

Anti-Aging Actives in Nano-Cosmeceuticals: The Theory of Bio-Structural Aging

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“Anti-aging actives” are active ingredients formulated into intra-dermal and trans-dermal nano-delivery vehicles. Actives can reverse appearances of age-related skin blemishes and are more than mere sales hype. Anti-aging actives can reach underlying skin areas where they can be most useful. Novel actives are key to anti-aging nano-cosmeceuticals.

Bio-Structures, Aging, and Nanotechnology

- **What is the Bio-Structural Aging Model?**
- **What is the Nanotechnology Basis of Bio-Structural Aging Model?**
- **How Can Nanotechnology Help in Identifying and Intervening in Nano-Structural Age-Related Changes?**

Can Aging be Defined?

- It's easy for people to recognize age; people still try to make it hard.
- It's hard for scientists to measure age; scientists still try to make it easy.

Major Theories of Aging

The immune system decline theory

The neuroendocrine system decline theory

The somatic cell mutation theory

The genetic program theory

The error accumulation theory

The selected physiological states theory

The generation and scavenging of free radicals theory

The cross-linking of molecules theory

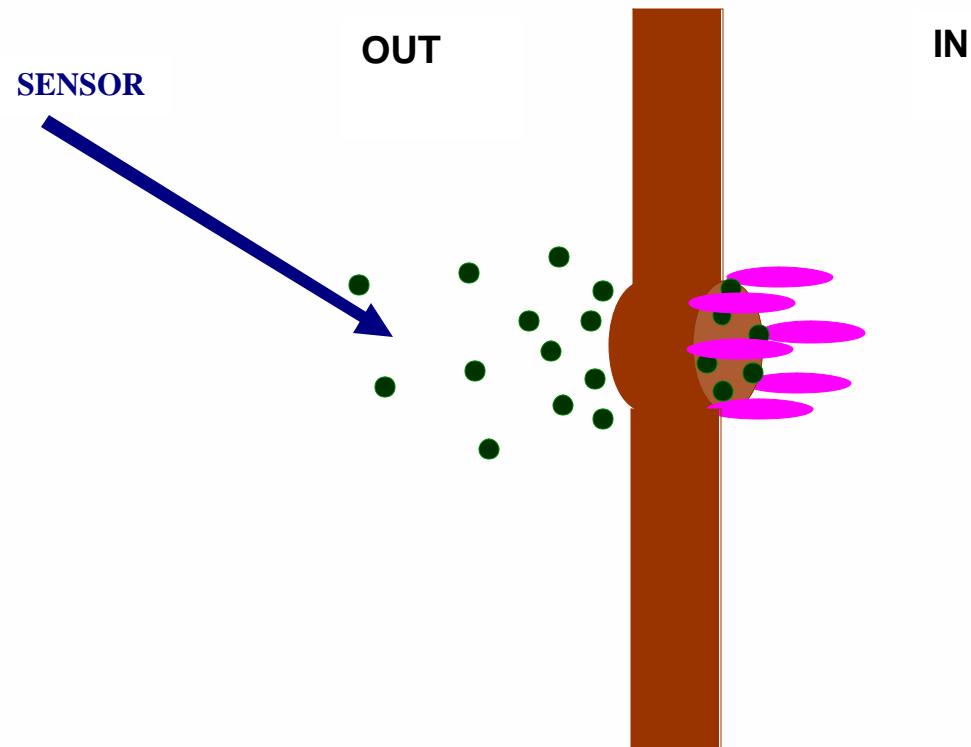
The increased entropy theory

The lipofuscin accumulation theory

The cell loss theory

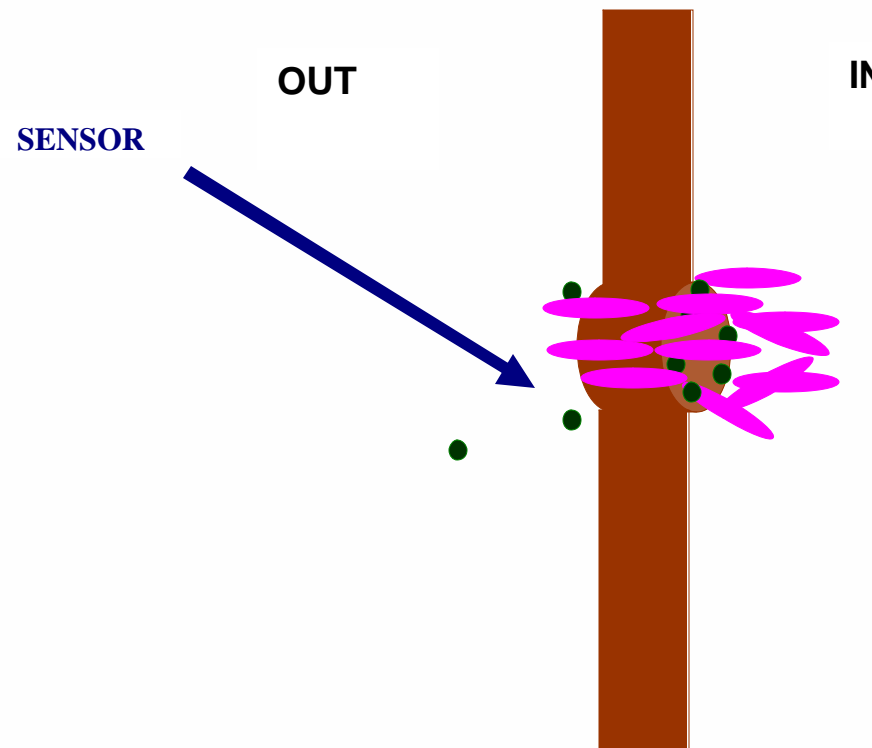
The Nano-Structural Loss Theory of Aging: Chemical vs Physical Signals

