

Parietal Lobe, Thermoregulation, and Febrile Seizures

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in an Evolutionary Quest

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**Introduction:**

Febrile seizures (FS) have remained a relevant topic; their febrile responses and thermoregulation are complex processes; this intertwined relationship is an important aspect of the unsolved problem.

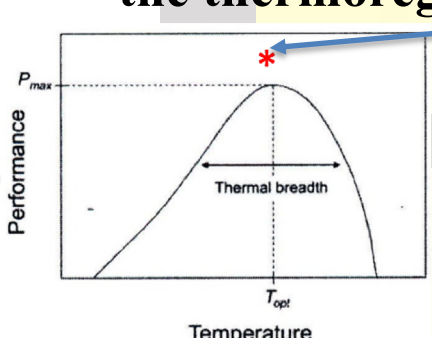


Methods: 

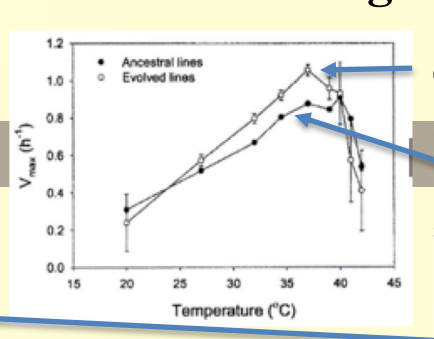
Here, thermoregulation, the parietal lobe, & febrile seizures are explored from evolutionary-pressure data-sets for insights & contributing factors to febrile seizures age-dependent vulnerability & with significant relevant consequences also for mainstream ongoing investigations in adult (developmental) areas especially Alzheimer’s disease.

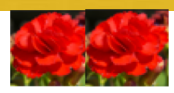
**Evolutionary Thermal Biology**

Human’s thermoregulation quest is: optimum temperature for maximal performance; the thermoregulatory system is precise!



The environment exerts a strong selective pressure on all organisms.



Results/ Discussion: 

Human Thermoregulation: 4-tier venous pathway


Because the human brain has no heat-storage facility, T_{brain} is dominated by cerebral blood flow (CBF) which couples T_{brain} & T_{trunk}; for maximal performance, incoming CBF, warmed by T_{trunk} supports & replenishes T_{brain}, perfusing its vascular channels.

