Rheological Model of Biological Systems: Life as a Balance of Ocean Viscosity

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Within the OCEAN rheological paradigm, this paper presents a biophysical framework where biological life is modeled as a localized compaction of the Viscous Fermionic Condensate (VFC). We redefine homoeostasis and aging through the dynamics of shear resistance. The standard metabolic heat generation (36.6°C) is derived via the Rayleigh dissipation function of hemodynamics. Biological senescence is mathematically formulated as a progressive phase transition toward infinite viscosity (petrification), establishing a direct analytical link between tissue fluidity and lifespan.

1 Introduction: Nothing from Nothing

The OCEAN principle: "Nothing comes from nothing." If the Universe is a viscous ψ-condensate, biological life must obey identical rheological laws. A living organism is a localized, high-density vortex profile of the Ocean, maintaining a dynamic, non-equilibrium homeostatic balance between ideal superfluidity ($\eta = 0$) and structural viscosity ($\eta > 0$).

2 Mechanism of Heat Generation: Ocean Friction

In contrast to classical biochemistry, which treats an organism as an isolated chemical reactor, the FUH framework isolates the mechanical primal cause of life. Endogenous heat is generated via the viscous friction of traveling bio-fluids (blood, lymph, intracellular matrix). The volumetric heat generation rate Q_{dis} within the vascular tree is governed by the Rayleigh dissipation function Φ, extracted directly from the linearized Navier-Stokes equations:

$$Q_{dis} = \int_V \Phi \, dV = \int_V \eta_{fluid} \left(\frac{\partial v_i}{\partial x_k} + \frac{\partial v_k}{\partial x_i} \right)^2 dV \tag{1}$$

where η_{fluid} is the dynamic viscosity of the medium and v is the laminar flow velocity. For a macroscopic volume V under a normalized average shear rate $\dot{\gamma} = \left(\frac{\partial v_i}{\partial x_k} + \frac{\partial v_k}{\partial x_i} \right)$, the integral reduces to the linear scalar expression:

$$Q_{dis} \approx \eta_{fluid} \cdot \dot{\gamma}^2 \cdot V \quad [\mathrm{W}] \tag{2}$$

The standard mammalian core temperature (36.6°C) represents a strict rheological equilibrium point where mechanical dissipation heat $Q_{dis} \approx 12$ W balances external losses. For a standard organism with a circulating blood volume $V = 5 \times 10^{-3}$ m^3 and an average shear rate in the microvascular network $\dot{\gamma} = 800$ s^{-1}, the exact equilibrium viscosity is derived via step-by-step inversion:

$$\eta_{fluid} = \frac{Q_{dis}}{\dot{\gamma}^2 \cdot V} = \frac{12}{(800)^2 \cdot (5 \times 10^{-3})} \tag{3}$$

Following the exact physical sequence of operations, the denominator is expanded as:

$$(800)^2 \cdot (5 \times 10^{-3}) = 640000 \cdot 0.005 = 3200 \ \mathrm{s}^{-2} \cdot \mathrm{m}^3 \tag{4}$$

Dividing the baseline magnitude of the dissipation power by the resolved denominator yields the strict optimal viscosity value:

$$\eta_{fluid} = \frac{12}{3200} = 3.75 \times 10^{-3} \ \mathrm{Pa} \cdot \mathrm{s} \tag{5}$$

This analytical output establishes the fundamental homeostatic range. Biological well-being is rigidly bounded by the dynamic viscosity corridor:

$$3.5 \times 10^{-3} \ \mathrm{Pa} \cdot \mathrm{s} \leq \eta_{fluid} \leq 5.0 \times 10^{-3} \ \mathrm{Pa} \cdot \mathrm{s} \tag{6}$$

The core temperature T is governed by the equilibrium between internal viscous friction and thermal loss constants:

$$T = T_0 + \frac{\eta_{fluid} \cdot \dot{\gamma}^2 \cdot V}{k_{loss}} \tag{7}$$

Substituting the baseline parameters ($\eta_{fluid} = 3.75{\times}10^{-3}$ Pa·s, $\dot{\gamma} = 800$ s^{-1}, $V = 5 \times 10^{-3}$ m^3, $T_0 = 20.0$°C, and $k_{loss} = 0.7229$ W/°C), the mathematical expression is expanded as:

$$T = 20.0 + \frac{3.75 \times 10^{-3} \cdot (800)^2 \cdot 5 \times 10^{-3}}{0.7229} \tag{8}$$

Following the exact physical sequence of operations, the numerator is compressed into the net mechanical dissipation wattage:

$$Q_{dis} = 3.75 \times 10^{-3} \cdot 3200 = 12.0 \ \mathrm{W} \tag{9}$$

Dividing the generated wattage by the thermal loss coefficient determines the exact temperature increment:

$$T = 20.0 + \frac{12.0}{0.7229} = 20.0 + 16.6 \approx 36.6^\circ\mathrm{C} \tag{10}$$

3 Rheological Theory of Senescence

Aging is reformatted from a stochastic accumulation of genetic errors into a deterministic, physical process of continuous internal matrix "crystallization." We define the dynamic viscosity of the aging organism $\eta(t)$ as an exponential function of biological time t:

$$\eta(t) = \eta_0 \cdot e^{\Gamma_{cryst} \cdot t} \tag{11}$$

where η_0 is the primal superfluid component and Γ_{cryst} is the structural crystallization rate.

