LB145-Spring *2025*

1. Pick up Name Folder

- Add pronouns in -> (,)

2. Clicker Attendance

- Launch your Top Hat app on phone, orTopHat.com website, or text to the phone number.

3. Fill out Index Card

- Front: NAME & tips for how to pronounce well
- Back: CAREER & learn?

Index Card

NAME (in BIG LETTERS)

Front

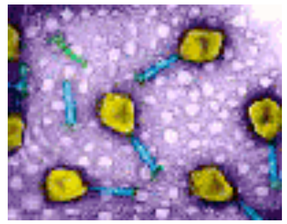
Career; What do you want to learn in this class?

Back

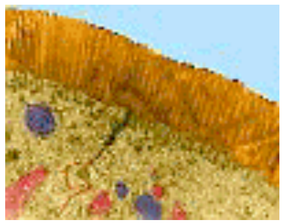
Hello

(IAmA, this is, these are, what to do?)





See *different*



You are an intern

Week 1

(Preparing for the first day of class) **Monday's lecture:**

Budgeting homework time (45 min): Read the 1995 *Review paper* on Cystic Fibrosis by Welsh and Smith in your Course Pack. Take a few handwritten notes in your notebook that focus on defining the normal functions of the CFTR protein and what happens to it that leads to the disease.

(Preparing for the second day of class) **Wednesday's lecture:**

Budgeting homework time (70 min): Ch. 1, section 1.2 is approximately 2600 words in length. At what's considered slow reading speed, 200 words per minute, reading section 1.2 should take 13 minutes. But when done properly, when you pause to review figures, read and think about a few of the Integrating Questions, and take careful notes, if you focus (avoid distraction) it should take you approx. 70 minutes.

1. _____ For the first lecture, read the 1-page **Foreword** written by the very famous Dr. Bruce Alberts, review the Student Resources in **Chapter 0**, and then begin reading **Chapter 1: Heritable Material** of our textbook, Integrating Concepts in Biology (ICB). Read the single Introduction page, and the short section 1.1 of Chapter 1, but you do not need to take notes on any of those pages

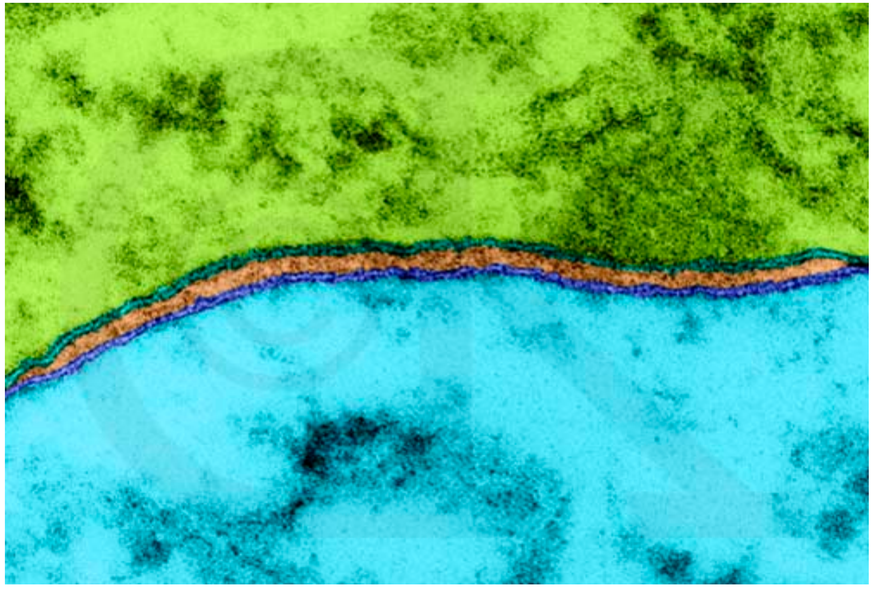
M1: CFTR -Predict what happens

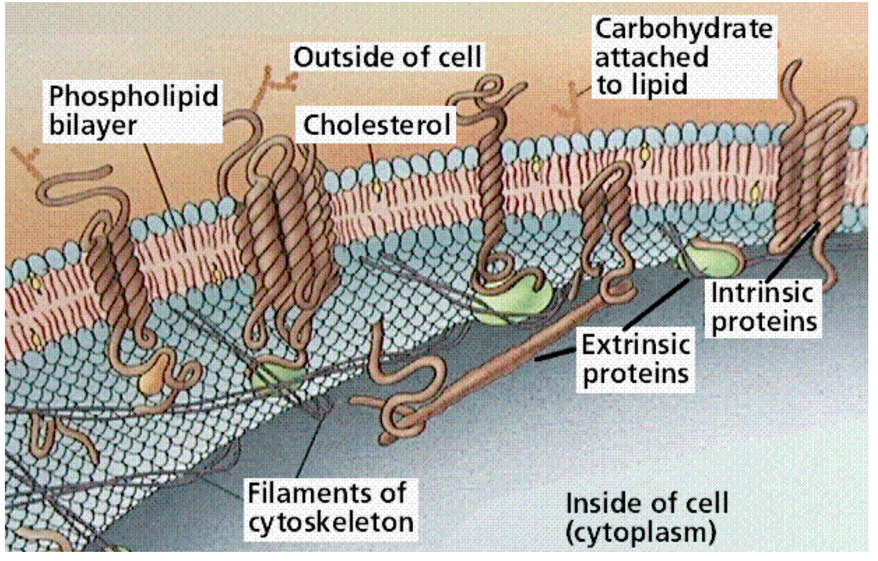
(Review the Welsh and Smith 1995 paper from Scientific American that starts on page 267 of the Course Pack; quick access to Course Pack is via class website http://ctools.msu.edu/145)
CFTR is a Cl- channel protein that functions in the apical membrane of epithelial cells. In patients with cystic fibrosis, the transport of Cl- through CFTR is disrupted. What do you predict may happen to ion concentrations, osmotic balance, and H2O movement (inside and outside an airway epithelial cell) once that path is disrupted?

