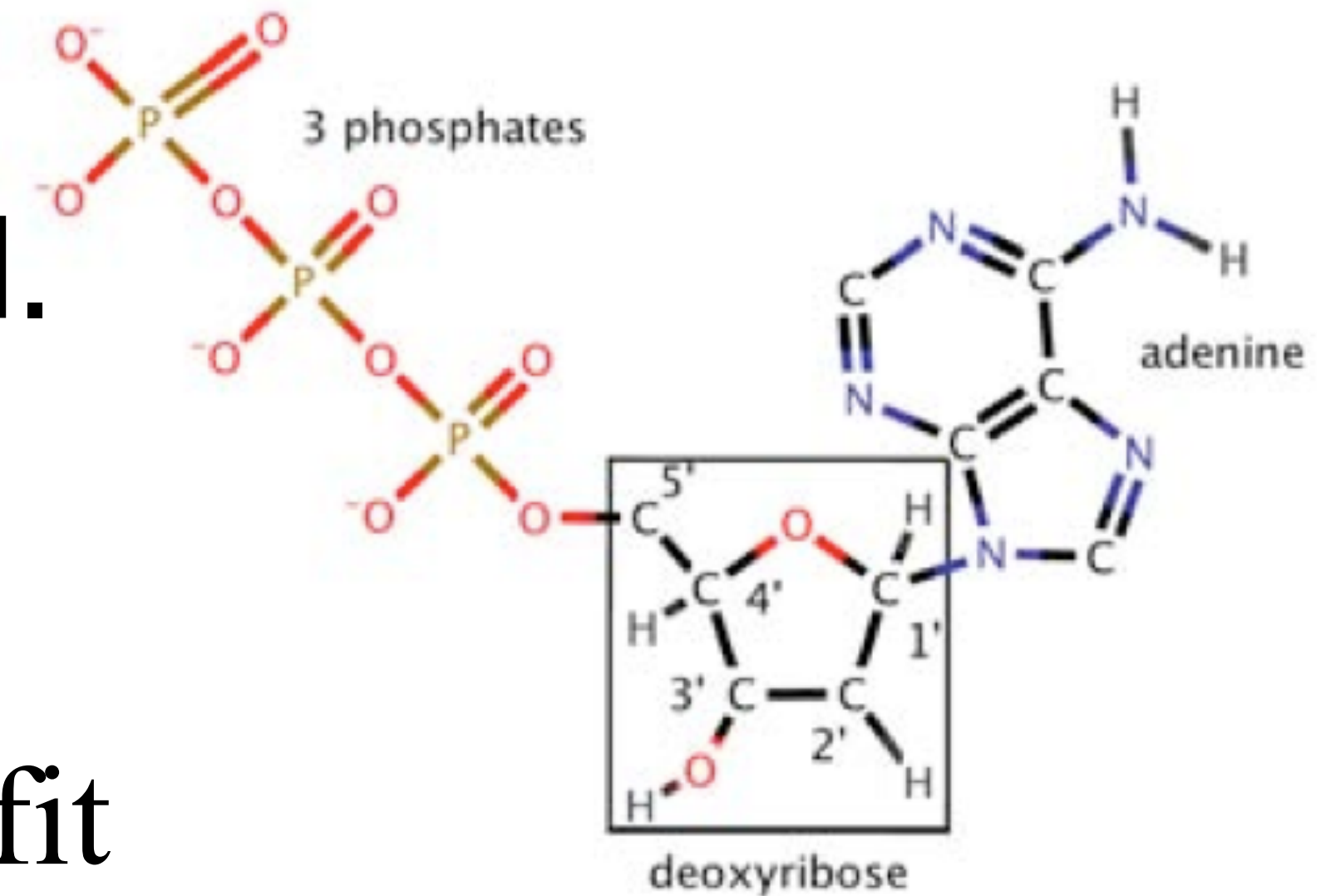


- A. A=T have two hydrogen bonds
- B. G=C have three hydrogen bonds
- C. G + A are bigger and C + T are smaller
- D. two bases cannot pair with just one
- E. None of the above

# Integrating Questions

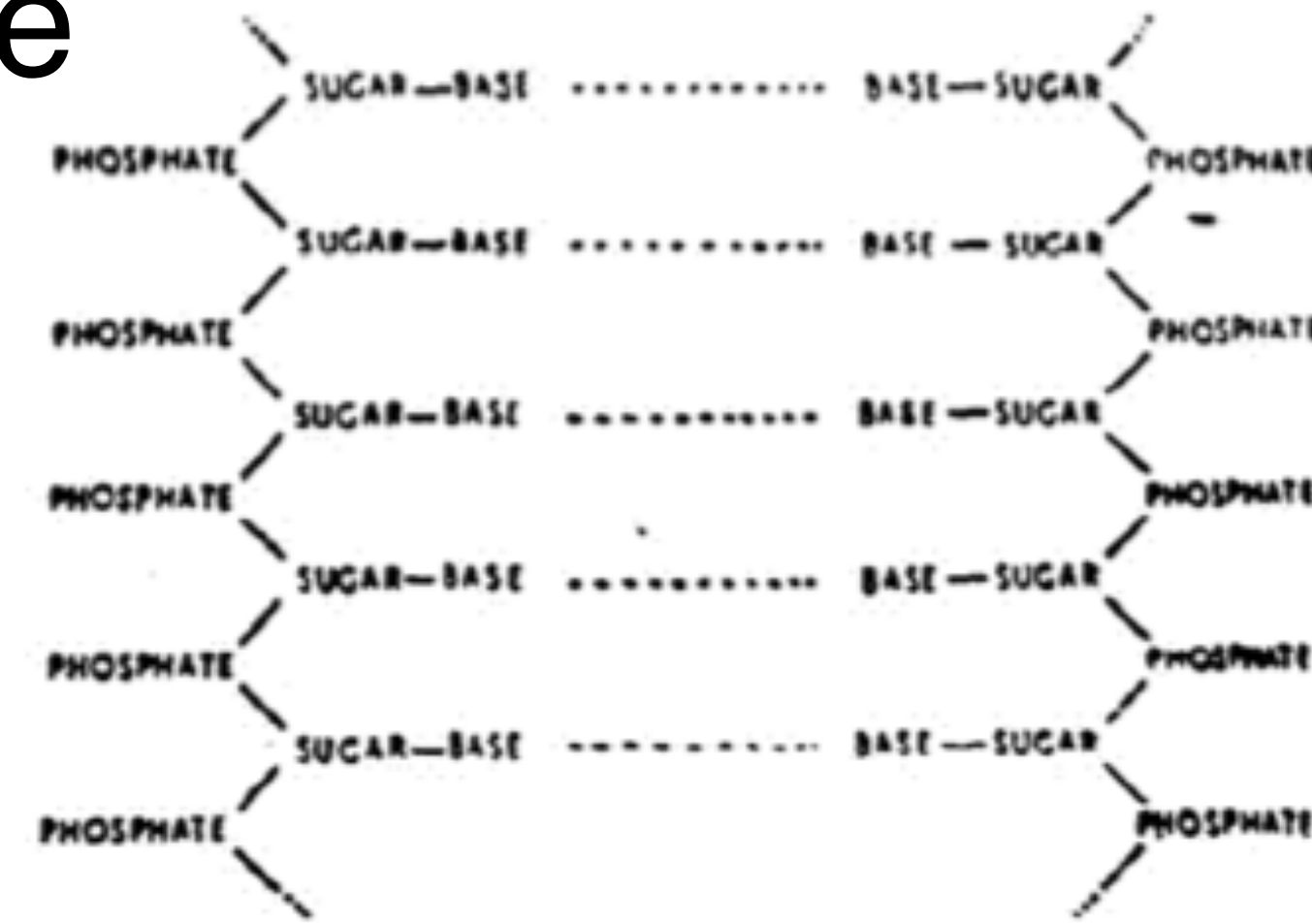
3. Speculate why a triple-stranded DNA molecule with the negatively charged phosphates in the center would be unstable -not good.

- A. phosphates would attract
- B. phosphates would repel
- C. phosphates are too big to fit
- D. phosphates would form covalent bonds
- E. None of the above

