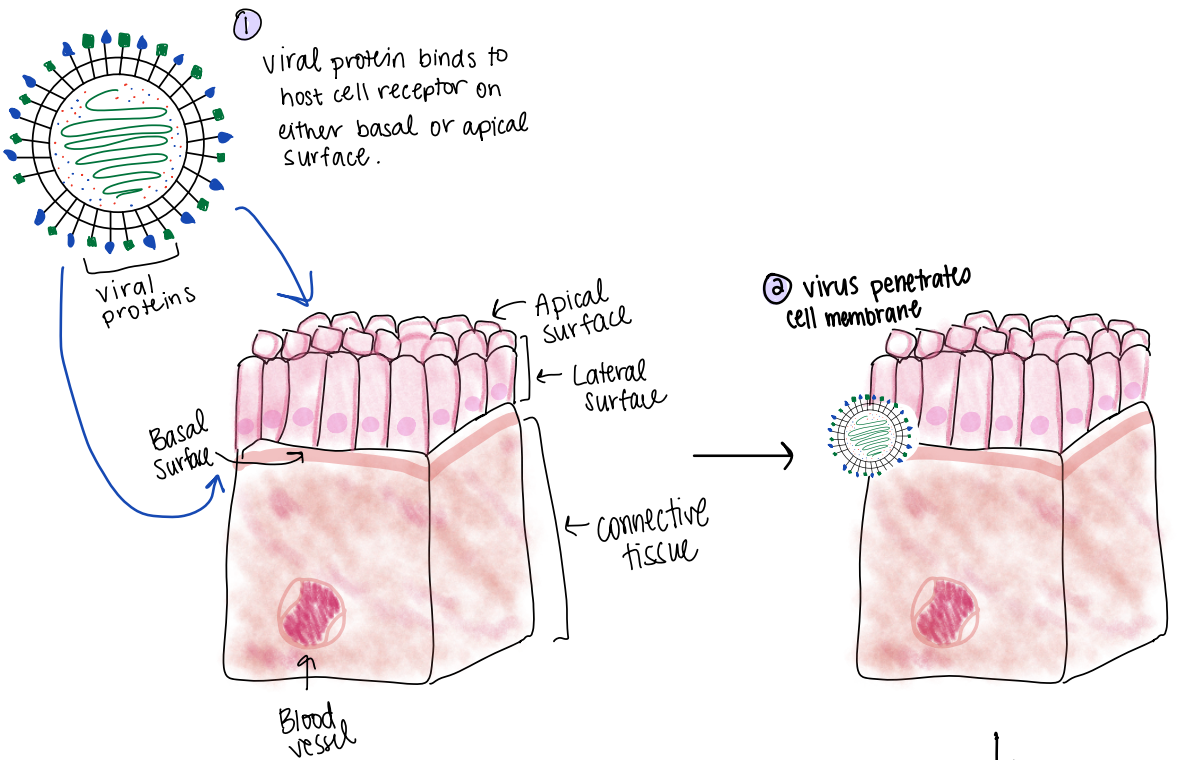
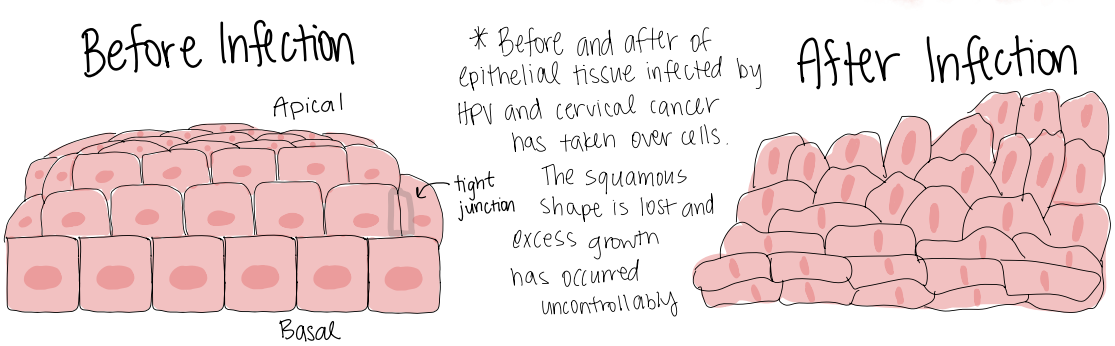
viral pathogenesis: mechanism in which virus uses to infect host cell so replication can occur.