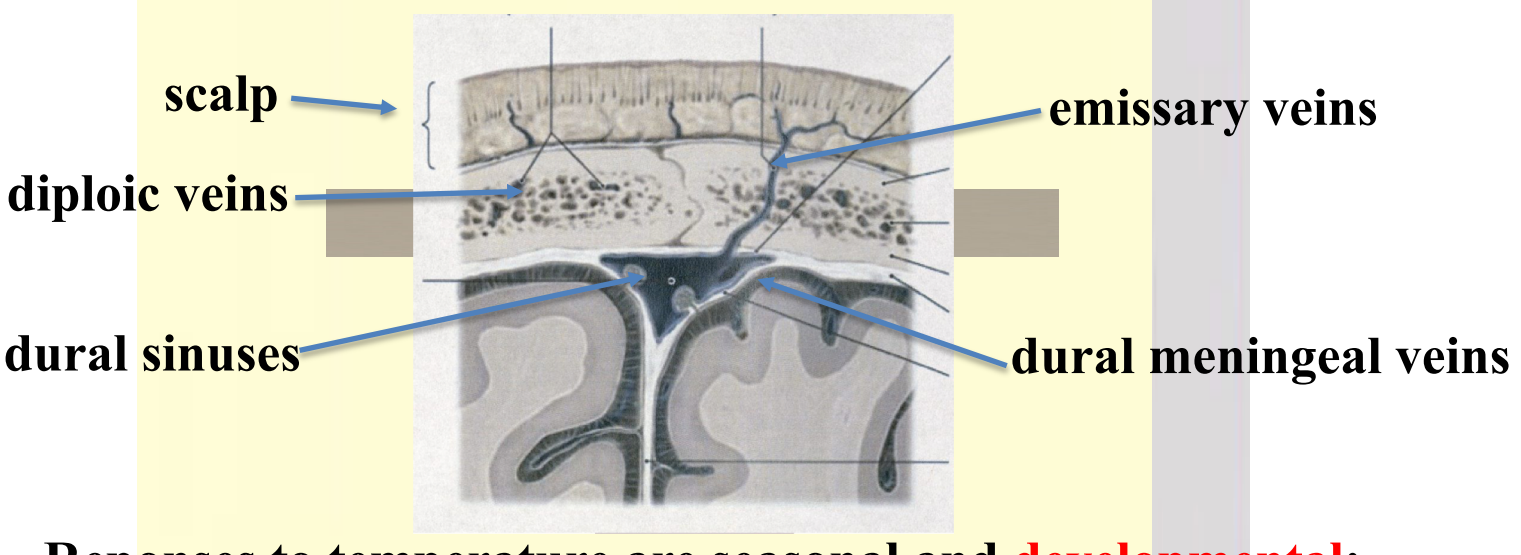
Insects & viruses: ...a GROWTH focus

Endotherms: ...a NATURAL SELECTION focus

Exotherms: ...a HEAT-LOSS PROMOTIOG focus

T_{body} over T_{environment}

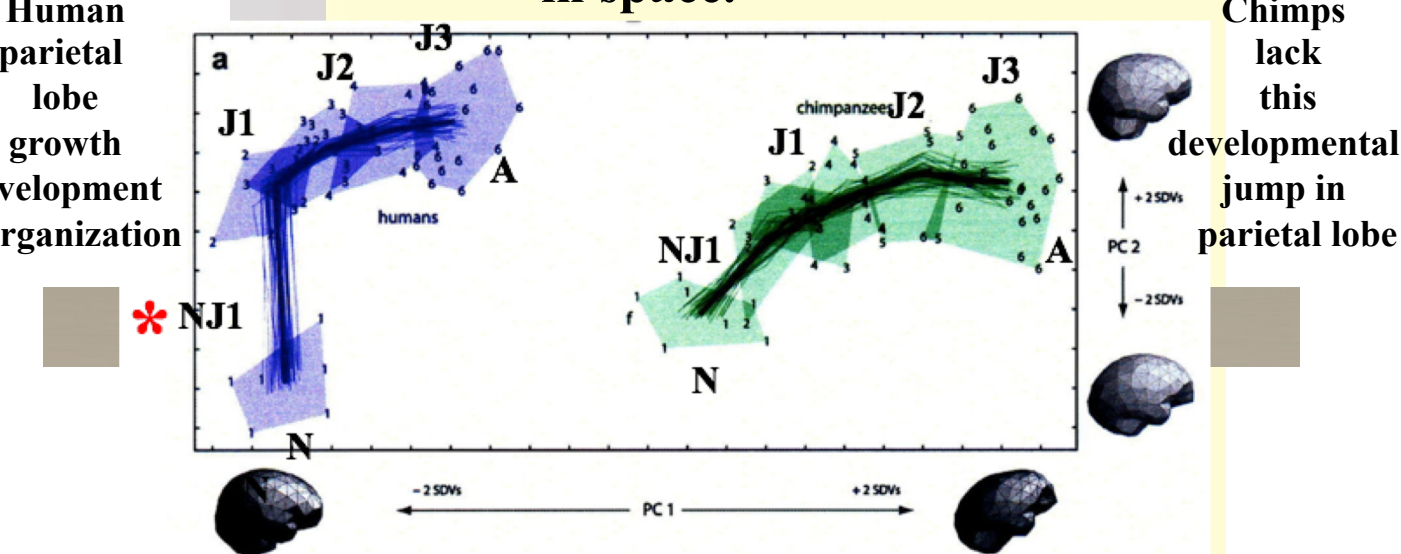




Reponses to temperature are seasonal and **developmental**; the latter is *irreversibly* changeable!