M1: Rowe Figure 3- Sweat ducts

(Review Figure 3 from Rowe's 2005 paper from New England Journal of Medicine that starts on page 275 of the Course Pack; quick access to Course Pack is via class website http://ctools.msu.edu/145).
Why is the sweat of a person with CF saltier than that of a control healthy subjects? Do you predict the sweat of a person carrying only a single "broken" allele (heterozygote) would be saltier than someone who was homozygous wild-type for CFTR genes (had zero "broken" CF alleles)?

CF Research Lab @ MSU





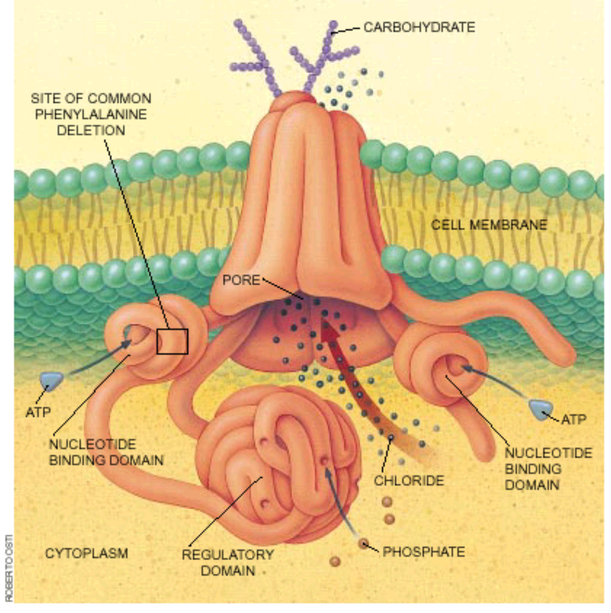
ABC Transporter Family

Clinical Relevance

MDR- Cancer

SUR- Diabetes

CFTR- Cystic Fibrosis



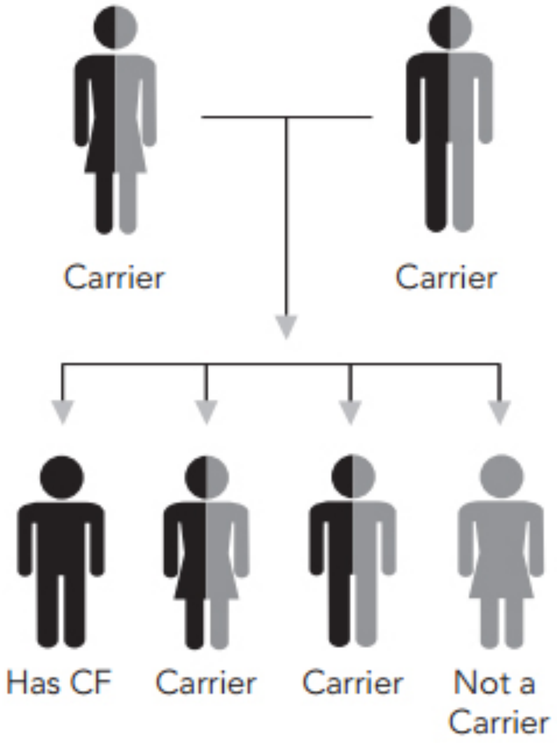
SCIENTIFIC AMERICAN *December 1995*

Cystic Fibrosis

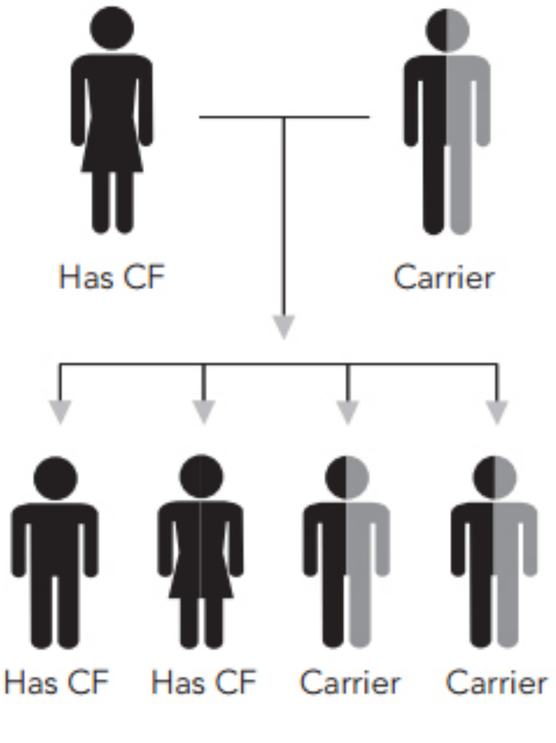
How a Person Gets CF

To have CF, you must get one copy of the CF gene from each parent.
That means that each parent must be a carrier of the CF gene.

When two people who are carriers have a child, there is a 25 percent chance of having a child with CF.



When one parent has CF and one parent is a carrier, there is a 50 percent chance having a child with CF.



