

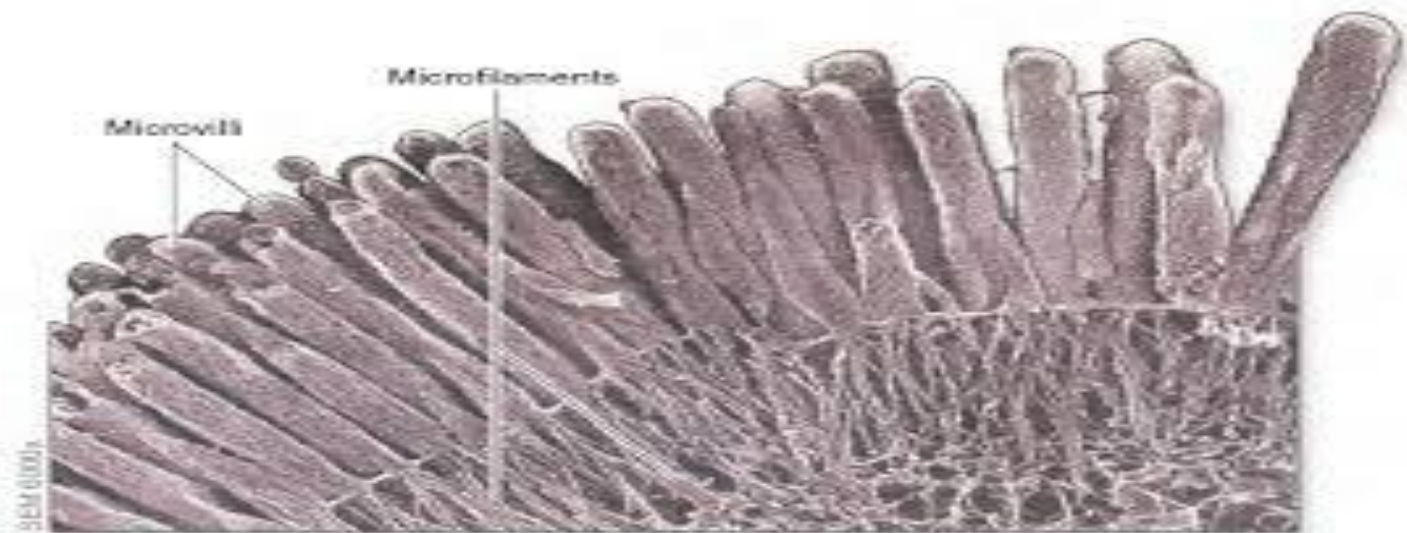
BIOCHEMISTRY AND CYTOGENETICS

TOPIC : MICROVILLI

I SEMESTER M.SC ZOOLOGY

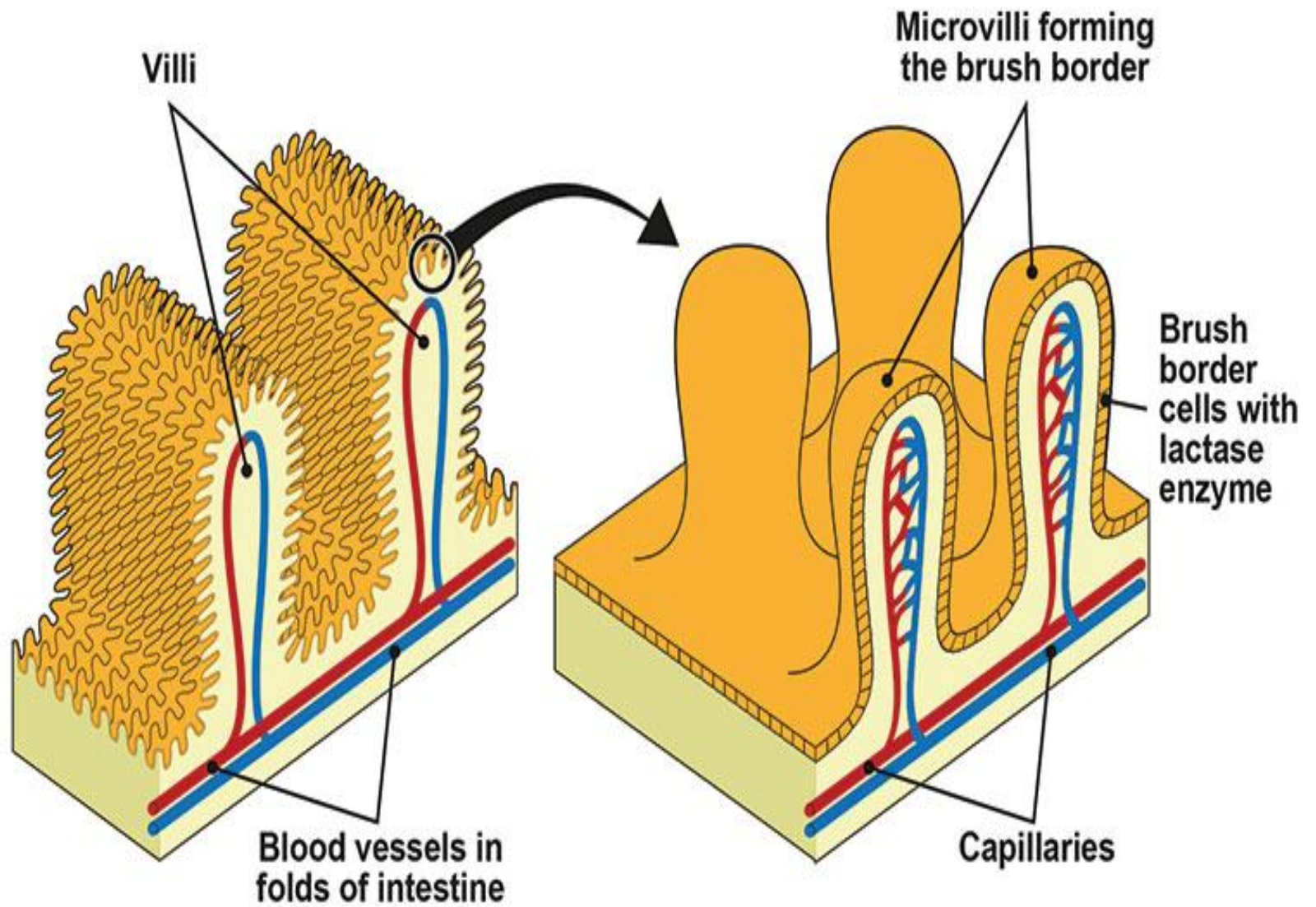
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MICROVILLI



