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## Additions to St. Hildegard's *Physica*

*Author's note: In the twelfth century, Hildegard von Bingen published a scientific treatise on the habits and uses of plants and animals. The following is a modern update for some species in North America she would not have known.*

### Mule Deer

Deer are metaphysicians. They teach the world leaping and walking with grace. Harts despise Euclid and abhor straight lines. All their postulates are structured using the scents drifting through thick forest trees, supported by the logic of bird song. To prove a conjecture about the physics of necessity, they will leap in front of a moving vehicle that they might convince their comrades that their logic is sound. They are guardians of silence and will defend stillness with their lives. Their gaze is Hegelian, offering thesis to your antithesis, and the synthesis will break your heart and leave you confused and tired, good only ever after for sighs and long walks. Old deer, whose antlers have grown forked with many points, are ridiculed by younger deer; they then are forced to live solitary lives, hiding the shame of their deficit of daring when they stood among wolves and mountain lions. Deer resemble humans most in their arrogance and cunning. They understand the calculus of shadows and hide their offspring in its intricacies. When the world is white with snow and the moon's glow illuminates and softens the earth's rugged undulations—its rocky and rough coarseness—deer will gather and in the sparkling snow practice a magic fierce and unrelenting. This sorcery will draw down what it is to frolic without a fear of death. If you see this, your heart will be replaced by that of a deer, and you will grow both quiet and contemplative, unassuming and steady-eyed. If you meet someone like this, you may be sure they have seen a coven of deer's spellwork; there is nothing you can do for them. Be content. They are lost.

## Opossums

Opossums are marsupials, so they carry their questions outside their bodies in a pouch. This leads to particular vulnerabilities, including an unpleasant openness and awkward frankness when they ponder the world into which they were thrown. Who they are is nakedly exposed to the world for further inquiry and sometimes they will play dead rather than suffer the needling of those who mock and pester them. They have evolved ugliness as a defense against ridicule, and their ratty tangle of unruly hair and naked tail allow them to withstand the boorish taunts of rascals. An attitude of forbearance in personal hygiene belies a bellicose commitment to purity of expression—an almost positivist reluctance to treat their, admittedly primitive, concepts as fuzzy or their notions as inexact. When a persimmon they perceive, a persimmon they expect it to be. They most resemble humans in their tendency to believe their own narrative and in their reluctance give others the benefit of the doubt in constructing their own. Opossums have only four kinds of teeth, and so their cosmology is based upon a fourfold conception of reality: wood, pavement, enemies, and persimmons. Their magic is simple and might be better characterized as a kind of sleight of hand rather than proper conjuring. They are without science. They do not readily accept blame even if at fault and are inclined to petulance if accused of anything carrying the odor of scandal. If you meet one in the woods, pass by with a nod. And never make fun of it just to see it fall into a torpor. Such is considered rude and ill mannered.

## Coyotes

When coyotes take holy orders, and all do, they take a vow to wander. Over the natural world they are called to roam far and wide, visiting many climes to sample the ecosystems of the world in their variety and fullness. While solitary, they are not inclined to loneliness. They are tasked by their vocation to chronicle with their mind's eye the substances, shapes, and events of existence. This they take seriously. Such an undertaking requires a level of attention that does not lend itself to the contemplation of their isolated state, so in large, they are content in their seclusion. Many believe they gather in groups to sing their mournful, sharp, and wintry-voiced whines to alleviate their friendless state, but this is not true. When a coyote dies, its ghost flies over the landscape until it finds a living member of its species and listens to its aria; if the eidolon is pleased, it attaches itself to the soloist for the remainder of the singer's mortal life. Thus, when a coyote howls, others nearby know it is presenting to a ghost and

they run en masse toward the sound that they too might be considered for attachment by the spectral beast. A successful crooner may attract many ghosts to its retinue, sometimes as many as ten or even twenty. A coyote without an attached spirit feels incomplete and others hold it in contempt (this is why dogs are so despised—they are always ghostless). Their love of science is well known. They are especially like humans in their love of nuanced tastes and in the epicurean delight they take in sampling a selection of different flavors in their daily ration. Coyotes will, of course, take what they find; they are mendicant wanderers, after all. Nevertheless, they have a refined palate and enjoy things they can first savor. It also must be remembered that these sage canids have a deep, inherent spirituality accorded in proportion to the number of apparitions they have been able to gather. This gives them power to perform miracles of a particular natural type, such as making the moon appear larger, more hallowed, and brighter than usual. If you meet one at night under an enchanted moon, ask for a blessing. It will willingly grant your petition, allowing you ever after to hear the music of any coyote's attending shadow souls.

