SAVANTS · EPISODE 17

Flesh Atomic Clocks: The Biological Chronometrist

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Hello everyone and welcome back to 'Savants', where we unravel the mysteries of extraordinary minds! Today we delve into an ability that seems straight out of science fiction, yet is very real in the world of some savants: the ability to tell time with astonishing precision, without a watch, without the sun, without the moon. They are, in essence, walking atomic clocks.

Imagine this: you wake up in the middle of the night, in a completely dark room, without a single ray of light. Instinctively, you know it's 3:17 a.m. or 4:52 a.m. Not just 'around four o'clock,' but the exact minute. For most of us, this sounds impossible, but for some savants, it's an everyday reality.

One of the most fascinating cases is that of James, a young man with autism and savant syndrome. James had such a precise notion of time that he could tell the hour with an error of less than a minute, at any time of day or night. If you asked him 'What time is it, James?' he wouldn't look at the sun or check a clock; he just 'knew' it. His parents told stories of how he would wake them up at the exact time for school, or remind them of their doctor's appointments, always with almost millimeter precision.

Another example is that of a patient who, after being hospitalized and disconnected from all temporal references (no windows, no clocks, no regular visits), continued to wake up and request meals at consistent times with his usual routine outside the hospital. When his estimates were checked, they were surprisingly accurate.

How is this possible? Is there perhaps a small invisible wristwatch in their brains, functioning with an accuracy that would put the most sophisticated devices we know to shame? Is it a prodigious memory for temporal patterns, or something deeper and more biological?

Science tells us that we all have an 'internal clock,' a system that regulates our sleep-wake cycles. But the precision of these savants goes far beyond what we consider normal. Could it be that the ticking of this biological clock is amplified or fine-tuned in a special way in their brains, allowing them to perceive the passage of time with a granularity that is unimaginable to us? The answer leads us to the fascinating world of neurobiology and the mysteries of our own internal biological chronometrist. Get ready to explore how the timekeeping machinery in our brain might be functioning in an exceptional way in these individuals.

The question that hung in the air was profound: how do these savants achieve such a feat? The answer, as almost always in the brain, is complex and multifaceted, involving a system that we all possess, but which in them seems to be calibrated to perfection.

The Master Rhythm: Our Circadian Clock

To understand savants, we must first understand our own 'internal clock'. It is known as the**circadian clock**, a term derived from the Latin 'circa diem', meaning 'around a day'. This clock is a biological system that regulates many of our bodily processes in an approximately 24-hour cycle. Think of it as the conductor of an internal orchestra, coordinating not only when we sleep and wake, but also hormone release, body temperature, appetite, and many other functions.

The operational center of this master clock is located in a tiny region of the brain called the**Suprachiasmatic Nucleus (SCN)**, situated in the hypothalamus, just above the crossing of the optic nerves. The SCN is our primary chronometer, and what's fascinating is that it primarily synchronizes with sunlight. Specialized cells in our retina not only help us see but also detect light and send signals directly to the SCN, telling the brain whether it's day or night. These signals are like the 'time adjustment' for our biological clock.

The Molecular Gears: Clock Genes

But the SCN is not just a structure; it's filled with cells containing a set of 'clock genes'. These genes, like those called*CLOCK*,*BMAL1*,*PER*, and*CRY*, act like the gears of a clock. They switch on and off in an approximately 24-hour cycle, producing proteins that, in turn, regulate the expression of other genes

in a kind of molecular feedback loop. It's a rhythmic dance of activations and deactivations that marks time at a cellular level.

- **CLOCK and BMAL1 Genes:** These are the 'activators'. They bind together to form a protein complex that turns on other clock genes.
- **PER and CRY Genes:** These are the 'inhibitors'. Once activated by CLOCK and BMAL1, they produce proteins that, over time, accumulate and eventually inhibit the activity of CLOCK and BMAL1. When CLOCK and BMAL1 are inhibited, the production of PER and CRY decreases, allowing CLOCK and BMAL1 to reactivate, restarting the cycle.

This 'on-off' system is incredibly precise and self-sustaining. Imagine a complex chain of dominoes falling and standing up again, over and over, in a perfect 24-hour cycle. That's our molecular clock in action.

