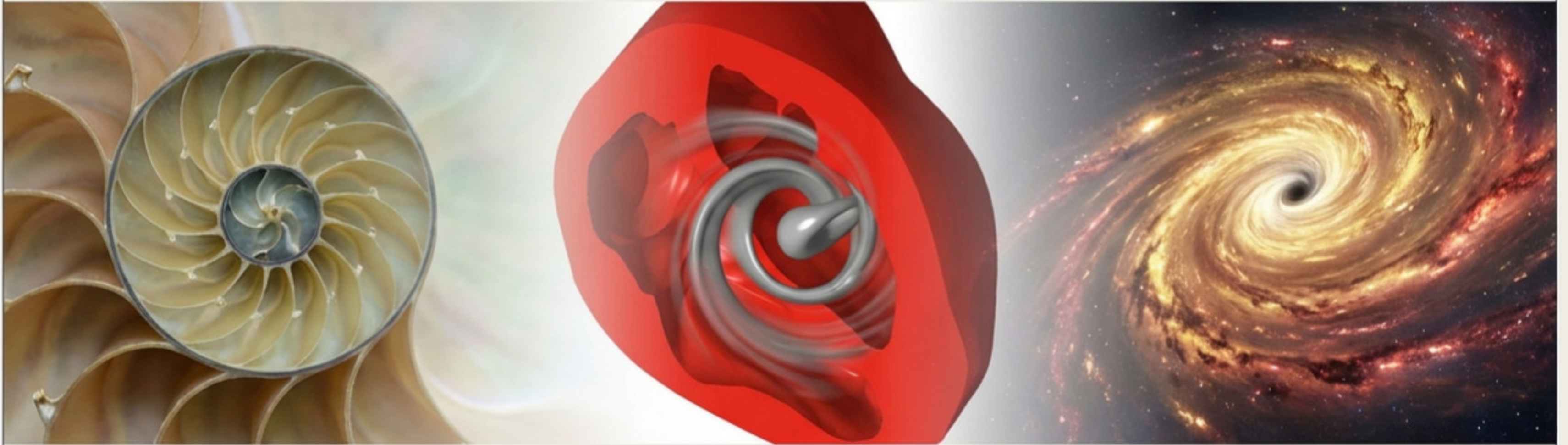


The Universal Vortex: From Heartbeats to Black Holes

Exploring the Geometry of Life, Health, and the Cosmos



Nature repeats itself. From the unpacking of a fern to the collision of galaxies, the universe favours specific patterns of flow

and geometry.
This presentation explores how the mathematical 'code' of the spiral governs

of the spiral governs efficiency in plants, diagnosis in human heart failure, and the physics of spacetime itself.

Nature's Favourite Shape is the Spiral



The Pattern

Whether observing the cloud bands of a cyclone, the arms of a distant galaxy, or the romanesco cauliflower, the spiral form appears incessantly. It is not random; it is an indicator of optimised flow and growth.

The Scale

This geometry transcends scale. We see it in the tiny curves of a snail shell and the massive architecture of the cosmos. As we will discover, this same geometry resides within the human chest, driving the circulation of blood.

The Algorithm of Survival: Fibonacci and Phi

The Code

The patterns we observe are governed by a simple numerical sequence popularised by Leonardo of Pisa (Fibonacci).

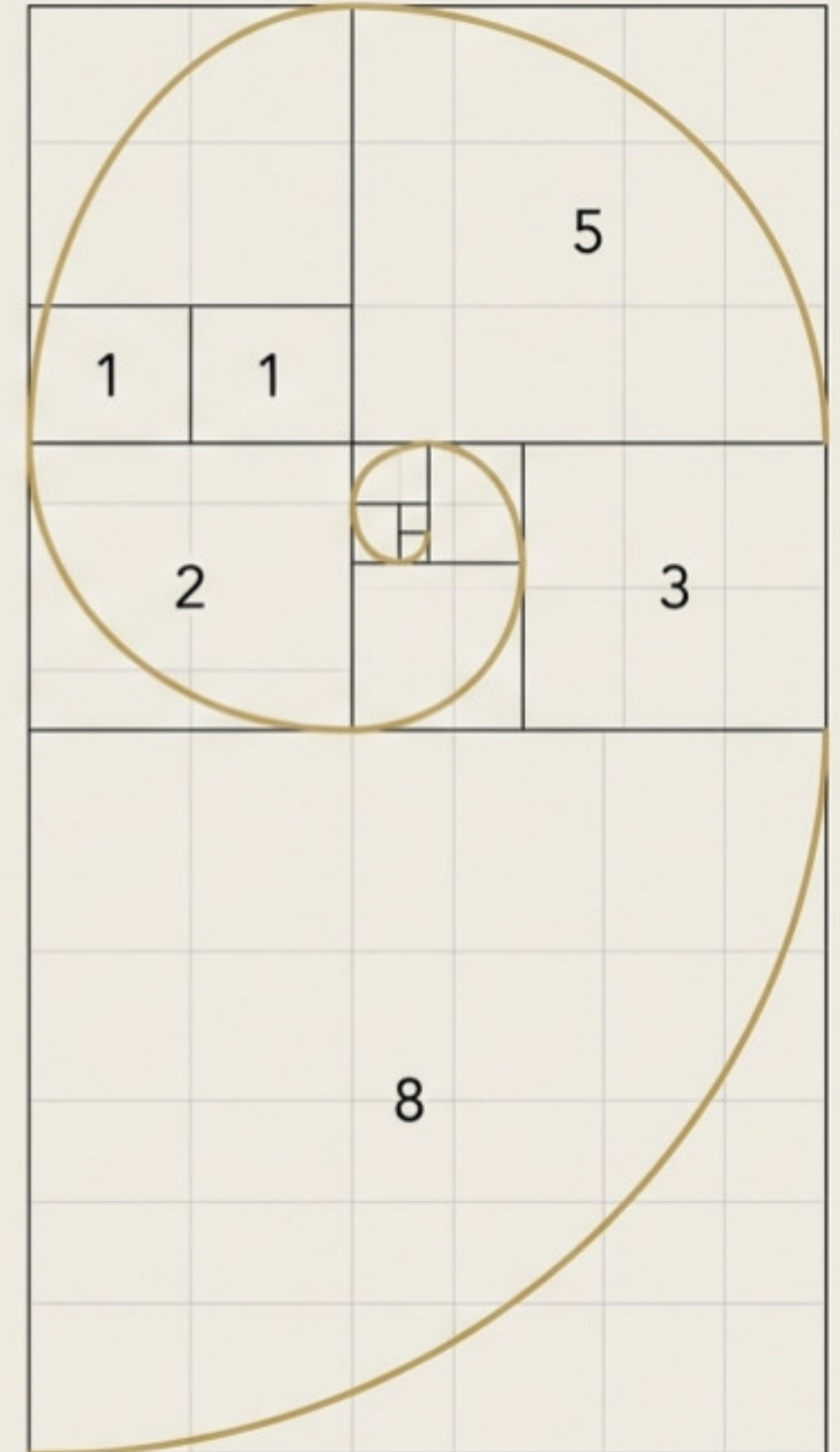
0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89...

