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Evolution of new brain area enables complex movements

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A new area of the cerebral cortex has evolved to enable man and higher primates to pick up small objects and deftly use tools, according to neuroscientists at the University of Pittsburgh School of Medicine and Pittsburgh's Veterans Affairs Medical Center.

The brain's primary motor cortex turns out to have neighboring "old" and "new" parts. In most animals, including cats, rats and some monkeys, the old primary motor cortex controls movement indirectly through the circuitry of the spinal cord, explained senior author Peter Strick, Ph.D., professor in the department of neurobiology at the School of Medicine and senior career scientist at the VA Medical Center.

But in man, the Great Apes and some monkeys, another area of the motor cortex developed and is now home to a special set of cortico-motoneuronal (CM) cells, he said. These cells directly control spinal cord motor neurons, which are the nerve cells responsible for causing contraction of shoulder, elbow and finger muscles. The direct control exerted by CM cells bypasses the limitations imposed by spinal cord circuitry and permits the development of highly complex patterns of movement, such as the independent finger action needed for playing an instrument or typing.

"What we've shown is that along with evolution of direct control over motor neurons, a new cortical area has evolved that's right next to the old one," Dr. Strick said. "We still have much the same spinal machinery the frog has, but the new cortical area with CM cells endows humans with

the superior hand skills to manufacture and use tools - an especially human trait."

He and co-author Jean-Alban Rathelot, Ph.D., a research associate in Dr. Strick's lab, based their conclusions on a series of experiments in which rabies virus was injected into single muscles in the shoulders, elbows or fingers of monkeys. The virus, chosen because of its unique ability to travel between networked nerve cells, was tracked to locate CM cells in the primary motor cortex. The findings have been published in the early online edition of the *Proceedings of the National Academy of Sciences.* Dr. Strick noted that the direct connection from the cortex to motor neurons is not present at birth, but develops during the first few months of life and becomes fully mature around two years of age. Thus, the progress of an infant's motor skills is a display of the establishment of these connections.

Source: University of Pittsburgh