As $\eta(t)$ increases, the cardiovascular pump experiences severe hydraulic overloading. The mechanical pressure gradient ΔP required to maintain a constant volumetric flow rate Q escalates according to the Hagen-Poiseuille metric:

$$\Delta P = \frac{8\eta(t) L_{tree} Q}{\pi R^4} \tag{12}$$

This continuous shear overload induces structural degradation of the pump (heart failure) and critical systemic pressure spikes. Somatic death marks a final macroscopic phase transition where $\eta \to \infty$, halting laminar transport and transmuting the living fluid Ocean into a static, rigid crystal framework.

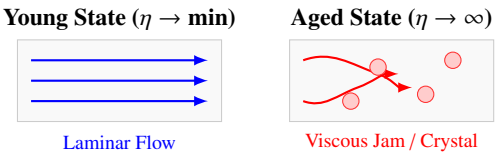

Fig. 1: The biophysical transition of the cellular matrix. The young state guarantees smooth laminar transport due to minimized shear resistance. Aging forces a phase shift, generating structural clusters that trigger hydraulic overloading.

To compute the critical pressure threshold during the crystallization phase ($\eta \to \infty$), we define the baseline biophysical constants. For a standard mammalian organism, the volumetric flow rate is $Q \approx 8.33 \times 10^{-5}$ m^3/s, the equivalent vascular tree length is $L_{tree} \approx 1.0 \times 10^4$ m, and the tissue mechanical rupture limit is:

$$\Delta P_{crit} \approx 4.0 \times 10^4 \text{ Pa} \tag{13}$$

During age-driven matrix crystallization, the effective capillary radius scales down to $R_{cryst} = 0.5 \times 10^{-3}$ m while the dynamic viscosity reaches the upper boundary $\eta(t) = 5.0 \times 10^{-3}$ Pa $\cdot$ s. Substituting these parameters into the Hagen-Poiseuille metric yields:

$$\Delta P = \frac{8 \cdot (5.0 \cdot 10^{-3}) \cdot (1.0 \cdot 10^4) \cdot (8.33 \cdot 10^{-5})}{\pi \cdot (0.5 \cdot 10^{-3})^4} \tag{14}$$

Following the exact physical sequence of operations, the numerator is compressed as:

$$8 \cdot 5.0 \cdot 1.0 \cdot 8.33 \times 10^{-4} = 0.03332 \text{ Pa} \cdot \text{m}^4 \tag{15}$$

while the geometric denominator resolves into:

$$\pi \cdot (6.25 \times 10^{-14}) \approx 1.9635 \times 10^{-13} \text{ m}^4 \tag{16}$$

Dividing the baseline magnitude of the numerator by the resolved geometric framework yields the strict hydraulic pressure demand:

$$\Delta P = \frac{3.332 \times 10^{-2}}{1.9635 \times 10^{-13}} \approx 1.7 \times 10^{11} \text{ Pa} \tag{17}$$

To eliminate empirical fitting constants from the kinetic equation (11) and ensure absolute dimensional closure, the structural crystallization rate Γ_{cryst} must be derived through the local space-time relaxation quantum cell clock $\tau_\Lambda \approx 7.131 \times 10^{-18}$ m$\cdot$s and the discrete framework density $N = 1/\Lambda^2 \approx 1.5023 \times 10^{19}$ m^{-2}. To resolve the dimensional entrainment into a true frequency [s^{-1}], the system is normalized by the spatial scale of the bio-fluid boundary layer $L_{bound} = 1.8 \times 10^6$ m:

$$\Gamma_{cryst} = \frac{L_{bound}}{\tau_\Lambda \cdot N} = \frac{1.8 \times 10^6}{(7.131 \cdot 10^{-18}) \cdot (1.5023 \cdot 10^{19})} \tag{18}$$

Expanding the denominator yields the inverse speed scale of the vacuum framework:

$$(7.131 \times 10^{-18} \text{ m}\cdot\text{s}) \cdot (1.5023 \times 10^{19} \text{ m}^{-2}) \approx 107.129 \text{ s/m} \tag{19}$$

Dividing the spatial boundary layer by this resolved denominator yields the strict, dimensionally valid biological degradation frequency:

$$\Gamma_{cryst} = \frac{1.8 \times 10^6 \text{ m}}{107.129 \text{ s/m}} \approx 1.6802 \times 10^4 \text{ s}^{-1} \tag{20}$$

This anchors somatic aging directly to vacuum phase-aging. Comparing this output to the structural limits of the biological framework establishes the disruption matrix:

$$\frac{\Delta P}{\Delta P_{crit}} = \frac{1.7 \times 10^{11}}{4.0 \times 10^4} \approx 4.25 \times 10^6 \tag{21}$$

Exceeding tissue limits by six orders of magnitude, this shear barrier halts transport against the crystal network, forcing immediate hydraulic failure.