Rule: Each number is the sum of the two preceding it.

The Golden Ratio (ϕ)

Dividing two consecutive numbers (e.g., 55/34) approximates **1.618**. This is Phi.

This number is self-referential: The ratio of the short segment to the long segment equals the ratio of the long segment to the whole. Nature utilises this not just for beauty, but for survival.



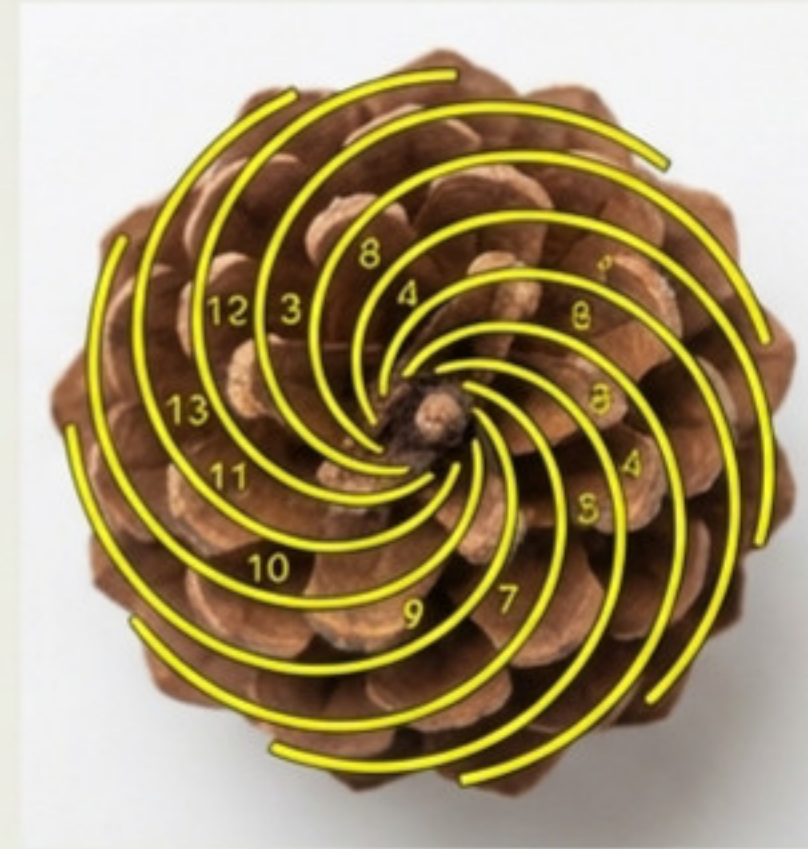
Botanical Efficiency and the Golden Angle

The Golden Angle

(137.5°): Plants grow according to this angle to ensure no new leaf or seed completely covers the previous one.



8 Spirals (Counter-clockwise)



13 Spirals (Clockwise)

Maximised Capture:

- **Sunflowers:** Spirals often appear in Fibonacci pairs (21/34).
- **Pinecones:** Consistent pairs like 8/13.
- **Phyllotaxis:** Leaf arrangement avoids self-shading, maximising photosynthesis.