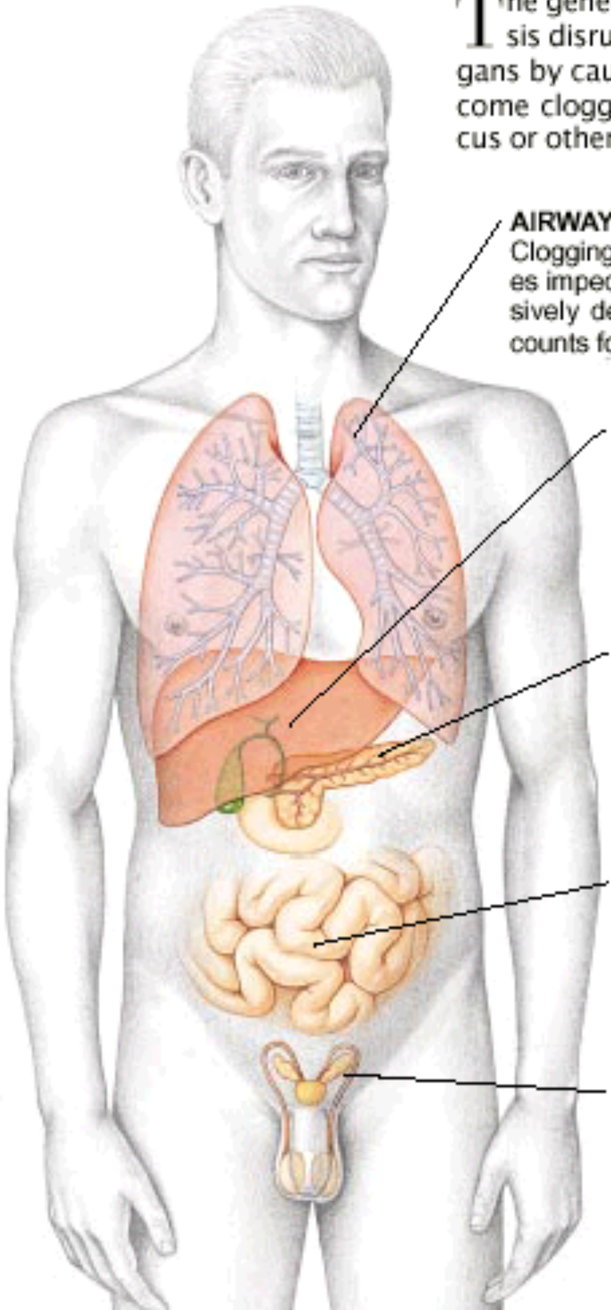
Exercise #1:

'What *causes* the disease cystic fibrosis?'

A.. B.. C..

Organs Affected by Cystic Fibrosis

The genetic defect underlying cystic fibrosis disrupts the functioning of several organs by causing ducts or other tubes to become clogged, usually by thick, sticky mucus or other secretions.



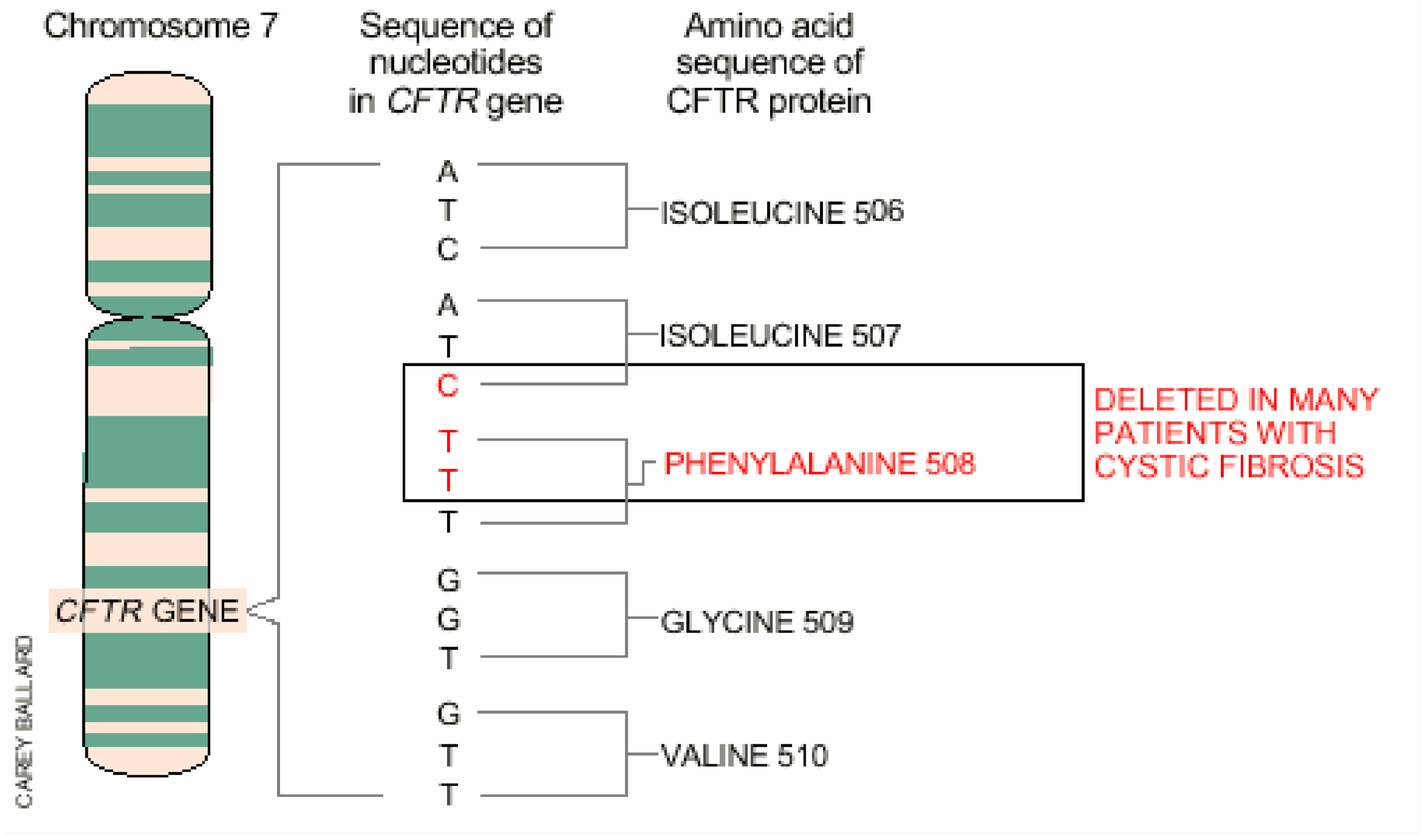
AIRWAYS
Clogging and infection of bronchial passages impede breathing. The infections progressively destroy the lungs. Lung disease accounts for most deaths from cystic fibrosis.