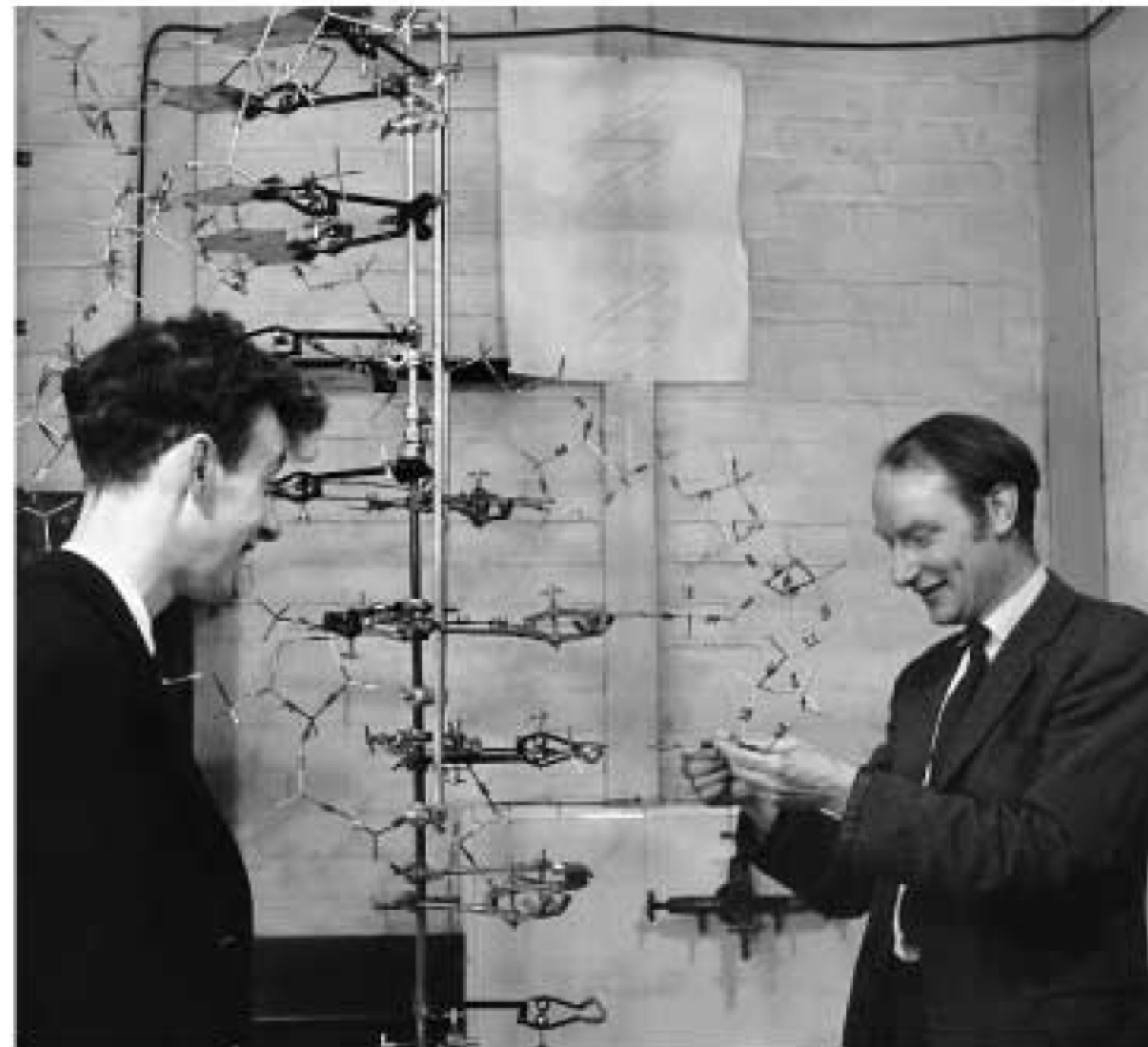
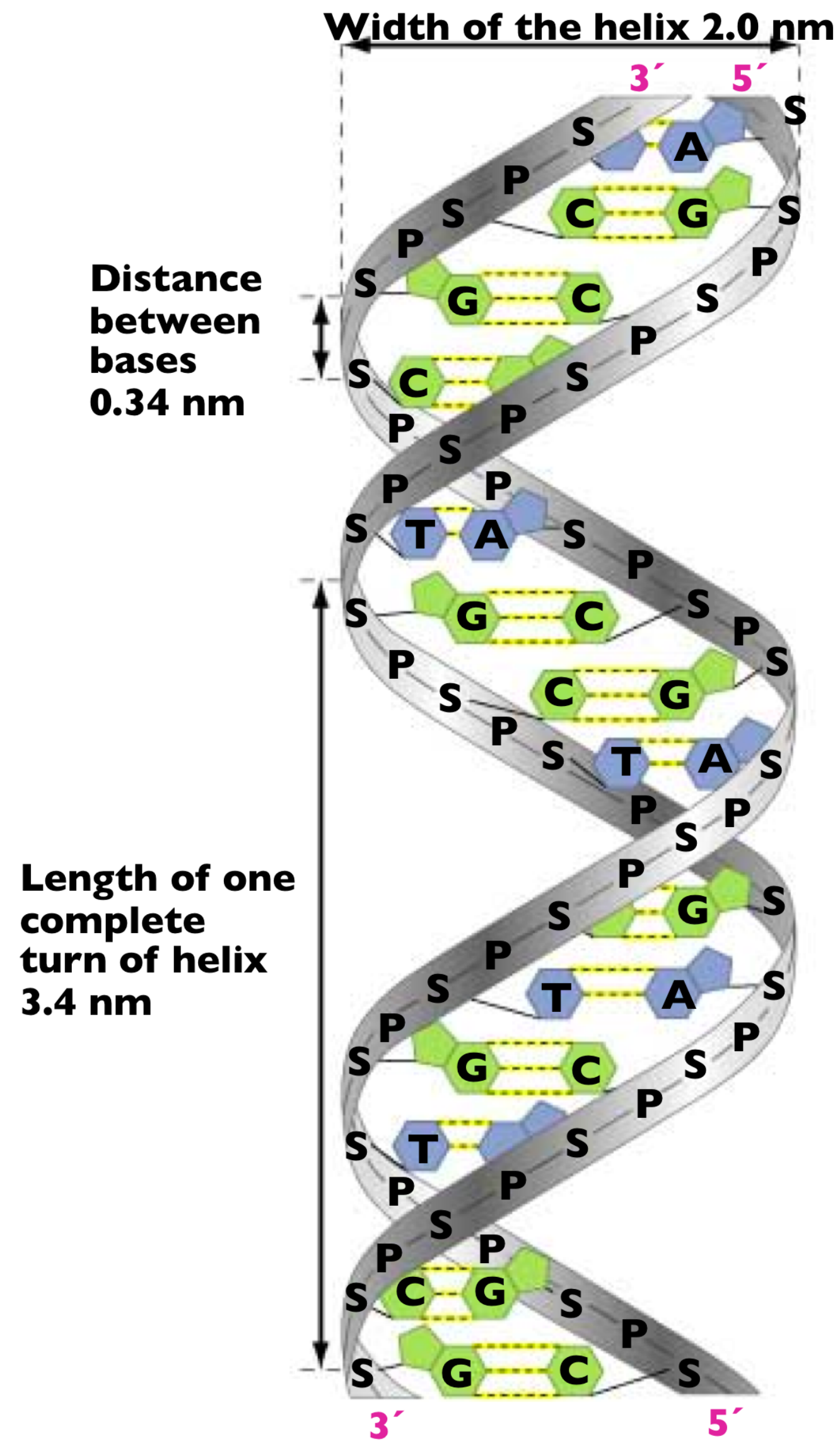


# Integrating Questions

4. Look at the Figure and find the misleading aspect of the diagram, given the two strands are supposed to be anti-parallel. What should be done to correct this historic figure?



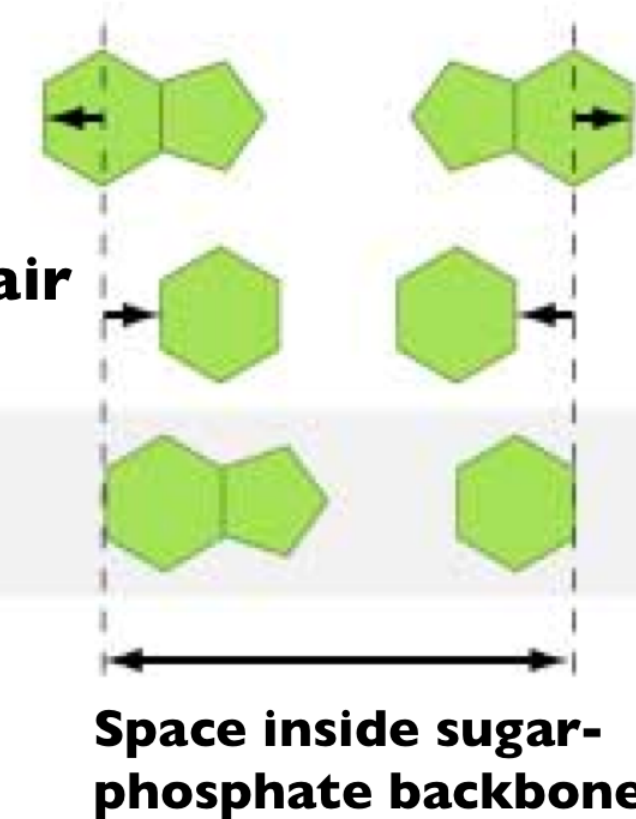
- A. One strand's words should spell backwards
- B. One strand's phosphates should move inside
- C. One strand should be upside-down
- D. More than one hydrogen bond should be there
- E. None of the above