The Heart is a Vortex Generator, Not Just a Pump

Vortex Dynamics

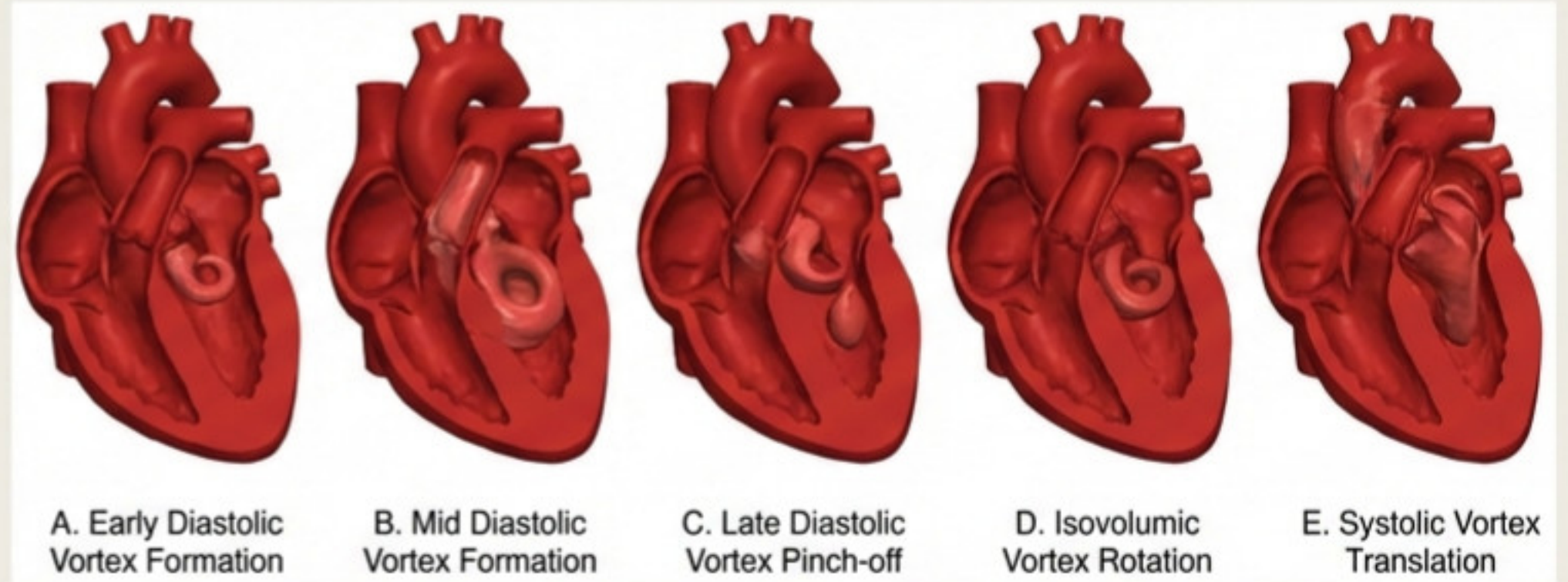
The Left Ventricle (LV) does not merely squeeze blood; it swirls it. During diastolic filling, blood enters the LV and rolls up into a doughnut-shaped vortex ring.

Energy Conservation

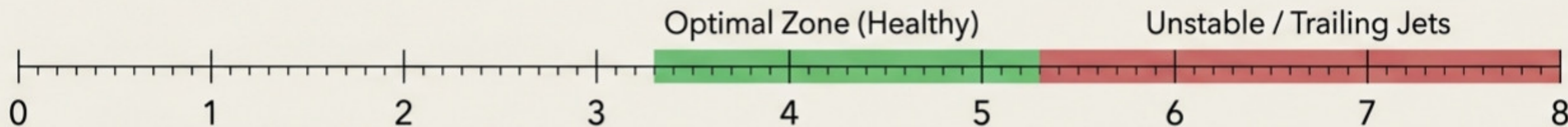
This rotary motion stores the kinetic energy of the incoming blood. Instead of colliding with the walls (dissipation), the blood rotates, ready to be ejected into the aorta.

The Shape of Health

A healthy vortex is **asymmetric** and non-planar. This asymmetry is crucial for smooth redirection of flow towards the outlet.



The Goldilocks Zone: Vortex Formation Number (VFN)