LIVER
Plugging of small bile ducts impedes digestion and disrupts liver function in perhaps 5 percent of patients.

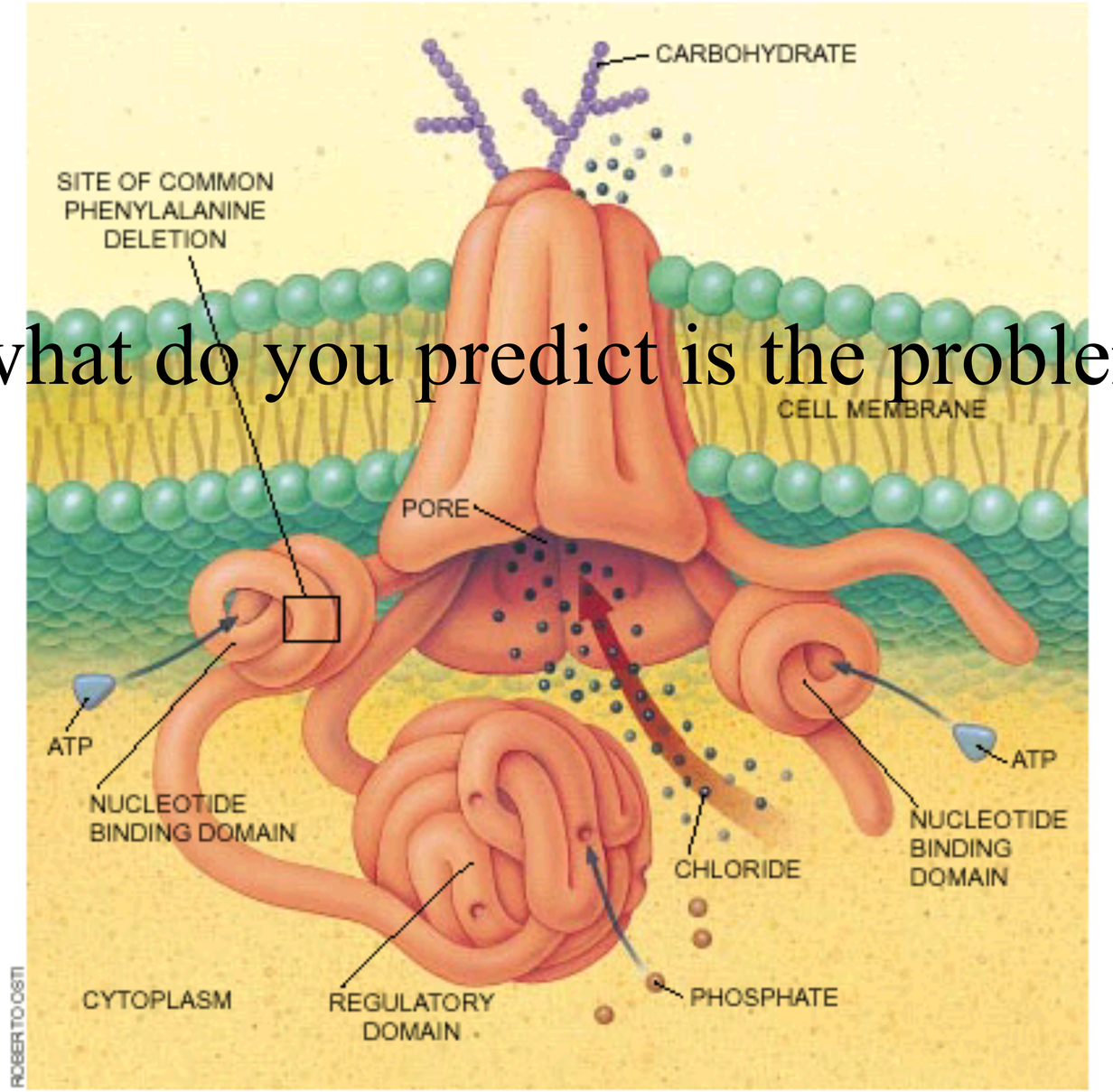
PANCREAS
Occlusion of ducts prevents the pancreas from delivering critical digestive enzymes to the bowel in 85 percent of patients. Diabetes can result as well.

SMALL INTESTINE
Obstruction of the gut by thick stool necessitates surgery in about 10 percent of newborns.

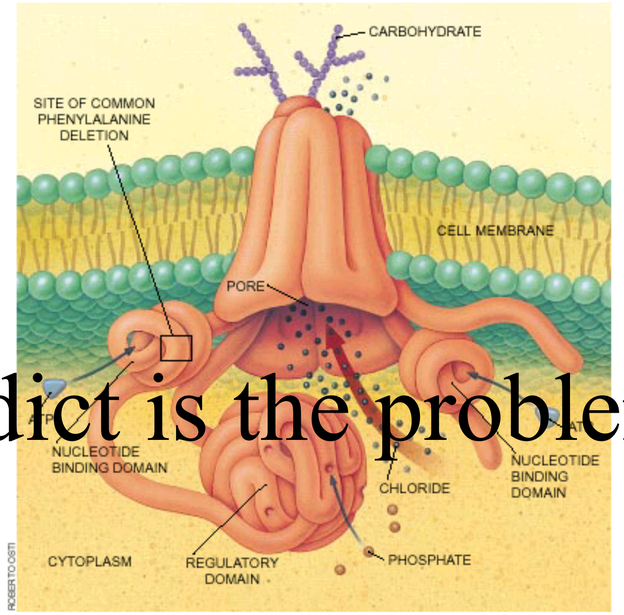
REPRODUCTIVE TRACT
Absence of fine ducts, such as the vas deferens, renders 95 percent of males infertile. Occasionally, women are made infertile by a dense plug of mucus that blocks sperm from entering the uterus.