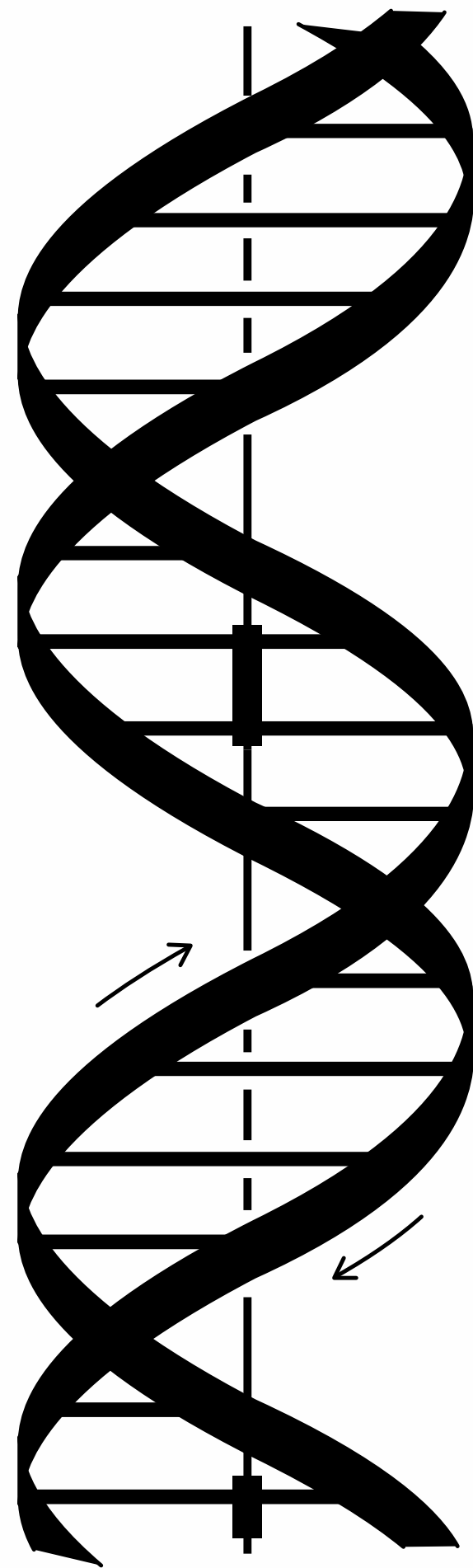
**Purine-purine pair  
TOO WIDE**

**Pyrimidine-pyrimidine pair  
TOO NARROW**

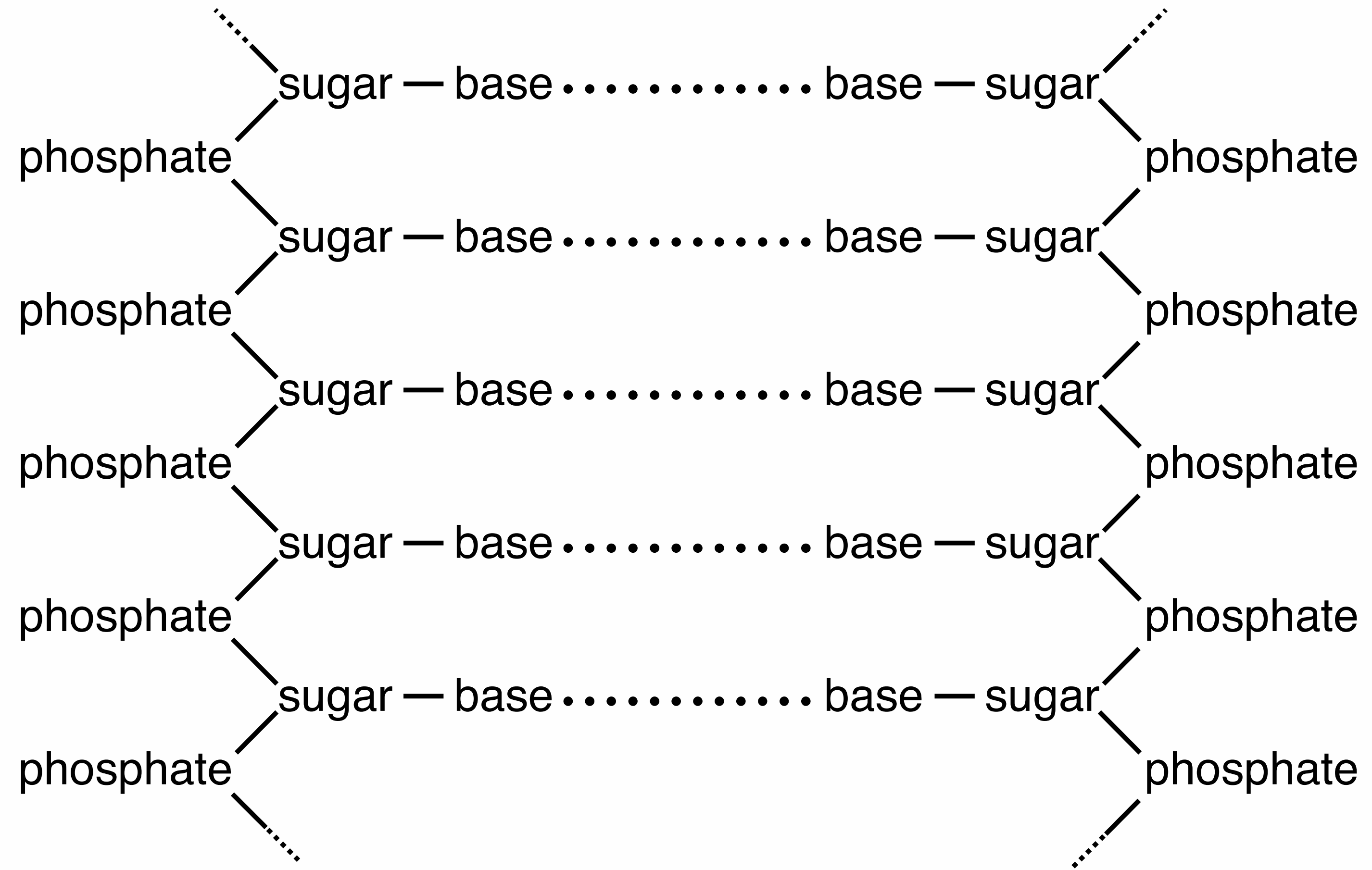
**Purine-pyrimidine pair  
JUST RIGHT**



# Watson and Crick DNA Model



A

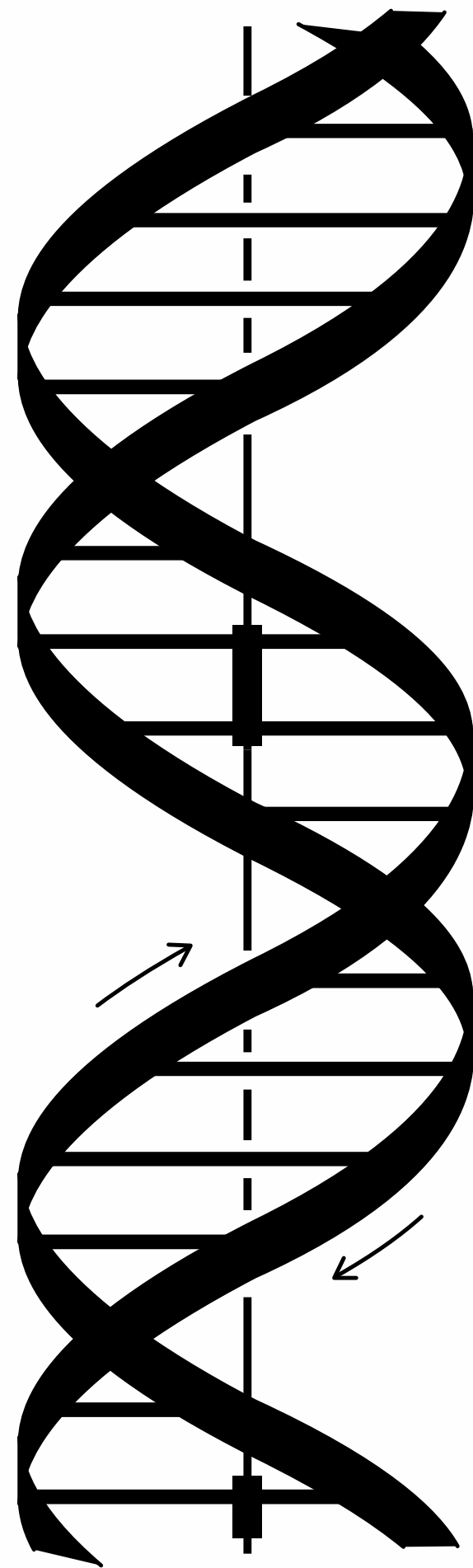


B