Bio-Systems Understand Chemistry but not Physics



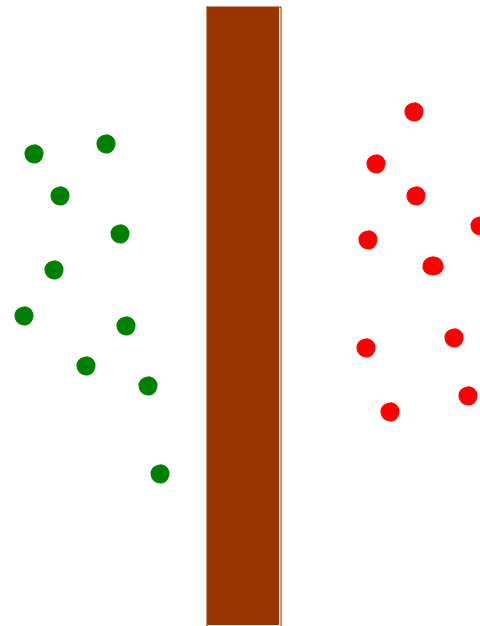
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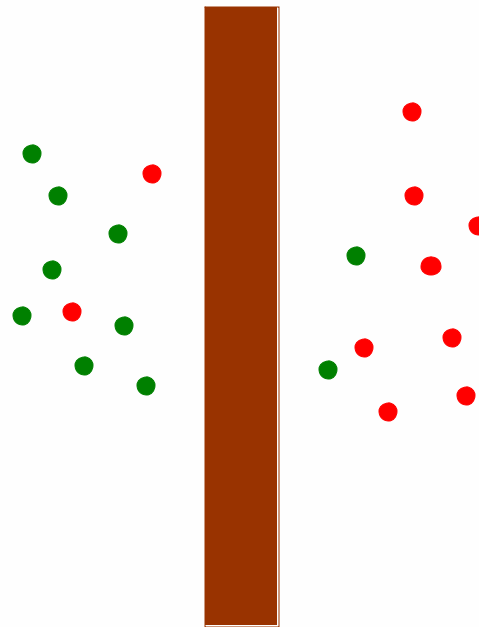
The Nano-Structural Loss Theory of Aging: What is Compartmentalization?

Loss of Compartmentalization



The Nano-Structural Loss Theory of Aging: What Is Semi-Permeability?

Loss of Selective Permeability (Semi-Permeability Loss)



The Nano-Structural Loss Theory of Aging: What Is Cumulative Damage?

Loss of Effectiveness of Repair Mechanisms

Biosystems have repair mechanisms which can repair damage by internal or external factors.

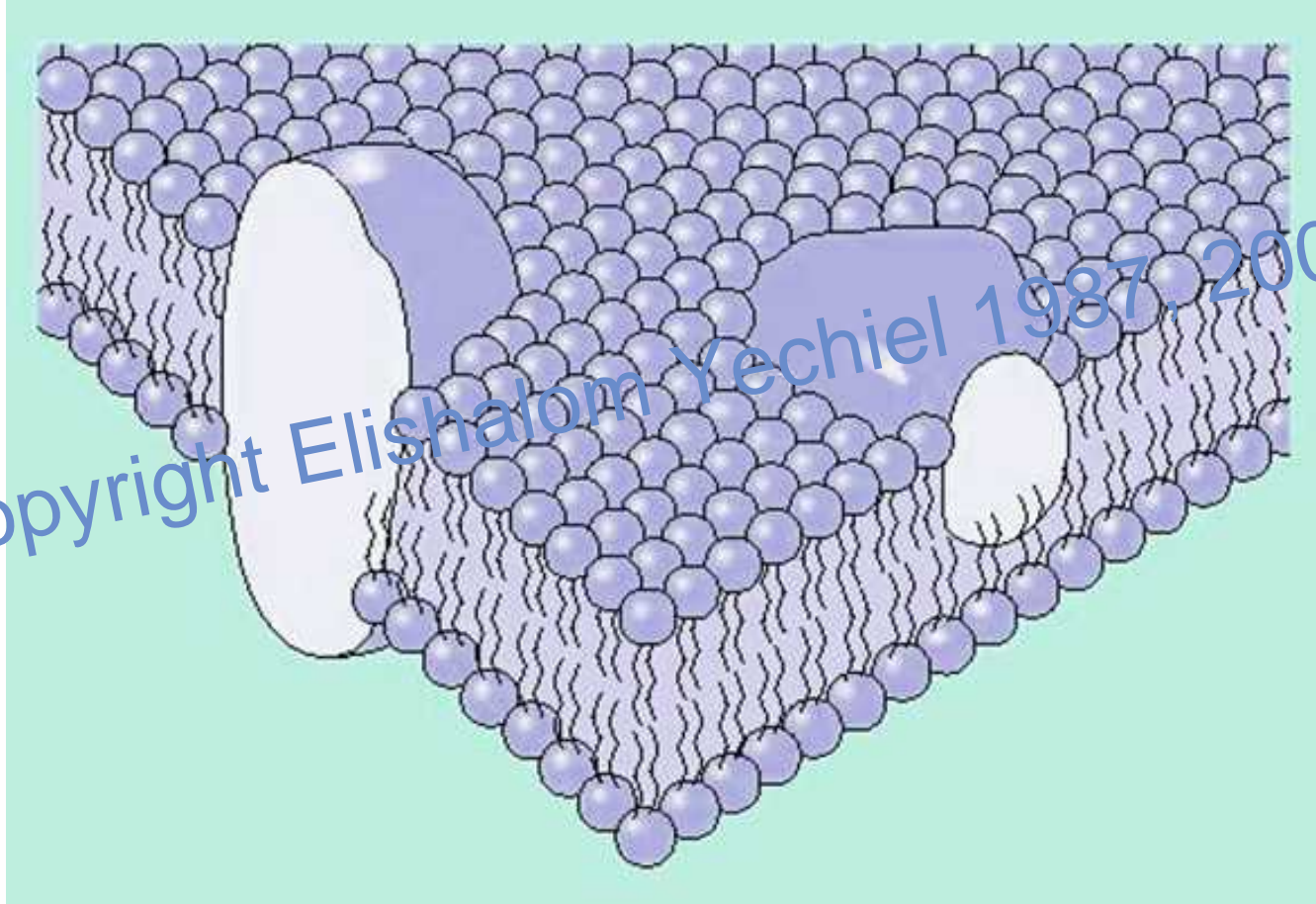
Repair mechanisms are also affected by damaging factors and their repair efficiency is reduced with time.