## Aspens

Aspens capture a fullness of being unlike any other organism in the universe. Indeed, alien races across multiple galaxies have argued whether such an organism is even possible, and had they known it existed on Earth would have spared no effort to travel here to behold it, if only for a moment. An aspen's consciousness exceeds that of humans in capacity and depth of expression by orders of magnitude. As you know, this white-barked tree of the genre *Populus* is a forest of trees knit together by a vast and complex root system sometimes covering many hectares. These roots combined with mycorrhizae soil, and the soil's associated microfauna form the plexus over which information is routed and woven into a framework of mind that can contemplate the cosmos in ways beyond the limited convolution of the primitive mammalian mess of wet cells splashing within our frenzied electrical soup. This we cannot hope to mimic. However, while these plantish algorithmic progressions are agile and bold, their slow tick-tock through the libertine channels of thought are uncanny and slow, but in reciprocal strength glorious. Their comprehension of a single idea, or the fragment of the beginning of an idea, might take a year to ponder properly. The formation of a perceptual moment may stretch over days and weeks. Aspens resemble humans in no thing. They contemplate the mountains. They ruminate on the fall of winter snows,

and mull over the summer winds that carry with them the roiling clouds of a thunderstorm—those great engines of moving water and electron exchange. The changing seasons condition an aspen's perspective and provide a metaphor for an epistemology of being. We cannot begin to understand their world in our compressed time scales and over our paltry and limited spatial scales. They see patterns we cannot contemplate, movements and harmonics that will ever escape our gaze. Their ideas are sublime and infused with the absolute. Yet, there is a strange hope that we can still commune with them. Only a modicum of their knowledge and experience will be transferred, of course, but that is no trivial thing and is worth the patient work of translation and the required engagement of the eerie hermeneutics demanded in species-bridging interchanges. It takes significant work to even capture an ill-formed and inadequate hello. Here is how it is done. Find an aspen, of at least a hectare in size, growing alone, far away from distractions, on a south-facing slope. Make it a cool day in late spring. Lie on your back and watch the deep blue dome of heaven through their scintillating leaves dancing before your eyes. Find in the chaos of that frolicking shimmer a notion, or the scrap of a notion, and hold it, treasuring its shape and contours. It will, like a fleeting dream, be hard to grasp, slipping and sliding in and out of memory, its presence giving hints as to its dimensions. Like a bubble bursting just as its shape seems to be materializing from a subtle emergence. You will find this frustrating and depressing. Do not give up. It is in this effort, not in its success, that your mind is conditioned and prepared to hold audience with these imperial entities. Continue your gaze until the breeze dies and the stars gather in a sky as cold and black as a raven's eye. Thus, the aspen begins to coerce things from your dim human longings. Thoughts will appear that you did not imagine possible, and that "go beyond," as it were. Visions will form that seem so ineffable and large that you are sure you will burst in an explosion of beauty and light. You will touch something. However, like a beetle crawling across Newton's desk, you will not comprehend the equations of existence you have encountered, but you will know, yes, you will know, that there are worlds of mind beyond ken. And mark this. You will be changed into something vast and soulful, which will allow you to glory in your smallness and allow you in humility to fall to your knees in recognition that you have touched the heart of the aspen.

### Harvester Ants

Harvester ants are gifted with unsullied freedom. They epitomize the embodiment of agency. Every deed in an ant's repertoire is an act of free

will and choice. While every animal is a pastiche of locked deterministic behavior, instinct, and genetic algorithms, ants are unique in that they have no nature other than prerogative. No tick. No tock. They are the playful indulgence of a universe obsessed with discretion. Volition refined, encased, and poured into the chitin shell we call an ant. This perplexes you. You wonder how this can be so. Are not ants the paradigmatic case of the well-oiled biological machine? Do they not exemplify the very idea of lockstep order and unrelenting necessitarianism? No! It is an illusion. For the last 150 million years, ants have chosen to act in such a way that to us appears to be deterministic. When one ant follows another in a long line, say, from some hole in your flooring to the edge of your cabinet, it is only by coincidence they have all chosen the same place to go. Nothing more. It so happens that there are an infinite number of universes. In some, ants wander willy-nilly hither and yon. In some, they appear to act under rules of behavior for a time, then wander off in their freewheeling directions toward unspecified purposes. It is just by chance, however, that we live in a universe in which ants have all chosen to do exactly what they would do if they could not do otherwise. They all choose the alternative they would be forced to take if there was no other choice! This could end at any moment, of course, with ants careening off in multiple directions as their will ceases to match necessity. Ants most resemble humans in their radical, existential freedom. You can occasionally catch a particular ant whose choice does not match that of what a machine-ant world would predict. Watch a colony. Notice that one ant that just takes off on its own. That ant is no more or less free than its compatriots, but it has chosen to wander in a direction strange when viewed through the lens of determinism. But all ants are so choosing, it's just that their choice coincides with robotic behaviors and widget-like conduct. One day it is possible that all ants everywhere will just head off in a random (to us) direction, peeling off into whatever adventure strikes their fancy; there are universes in which that very thing happened today, but it is not this one. How likely is this to happen in our reality, in that they have thus far comported themselves identically to an automaton? It is hard to say. It is their choice, after all.