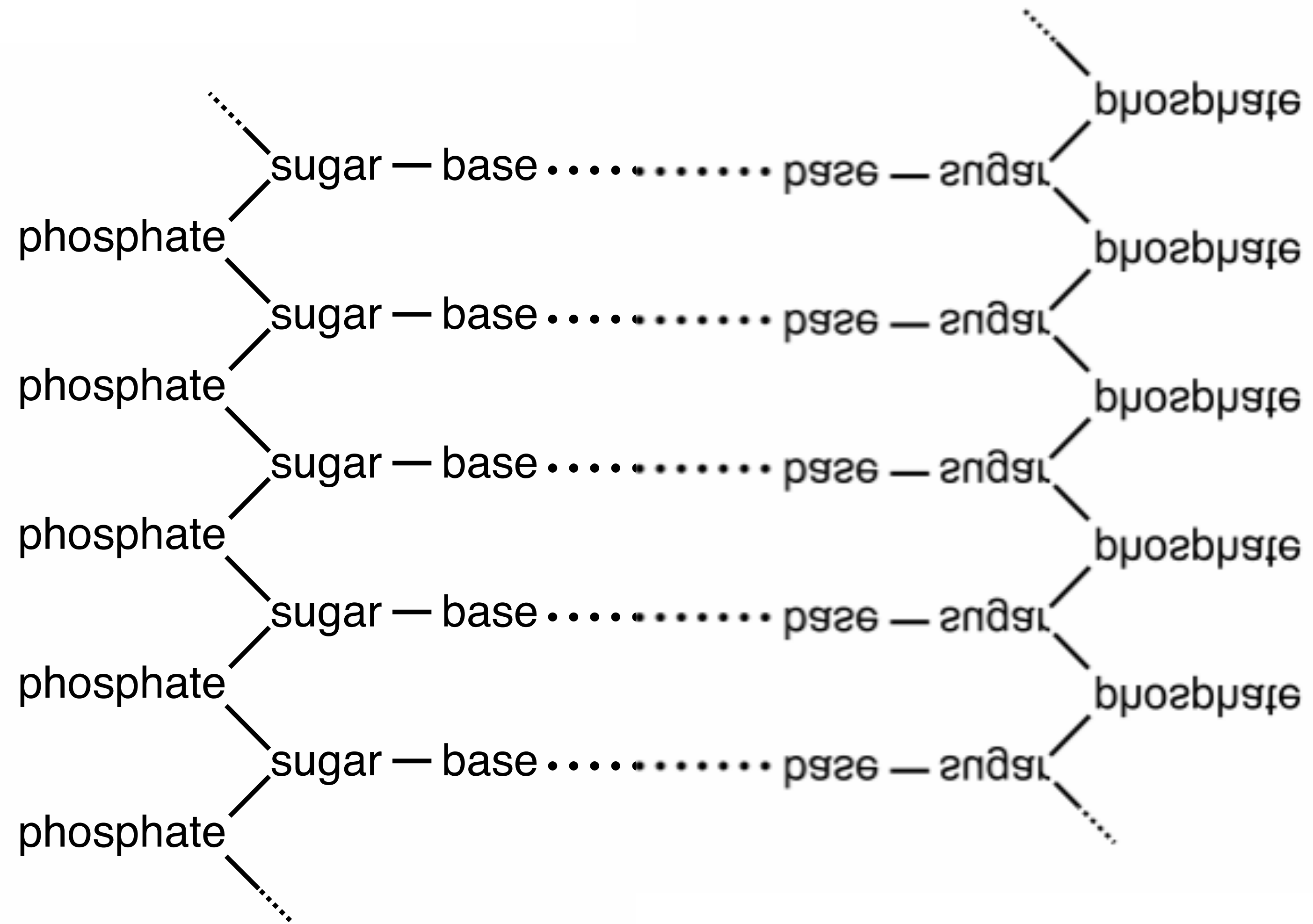
**Where's the error?**

Fig. 1.10

# Watson and Crick DNA Model



A

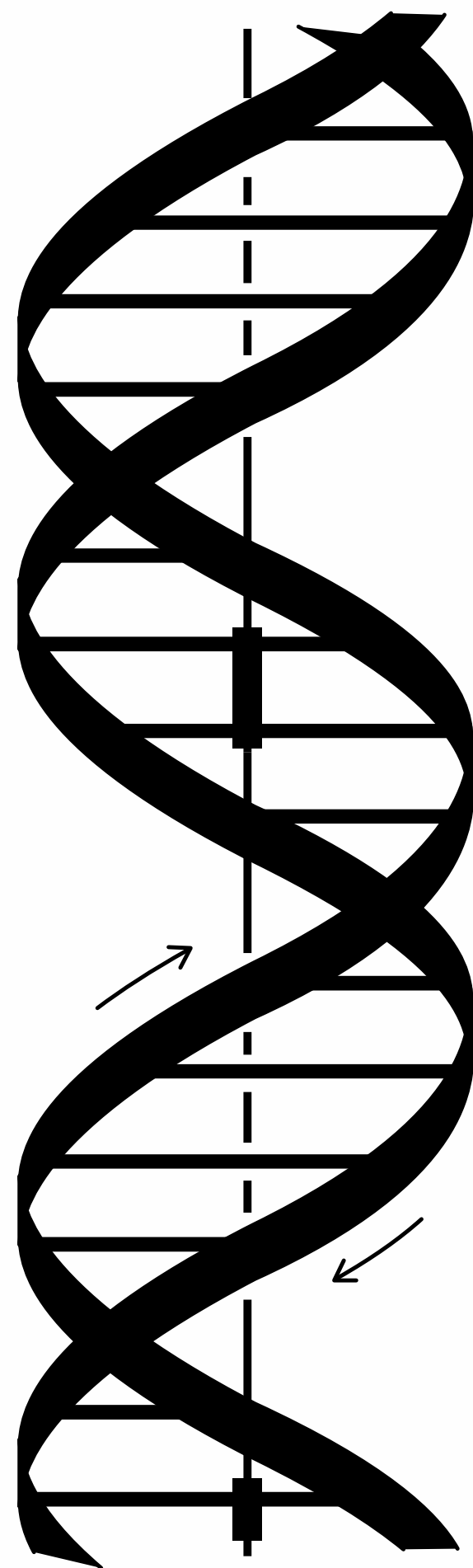


B

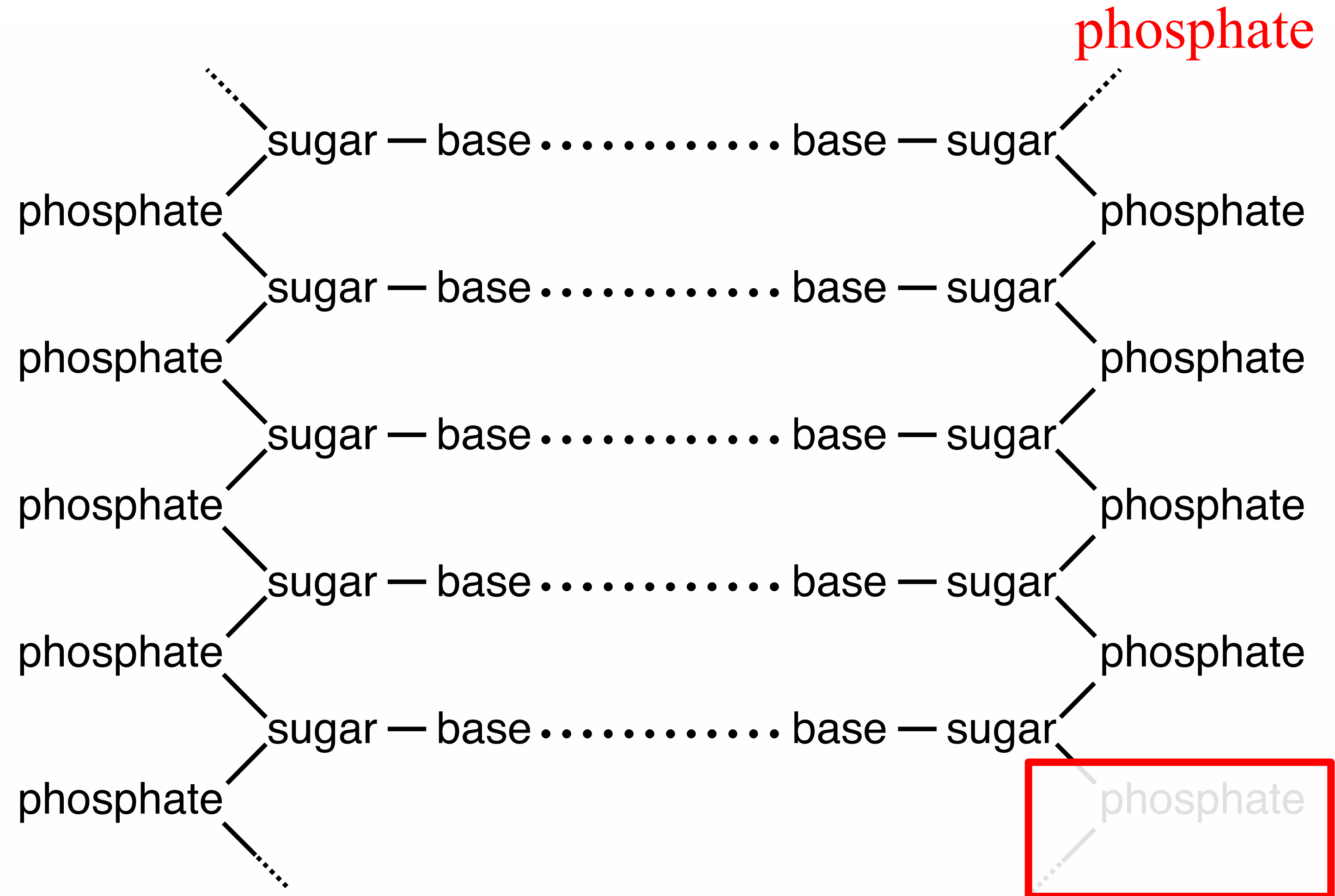
**should be anti-parallel strands**

Fig. 1.10

# Watson and Crick DNA Model



A

