Lipid Raft

Lipid raft

- **Lipid rafts** are subdomains of the plasma membrane that contain high concentrations of cholesterol and glycosphingolipids (sphingomyelin)
- Lipid rafts are small microdomains ranging from 10–200 nm in size
- hydrophobic chains of the lipids contained in the rafts are more saturated and tightly packed than the surrounding bilayer
- Cholesterol is the dynamic "glue" that holds the raft together
- cholesterol can pack in between the lipids in rafts, serving as a molecular spacer

Curr Opin Cell Biol. 1997;9(4):534–42

The lipid rafts extraction

- When such a detergent such as Triton X-100 is added to cells, at low temperatures (4 °C)

  the fluid membrane will dissolve while the

  lipid rafts may remain intact and could be

  extracted.

- lipid rafts are also called detergent-insoluble glycolipid-enriched complexes (GEMs) or DIGs or Detergent Resistant Membranes (DRMs)

Mol Cell Neurosci. 2002;19(1):18–31

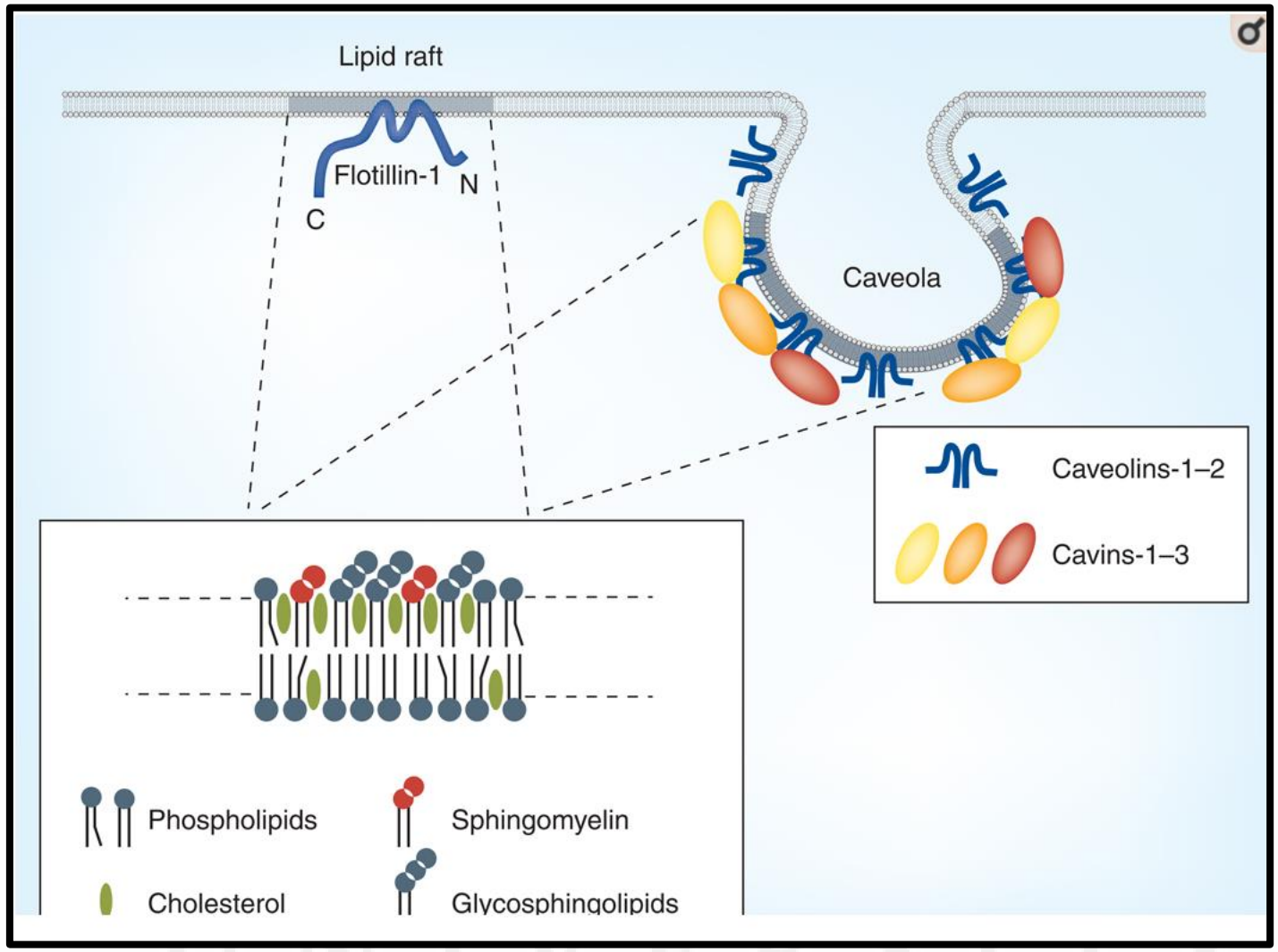
Type of lipid raft

Two types of lipid rafts have been proposed: planar lipid rafts (non-caveolar, or glycolipid, rafts) and caveolae.