Chromosome 7
Sequence of nucleotides in *CFTR* gene
Amino acid sequence of CFTR protein
CFTR GENE
A
T
C
ISOLEUCINE 506
A
T
C
ISOLEUCINE 507
T
T
T
PHENYLALANINE 508
DELETED IN MANY PATIENTS WITH CYSTIC FIBROSIS
G
G
T
GLYCINE 509
G
T
T
VALINE 510
CAREY BALLARD

So what do you predict is the problem?



So what do you predict is the problem?



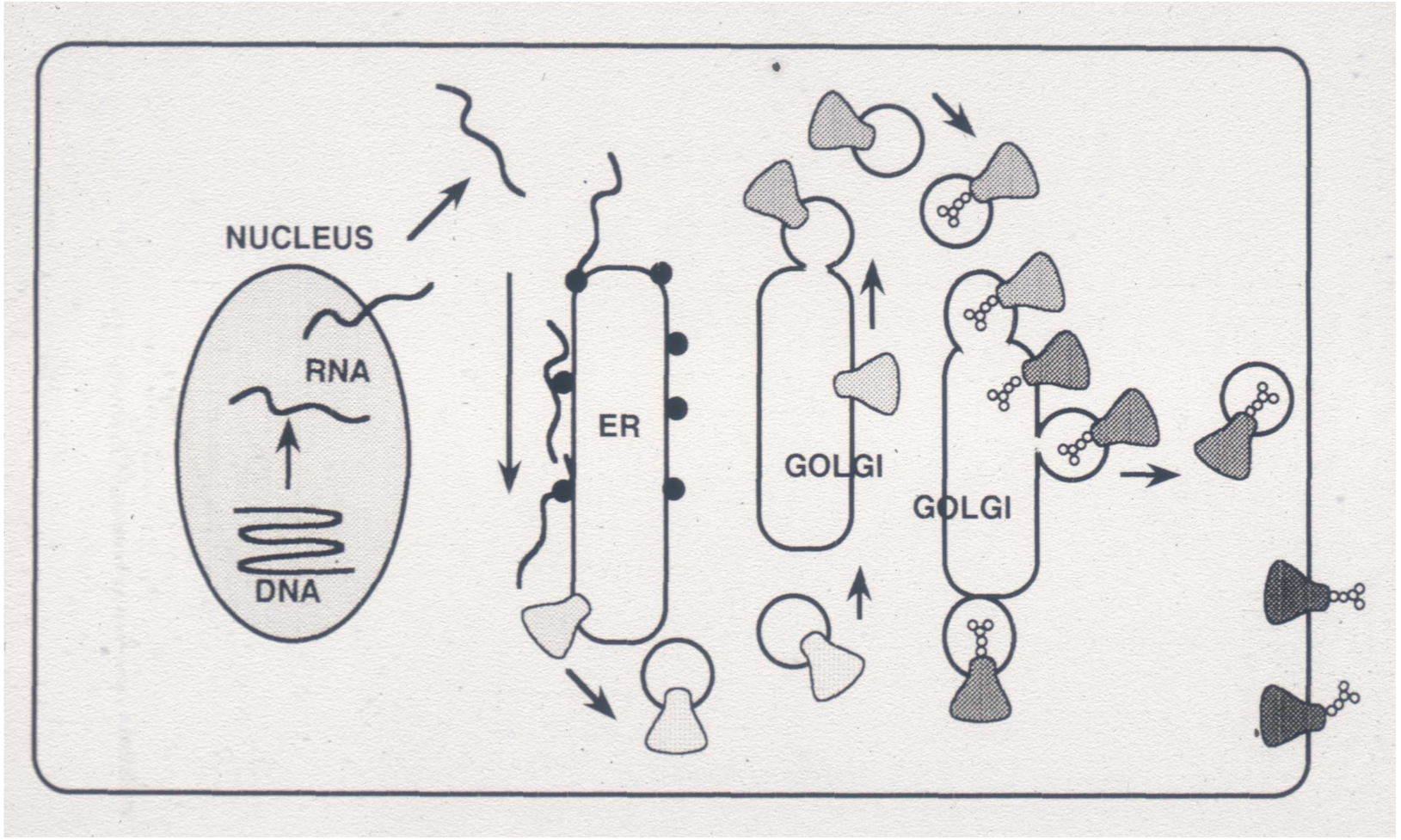
A. The deletion alters gating, thus blocking the CFTR.