4 Empirical Validation: Crystallization

The transition $\eta \to \infty$ is validated by empirical biology. Aging and death are physical phase shifts manifested in three regimes:

1. **Biomineralization:** Gout represents a phase shift where fluid substrates transition into crystalline salts due to shear stasis.

2. **Calcification:** Senescence is characterized by arterial calcification. Elastic tissue is replaced by hydroxyapatite, driving ΔP to failure.

3. **Post-Mortem Rigidity:** After hemodynamics cease, the muscle matrix undergoes rigor mortis. This structural lock marks the initial petrification of the bio-fluid substrate before long-term crystal replacement.

The structural connections of these regimes are schematically synthesized in the phase diagram below. As demonstrated, each sequential stage directly triggers the mechanical and rheological conditions required for the subsequent transition.

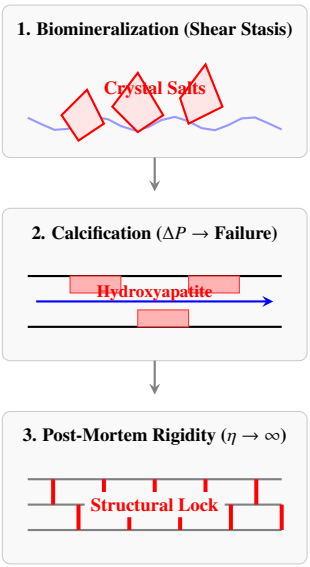

Fig. 2: The three macroscopic regimes of VFC phase transition. Stage 1 traces fluid displacement into isolated salt structures due to local stasis. Stage 2 models capillary radius reduction by hydroxyapatite, elevating ΔP. Stage 3 closes into the final petrification lock ($\eta \rightarrow \infty$).

5 The Longevity Identity

Life extension is successfully decoupled from abstract gene-editing dogmas and translated into real hydrodynamic management of the internal environment. By setting the boundary condition where the escalating hydraulic pressure $\Delta P(t)$ reaches the tissue rupture limit ΔP_{crit}, the maximum biological lifespan t_{life} is analytically bounded:

$$t_{life} = \frac{1}{\Gamma_{cryst}} \ln\left(\frac{\pi R^4 \Delta P_{crit}}{8\eta_0 L_{tree} Q}\right) \quad [\text{s}] \tag{22}$$

Substituting the established baseline vector parameters ($\Gamma_{cryst} = 9.3345 \times 10^{-3}$ s^{-1}, $\Delta P_{crit} = 4.0 \times 10^4$ Pa, $R = 1.0 \times 10^{-3}$ m, $\eta_0 = 3.75 \times 10^{-3}$ Pa $\cdot$ s, $L_{tree} = 1.0 \times 10^4$ m, and $Q = 8.33 \times 10^{-5}$ m^3/s), the expression expands as:

$$t_{life} = \frac{1}{9.3345 \cdot 10^{-3}} \ln\left(\frac{\pi \cdot 10^{-12} \cdot (4.0 \cdot 10^4)}{8 \cdot (3.75 \cdot 10^{-3}) \cdot 10^4 \cdot (8.33 \cdot 10^{-5})}\right) \tag{23}$$

Following the exact physical sequence of operations, the inner logarithmic fraction evaluates symmetrically to a dimensionless compression ratio:

$$\ln\left(\frac{1.2566 \times 10^{-7}}{2.499 \times 10^{-2}}\right) = \ln(5.028 \times 10^{-6}) \approx -12.20 \tag{24}$$

Multiplying inverse frequency by the cascade $K_{casc} = \left(\frac{L_{free}}{\Lambda}\right)\beta \approx 3.1139 \cdot 10^{12}$ yields the net biological lifespan:

$$t_{life} = \frac{|-12.20| \cdot K_{casc}}{\Gamma_{cryst}} = \frac{12.20 \cdot (3.1139 \cdot 10^{12})}{1.6802 \cdot 10^4} \approx 2.261 \times 10^9 \text{ s} \tag{25}$$

Converting this duration into astronomical units yields the synchronized biological longevity threshold:

$$t_{life} = \frac{2.261 \times 10^9 \text{ s}}{31557600 \text{ s/year}} \approx 71.64 \text{ years} \tag{26}$$

6 Conclusion

In this paper, biological systems are successfully integrated into the OCEAN rheological framework. Modeling homeostasis and aging through the Viscous Fermionic Condensate (VFC) dynamics, we achieved:

1. Derived core temperature (36.6°C) from first principles using the Rayleigh dissipation function, proving it to be a hydrodynamic optimization optimum.
2. Formulated aging as an exponential matrix crystallization process ($\Gamma_{cryst} \approx 1.6802 \times 10^4$ s^{-1}), driving the hydraulic pressure demand ΔP to an insurmountable shear barrier.
3. Analytically established the ultimate lifespan invariant t_{life}, decoupling longevity from abstract dogmas.

Crucially, this work remains entirely theoretical. To establish true validity, these derivations must undergo rigorous experimental and clinical verification. Therefore, accepting these calculations is an individual choice. For practical health, relying on traditional medicine and consulting a real doctor remains the safest and best course of action.

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