Parietal lobe: evolutionary comparison

Unique to our human species, early ontogeny, 4-6 months timeframe, the parietal lobe begins to grow, develop, reorganize in space.



Chimps lack this developmental jump in parietal lobe

Dental eruption-pattern timeline

Group	Age human (yr)		N human	N chimps	Age chimps (yr)
1 (N)	0-0.33	No erupted teeth	7	7	0-0.25
* 2 (NJ1)	0.5-2	Incomplete deciduous	7	5	0-0.25
3 (J1)	1.83-5.33	Complete deciduous	19	7	1.12
4 (J2)	6-7	M1 erupted	6	12	3.26
5 (J3)	12-13	M2 erupted	0	7	NA
6 (A)	17-21	M3 erupted	19	22	11.35

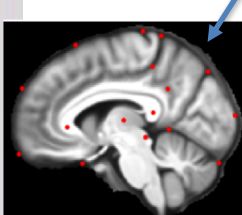
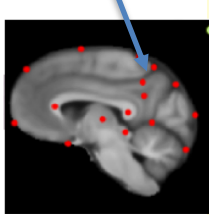
Parietal precuneus: a primary integration center

The origin of modern human’s brain morphology is associated with medial parietal changes, the precuneus, major reorganization hub & widespread connector between brain modules & often reciprocal.

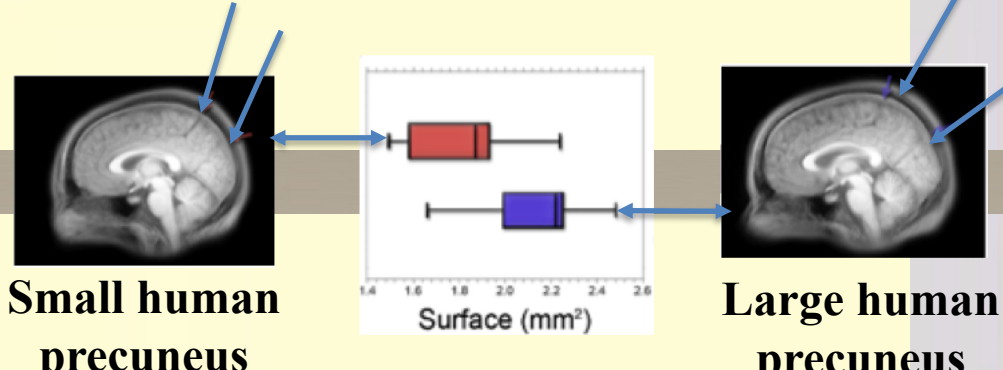
- visual-spatial integration: reaching/pointing
- memory: episodic & autobiographical
- self-awareness/self-processing operations
- integrates external & self-generated information
 - mental travel/imagery


Major node of Default Node Network (DMN):

- ongoing neural & metabolic activity
- NOT associated with a subject’s performance
- prominent & active in default resting states




Interspecies variation of humans 1.5xs chimps



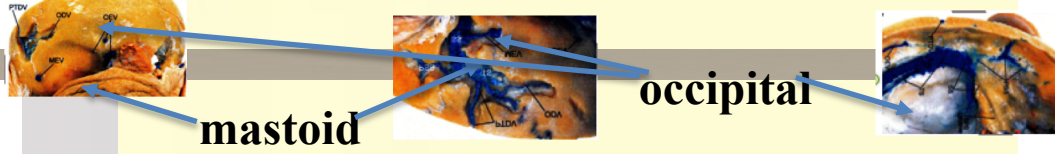
**Developmental non-linear changes**

parietal lobe: N-NJ1: discontinuity of size-shape at 4-6 months



...a noteworthy **evolutionary** step, a structure-function signal with geometry, architecture & connection changes; new intrinsic relationships of energy-efficiency balance & **thermoregulation**


...the middle meningeal vessels’ vascularized patterns increased in complexity, preferentially anastomosing around parietal surface



Seizures from high fevers: febrile seizures

As a common pediatric neurological disorder, worldwide, & epidemiology ranging 2-5% (Western countries) and 7-9% (Asian Pacific), febrile seizure susceptibility focuses specifically in childhood, 6 months to 5 years; genetic mutations have accounted for a **minority** of children with FS; in most instances the underlying basis remains unsolved.