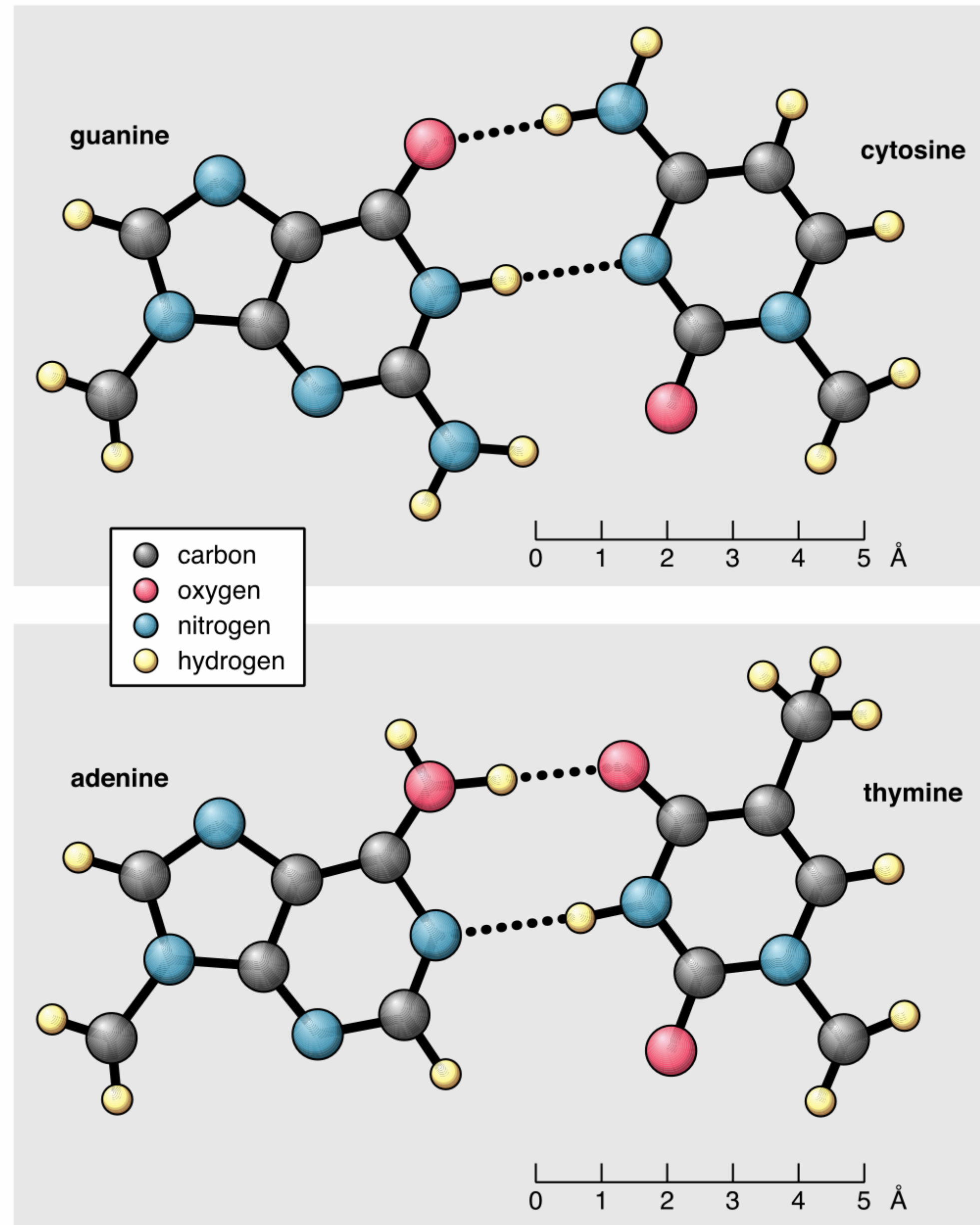


B

**should be anti-parallel strands**

Fig. 1.10

# IQs What's interesting about this famous image?

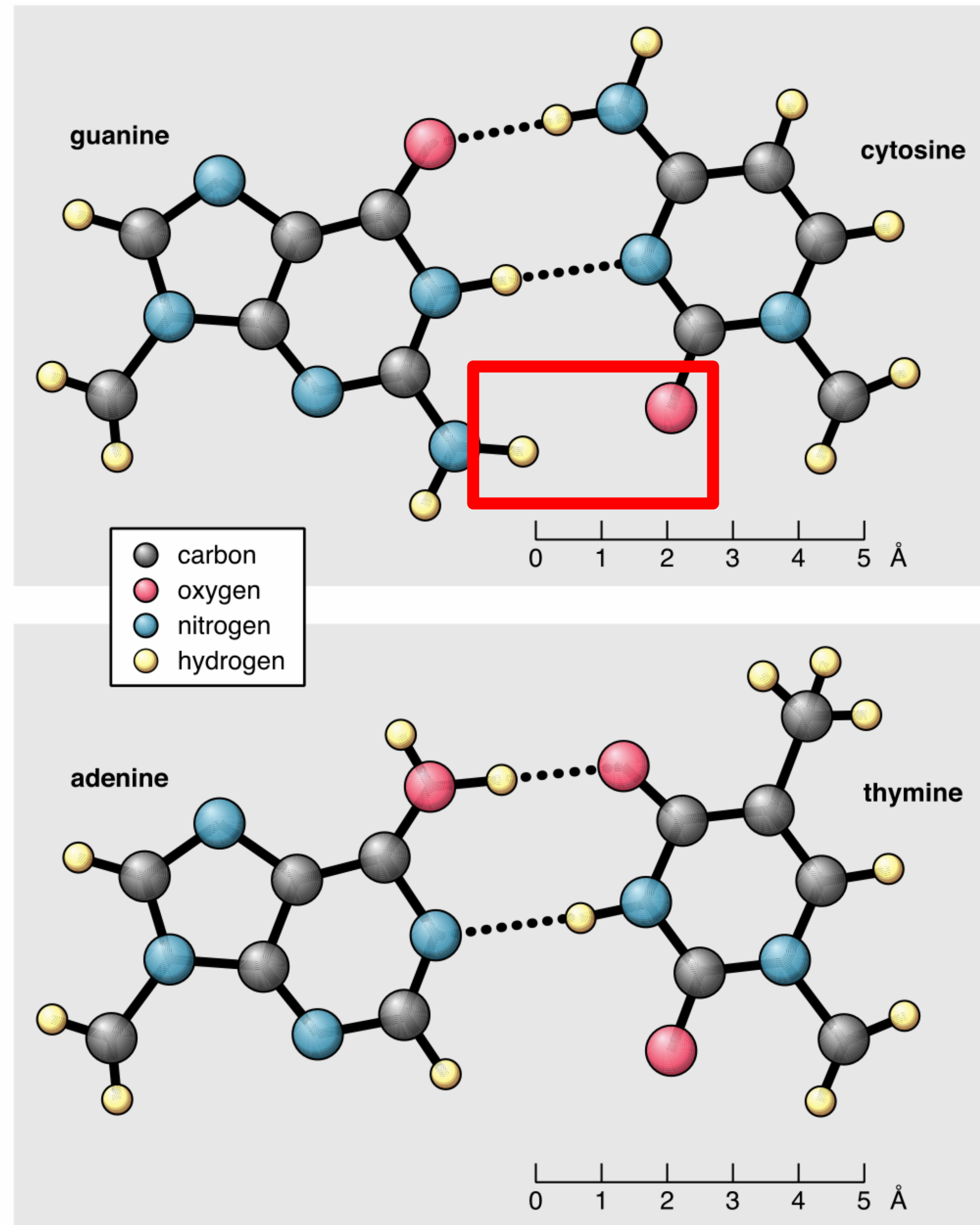


Find their mistake.

Fig. 1.13

modified from  
Watson and Crick. 1953b

# Watson & Crick Base Pairs



Find their  
mistake.