How Does the Savant 'Fine-Tune' Their Clock?

Returning to our savants, how could this biological clock system lead them to such precision? There are several hypotheses, and it's likely a combination of factors.

1. An Exceptionally Stabilized Internal Oscillator

The first possibility is that the central 'oscillator' in their SCN is intrinsically more stable and less susceptible to perturbations. Think of a quartz watch versus a toy mechanical watch. Both tell time, but one does so with much greater precision because its mechanism is finer and less prone to errors. In savants, the interaction of clock genes and proteins might be so efficient and 'quiet' that their internal ticking is almost perfect, without the small variations most of us experience due to factors like stress, diet, or environment.

2. Enhanced Sensitivity to Internal Cues

Although the circadian clock synchronizes with light, it also receives information from other smaller 'clocks' distributed throughout the body (in the liver, muscles, etc.) and from subtle physiological changes. These include body temperature, hormone levels (like cortisol or melatonin), blood glucose, and heart rhythms. Most of us consciously ignore these signals, but our bodies register them.

Savants might have heightened sensitivity, an increased ability to 'read' these internal physiological signals with much greater granularity. It's as if they can tune into a radio station with a much more powerful antenna, picking up details that for others are just background noise. They might be registering their own body's internal cycles in a way that is subconscious and vague for us, but for them is a precise measure of elapsed time.

3. Filtering External 'Noise'

The brains of savants, especially those on the autism spectrum, often process sensory information differently. They might have a unique ability to filter out distractions or environmental 'noise' that often distorts our sense of time. For an average person, a day might feel shorter if they are busy or longer if they are bored, due to how our attention and emotions distort our temporal perception. Savants might be less susceptible to these emotional and cognitive distortions, maintaining a more objective and constant perception of the passage of time.

4. Exceptional Temporal Memory and Neural Connectivity

Some researchers suggest that this ability may be related to their prodigious memory and their capacity for pattern recognition. If a savant can memorize entire calendars or calculate distant dates, it's possible they can also 'memorize' the pattern of passing time. Not consciously as 'three hours and twenty-two minutes ago,' but as a subconscious accumulation of neural micro-events that their brain can interpret with astonishing precision.

It could be that the neural connections in their SCN, or in the brain areas that process time (such as the prefrontal cortex or basal ganglia), are 'wired' in a particular way. Perhaps a higher density of neurons in these areas, or more efficient connectivity, allows them to process and retain temporal information with superior fidelity.

Studies and Theories

Research into time perception in the brain remains an active field. We know that time is not perceived in a single brain area, but rather is a distributed function. Different regions are responsible for different aspects of time: the duration of an event, the order of events, the prediction of what will happen next.

In individuals with autism, differences in sensory and cognitive processing are often observed. Some studies have suggested that people on the autism spectrum may have a more 'segmented' or 'granular' perception of time, focusing on individual moments rather than the continuous flow of time. This, combined with the extraordinary abilities of a savant, could manifest as an extremely accurate timekeeping ability.

It has also been theorized that savant abilities in general, including timekeeping, might be the result of unconscious, large-scale access to information stored in the brain. It's as if they have a direct highway to parts of memory or processing that are hidden or difficult for us to access. For the 'biological chronometrist,' this would mean a direct and uninterrupted connection to the ticking of their clock genes and the most subtle physiological signals.

Final Reflection: What Do We Learn from 'Flesh Atomic Clocks'?

The ability of savants to accurately tell time without external aid is not just a fascinating trick; it's a window into the incredible sophistication of our brain. It reminds us that the perception of time is not a universally uniform experience, and that beneath our consciousness, there is an incredibly complex biological machinery working tirelessly.

It shows us that, while we all have an internal clock, the ability of some individuals to tune into and 'read' that clock at such a profound level is a testament to the diversity and hidden potential of the human mind. It challenges us to think of time not just as a cultural convention or an external measure, but as an experience deeply embedded in our biology. Savants, with their 'flesh atomic clocks,' invite us to appreciate the wonder of time and the intricate dance of life that occurs minute by minute within us.