Case study: Dystrophic epidermolysis bullosa

Your role during this case study: You will be interacting with Johnny as you discuss the results of his genetic test and change his dressings. During these situations, it is your responsibility to explain the biochemical, physiological, and histological implications of his disease. He finds much comfort in your presence as some of the only contact he has with medical staff in the hospital is with his nurses. During his time in the hospital, he's developed an amicable and trusting relationship with you. To this end, he feels quite comfortable chatting with his nurses and asking questions about his disease. Do your best to provide him with relevant and accurate information.

A. Results of Johnny's genetic test: In the hopes of explaining the mutation in Johnny's COL7A1 gene and providing him more insight into what it means to have a mutated gene and a dysfunctional protein, you've decided to show him a small portion of his COL7A1 gene and explain to him how it gets expressed into the collagen 7 protein. Below are small portions of the coding strand from a normal COL7A1 gene (*this portion does not code for the start or stop codon*) and Johnny's mutated COL7A1 gene:

Normal:	Coding:	5' - G G C A A G G G C G A A G G G - 3'
	Template:	
	Transcript:	
	Polypeptide:	
Johnny's:	Coding:	5' - G G T A A G C G C G A G G G G - 3'
	Template:	
	Transcript:	
	Polypeptide:	

Draw in the portions of the template strand and their resulting transcripts. Assume the transcript is in frame and translate it using the genetic code. Answer the following questions:

1. How many nucleotides are different between the two coding strands?
2. How many amino acids are different in the resulting polypeptides?

B. Answering Johnny's questions: Johnny's curiosity with his disease has prompted a few questions about its pathophysiology. You've been brushing up on his disease ever since you started working with him. You've spoken to colleagues, watched a documentary, took notes from Wikipedia, and even cracked open that surprisingly useful purple A&P textbook from your nursing program. For the sake of being thorough, you've developed a neat little puzzle and printed some pictures to help explain to him why the mutation in his COL7A1 gene is related to the symptoms and complications of his disease.

For the first activity, you will use a puzzle to help understand the basics of histology and cellular junctions. Understanding how epithelia and connective tissues interact and how cellular junctions keep cells together and cell attached to basement membranes will help Johnny understand the nature of his disease. To solve the puzzle, use the template to give you an idea of where the pieces fit. Next, you will need to match the tissue type or cellular junction on the edges of each piece with their appropriate description on the edge of another.

For the second image, you plan to explain the organization of Johnny's integument. The picture represents a cross-section of the skin. Identify the following structures: epidermis (**a**), stratum corneum (**b**), stratum spinosum (**c**), stratum basale (**d**), dermis (**e**), hypodermis (**f**), sweat gland (**g**), sebaceous gland (**h**), blood vessels (**i**), nerves (**j**), Meissner's corpuscle (**k**), Pacinian corpuscle (**m**), hair follicle (**n**), and arrector pili (**o**). Draw an asterisk where you expect to find the basement membrane.

C. Discussion (10 pts): **Names:** **Bag no.:**

Questions:	Answers:
1. a) In part A of this case study, why is there a discrepancy between the numbers you answered in question 1 and 2 (what property of the genetic code explains this)? (1 pt) b) What is the lowest level of protein structure affected by the mutation in Johnny's COL7A1 gene? How could this affect the higher levels? (1 pt)	a) b)
2. How do the cells of the stratum basale interact with the basement membrane in normal, healthy individuals? Be specific. (2 pts)	
3. Collagen VII is a protein that is secreted into the extracellular space by the basale keratinocytes and dermal fibroblasts. Considering this protein is secreted, name the organelle in which the gene is transcribed, by which the protein is translated, that modifies and sorts the protein for secretion, and that transports the protein outside the cell. (2 pts)	Transcription: Translation: Modification/sorting: Transportation outside:
4. Collagen 7 is located in the basement membrane of stratified squamous epithelium. Name one other location in the body (besides the skin) with this type of epithelium and describe and briefly explain one symptom you would expect to manifest as a result of a faulty COL7A1 gene in this organ. (2 pts)	Organ with stratified squamous epithelium: Symptom:
5. Draw a flowchart/concept map illustrating the *mechanism* whereby the faulty COL7A1 gene causes the symptoms of dystrophic epidermolysis bullosa in Johnny's skin and why he's susceptible to chronic infections. Start at the molecular level and work your way up to the cellular, tissue, and organ level. (2 pts)