

# BLEMMYES/EWAIPANOMA HYPOTHETICAL MODEL

## Evolutionary Context and Developmental Constraints

### 1. Evolutionary Context

The proposed phenotype — a stable population with extreme craniofacial displacement, shortened neck stub, and reliance on soft tissue/cartilage protection — must be evaluated against known evolutionary pressures on primate and hominin craniofacial and brain morphology. Primate evolution has been shaped by strong selection on brain size, thermoregulation, facial structure, and developmental robustness.

#### **1.1 Brain Size and Thermoregulation Trade-offs**

Across primates, brain size is constrained by metabolic cost and heat dissipation capacity. Humans represent an extreme in encephalization, made possible by unique adaptations including hairlessness, high sweat gland density, and vascular mechanisms for brain cooling. Great apes, despite large body size, have relatively smaller brains partly due to thermoregulatory limits. The model's soft superior neck stub and vascular ears represent a hypothetical alternative cooling strategy that avoids heavy bony enclosure while still permitting functional brain thermoregulation — consistent with primate reliance on vascular and behavioral mechanisms rather than a carotid rete.

#### **1.2 Craniofacial Evolution and Developmental Robustness**

Primate craniofacial morphology has evolved under strong constraints linking brain growth, basicranial flexion, and facial orientation. Human basicranial flexion is pronounced in association with bipedalism and large brain size. Severe holoprosencephaly demonstrates that extreme disruption of these integrated developmental modules can occur, but such disruptions are almost universally deleterious. A stable population phenotype with major facial displacement and truncated cranial structures would require either strong positive selection for the trait or extreme developmental canalization — both of which are difficult to reconcile with the high lethality observed in comparable human malformations.

#### **1.3 Population-Level Persistence Requirements**

For such an extreme phenotype to persist across generations, several conditions would be necessary: (1) a strong founder effect or population bottleneck allowing the variant to reach high frequency, (2) sufficient reproductive fitness despite anatomical constraints, (3) environmental conditions favoring the phenotype (e.g., stable warm climates reducing thermoregulatory demand), and (4) behavioral and cultural adaptations compensating for sensory and mobility limitations. No known human or primate population has maintained a comparable level of craniofacial reorganization over multiple generations.

### 2. Developmental Constraints from Human HPE

Human holoprosencephaly provides the clearest window into the developmental limits of extreme craniofacial reorganization. Severe alobar HPE with cyclopia demonstrates that major displacement of facial primordia and forebrain malformation can reach late gestation. However, survival beyond the neonatal period is rare, and long-term population persistence is unknown. The model's proposed adaptations (soft neck stub, cartilage protection, long hair concealment) may mitigate some of the immediate viability challenges seen in HPE, but do not address the deeper evolutionary problem: such extreme developmental variants are typically removed by purifying selection rather than stabilized as population-level traits.

### 3. Implications for Archaeological Interpretation

If a population with this phenotype existed, archaeological signatures would likely include consistent high cervical trauma at the C3–T1 level, absence of conventional cranial vault fragments, and possible subtle remodeling in the clavicular/supraclavicular region. The lack of clear diagnostic skeletal markers (due to cartilage-dominant protection) would make identification difficult without targeted re-examination of existing collections. Evolutionary context suggests that any such population would have been under strong selective pressure and likely geographically or temporally restricted.

Evolutionary Context Section Added — July 2026