$$VFN = \frac{U \times T}{D}$$

U = Velocity, T = Filling Time, D = Mitral Diameter

Nature's Standard

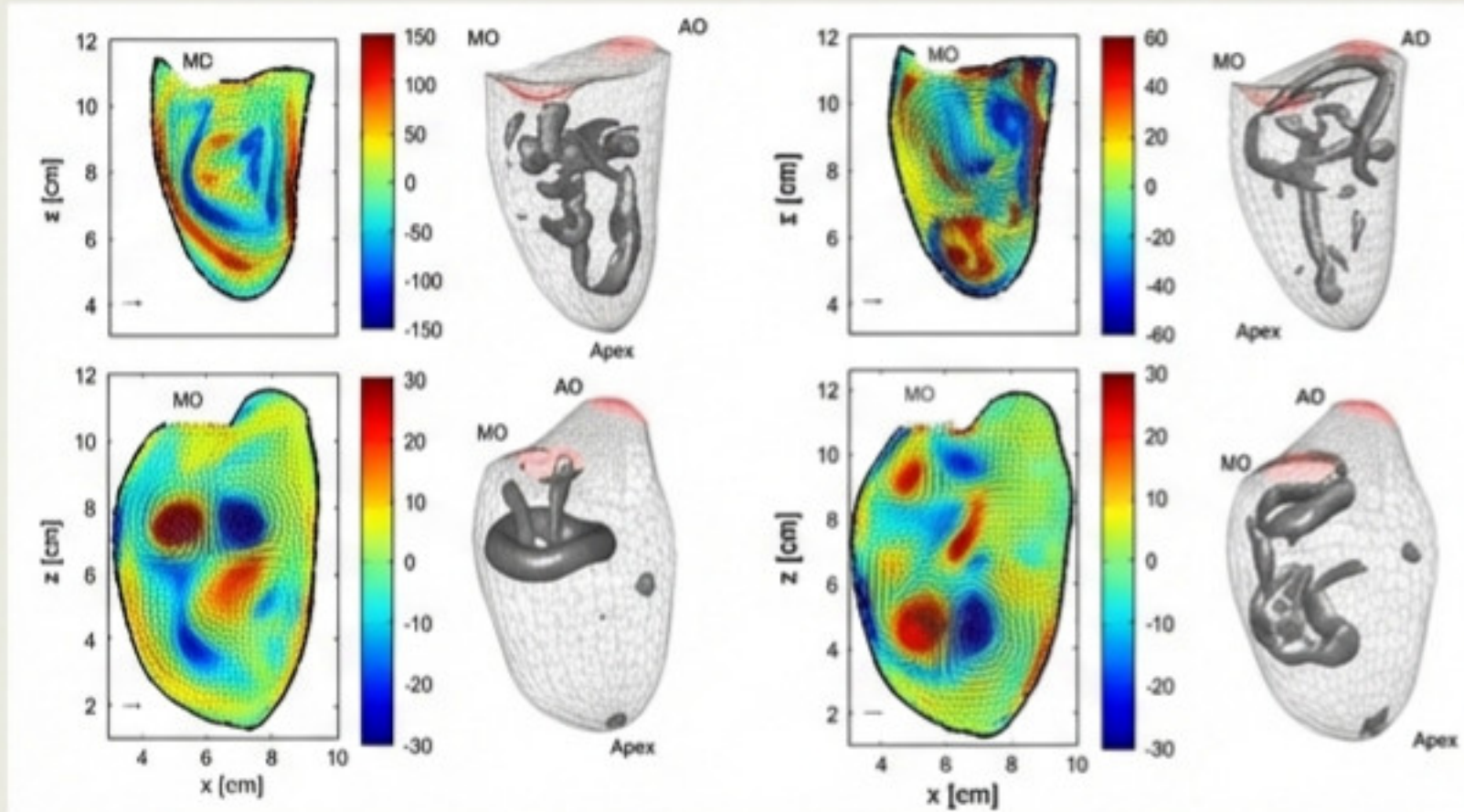
Remarkably, all biological propulsion systems in nature (from jellyfish to cardiac flow) operate within this range.

Consequence

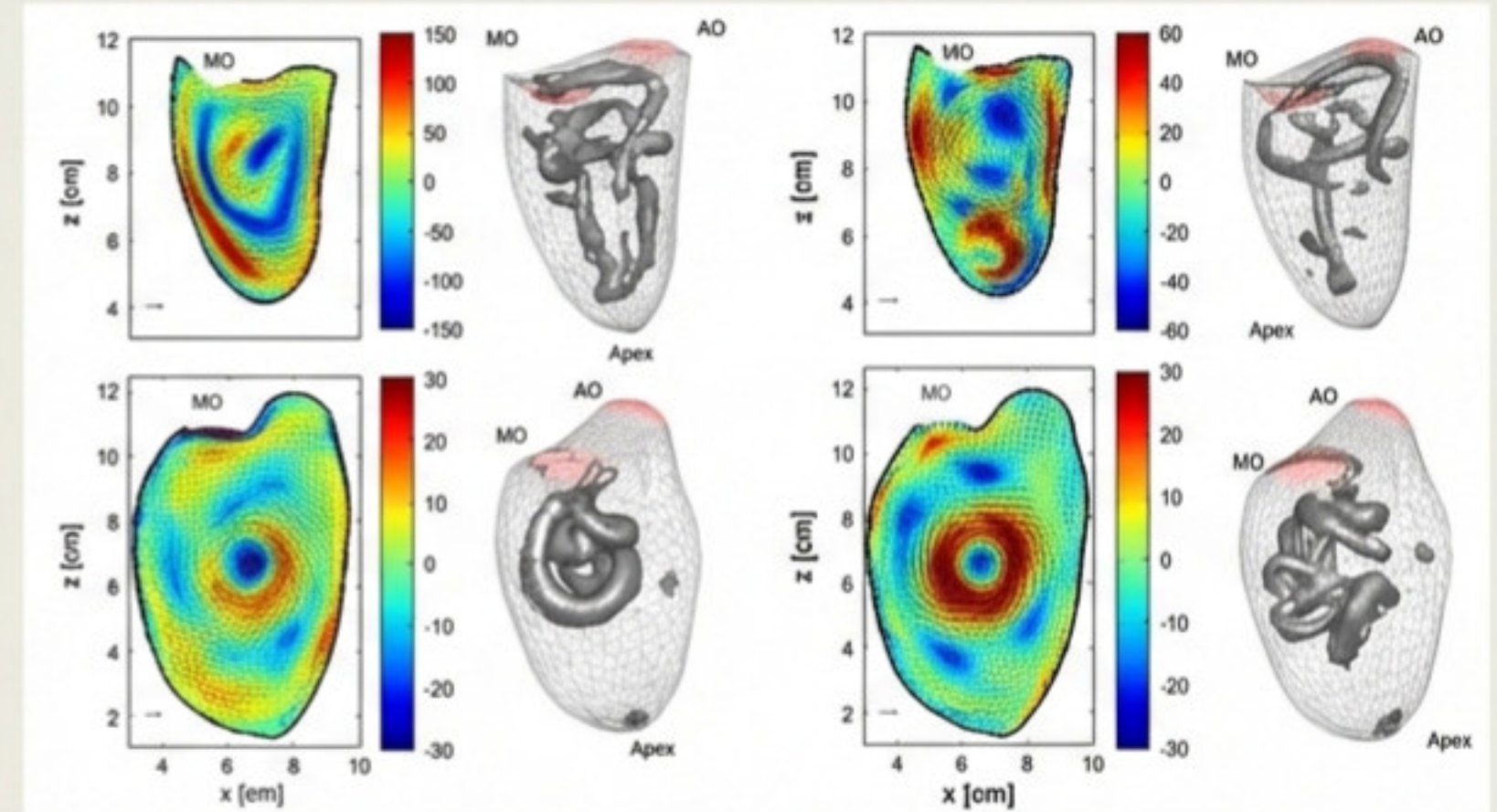
When $VFN > 5.5$, the vortex becomes unstable, leading to inefficient transport and energy loss.

