PRESS RELEASE

12th International Breastfeeding and Lactation Symposium

300 million years of evolution have matched mother's milk to the baby's brain: Cow's milk for a human brain?

Baar/Bologna, 2 May 2017. "Moms liquefy their bodies to feed their babies," says evolutionary biologist Katie Hinde. Her latest cross-species research offers indisputable evidence that human breast milk is peerless in providing the necessary nutrients, hormones and bioactive constituents to form and fuel the most complex organ in existence, the human brain.

In just under 4 weeks, Assoc. Prof. Katie Hinde's 10-minute TED Talk "What We Don't Know About Mother's Milk" has drawn over 685,000 viewers into the global breastfeeding dialogue. **What is it about cross-species analysis, or comparative lactation, that is revolutionizing the field of breastfeeding science, and getting people to talk about it in a new way?**

At the 12th International Breastfeeding and Lactation Symposium, the answer was clear: Context. Cross-species milk comparison reveals that the branching off of each individual species to evolve along a different path directly influences the milk evolution of that species. The result is a striking diversity of mother's milk components between the milk of different species, and proof that the milk of each mammal is inimitably suited to nourish its own young.

"People think the dinosaurs came first, and then mammals," says Hinde, "Actually they coexisted. **Over 300 million years ago**, the synapsids and the sauropsids diverged; the synapsids became mammals, and the sauropsids became dinosaurs and reptiles."

At that moment, **milk began to evolve as a uniquely mammalian adaptation for providing protection and nutrients to offspring**--long before the rise of the first known dinosaurs 230 million years ago. **Mammals became distinguished by the unique ability of mothers to "liquefy their bodies to feed their young,"** as Hinde now famously puts it. As a mother's body has already adapted to the environment in which she is living, this liquefication passes on that adaptation in the form of sustenance, which enables the young of every species to grow, develop and thrive, regardless of the supply of food and clean water in the immediate environment.

For 300 million years, milk has continued to evolve, to supply the needs of every organ in an infant mammal's body, including the most complex organ, the brain. This evolutionary history makes it easier to understand why **the human brain**, still more sophisticated than any man-made technology and exponentially more complex than the next smartest animal brain, **is only fully supported in its infant development by human milk. A human mother's milk is equally as complex in comparison to the milk of all other mammals.**

Human milk contains hundreds of thousands of bioactive molecules[i], most of which influence the brain either directly or indirectly. Long-chain fatty acids in breast milk are used to form myelin sheaths around neurons, causing faster and more complex brain processing.[ii] Over 400 proteins[iii] not only feed the body, they also activate the immune system and supply neurotrophins which protect and cultivate the neurons in the brain. At least 200[iv] different types of oligosaccharides (pre-biotics) feed the microbiome (intestinal flora) and play a decisive role in lifelong immunity. By boosting the immune system, they reduce inflammation in the brain, indirectly promoting brain development. Pluripotent stems cells[v] are believed to travel to all the infant's organs, including the brain, to facilitate development. Micro-RNA are powerful genetic regulators[vi] that foster healthy cell development, including the white and grey cells in the massive cortex and the extraordinary network of fibres connecting the brain regions which distinguish the human intellect.

"**Of the 7,000 mammals**, nearly 40% of which are rodents and bats, **primates have the most complex lives and social relationships," says Hinde. "Human lives especially, offer the clearest evidence of the unparalleled complexity of the human brain.** Getting food is important, but so are your rivalries and your friendships. We are problem solvers, we are co-operators, we are competitors, we are strategists. We lead incredibly complex lives, based on the lessons we learn as we grow and develop. Those lessons are framed, fuelled, and built by mother's milk." **Both the human brain and human milk are unequalled.**

Hinde's latest research seeks to identify how unique hormones in mother's milk determine whether the milk is used by infants as fuel, or whether it is directed towards brain and organ formation. "You can burn a calorie only once. How a calorie becomes fuel or tissue has to be orchestrated in some way," says Hinde. "The hormones in milk guide the body's decision, when trade-offs are needed, whether to fuel development or provide fuel for behavioural action. This process depends on the mammal, the culture, and even the mother's local community environment. It is most complex for humans."

How the milk forms the brain in the infant and toddler years impacts much more than that early cognitive development. The most recent human research shows that mother's milk and breastfeeding also cause more advanced cognitive development later, during the tumultuous adolescent period[vii]. Beyond that, **the brain directs the lifetime course of the body**. A brain formed

and fuelled optimally through its evolutionary milk match is a brain that delivers a lifetime of optimal instructions to the entire body.

As bewitching as a "Tarzan" inspired fantasy of an ape mother nursing an orphaned human baby might be, in reality, an ape mother could offer only the bare essentials to the human baby's brain and body. **Mutual primate heritage only supplies the most rudimentary similarities in roughly equivalent percentages of milk fats, sugars, and proteins. The nuanced constituents of human milk are not found in ape milk (nor even in the milk of chimpanzees, a closer human cousin.)** Tarzan's brain would have suffered from the absence of the human milk constituents necessary for full development—another reason he didn't talk?

What about cow's milk? Does the ubiquitous availability of cow's milk for human consumption indicate a special compatibility of cow's milk for humans or human babies? "Actually, in the mammalian order, says Hinde, "rats and humans share more recent common ancestors than cows and humans." Anybody for rats milk? Cheers!

Nevertheless, **it is not genetic suitability, but rather the industrialized, worldwide supply of cow's milk**—it would take a lot more rats to get that much milk – **which has made it the basis for most mother's milk substitutes (infant formulas).** Since less than 40% of the newborn population is exclusively breastfed during the crucial first six months of life[viii], this means that 60%, or roughly **78 million newborns each year, are receiving a milk replacement which is profoundly mismatched to their genetic requirements as human babies, and particularly suboptimal for their brain development.**

Cow's milk is no match for the needs of a human infant brain, and so far science has not been able to reproduce the thousands of constituents necessary to create a formula that comes close to human milk. **Hinde concludes: "Breast milk is food, medicine, and signal; it is the first food a baby has evolved to eat, and we do not know enough about it to replicate it."**

Associate Professor Katie Hinde
Founder of the blog "Mammals Suck... Milk!" Assoc. Prof. Katie Hinde is making lactation science popular with a rising generation of parents, clinicians and academics. Associate Professor at the Centre for Evolution and Medicine and the School of Human Evolution and Social Change at Arizona State University, she directs the Comparative Lactation Laboratory at the California National Primate Research Centre. She has also served on Executive Council of the International Society for Research in Human Milk and Lactation.

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