The Nano-Structural Loss Theory of Aging: Identifying Aging-Sensitive Nano-Structures in Cell Membranes

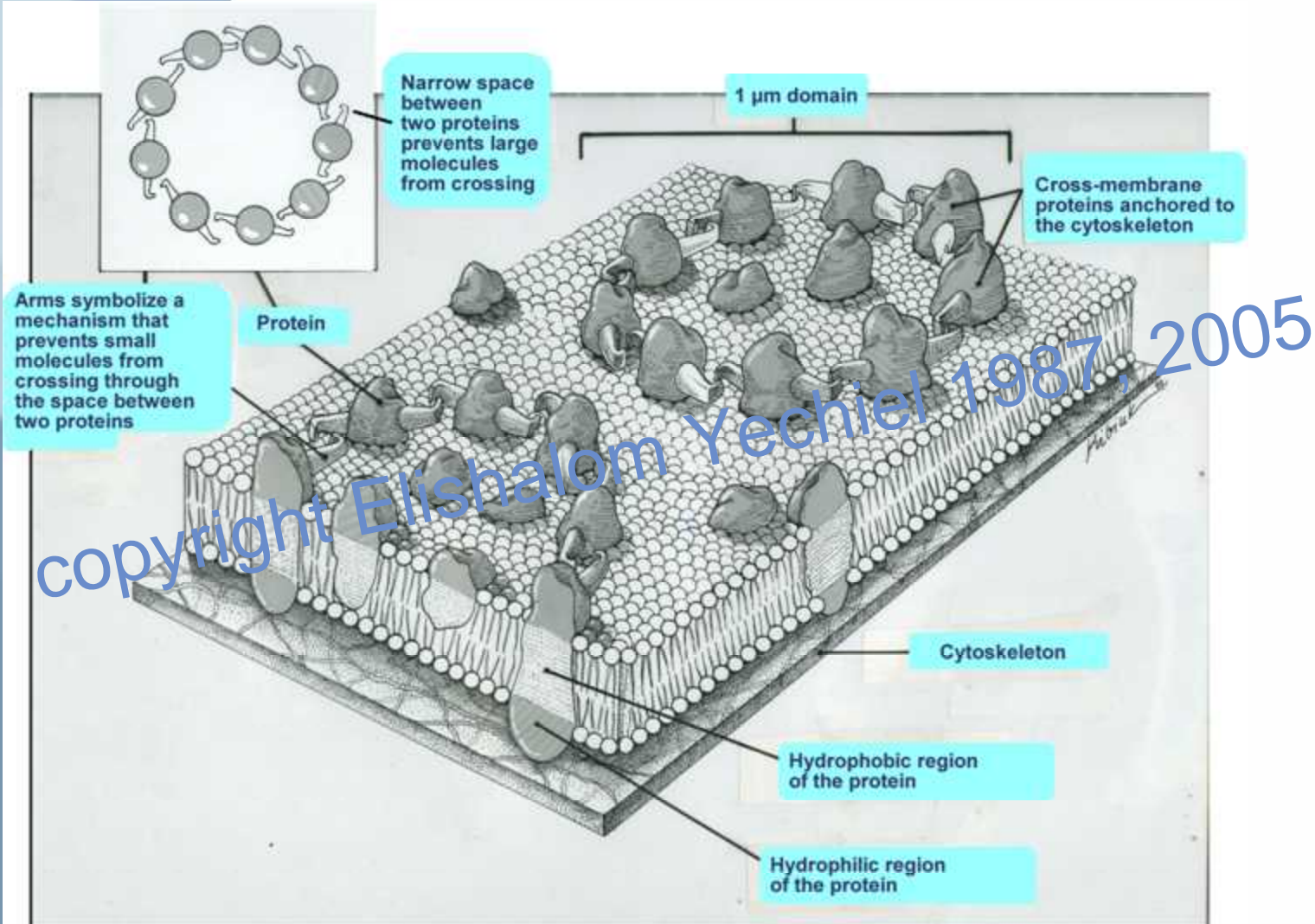
**Nano-structures in bio-membranes and their aging
related loss of organization**

The Fluid Mosaic Model (Singer & Nicholson): A Passive View of Cell Membrane Structure