Fig. 1.13

modified from  
Watson and Crick. 1953b

# Watson & Crick Base Pairs

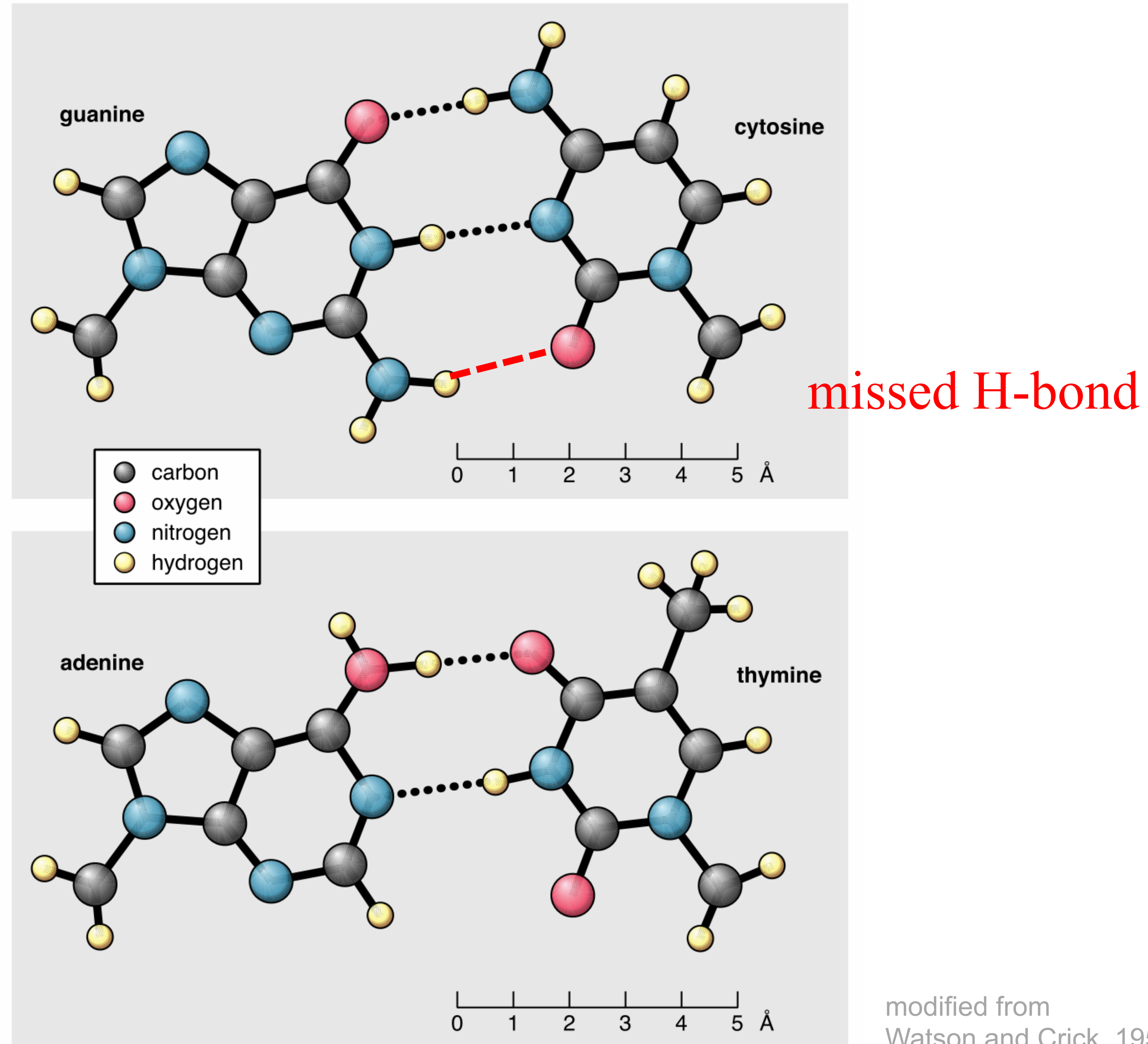


Fig. 1.13

modified from  
Watson and Crick. 1953b

# Watson & Crick Base Pairs

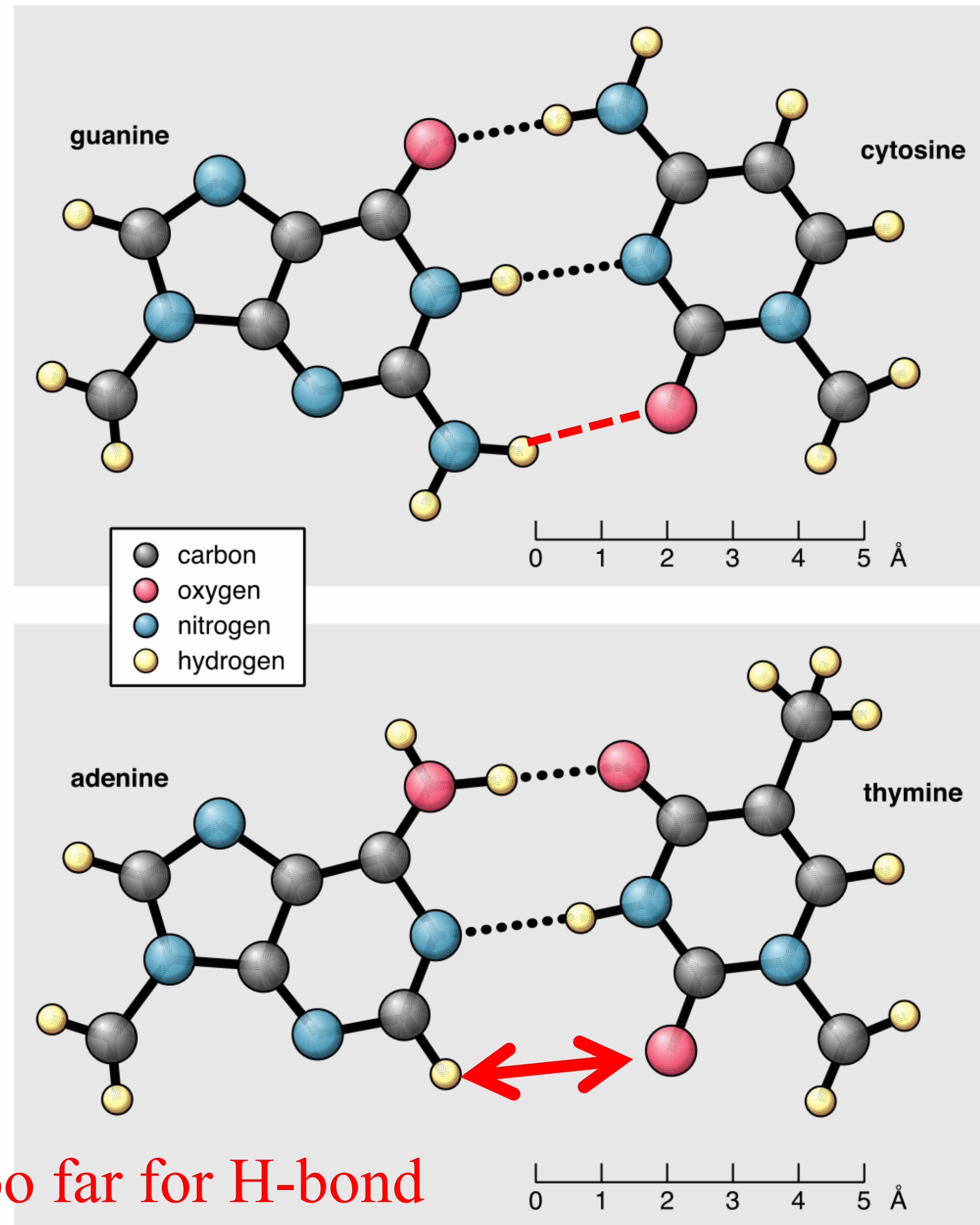


Fig. 1.13

modified from  
Watson and Crick. 1953b