- Microvilli, in the most simplistic terms, are tiny little microscopic projections that exist in, on, and around cells.

- They can exist on their own or in conjunction with villi (projections of some mucous membranes, most specifically of the small intestine, which are tiny folds that project out like numerous fingers).



- On each of the villi, there are even smaller folds that stick out like fingers called microvilli.
- Microvilli are most often found in the small intestine, on the surface of egg cells, as well as on white blood cells.

- Thousands of microvilli form a structure called the **brush border** that is found on the apical surface of some epithelial cells, such as the small intestines.

- Microvilli form a rather polymorphic class of surface protuberances that are regularly packed in some tissues and loosely positioned in others.

- Generally, they are shorter and smaller in diameter than **cilia**.
- They are commonly about 0.1 μm diameter and range in length from a fraction of a micrometer to about 2 μm .

- Microvilli are essentially bundles of cross-linked actin fibers.
- Although they are cellular extensions, there are little or no cellular organelles present in the microvilli.

- However, they are covered in their own plasma membrane, which encloses cytoplasm and microfilaments.
- Each microvillus has a dense bundle of cross-linked actin filaments, which serves as its structural core.

- 20 to 30 tightly bundled actin filaments are cross-linked by bundling proteins fimbrin (or plastin-1), villin and espin to form the core of the microvilli.

- Actin filaments, present in the cytosol, are most abundant near the cell surface.
- These filaments are thought to determine the shape and movement of the plasma membrane.

- The nucleation of actin fibers occurs as a response to external stimuli, allowing a cell to alter its shape to suit a particular situation.

- In the enterocyte microvillus, the structural core is attached to the plasma membrane along its length by lateral arms made of myosin 1a and Ca^{2+} binding protein calmodulin.

- The space between microvilli at a cell's surface is called the intermicrovillous space. Intermicrovillous space increases with the contractile activity of myosin II and tropomyosin and decreases when contraction ceases.

- **Functions of Microvilli**

- The microscopic microvilli effectively increase the surface area of the cell and are useful for absorption and secretion functions.
- In the intestine, they work in conjunction with villi to absorb more nutrients and more material because they expand the surface area of the intestine.

- The microvillar membrane is packed with enzymes that aid in the breakdown of complex nutrients into simpler compounds that are more easily absorbed.

- For example, enzymes that digest carbohydrates called glycosidases are present at high concentrations on the surface of enterocyte microvilli.

- Thus, microvilli not only increase the cellular surface area for absorption, but they also increase the number of digestive enzymes that can be present on the cell surface.

- They play a role in egg cells as they help in anchoring the sperm to the egg, thus allowing for easier fertilization.
- In white blood cells, the microvilli act as an anchoring point. They aid in the migration of white blood cells.

- The second type of proposed function is to store membrane and microfilament materials.
- Motility is another function of microvilli. The microvilli on the cell surface may sweep unwanted materials toward a resorptive area of the cell.

- They are also involved in a wide variety of other functions, which include absorption, secretion, cellular adhesion, and mechanotransduction.