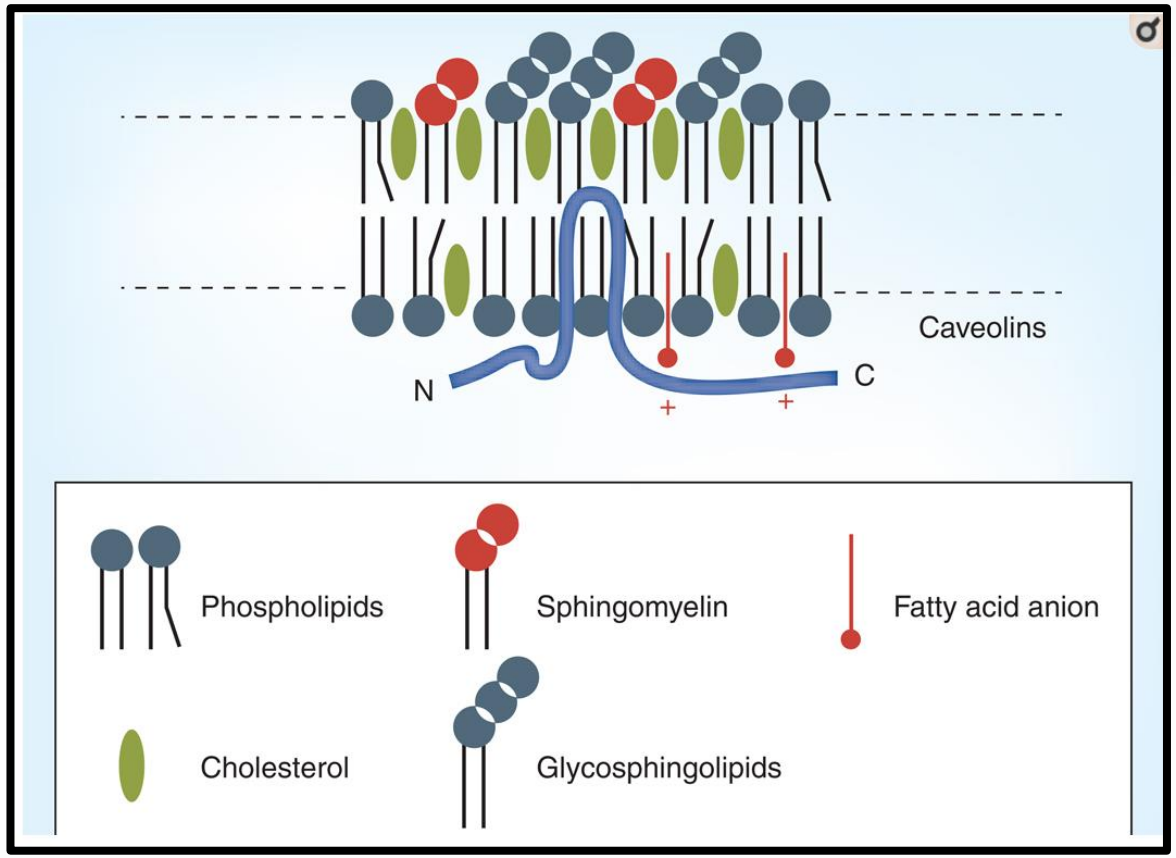
Planar rafts are defined as being continuous with the plane of the plasma membrane (not invaginated) and by their lack of distinguishing morphological features.

Planar rafts contain flotillin proteins and are found in neurons where caveolae are absent

Textbook of Cell and Molecular Biology by P. K. Gupta



Clin Lipidol. 2011; 6(1): 49–58.



The positive charges on the C-termini of caveolins stabilize fatty acid anions and allow their high concentration on the inner membrane leaflet of caveolae.

Clin Lipidol. 2011; 6(1): 49–58.

1. Caveolae, are flask shaped invaginations of the plasma membrane that contain caveolin proteins

2. Caveolae are a special type of lipid raft are small (50-100 nm) invaginations of the plasma membrane in many vertebrate cell types, especially in endothelial cells, adipocytes and embryonic notochord cells.

3. They were originally discovered by E. Yamada in 1955 (Yamada, 1955)

4. Caveolae are the most readily-observed structures in lipid rafts

5. Caveolins are widely expressed in the brain, micro-vessels of the nervous system, endothelial cells, astrocytes, oligodendrocytes, Schwann cells, dorsal root ganglia and hippocampal neurons.

(Nat Cell Biol 20046(3):238–43)

6. Caveolae are required for the protection of cells from mechanical stress in multiple tissue skeletal muscles, endothelial cells and notochord cells

7. Caveolae can be used for entry to the cell by some pathogens and so they avoid degradation in lysosomes. However, some bacteria do not use typical caveolae but only caveolin-rich areas of the plasma membrane

8. Caveolae are also involved in regulation of channels and in calcium signaling

9. Caveolins associate with some signaling molecules (e.g. eNOS)

Annu Rev Cell Dev Biol. 1998;14:111–36.

10. Caveolae also participate in lipid regulation

11. Caveolae can also serve as mechanosensors in various cell types.

12. In endothelial cells, caveolae are involved in flow sensation

13. Chronic exposure to the flow stimulus leads to increased levels of caveolin Cav1 in plasma membrane, its phosphorylation, activation of eNOS signaling enzyme and to remodeling of blood vessels.

Nat Rev Mol Cell Biol. 2000;1(1):31–9

Function of lipid raft

1. Lipid rafts are involved in many signal transduction processes, such as
2. Immunoglobulin E signaling,
3. T cell antigen receptor signaling,
4. B cell antigen receptor signaling,
5. EGF receptor signaling,
6. insulin receptor signaling

Annu Rev Cell Dev Biol. 1998;14:111–36.

J Cell Biol. 1993;122(4):789–807

Thanks