# Watson & Crick Base Pairs

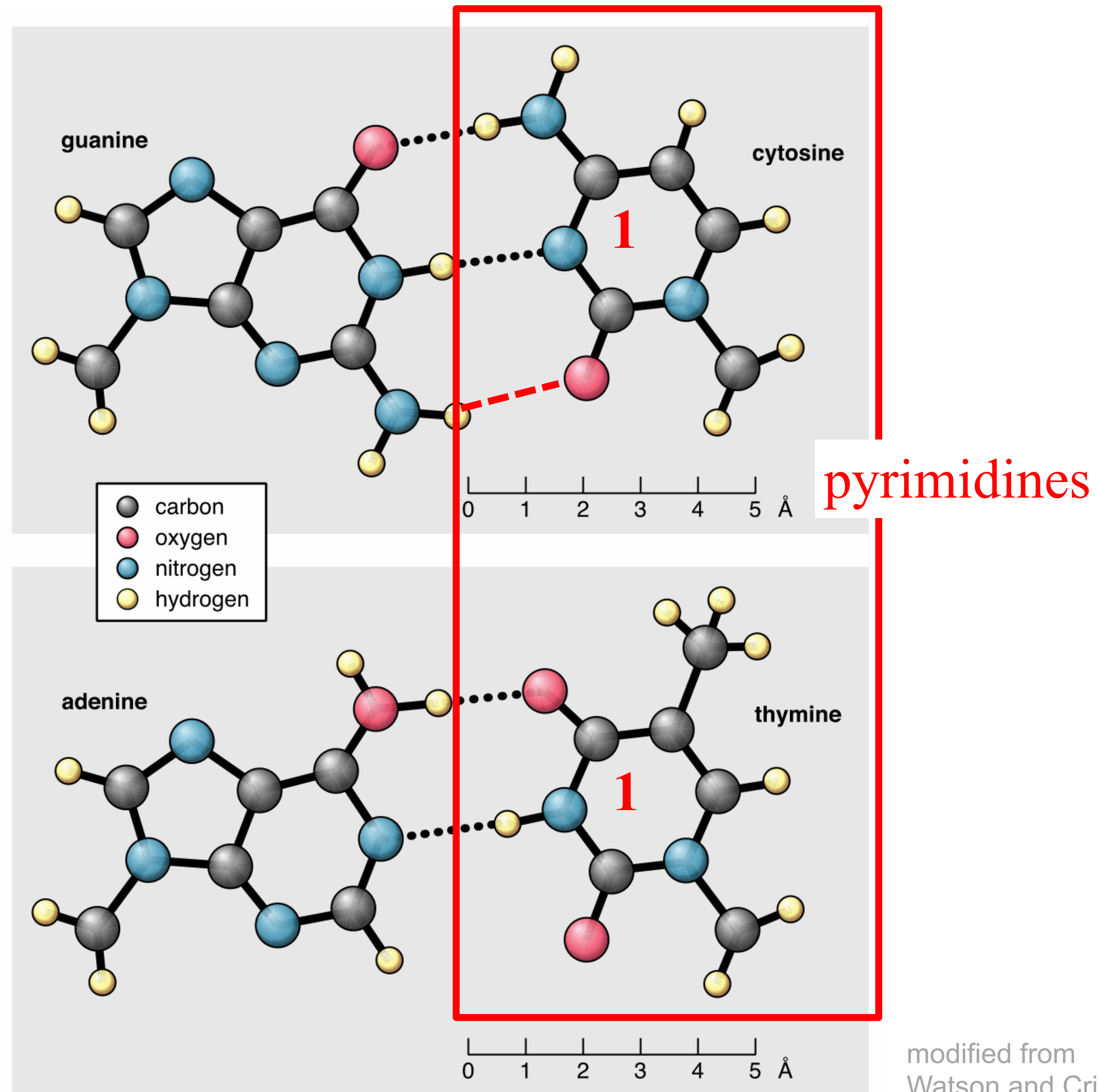


Fig. 1.13

modified from  
Watson and Crick. 1953b

# Watson & Crick Base Pairs

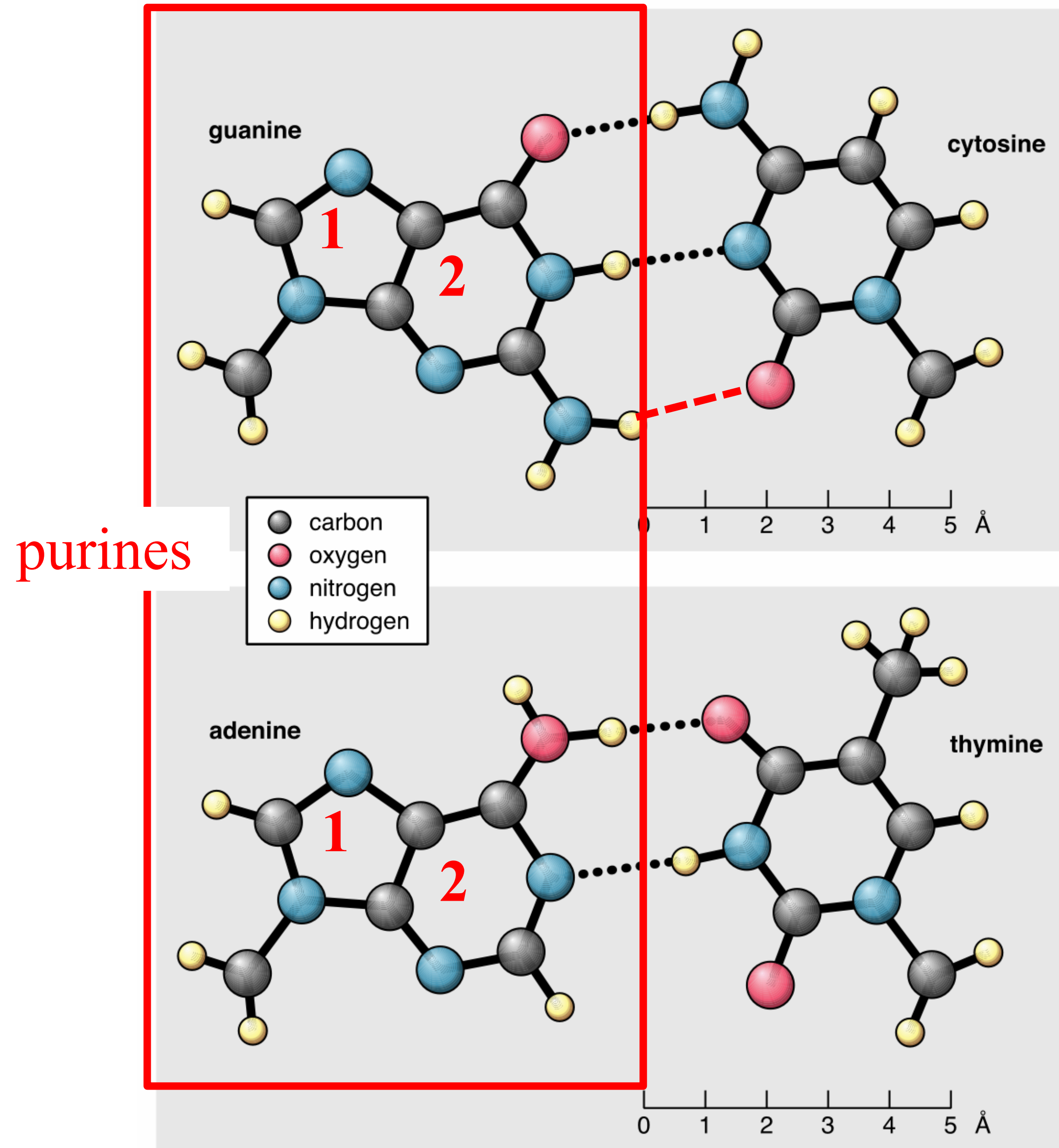


Fig. 1.13

modified from  
Watson and Crick. 1953b

# Always Three Rings Wide

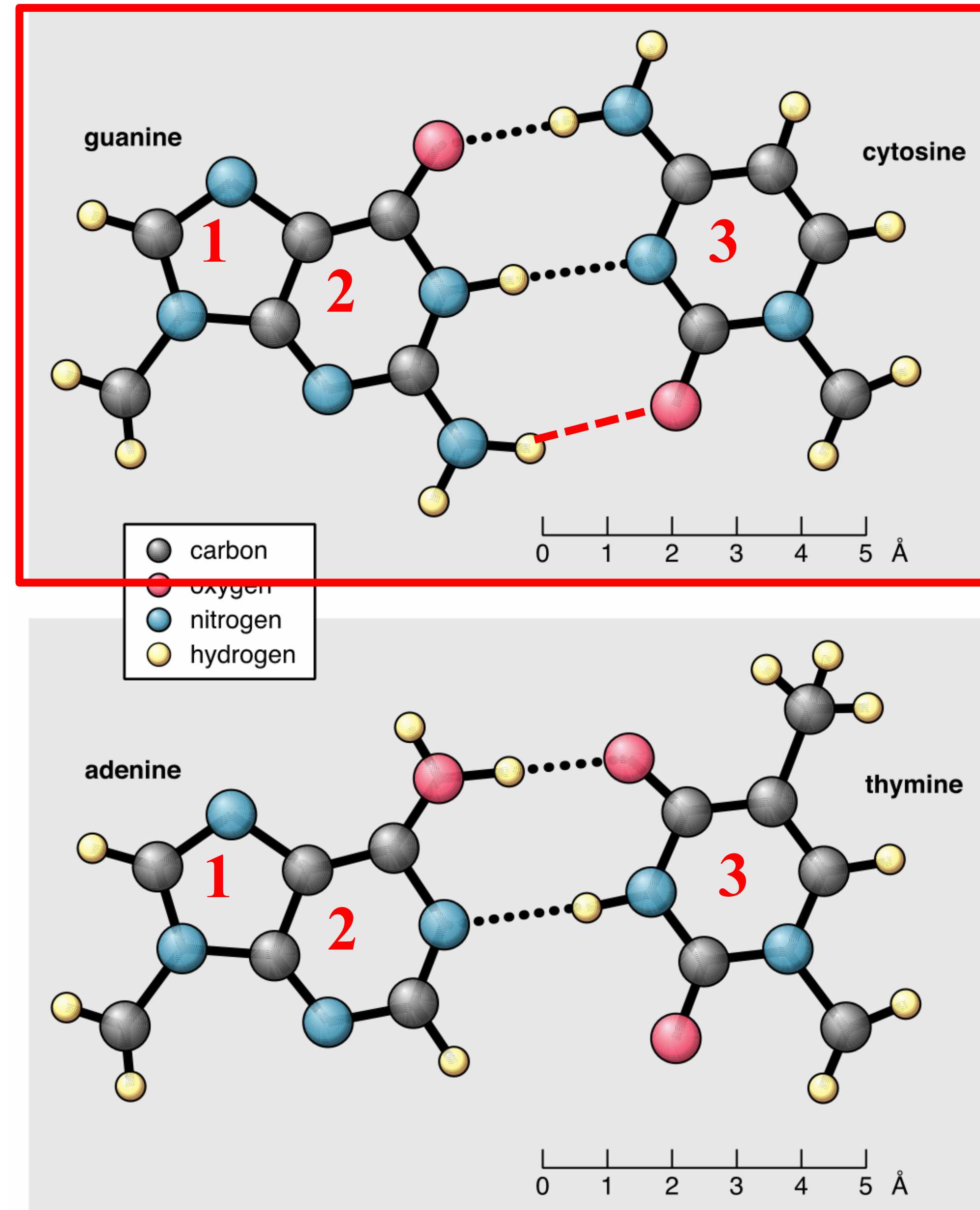
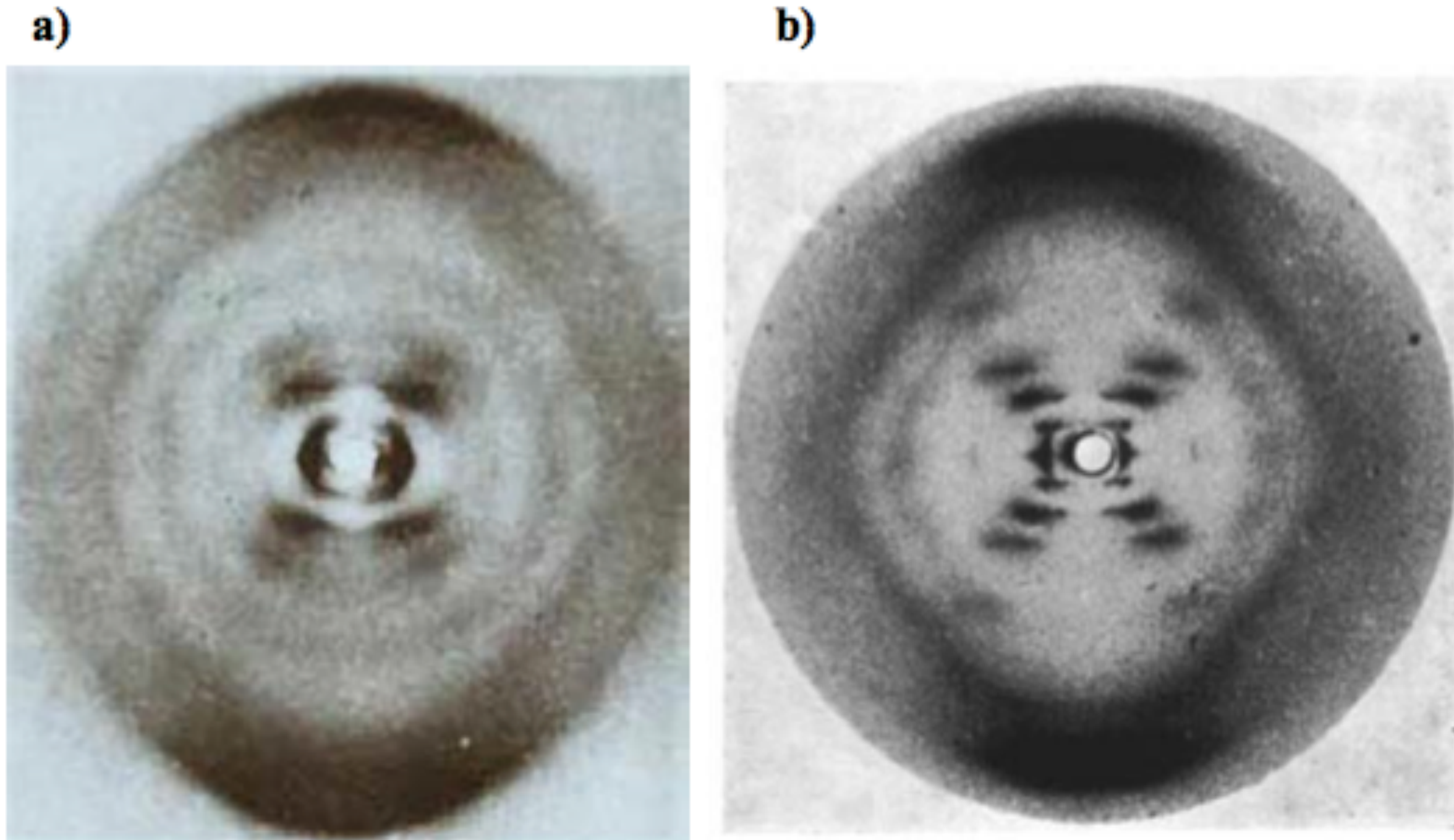