When Geometry Fails: Dilated Cardiomyopathy (DCM)

Healthy Heart



DCM (Dilated Heart)



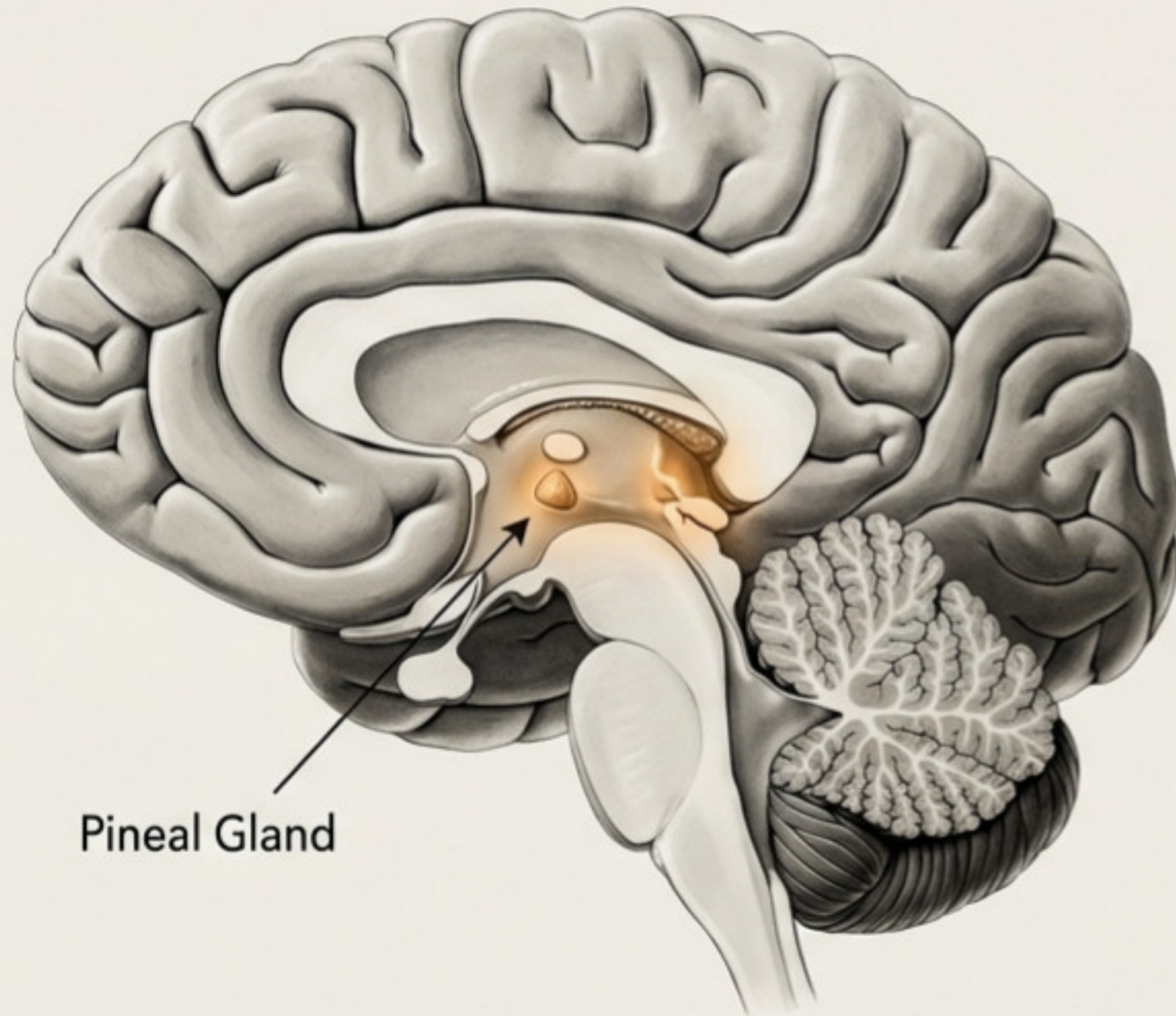
The Pathology: In DCM, the LV becomes enlarged with weaker walls.