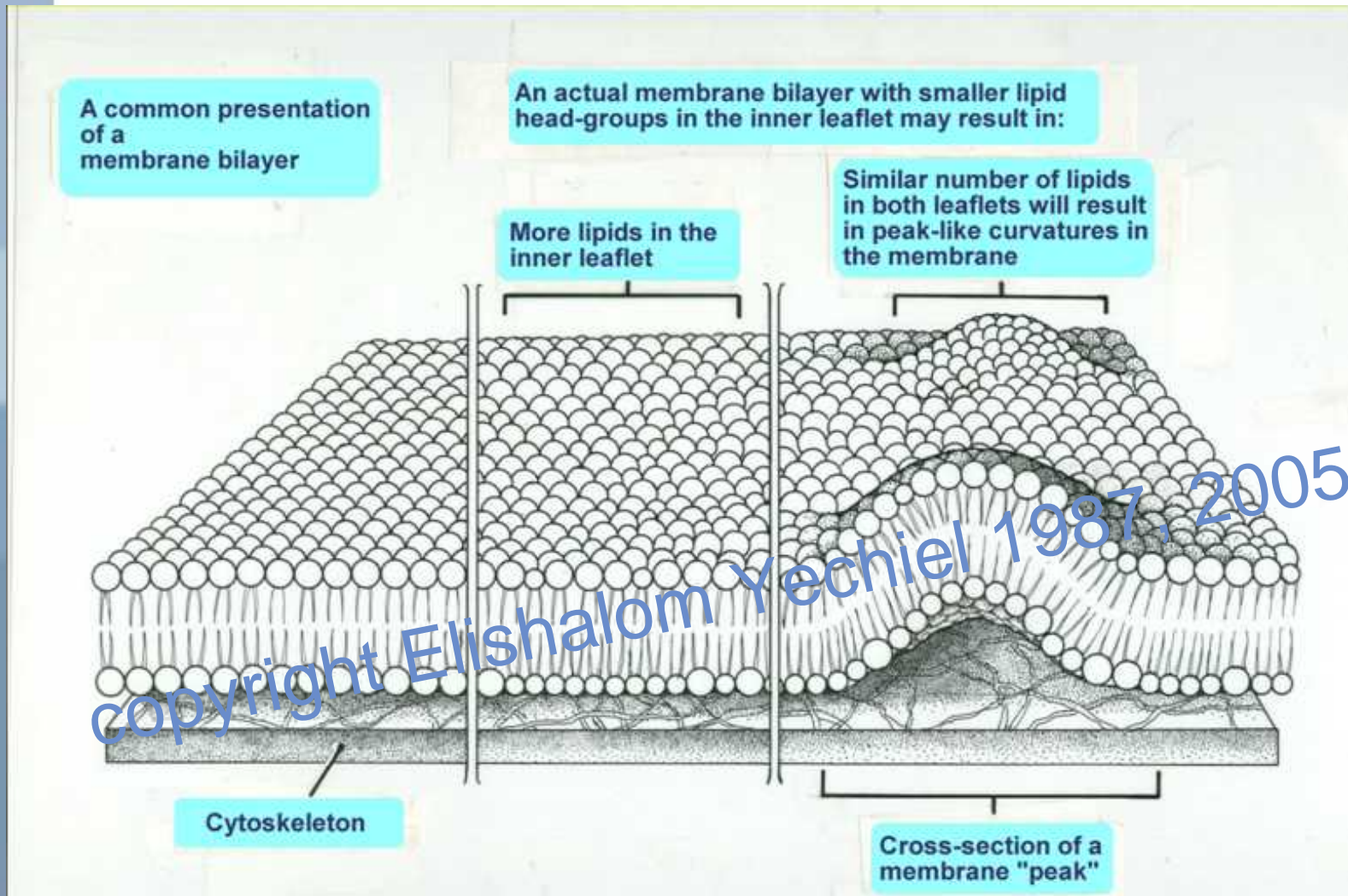


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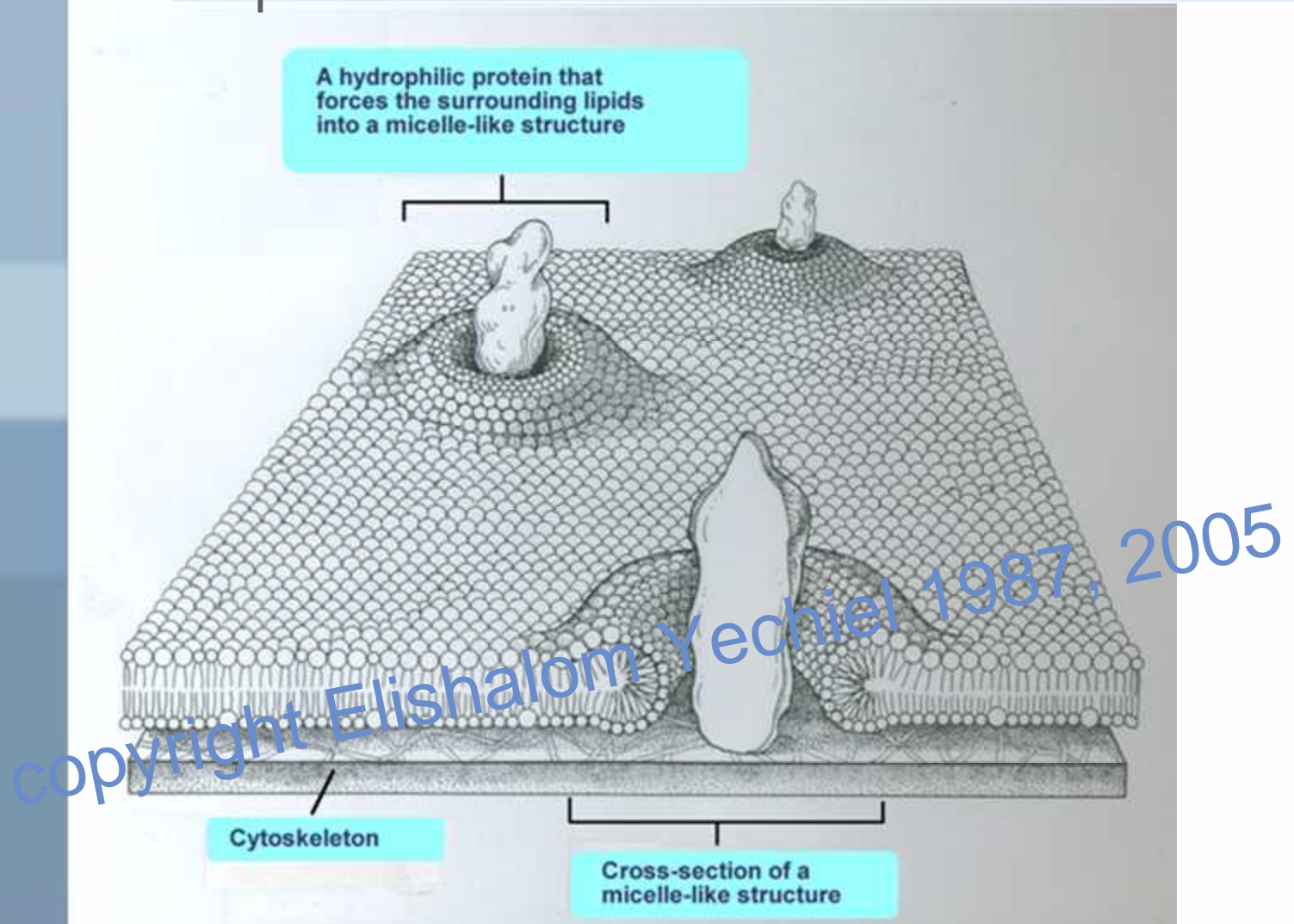
The Membrane Nano-Domain Model: Lateral Domains in Cell Membranes