B. The deletion alters ATP binding, thus stopping CFTR.

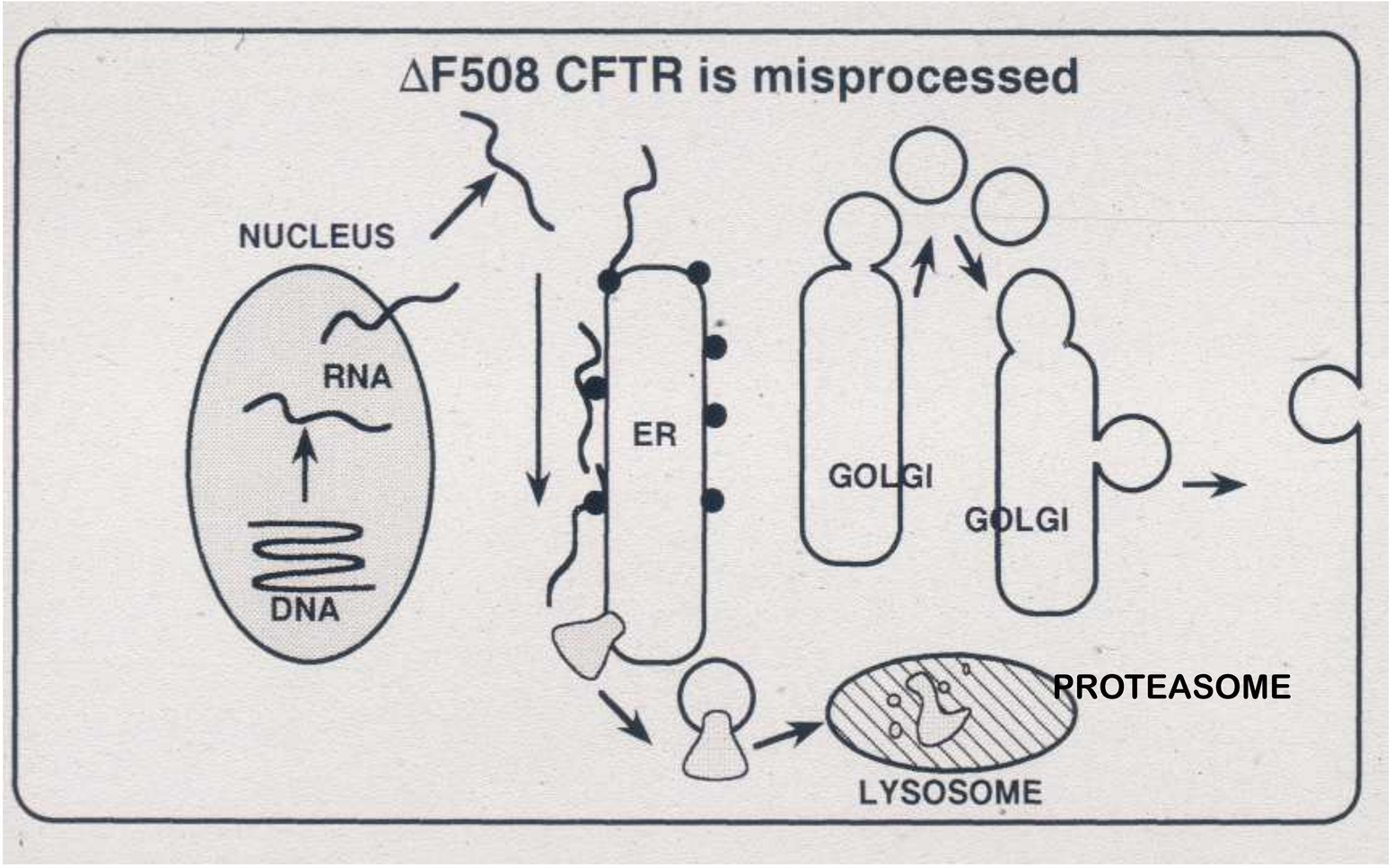
C. The deletion alters the folding, but CFTR still works.

D. None of the above cause the disease.

biosynthesis of normal wild-type CFTR



biosynthesis of mutant CFTR



How many CFTR channels are on the surface of a cell of a patient with severe CF? (normal=100)

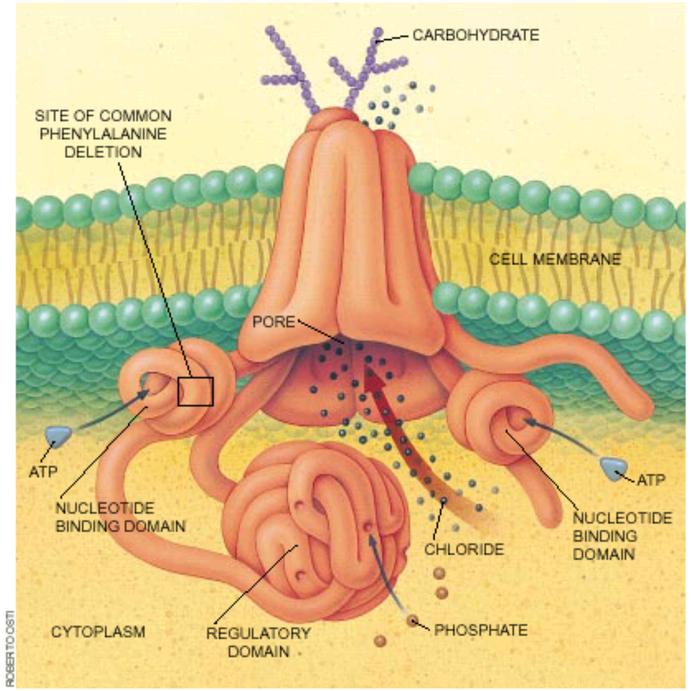
A. 50

B. 25

C. 10

D. 5

E. 0



How many CFTR channels are on the surface of a cell of a **CF carrier** [heterozygote]?? (normal=100)