Flow Impact: The vortex shifts from a healthy asymmetric wash to a compact, symmetrical circle restricted to the centre.

The Danger: Stagnation at the apex leads to thrombus (clot) formation.

Early Warning: Vortex patterns often degrade *before* the heart's shape changes.

The Geometric Centre of Rhythm: The Pineal Gland



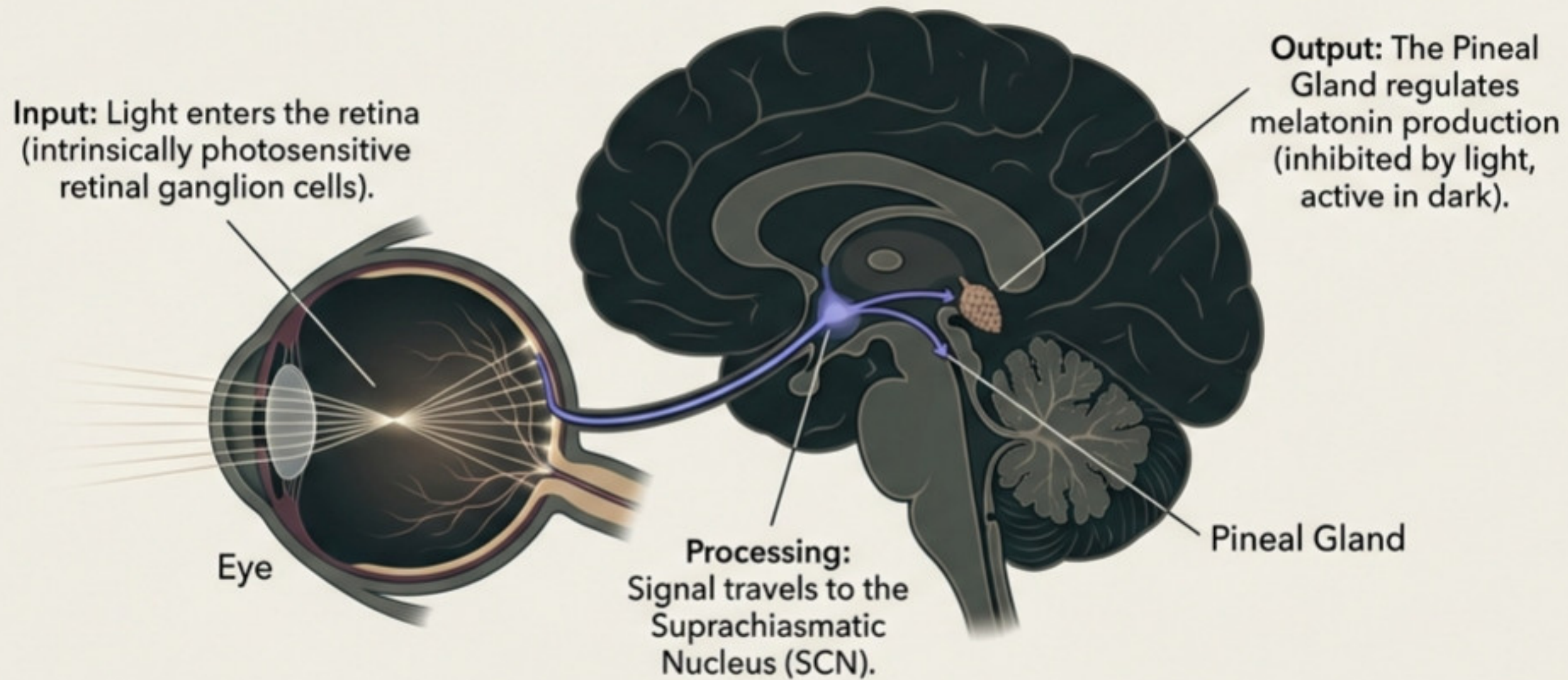
Pineal Gland

Anatomy: Deep in the centre of the brain lies the pineal gland, shaped like a pine cone (a Fibonacci form).

Historical Context: René Descartes described it as the 'seat of the soul,' the meeting place of the physical and spiritual worlds. In ancient traditions, it corresponds to the Ajna Chakra or 'Third Eye'.

Function: It acts as the body's chronometer, secreting **melatonin** to control circadian rhythms. It coordinates the rhythmic orchestra of molecular and physiological activity.