## Ravens

Like a Leibnizian monad, ravens hold a representation of the entire universe within their mind. Look deeply into their eye, and a glimpse of the radical depth of which they partake will emerge. You might see the sun and the forces that hold sway in the heart of its fiery nuclear engine, or the

mysterious ort cloud hugging the far edge of our star's gravity well, or the local galactic cluster, or even the seas of distant planets wherein true leviathans swim defying even great war gods who attempt to hook their fearsome beaks. All these are represented in the bird's unfathomable consciousness and, like a strange Mandelbrot set, if you tried to drill down to the bottom of a particular bird's manifest image, you would find no sea bed on which to fix an anchor. A scientist of a materialist stripe would challenge this assertion, claiming that this would be impossible. She might open a raven's skull and carefully section the brain in a thorough and banal dissection. She might count the dendrites and their branching possibilities. She might establish within some error-barred estimate the total possible connections these neural structures might share, and finding it finite, calculate, using Shannon's Index, some upper estimate of the total information such a brain might contain. With scoffing delight she might declare all those who claim to know the ways of ravens fools. Nevertheless it spins. I did not say a raven's brain contained a simulacrum of the universe. No, I said its mind. For the raven's brain unlocks new potentials that lie hidden and which open and revel vast arenas in this rapturous cosmos. Mind. One that with limitless unfoldings dares the seeker to descend into habitats of unexplored being, a Mariana Trench of thought compared with the rake scratch on granite that all of human knowledge has thus far uncovered. For example, think on this. If our chamber-door-rapping friend's mind mirrors the entire universe, then because our exemplary raven is an inhabitant of said universe, its own mind is represented again fully in its own mind again, and again, and again, and again, ad infinitum. And you wonder that you cannot comprehend the raven! Ha! Yet, despite the bird being all-knowing, it is also humble, and thus resembles humans in their ability not to take themselves too seriously. Therefore the raven is content to forage on carrion, to cry out courage to the flagging spirits of fellow predators, and to fly shamelessly in their murders of delight.

### Vesper Bats

The vesper bat lives in a field of textured space. It encounters a world with supple horizons of perception, reaching its limit at the point where reflected sound becomes an unrecognizable white noise. It knows nothing of the stars for there is no chirp that can be reflected from those distant points of light. The source of rain is not roiling clouds but arrives from changes in temperature, moods of wind and pressure, a barely noticeable darkening. After the rain starts, the world changes, the way leaves dance

in space follow new patterns, and the world takes on new acoustic flavors as the echoed sounds become softer and nuances of texture are masked and dampened. Their world is not the sharp-edged realm we encounter using light. No. Sound bends around corners. It is reflected off nearby objects and is changed by the way it combines with other sounds in the ambient air, adding to the depth of a bat's perception, giving a more complete aural picture of the three dimensions that they inhabit. Their world of sound is rich with information about textures tinged with traces of tonal changes, making the music of their clicks reflect aspects of the natural world invisible to us. Vesper bats are like humans in their love of insects. Not just as a source of food (in which they take delight) but because an insect's hard chitin shell is dappled and stippled, variegated, traced with soft hairs that return a beautiful and complex resonance pattern from the bat's echoed intonations. The creatures can then "play" the insect by modulating and tempering its carefully orchestrated clicks and pipings into a spatial manifestation that can only be called art—a kind of bat art that other chiropterans might appreciate and honor. Remember, this is not music as we know it; sound is how they represent the world of space as we do in oil, acrylic, and watercolor. Sometimes bats of different species will combine their voices when the air is filled with a variety of insects in late summer, creating a symphony of three-dimensional representation that would be forever cherished in our finest museums if we could translate this sound-painting into the limitations of our light-based artworks. They do it because of the delight that it brings them. The aesthetic pleasure of creating art. Bats are also creatures of home. Their caves are places of safety and comfort. To us their caves look dull-walled and nondescript, but from the bat's perspective they live in a hall of mirrors. When a chirp reaches the wall, it bounces back to the bat and off the bat and back to the wall creating an image of the bat in the depth of the wall, giving them the same effect a mirror does for us. In these echoes, they see themselves reflected as they make love, or share their food with offspring, or as they snuggle with their friends, and press their noses together with all those they love. The back-and-forth reflection creates the illusion of an eternity of bat life stretching to the horizon of their perception, like a room with facing looking-glasses in our world seems to stretch to an infinite vanishing point of endless mirrors, reminding them of the depth of existence and the joy of sharing life with other creatures that together create a community of warmth and food and chirps that carry meaning and artistic pleasures. But this does not negate the great joy bats feel when they press tightly against the body of another, whether lover or



friend (and bats make little distinction between the two), for their bodies are like glass to each other. They can hear the position of their bones as they press their bodies together—sense the movement of the rib cage as the breath moves in and out. The beating heart is present to them in its motion, its thump and reverberations. They “see” the rush of blood through the veins because it is not just a sound but a picture of the entire circulatory system. Further, not only is the body of their mate present but so is their own in relation to that other body, for the bat’s own body is visible in the sound as well. They see both personas in the sound waves that dance in that spatial representation, and this is reflected in the wall, again and again, dancing back and forth, making all the world one joyous work of art in motion. And because they can distinguish their own voice, and the voice of their beloved (there is no other human word that reflects better what a bat might feel for those in their embrace), from the voices of those all around them hanging crowded on the cave ceiling, they can in effect make themselves alone in a cavern of thousands. Alone with scores of their own reflections bouncing off the walls and floor, filling the universe with multiple instances of their love.