Epithelial cells are one of the most common cells affected by viral pathogenesis. Viruses such as Human Papillomavirus (HPV), Human Immunodeficiency Virus (HIV), and respiratory viruses such as SARS-CoV-2 and Influenza strains are all viruses that target cell receptors of epithelial cells (Diana, et al., 1996). The binding of the viral surface protein to the host cell receptor causes infection by integrating the viral genome into the host cell. Viral pathogenesis occurs when the virus establishes attachment to the host cell and is able to penetrate the barrier and cause infection (Bomsel, et al., 2003). The polar characteristic of epithelial tissue is due to different protein and lipid composition on the apical and basal surfaces, which face the lumen and the interior of the body, respectively (Coradini, et al., 2011). The tightly packed, layered structure of epithelial tissue contributes to diffusion barriers that prevents molecules from diffusing across the cell layer. Epithelial tissues can vary in the amount of cell layers and cell shape as well. Squamous refers to laterally flattened shape, columnar refers to long column-like shape, and cuboidal refers to cube-like shape. Tight junctions between the adjacent individual cells correlate with the apical-basal polarity and allow for no movement due to the lack of extracellular space between cells. This polarity is thought to be an important determinant of viral pathogenesis and eventual infection because specific families of viruses may enter and release their progeny exclusively through the apical or basal surfaces (Diana, et al., 1996). If the virus releases progeny virions at the apical surface, and the epithelial cell layer remains intact in the tissue, the virus is able to move between adjacent cells, remaining on the apical surface, and continuing infection along the way. Viruses may also enter and release virions through the basal surface, which allows for the viral particles to reach other cell layers and tissues, thus potentially spreading infection to other organs. The tight junctions between individual epithelial cells act as the first line of defense against pathogens and viral infection, but many viruses have evolved to utilize tight junctions to create an environment conducive for facilitating viral infection (Diana, et al., 1996).

Different viruses have different surface proteins that target specific epithelial cells depending on the cell receptors of the host epithelial cells. The location of the cell receptor influences viral entry and pathogenesis. Cell receptors located on the apical surface may pose an easier job for the virus as it does not have to traverse through the cell layers to reach the receptor, as opposed to cell receptors located on the basolateral surface. Viruses such as HIV, coronaviruses, and HPV all target cell receptors located on the basal surface of epithelial tissue, while influenza targets apical cell receptors (Diana, et al., 1996).

Epithelial cells are found throughout the body in the air sacs of lungs, kidney glomeruli, lining of heart and blood vessels, the upper respiratory tract, mucosal surfaces, and in the walls of excretory ducts of glands (Betts, et al., 2024). While they function as the body's first layer of protection, they also are responsible for absorption, secretion and filtration processes (Betts, et al., 2024). As viruses adapt and evolve to the protection mechanisms of the body, they can adopt the body's cellular machinery to aid in their infection and replication process. This can have a major impact on epithelial cells' ability to properly function. HPV, a papillomavirus known to cause cervical cancer, infects squamous epithelial tissue and glandular tissues (cuboidal), leading to disrupted tissue homeostasis and increased cell proliferation without regulation. HIV, a retrovirus that can cause AIDS if post-exposure prophylaxis is not received, can lead to a decrease in expression of tight junction proteins leading to further implications for the epithelial barrier (NIH, 2024). Understanding the characteristics, structure, and function of epithelial cells is critical for studying the ways in which viral pathogenesis can impact the health of tissues,

organs, and the entire body as a whole.

References:

Bomsel M, Alfsen A. Entry of viruses through the epithelial barrier: pathogenic trickery. Nat Rev Mol Cell Biol. 2003 Jan;4(1):57-68. doi: 10.1038/nrm1005. PMID: 12511869; PMCID: PMC/097689.

Blau M. Diana, et al., 1996. Polarization of Viral Entry and Release in Epithelial Cells. *Seminars in Virology.* Vol 7, 1996: pp 245–253.

Coradini, D., Casarsa, C. & Oriana, S. Epithelial cell polarity and tumorigenesis: new perspectives for cancer detection and treatment. Acta Pharmacol Sin 32, 552-564 (2011). https://doi.org/10.1038/aps.2011.20 E

J. Gordon Betts, et al., Anatomy and Physiology 2e. Rice University, Chapter 4.2 pg. 130-132.

National Cancer Institute, NIH. HPV and PAP Test Results: Next Steps After an Abnormal Cervical Cancer Screening Test. Retrieved June 2024. https://www.cancer.gov/types/cervical/screening/abnormal-hpv-pap-test-results