Fig. 1.13

modified from  
Watson and Crick. 1953b

# Integrating Questions

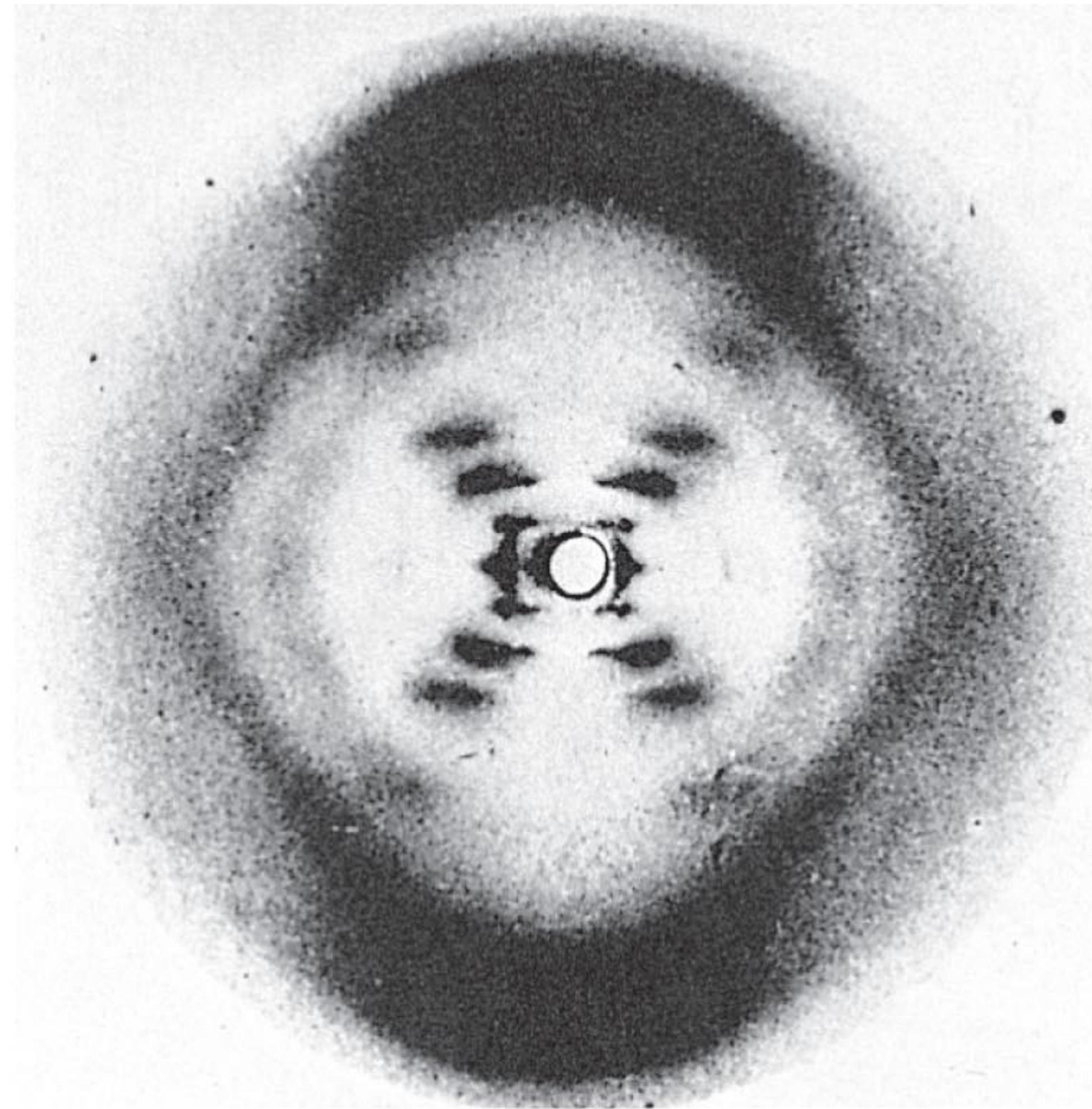
What's the controversy connected to these famous images? [Who, what, why?]



**Figure 1.12** Two X-ray film images of DNA published on the same day. (a) On page 738, Wilkins *et al.* published this diffraction pattern to explain how the structure of DNA was deduced from the data. (b) On page 740, Franklin and Gosling published their X-ray diffraction pattern of DNA.



**(a) Rosalind Franklin**



**(b) Franklin's X-ray diffraction photograph of DNA**

## Ethical, Legal, Social Implications 1.1: Who owns your DNA?

### Ethical, Legal, Social Implications Learning Objectives

- Critique the common misconceptions about DNA evidence in trials.
- Argue whether other people have the right to access your DNA information.

Each year, biologists sequence DNA faster and cheaper to determine the order of base pairs in chromosomes, and they can determine the exact sequence of bases in any person's **genome**. As you probably know from movies and television, DNA sequences can be used to identify a person due to the uniqueness of their DNA. However, DNA sequencing technology has presented many ethical problems as well as some common misconceptions, some of which come from movies and television.

First let's dispel the most common misconceptions:

**MYTH #1:** DNA sequencing is done almost instantaneously.

**TRUTH:** It takes several hours to isolate DNA from an environmental sample (such as a dried blood stain in clothing) and process it for sequencing. DNA cannot be seen directly by holding a light over it.

**MYTH #2:** A person's entire DNA sequence is used in criminal cases.

**TRUTH:** DNA legal evidence consists of very short fragments. The pieces are so small that an analogous photo might consist of postage stamp-sized fragments showing an earlobe and an elbow. Identifying anyone would be very difficult from these two partial photos alone. Although DNA sequencing is getting cheaper, we use less than 0.000001% of a person's genome for "DNA fingerprints."

**MYTH #3:** DNA evidence is properly used to convict criminals.

**TRUTH:** Because we use such small portions of DNA for identification, DNA evidence should be used to find innocence and *not* guilt. Let's return to the ear and elbow photo analogy. You can imagine comparing the photos to many different people. Two people might have ears and elbows that look alike, but only one committed the crime. However, if you find someone who has pierced ears or scars on their elbows, then you can be certain he or she is *not* the criminal. Likewise, it is appropriate to say that a suspect is not the criminal if the DNA evidence differs from the suspect. It is inappropriate to say that two matching samples of DNA *prove* the evidence came from the suspect.

**MYTH #4:** DNA evidence is infallible.

**TRUTH:** Producing DNA evidence is complex and performed by humans, therefore, mistakes happen. Perhaps the biggest mistakes are made in handling the evidence. What if your dead skin cells fell onto the sample? What if someone wanted to frame you and put your DNA at the scene of a

# Ethical, Legal, Social 1.1: Who owns your DNA?

**MYTH #1:** DNA sequencing is done almost instantaneously.

**MYTH #2:** A person's entire DNA sequence is used in criminal cases.

**MYTH #3:** DNA evidence is properly used to convict criminals

**MYTH #4:** DNA evidence is infallible

<https://youtu.be/xzfMfJxA0K0>

**EXHIBIT OF WORK AND EDUCATIONAL CAMPAIGN FOR JUVENILE MENTAL DEFECTIVES**

Between October 7 and 13, moving pictures at the Metropolitan Insurance Building will show the work for mentally defective children which the New York Department of Public Charities has undertaken through its clearing house for mental defectives. Started as an experiment the first of January, 1913, this clearing house has already proved its worth in meeting an actual need. Hitherto there has been no place where the mental condition of child or adult could be determined by scientifically trained experts and officially recorded for future reference and comparison.

Now, clinics in charge of Dr. Max Schlapp, seven assistant neurologists and three psychologists, held for the present at the Post Graduate Hospital, are receiving children from juvenile courts, from the Society for the Prevention of Cruelty to Children, from churches and settlements—in all, from 147 different individual sources, and are giving each child the best possible examination.

Binet tests. Reports are then sent to the organization from which the child came together with recommendations for treatment.

About 2800 such examinations have been made. The results are recorded by stenographers present at the clinic. These records are, of course, confidential and will be open for study only to accredited investigators. The facts will be confirmed by each child's finger print, to aid in any future identification and comparison of data.

Strange to say, strong opposition to institutional treatment comes often from

**STEPS IN MENTAL DEVELOPMENT**  
Where they stumble—the limit of development of each type.

The child's family history is sought, his antecedents and the influence surrounding his first years; any physical defects, such as defective teeth, adenoids, eye or ear trouble are noted and an examination made of personal tendencies and mental efficiency by the

parents, even when such care of the sick or defective child would be a great relief to the family. This is another proof of the need for a campaign of education of parents. Such education will be advanced in part by the nurses who visit the homes in an attempt to ensure the treatment recommended. It is hoped that the suitability and resources of Randall's Island as a place of retreat for children needing skilled care, may be increased and developed by adequate appropriation of funds.

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