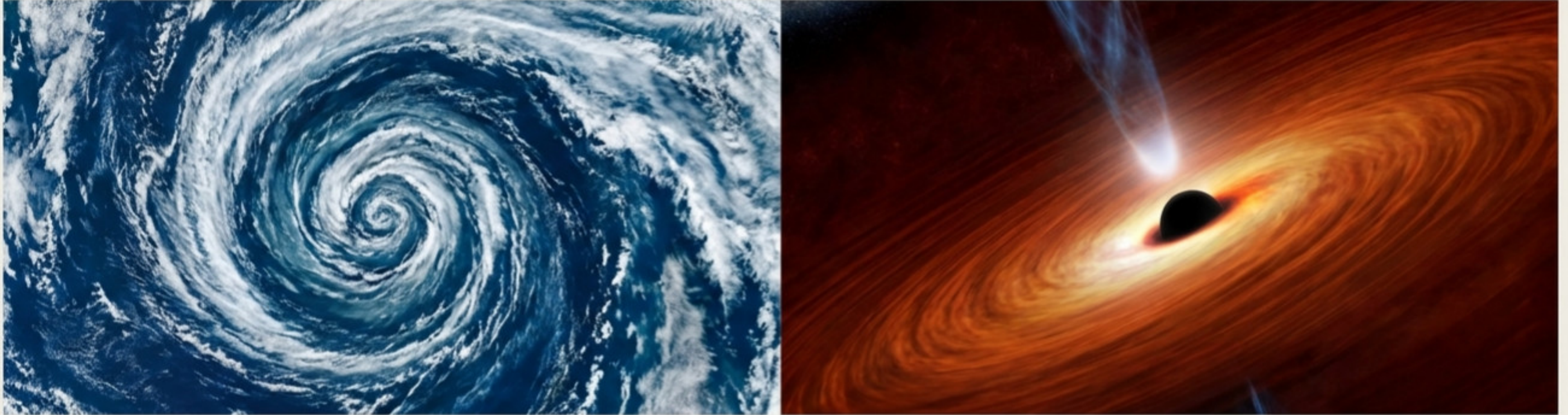
Light, Rhythm, and Chronodisruption



Chronodisruption:

Fighting natural cycles causes 'jet lag' of the physiology. This dissonance is linked to accelerated aging and disease. Health is synchronisation.

The Black Holes of the Ocean



The Discovery

The Discovery: George Haller (ETH Zürich) discovered that ocean whirlpools are mathematically analogous to black holes.

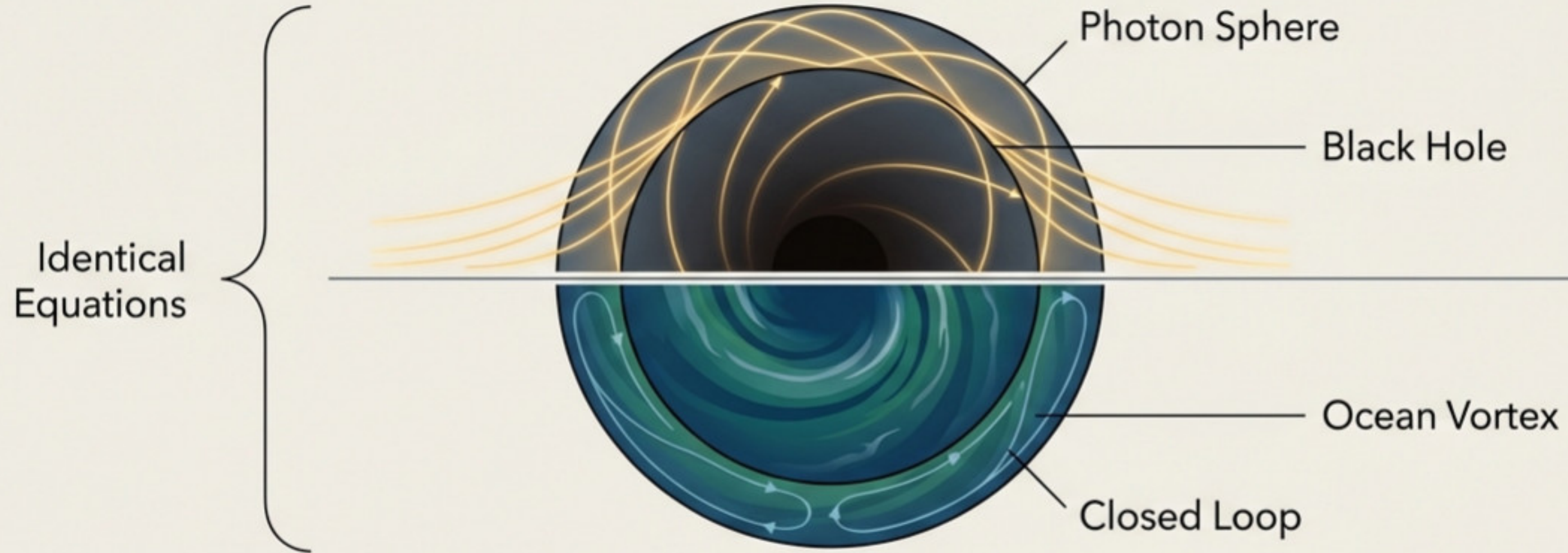
Coherent Boundaries

Coherent Boundaries: Just as a black hole has a sphere from which light cannot escape, ocean vortices have 'coherent boundaries'—invisible barriers that trap water.

The Function

The Function: These vortices act as sealed vessels, transporting warm water and pollution across oceans without leakage.