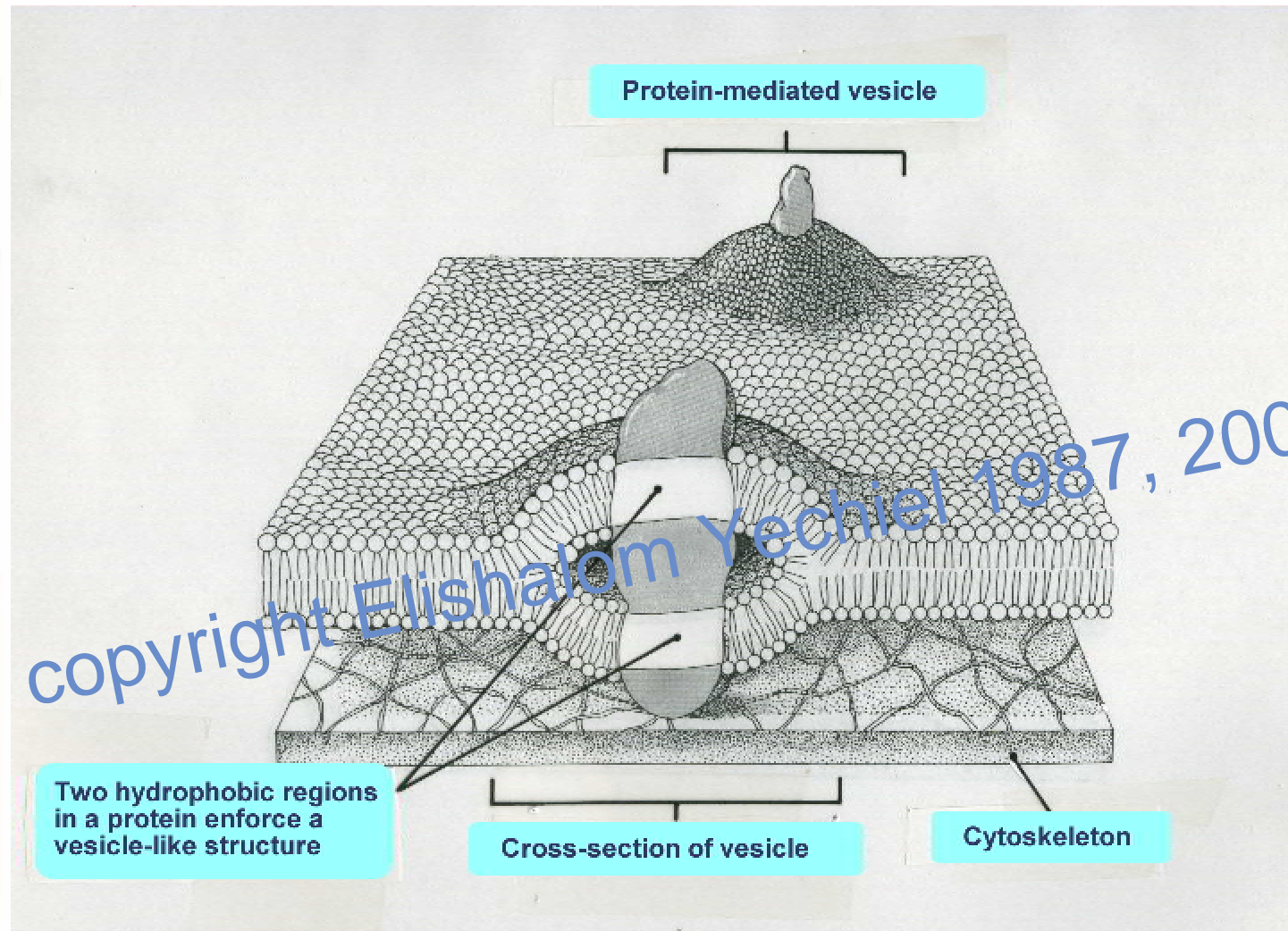
The Membrane Domain Model: Challenging the Passive Fluid Mosaic Model



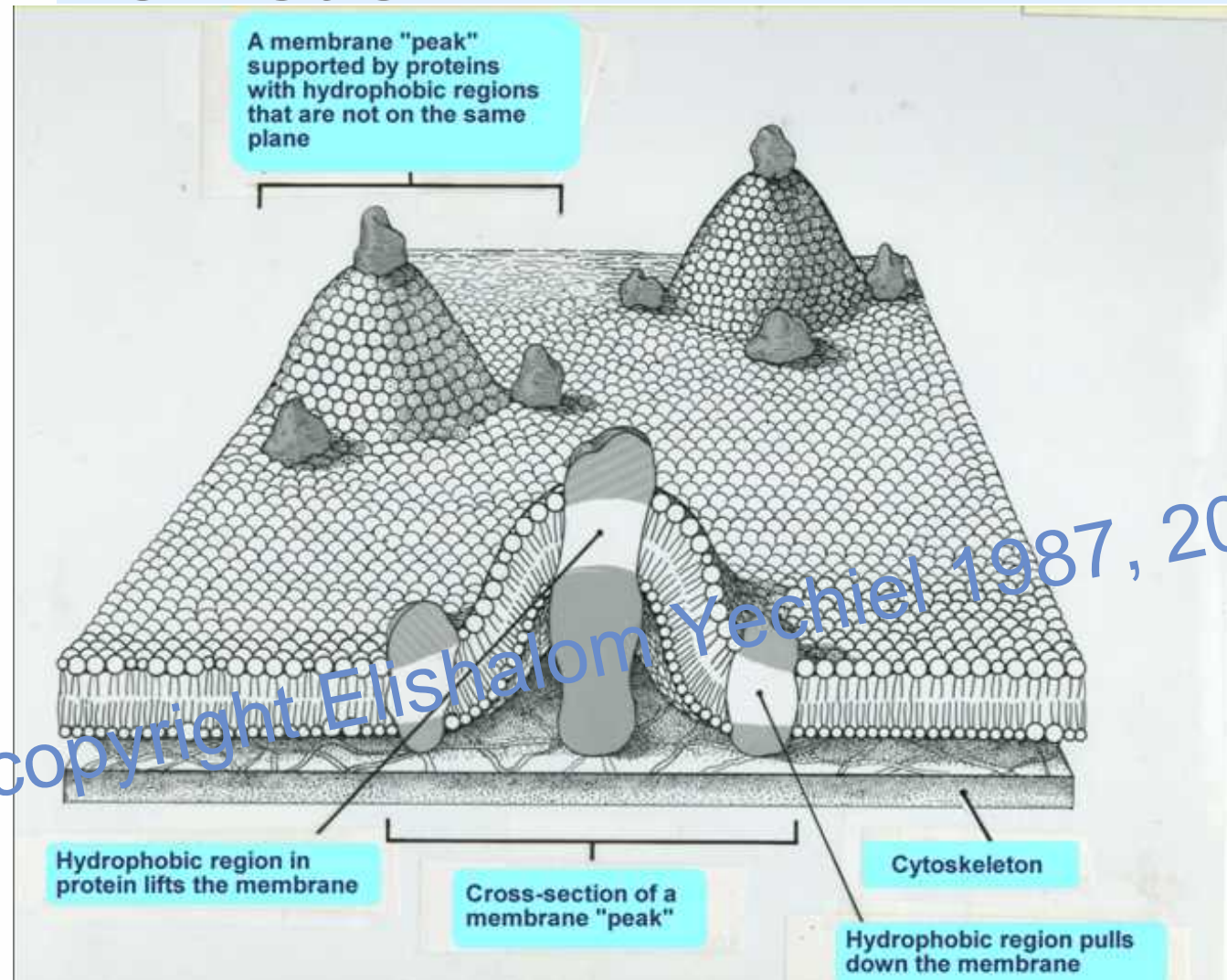
The Membrane Domain Model: Protein Role in Trans-Lateral Lipid Movement



