GLYMPHATIC SYSTEM

The brain is a tissue. As in any other tissue in our body, cells in our brain are being replaced by new ones all along our lifespan. Net brain performance at any stage of life is the balance between *degenerating* and *regenerating* these cells.

The volume of oxygen available for the chemical work of thinking is the principle factor that limits our capacity to put the increasing brain power of humans to work.

The human cortex continues to expand with each new generation, leading to ever-higher potential. There has been a threefold increase in human brain size in a mere 2.5 million years.

CLEANING UP THE GARBAGE

Not long ago, physicians believed that unlike other parts of the body, the brain had no lymphatic system (the system responsible for removing molecular waste)**. Well we do have a biological system for removing waste in the brain. Breakthroughs in higher resolution imaging over the past decade that enabled scientists to uncover that biological system.**

Glial cells' interactions can accelerate the rate at which waste molecules are eliminated from the brain. Glial cells eliminate waste products such as amyloid beta, from extracellular connective tissue during sleep or rest. Amyloid beta is known to accumulate in the brain with Alzheimer's disease.

In the cortex, the supportive glial cells maintain the relatively stable environment (homeostasis) **that our neuronal cells need to function smoothly. They are far more prevalent than neuronal cells, out-numbering neuronal cells by a factor of ten.**

These glial cells have four main functions:

1. **Surround neurons and hold them in place**
2. **Supply nutrients and oxygen to neurons**
3. **Insulate one neuron from another, and**
4. **Destroy any foreign microorganisms that cause disease, clean up the garbage… remove dead cells** (either glial or neurons) **and pathogens.**

The system is active mainly during sleep. Glial cells contract and expand as muscles do, removing extra cells such as soluble proteins and small molecules (metabolites) **in the brain that are no longer functioning. If we do not sleep well, the glymphatic system will not function as well as it should. Over time, poor sleep habits degrade our mental abilities. This may be one reason why all animal species, including humans, have a biological need for sleep.**

The biochemical integrity of the glymphatic system and its normal, healthy functioning is extremely important for maintaining healthy brain performance and regenerating cells to heal a damaged brain. The glymphatic system should be one of the main therapeutical targets for physicians to evaluate for treating brain disease or injury.

Recent studies indicate that failures of the glymphatic system may be a factor in stroke, traumatic brain injury, degenerative diseases such as Alzheimer's, and other disorders of the nervous system.

REGENERATION vs. TARGETING CELL MECHANISMS

The balance between regeneration and degeneration determines our brains' performance, just as the performance of any other organ in the body is determined, we can change our therapeutic approach toward the brain just as we can with other tissues.

Instead of targeting the function of a specific cells, we understand now how to replace those damaged cells with new ones through the new hyperbaric oxygen therapy protocols. It is a cleaner, comprehensive process, something like replacing a flat tire with a brand new tire, rather than trying to stop the leak with an adhesive patch, or plug.

Scientists are developing other fascinating therapies to stimulate conditions for neuroplasticity. These therapies enable neural networks in the brain to reorganize and grow with new blood vessels, new neurons, and new connections within cells. They include creating a magnetic field in specific areas of the brain (*transcranial magnetic stimul*ation, or TMS)**, manipulating genomics, injecting certain types of stem cells into the central nervous system, and creating patches that serve as a scaffold for damaged neuronal tissue to regenerate.**

The key is slowing the degenerative process as much as possible and inducing regeneration. Assess each individual's full biological profile: including their brain structure and functionality, physical fitness, metabolism, DNA, lifestyle, and diet and nutrition status.

The treatment for triggering cell regeneration and replacing damaged brain cells is framed by a new HBOT protocol. The goal is to produce the *hyperoxic-hypoxic paradox*; generate the *hypoxic-inducible factor* (HIF or *heef*)**; and produce the surge of stem cells, mitochondria number and function, and angiogenesis** (creation of new blood vessels)**.**