The Mathematics of Containment



Mathematical Unity:

The equations governing these vast scales are identical.

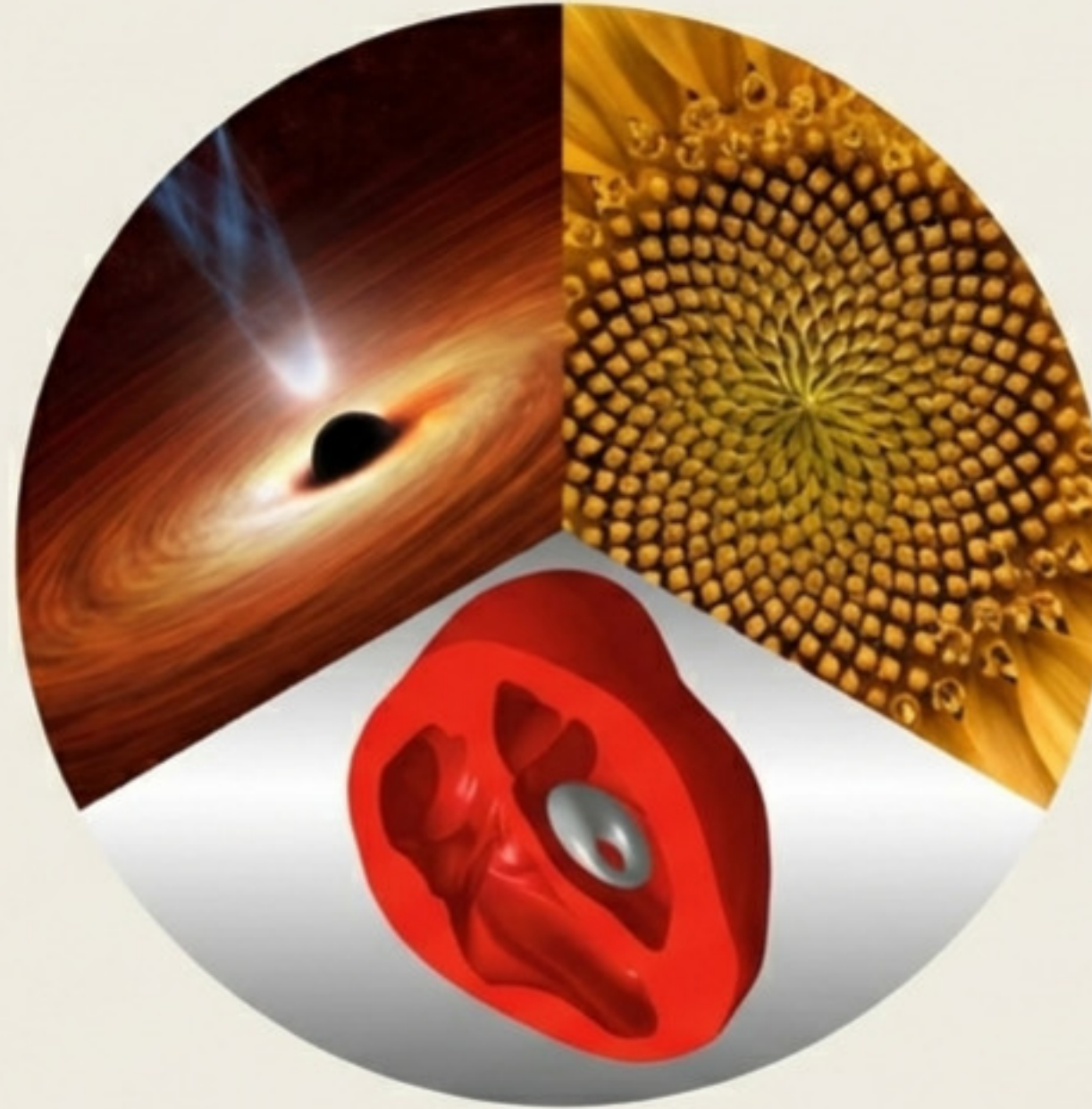
Applied Relativity:

Mathematical equations derived from General Relativity to describe black holes are now being used to track ocean pollution.

Quote: "Literally the same type of equation." – George Haller.

One Pattern, Infinite Scales

The Void:
The cosmos uses
coherent boundaries to
trap and transport matter.



The Code:
Nature utilises the Golden
Ratio to pack seeds and
capture light efficiency.

The Vessel: The heart utilises
asymmetric vortices to
conserve energy (VFN 3.5–5.5).

Nature optimizes for flow, containment, and efficiency using the same geometric rules.

We Are Not Separate from the Universe



We are built from its code. The same geometry that organizes a galaxy governs the beat of our hearts and the rhythm of our sleep. Understanding these universal patterns provides the keys to diagnosing heart failure, tracking pollution, and understanding our own consciousness.

Sources & Further Reading

- **Cardiovascular Dynamics:** Nagargoje, M. S., et al. (2025). *A review on vortex dynamics in the healthy and dilated left ventricles*. Flow.
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- **Neuroscience:** Kumar, R., et al. (2018). *Pineal Gland—A Spiritual Third Eye*. Indian Journal of Neurosurgery.
- **Video Reference:** Crevoisier Philippe. *Fibonacci, Golden Ratio & Spirals in Nature*.