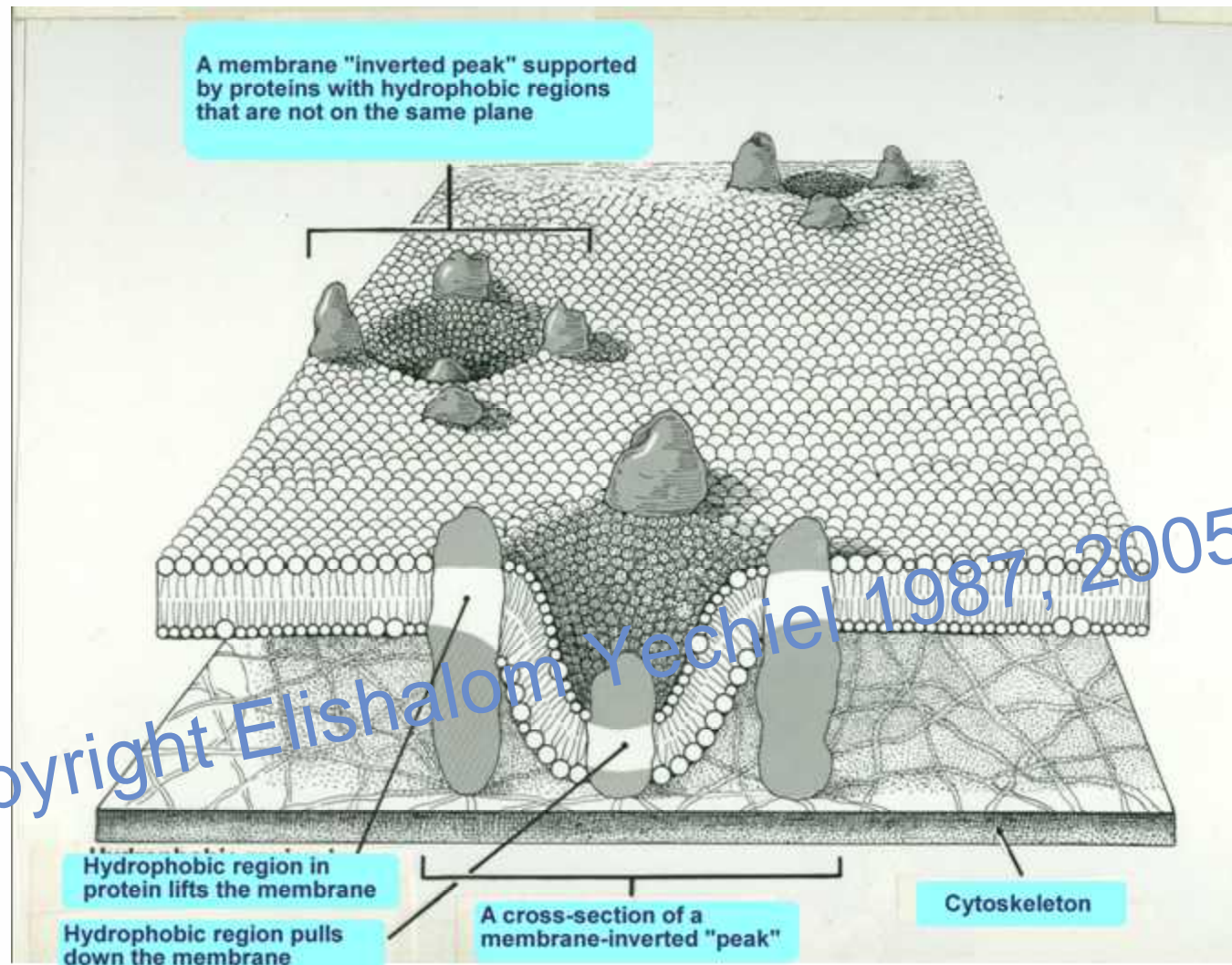
The Membrane Domain Model: Protein Role in Membrane Vesiculation



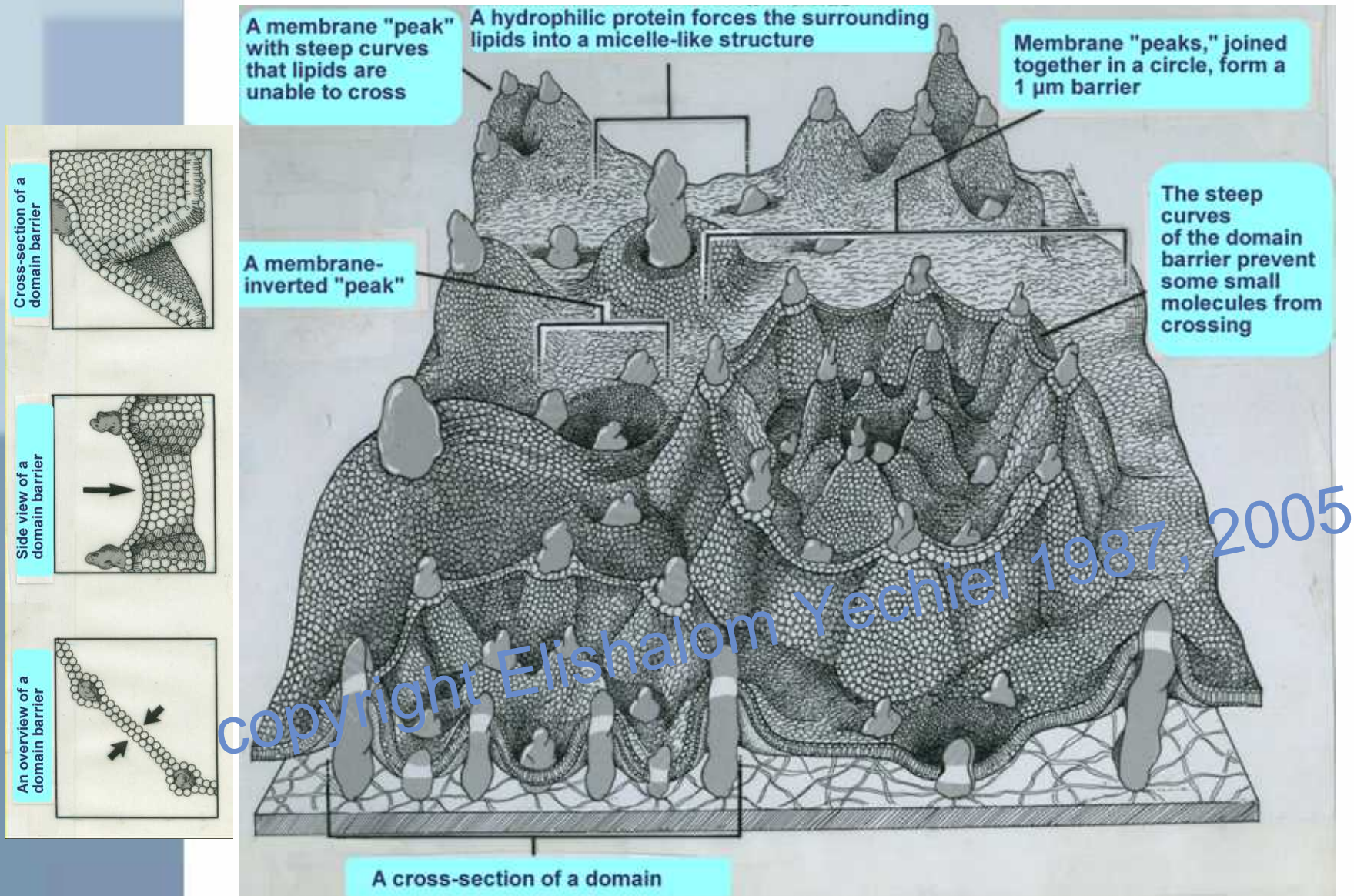
The Membrane Domain Model: Protein Role in Nano-Domain Formation



