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American Academy of Arts and Sciences Induction Ceremony

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I am truly honored to be here, on this colorful fall day in Boston. I am particularly honored to be speaking as a biologist on behalf of Class II, the Biological Sciences. My credentials, I must confess, are a bit unorthodox; some might say they are “turncoat” credentials, since my graduate training and my paying job were actually in philosophy – philosophy of mind, more exactly. But my passion for understanding the mind was channeled in a scientific direction as it became ever more apparent that if you want to understand the mind you have to understand the brain. Observing behavior and making concepts clear, though certainly helpful, is insufficient. Among the major inspirations was the split-brain research, showing that one hemisphere could be aware of things of which the other hemisphere had no clue. That consciousness could be split by surgically separating the hemispheres was a totally unexpected and completely stunning result. Dualists everywhere shuddered in their boots.

The ancient problems that have vexed philosophers – how do we know things about the world, how do we make decisions, where do values come from, how does consciousness emerge – are fundamentally problems about mechanism: about how the nervous system is organized to perform these functions. Unlike David Hume in the eighteenth century, I was lucky to be alive when neuroscience was on the brink of catching a monumental wave. By the early 1970s, the developing techniques and methods in neuroscience lent promise to the apparently far-fetched idea that progress can be made on the nature of brain mechanisms for higher functions – memory and learning, decision-making and choice, sleep and consciousness. Skeptics abound, of course, especially in philosophy, but grand predictions of failure have tended to be scaled back to quiet mutterings. Neurophilosophy is thus at the interface of traditional philosophy on the one hand and neuroscience on the other, linking also to genetics, experimental psychology, anthropology, and ethology.

In this context I want to mention a discovery-constellation that stands out as having unexpected relevance to philosophy, and to moral philosophy in particular. The immediate relevance is to Socrates’ abiding question: where do moral values come from?cells. Thus gene modification produced the neocortex, a kind of soft-tissue computer in birds and mammals that overlies and connects with the ancient structures embodying motivation, drives, and emotions.

Let me give the background first. Surprisingly, the evolutionary development that led to mammalian and bird styles of sociality, including what we might call morality, was all about food – not about altruism per se. When warm-blooded animals first appeared, they enjoyed a masterful advantage over their cold-blooded competitors: they could forage at night when the warmth of the sun was absent, perhaps even feeding on sluggish cold-blooded reptiles awaiting the sun's warmth to get them going. A disadvantage had to be overcome: gram for gram, the warm-blooded creature has to eat ten times as much. Changes accordingly emerged in body and brain of the warm-blooded to enhance survival: females produced fewer offspring, and the offspring were prodigious learners. Scaling up learning was accomplished by arranging for infants to be born with highly immature brains. After birth, these learning-ready brains could tune themselves up to whatever causal circumstance they happened to be born into. This essentially involved extending on a grand scale existing mechanisms for learning. As a strategy, this was a game-changer, and it depended on a massive supply of highly organized nerve cells. Thus gene modification produced the neocortex, a kind of soft-tissue computer in birds and mammals that overlies and connects with the ancient structures embodying motivation, drives, and emotions.

The downside of this strategy for expanding cleverness is that infant mammals are pitifully dependent and easy prey. The solution to their survival? Rig it so that a mature animal cares for the infants until independence. Changing maternal brains to be caring brains was easy. Essentially, self-survival mechanisms were modified so that the ambit of me extended to me-and-mine. Just as the mature rat is wired to care for her own food and safety, so she is wired to care for the food and safety of her pups. Both mother and babies feel pain when separated and pleasure when reunited. They are bonded, and the bonding is embodied in neural circuitry. Is the love we feel real? Yes, indeed. It is as real as anything the brain does, such as remembering where home is, seeing the moon, or deciding to hide rather than run.

With related genetic changes, mates, kin, friends, and sometimes strangers came to be embraced in the sphere of me-ness; we nurture them, fight off threats to them, keep them safe. My brain knows these others are not me, but if I am attached to them, their plight fires up caring circuitry, motivating me to incur a cost to benefit the other.

Oxytocin, the ancient body-and-brain molecule, is at the hub of the intricate neural adaptations sustaining mammalian sociality. The fountainhead discovery was that injecting oxytocin into the brain of a virgin sheep brings on full maternal behavior – nudging a lamb to suckle, huddling over the lamb, and so forth. In some species, oxytocin injected into the brain of a male will also bring on species-typical fathering behavior. Not acting alone, oxytocin works with the opioids our brains manufacture, as well as with other hormones and signaling neurochemicals. Among its many roles, oxytocin decreases the stress response, making possible the friendly, trusting interactions typical of life in social mammals. I can let my guard down when I know I am among trusted family and friends.

Although the strong similarities of all mammalian brains invites the conjecture that much of this story holds for humans, I should interject here that much less is known about oxytocin's role in the human brain than in the nonhuman brain. One problem has been to find ethically acceptable and experimentally meaningful ways to administer oxytocin. Unlike, say cocaine, which you can sniff up the nose and which readily crosses the blood-brain barrier, oxytocin does not readily cross and it denatures very quickly.

What of norms and rules, which are endemic to human morality? Other modifications to the ancient brain structures facilitate internalizing the social practices of the group. The center of this part of the story is the mammalian reward system, a system integrating the old basal ganglia with the new frontal cortex. As with evolutionarily older animals, the basal ganglia allow mammals to develop habits and skills that enhance their ability to compete. In mammals, some of these habits and skills structure social interactions with the upshot that certain plans are inhibited and other plans are put into action despite a cost. Generally, approval for an action is rewarding and feels good, whereas disapproval feels bad. We pick up appropriate social behavior by imitating, sometimes quite unconsciously, our siblings and parents, thereby facilitating social harmony. As conditions change, solutions to social dilemmas may also change, and problem solving kicks in.

Something like a conscience about what is right and what is wrong emerges in the developing animal as its brain internalizes social norms and solves social problems.

In closing, may I emphasize that these neurobiological developments clarify the platform, and only the platform, for human morality. They help us understand how it is that we are social animals. As a science, neurobiology can help us understand why we tend to have a moral conscience, but neuroscience per se does not adjudicate specific rules or laws that make up the superstructure on the neurobiological platform. For that, we, as a collective, still need negotiation, compromise, good sense, and practical wisdom.

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