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Title: Neural induction and neural plate patterning in natural and synthetic mammalian embryos

Abstract: Neural induction and the formation of central nervous system (CNS) occurs during gastrulation. In mammals, gastrulation is initiated by formation of the primitive streak through which epiblast cells ingress and give rise to the mesoderm and endoderm. Cells that do not travel through the primitive streak will form the neural plate and generate the future brain and spinal cord. How the CNS is initially specified and patterned along the anterior-posterior axis remains a central question in developmental biology. In mammals, the process of gastrulation and axis patterning occurs after the embryo has implanted into the uterine wall. Due to the inaccessibility of embryos implanted in the uterus, it is extremely challenging to study CNS specification and patterning in natural embryos. To overcome these technical challenges, we leverage recent technological advances of a 3-dimensional stem cell-derived embryo model developed in our lab that incorporates both embryonic and extra-embryonic stem cells and recapitulates neurulation *in vitro*. Using natural mouse embryos and stem-cell based embryos, we determined when the neural plate first becomes regionalized into fore- and mid-brain progenitors. We will determine when inhibition of essential signaling pathways such as BMP, Nodal, or Wnt is required, which tissues are the source of these inhibitory signals, or whether potentially inductive signals, such as Fgf, are also essential for neural induction and patterning. Together, these experiments will uncover the mechanisms of early formation of the nervous system and anterior-posterior patterning in mammalian embryos