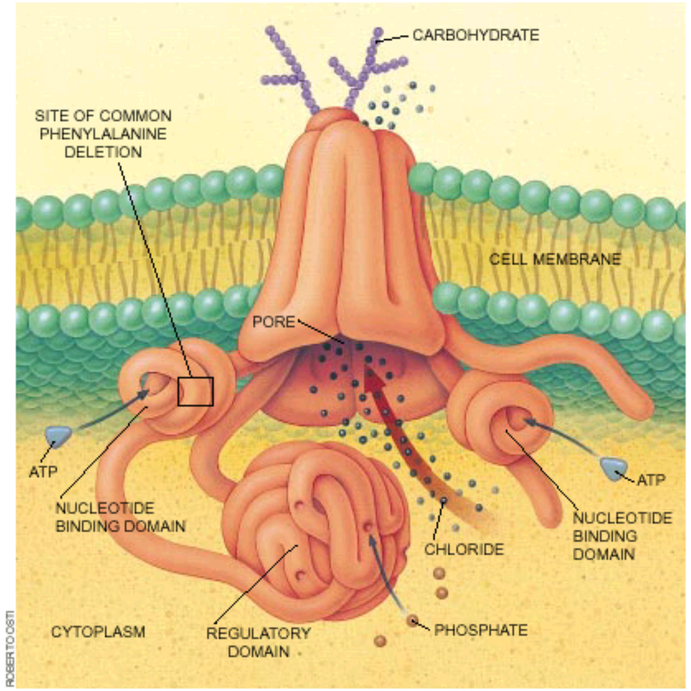
A. 50

B. 25

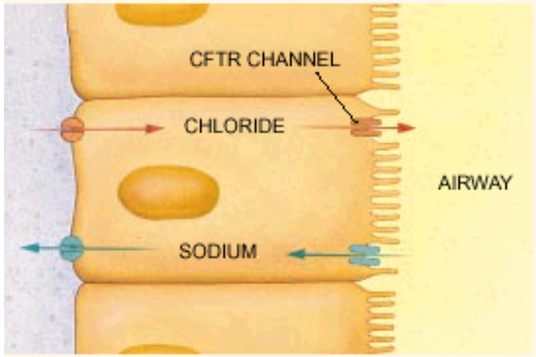
C. 10

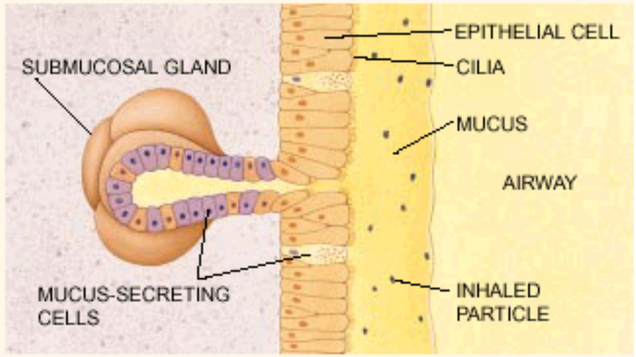
D. 5

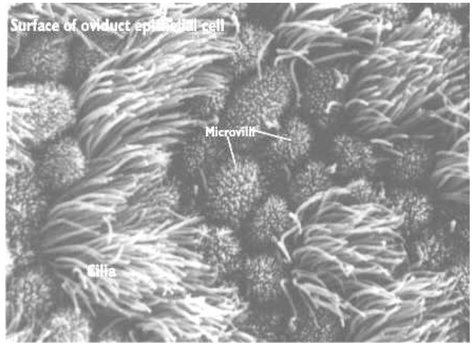
E. None of the above are correct.

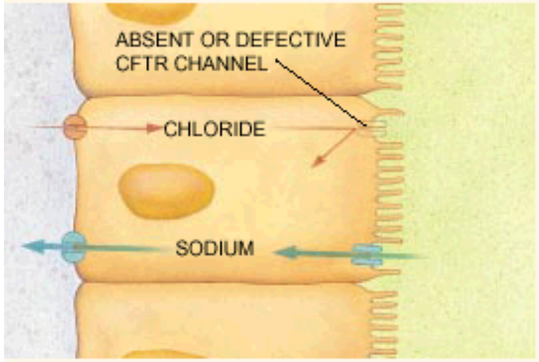


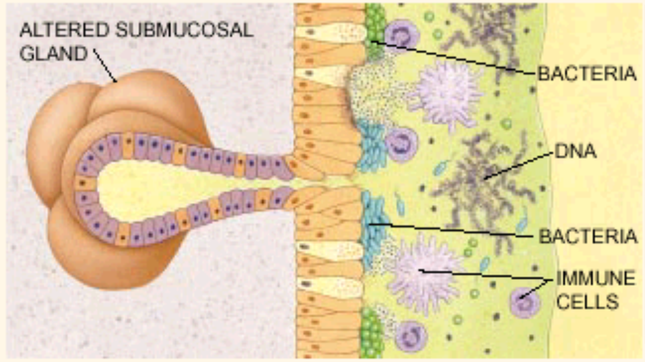
Healthy (normal)

