Does the Brain Storage of Information Generate a Hormone which acts Lamarckian Transgenerational to Evolve the Germ-cell Template?

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Abstract: An estimation of information-theoretic storage in the human genome and in the human prefrontal cortex suggests that the brain may be predisposed to produce a specific hormone which induces Lamarckian Transgenerational Epigenetics (LTE) in the germ-cell template. The DNA records of sperm-bank donors during peak information-storage years (males from 18 to 25 years old) may indicate such LTE.

Considerable interest has recently been attached to Lamarckian Transgenerational Epigenetics (LTE) [1-7]. The purpose of this note is to point out that the very large relative information storage in the human brain may be the instigator of LTE *via* a brain-produced associated hormone.

Let us first consider information-theoretic storage in the human genome. There are about 3.3×10^9 bp in human DNA, and each bp contains 2 bits of information ($2\times2=4$ available nucleotides). However, only about 15% of the DNA is active at any time, and an additional 15% of the DNA may become active subject to protein enzymes. Thus, there are about 10^9 bp with active or possibly active genetic information. Hence, human DNA stores about 2×10^9 bits $\cong$ 8 MB of active or potentially active information.

Now consider information-storage in the prefrontal cortex of a human brain. One bit of information is associated with each functioning synaptic connection in the prefrontal cortex, with the molecular chemical discharge either activating or deactivating the associated axon terminal. Let n_* denote the number of active pyramidal neurons in the prefrontal cortex for comprehension and environmental learning information storage. In a normal healthy human, we have

$$10^9 \lesssim n_* \lesssim 10^{10} \qquad (1)$$

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Next, let each neuron interface *via* synaptic connections with a consortium of $\hat{n}$ neighboring neurons. With an order-of-magnitude variation in healthy humans, we have

$$10^3 \lesssim \hat{n} \lesssim 10^4 \tag{2}$$

Hence, there are $n_* \hat{n}/2$ synaptic connections overall, storing $n_* \hat{n}/2$ bits of information; from (1) and (2) we obtain

$$1.8\ \text{GB} \cong 5\times 10^{11}\ \text{bits} \lesssim n_* \hat{n}/2 \lesssim 5\times 10^{13}\ \text{bits} \cong 180\ \text{GB} \tag{3}$$

The lower and upper bounds in the first and final members of (3) are respectively about 230 and 23,000 times greater than the 8 MB information-storage in the human genome. This constitutes a relatively very large information-theoretic reservoir, which Lamarck might view as "chomping at the bit". Under suitable conditions, does this information-theoretic reservoir promote production of a specific LTE hormone which, after either influencing the pituitary or passing directly into the blood circulation (oxytocin and vasopressin), acts to informatively evolve the germ-cell template?

Interestingly enough, this question can be answered by a cohort program that evaluates the germ-cell genome of sperm-bank donors over a period of several years. Such evaluations may show LTE variations in the DNA of sperm-bank donors during their peak-information storage years, *viz.*, males from 18 to 25 years old. Presumably, a correlation may appear between those in the cohort with the greatest information storage-rate and eventual information capacity and those that show the largest LTE change in their DNA. Conversely, the worst learners may correlate with those that show essentially unchanged DNA.

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