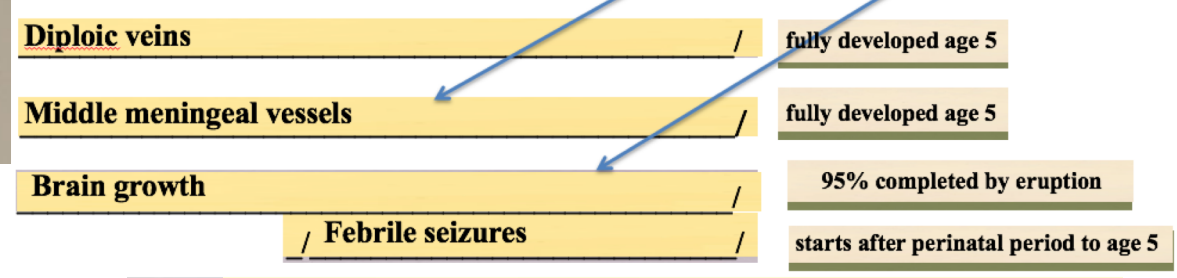
Life History Variables


**Dental stages:**

1	2	3	4	5	6
N	NJ1	J1	J2	J3	M3
no teeth	incomplete deciduous dentition	Complete deciduous dentition	M1 erupted	M2 erupted	erupted
4 months old	6 months old	2.5 years	6-7 years	12-13 years	17-21 years

Shape space change: “PARIETAL WINDOW”


- discontinuity parietal become GLOBULAR

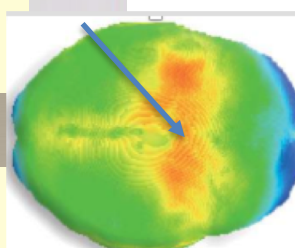
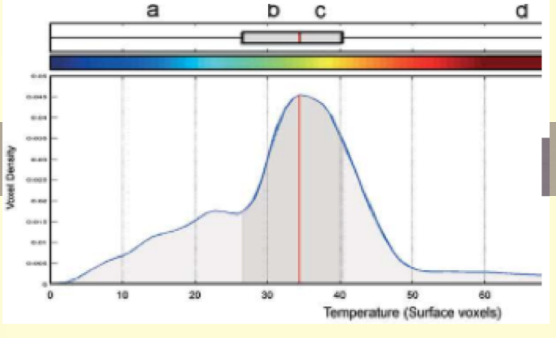
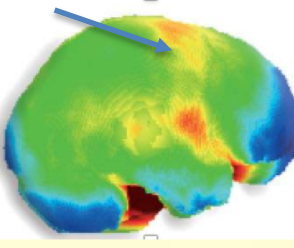


Evolution’s theorems 

Evolution’s fundamental truth of variability in timing of parietal tissue & vascular development applies; though the parietal lobe variability is known in adulthood (18%), this is yet not known for children...it is for us to now find out & FS are a starting point to discover this.

Parietal lobe developmental variability can be measured on MRIs, using an allometric relationship of surface area: volume, a comparative measurement for control & FS cohorts, a comparative measurement for species already known: **humans 0.97; chimps 1.59**

**Seizures from high fevers: febrile seizures**



Conclusion

This could be the tipping point for long awaited insights plaguing adulthood’s quality of life, reclusiveness, & loss of vibrancy because we are also measuring the major reorganization hub that gives us our cognitive complexity.