The Membrane Domain Model: Protein Role in Nano-Domain Formation



The 3D Membrane Nano-Domain Model

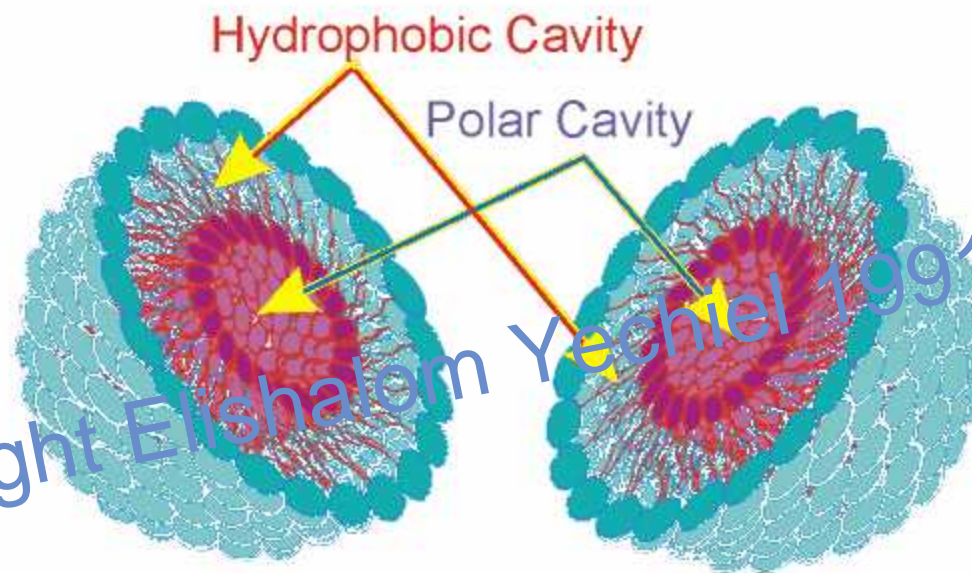


What Understanding Aging Means: How Nano-Technology Enables Interference in Bio-Structural Aging

- Topical Intervention In Aging
- Rapid Absorption of Actives
- Deep Absorption of Actives
- Modulation of Odor and Color of Actives
- Targeting Cellular and Sub-Cellular Action Sites
- Increasing Efficacy and Shelf Life of Actives
- Enabling Synergistic Cooperation of Actives

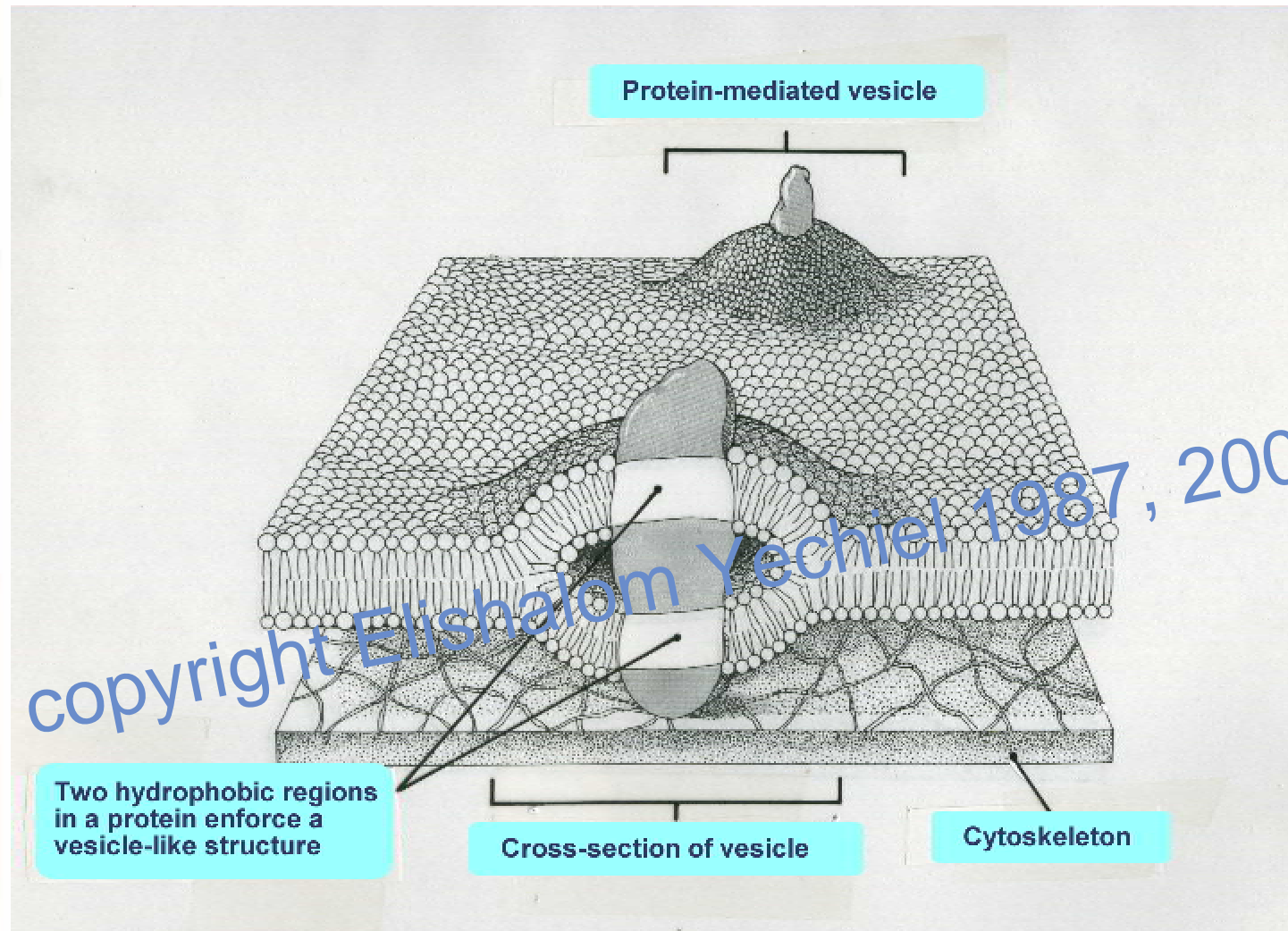
What Understanding Aging Means: How Nanosomes Carry Actives

