How did the central nervous system evolve?

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How did the central nervous system evolve? How did the simple brain evolve to become the complex brain? To answer these questions, we have extensively analyzed both the structure of the planarian brain and the genetic program for brain regeneration from pluripotent stem cells in planarians. We found that the planarian had already evolved a fundamental structure/function and the developmental genetic program for the brain which have been evolutionary conserved. Based on these studies, we proposed the **"stem cell- subfunctionalization"** hypothesis to explain the evolution of the complex brain from the simple brain. Here we'll introduce a new insight to explain the evolutionary process of the centralization of the nervous system. Recently, genomes of cnidarians and platyhelminths have been determined. Cnidarians have diffuse nervous systems, whereas planarians have evolved a well-organized brain. Therefore, comparative genomics between these two phyla may reveal genomic differences that gave rise to centralization of the nervous system. Here, we will introduce one of such candidate gene, ***nou-darake***, which was first identified as a gene involved in restricting brain formation to the head region during planarian regeneration. We now speculate that it might have enabled brain formation during nervous system evolution.