## FEATURE: What Darwin Didn't Know about Eyes

VOICE: What Darwin knew about the human eye amazed and bothered him.

PROF.: What he ***didn't*** know about it still astounds us. Let's talk about it.

FORMAT: THEME AND ANNOUNCEMENT

VOICE: In his book *What Darwin Didn't Know*, physician Dr. Geoffrey Simmons summarizes the major structural features and functions of the eye.

PROF.: The eye contains seventy percent of the human body's sensory receptors. Dr. Simmons says, "Visual cues are critical for nearly every action we take… In olden days they helped us escape a predator, find ripe fruit, avoid a precipice, or make our way home. For the present day, one could list thousands of visual needs."

VOICE: He points out, "Darwin…found the complexity of the eye to be so daunting that he feared it challenged his most basic theories."

PROF.: Many of those who agree with him today, continue to share that same feeling. To have changed from a unicellular animal that could sense some changes in light, to a multi-trillion-cell organism that can recognize hundreds of colors, sort through scores of shades and intensities, identify a multiplicity of shapes, recognize a relative not seen for fifty years, and spot the proverbial shiny needle in the haystack – would have been an enormous, multifaceted evolutionary step that defies the theory of natural selection.

VOICE: Which details of the eye especially impress Dr. Simmons?

PROF.: His overall answer is, "***Every*** anatomical, chemical and physiological aspect of our eyes suggests design."

First, the ***placement*** of the eyes seems well-thought-out. They are set back inside bony sockets that protect them from most injuries, yet they protrude enough to give a wide horizontal view. Only one-sixth of the eyeball is visible, while the remainder is protected by the skull.

VOICE; The eyes are set apart far enough to provide three-dimensional perception of depth, and they move in unison so that they follow the same moving object.

PROF.: He adds, "Millions of cells lining the interior of each eye function as photochemical receivers that convert light waves into electrical impulses, which are forwarded at a speed of about 300 kilometers per hour to the brain. The visual part of the brain sorts, organizes and analyzes these impulses within milliseconds."

Dr. Simmons sees engineering design even in the eyelashes and eyebrows. Eyelashes and the blinking reflex protect the eye from small flying debris. Eyebrows protect us from glare, and they keep perspiration from running into the eyes.

VOICE: But the eye needs lubrication.

PROF.: That's true. But perspiration isn't the right liquid for lubrication. The doctor explains, "Our eyes are kept moist and nearly sterile by tiny lacrimal glands along the outer edge of each upper eyelid. These glands secrete a viscous liquid that slowly moves downward and across the eye to an inner, lower tear duct and drains into the nasal passages."

When a foreign object enters it, the eye produces fluid to wash it out. This same fluid brings proteins to coat the eye and supplies oxygen to the cornea.

VOICE: Why doesn't the cornea get its oxygen from the bloodstream, the way the rest of the body does?

PROF.: Because blood vessels would block its vision. So a ***transparent*** fluid supplies oxygen to it.

Dr. Simmons provides other details about tears. Tears come in three very different forms: One geared for lubrication and protection, another associated with sadness, and another associated with happiness. Each type is secreted from a different location, contains different concentrations of salt, maintains different ratios of proteins, and flows at different rates. Emotional tears have 21 percent more proteins, suggesting they carry away chemicals that produce stress.

VOICE: Is that why people feel better after a good cry?

PROF.: It's at least part of the reason. He points out additional purposes for tears and the other liquids that are present in the eye. Without constant lubrication, our eyes would dry up and scar. Without enzymes killing bacteria, we might have constant infection. Without the ability to blink, our eyes would be pock-marked by debris and soon blinded.

VOICE: What else does Dr. Simmons say Darwin probably didn't know?

PROF.: The fact that six muscles attach to each eye, makes them able to move in nearly any direction. Their location near the top of the head also suggests design. This added elevation enables us to see greater distances. Eyes located in the head also minimize transmission time to the brain, which can save a person's life in an emergency.

VOICE: We've talked about the ***exterior*** of the eye. What about the ***interior?***

PROF.: The pupil of each eye functions like the aperture of a sophisticated camera, constricting to protect the retina when the light is bright, and dilating to enable us to see in dim light.

Light enters the eye through a path that includes a transparent protective layer called the cornea, then a buffering fluid in the anterior chamber, then the lens, and then the gelatin-like vitreous body.

VOICE: All this is preparation to get the light finally to the retina. There the image is collected and forwarded to the brain.

PROF.: Yes. Dr. Simmons says the retina "acts like a constantly-changing roll of film…made up of 7 million cone cells for color assessment, 125 million rod cells for adaptation to the dark, and 1**.**2 million nerve cells that collect billions of bits of information. …[T]he data is then forwarded to the optic nerve in the center of the retina."

VOICE: So the cones enable us to see in color, when there's adequate light. But the rods provide a backup system, so that we can see in black-and-white when the light is too weak to see in color.

PROF.: He continues, "When our eyes are open, a steady stream of information travels to the brain. One might compare this process to a crowd of a million schoolchildren taking endless photos that self-develop, and then handing them to a group of teachers who make immediate decisions about them."

VOICE: In order to transmit that visual information to the brain, doesn't the retina need several chemical changes?

PROF.: Yes. Dr. Simmons gives what he calls a vastly simplified sequence of the chemical changes that take place in just the cells of the retina. The list includes light causing structural changes in *retinene* [RET-uh-neen] of photopigment, the activation of *transducin* [trans-DOO-sin], activation of *phosphodiesterase* [phos-foh-DEE-sur-ace], closure of sodium channels, and several other steps.

When we're driving rapidly down a highway, we're glad the entire process works precisely and rapidly.

VOICE: Today we've summarized one chapter of Dr. Simmons' book, *What Darwin Didn't Know*. He labels part of his chapter, "Every aspect suggests design." As we've discussed some of the engineering design that is built into the human eye, we understand why Dr. Simmons sub-titles his book, "A doctor dissects the theory of evolution."

Early in the chapter, Dr. Simmons says, "Even the first steps in the development of rudimentary useful neurons to sense light would have involved a large number of purposeful mutations. For them to progress to the complexity of the present human eye would have required an incalculable number of continuing purposeful mutations."

PROF.: He concludes the chapter, "Every aspect of vision suggests purposeful design. Arguments favoring evolution require giant leaps of faith to conclude that millions of steps – some in tandem, some in parallel, many quite different – could have come about randomly." These involve steps needed to sort out colors, determine distance, assess movement, connect all the dots, give the whole image meaning, and initiate a response."

VOICE: But some scientists believe these improvements came gradually, one change at a time.

PROF.: Individual steps along the way would be useless, and they would not have come about by themselves without an underlying plan. Each step is so dependent on so many others, that isolated mutations could never have caused all of them at the same time. Causing even a few of them would take a sequence of very lucky mutations.

VOICE: A century and a half ago, Charles Darwin wrote, "To this day the eye gives me a cold shudder." He couldn't see a way that natural processes could have created it, and he feared that the complexity of the eye could undermine his theory.

PROF.: Yes, and that "shudder" was based on the fragmentary understanding of the eye that he had in 1859. If he were alive today and knew the extreme intricacy that scientists have discovered in the eye since then, his shudder would be so intense that he might not have been able to hold his pen to write his book!

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Sources:

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Geoffrey Simmons, *What Darwin Didn't Know* (Eugene, Oregon, USA: Harvest House Publishers, 2004), chapter on Eyes.