Liposomes can encapsulate and transport water-soluble ingredients in their polar cavity and oil-soluble ingredients in their hydrophobic cavity.

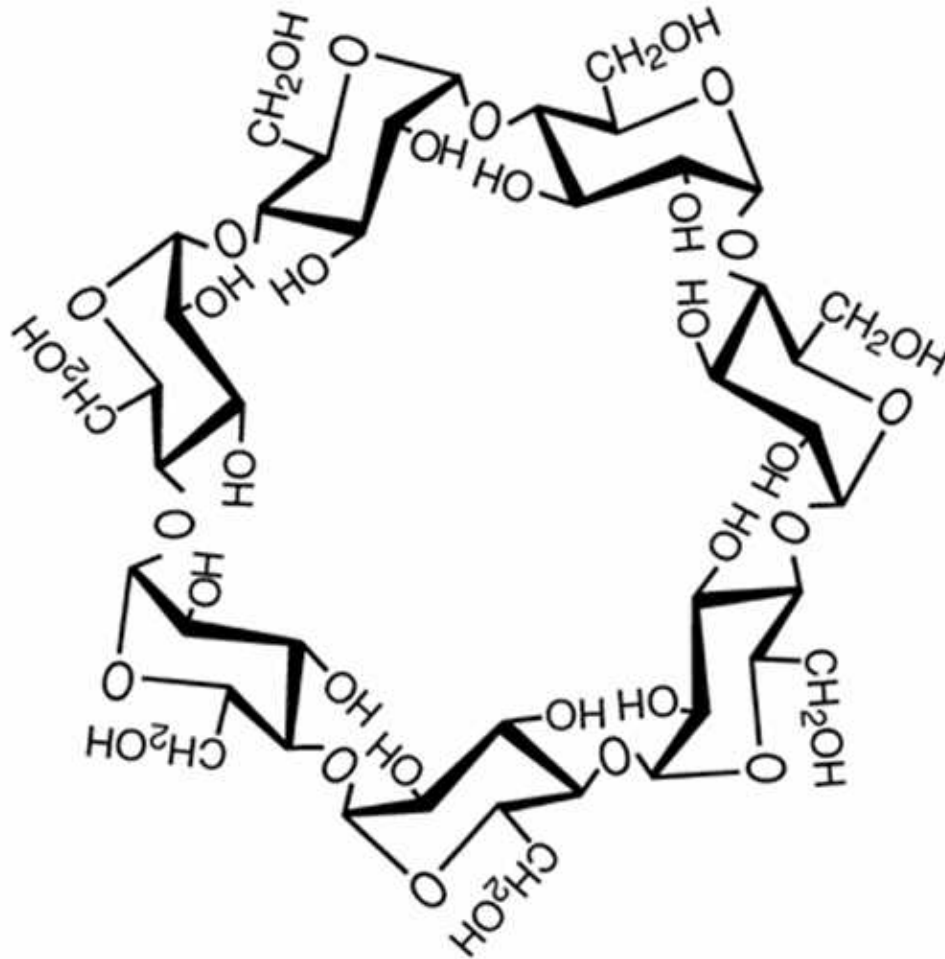


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The Membrane Domain Model: Protein Role in Membrane Vesiculation



What Understanding Aging Means: Nano-Encapsulation in Cyclodextrin



HBA Product Development Master Class:
New Developments in Nanotechnology

Bio-Structures, Aging, and Nanotechnology

- **What is the Bio-Structural Aging Model?**
- **What is the Nanotechnology basis of Bio-Structural Aging Model?**
- **How can Nanotechnology help in identifying and intervening in nano-structural age-related changes?**

Some Answers

- **The Bio-Structural Aging Model identifies sub-cellular nano-structures and their age-related changes.**
- **Extrapolated Visible-Light Imaging Technology can help identify structures which are smaller than the illuminating wavelength resolution.**
- **Our Nanosomes™, Nano-Encapsulation, and Nano-Emulsion Technologies can be used to target sub-cellular structures via topical application.**

We Have Developed

- Nano-Encapsulated (low odor and color) Vitamin A
- Nano-Encapsulated Vitamin E
- Nano-Encapsulated (low odor and color) Alpha Lipoic Acid
- Nano-Encapsulated (non-staining) Lutein
- Liposomal and Nanosomal Encapsulation of Various Actives

FOR MORE INFORMATION

- This model of Bio-Structures, Aging, and Nanotechnology will be discussed in detail in the online *Journal of Topical Formulations* October 2005
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 - 210.493.5225