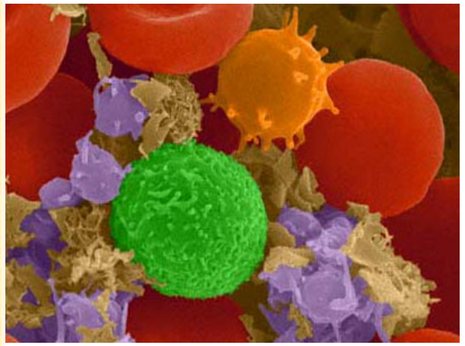




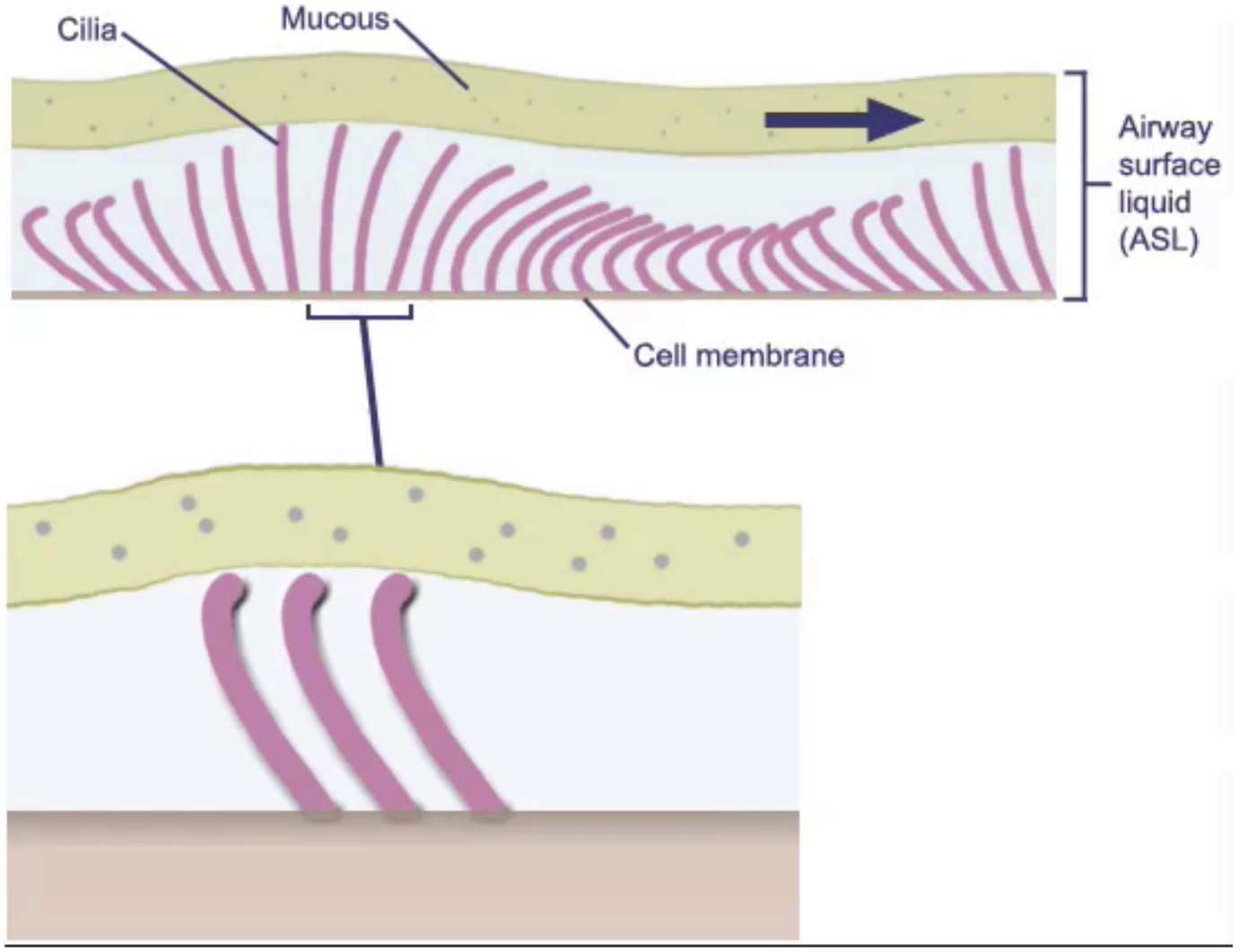




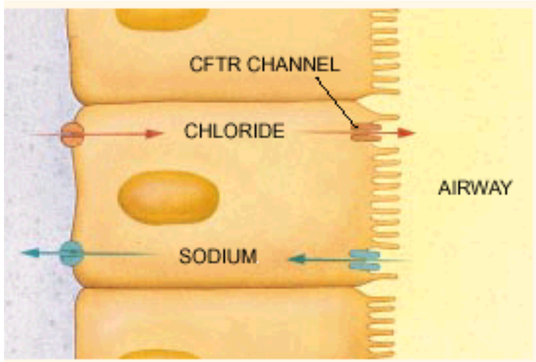


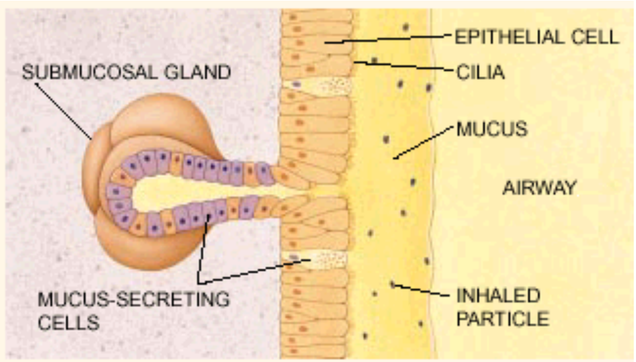


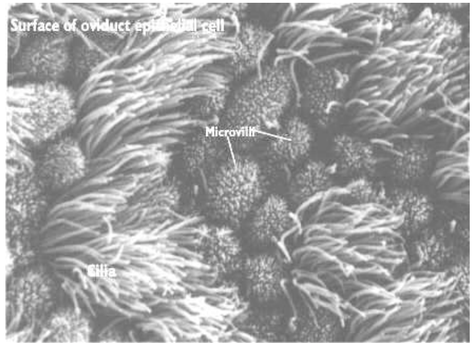
Sick (cystic fibrosis)

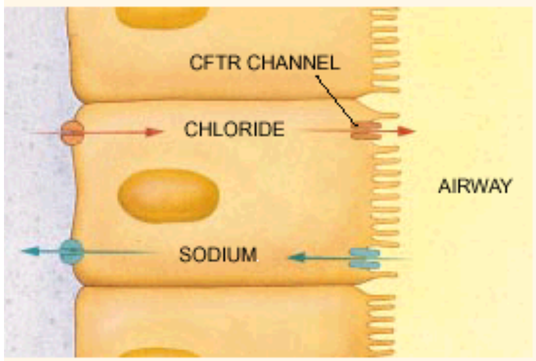

Cilia
Mucous
Airway surface liquid (ASL)
Cell membrane

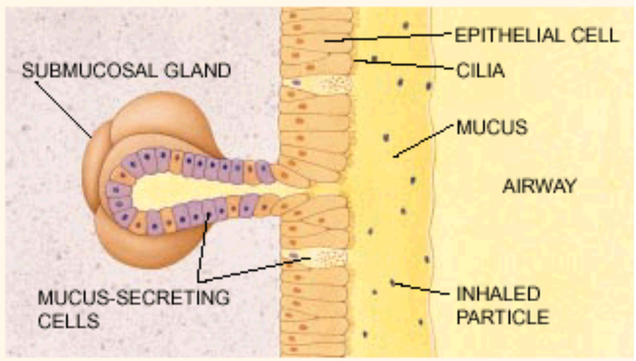
Healthy (normal)

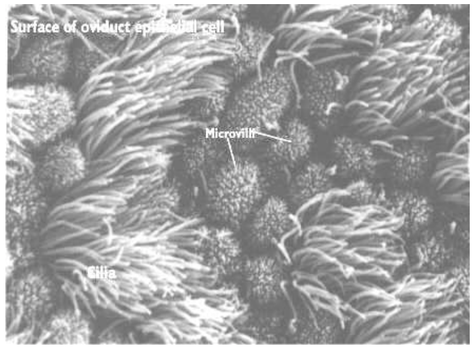












Sick (cilia dyskinesia)

Where are the CFTR channels found normally [in a healthy person]?

A. the apical surface ->

B. inside the ER

C. the lateral surface ->

D. in the lysosome

E. the basal surface ->