## Neural circuit building

During development, sensory neurons form neural circuits with motoneurons. Although the anatomical details of these circuits are well described, less is known about the molecular mechanisms underlying their formation. To investigate the involvement of motoneurons in sensory neuron development, Hirohide Takebayashi and colleagues analyse sensory neuron phenotypes in the dorsal root ganglia (DRG) of *Olig2* knockout mouse embryos, which lack motoneurons (see p. 1125). These embryos, they report, also have reduced numbers of sensory neurons but increased numbers of apoptotic cells in the DRG. In addition, the axonal projections of the sensory neurons in these embryos are abnormal. Because neurotrophin 3 (*Ntf3*) and its receptors are strongly expressed in motoneurons and sensory neurons, respectively, the researchers also investigate whether Ntf3 is one of the motoneuron-derived factors that regulate sensory neuron development. Notably, the sensory neuron phenotypes in *Ntf3* conditional knockout embryos resemble those observed in *Olig2* knockout embryos. Thus, the researchers propose, motoneuron-derived Ntf3 is a pre-target neurotrophin that is essential for survival and axonal projection of sensory neurons.
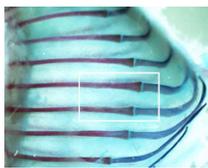
SIK3 bones up on chondrocyte hypertrophy

Most vertebrate bones develop through endochondral ossification. During this process, proliferating chondrocytes form a cartilage scaffold, differentiate into hypertrophic chondrocytes and die. The cartilage scaffold is then degraded and replaced by bone. Chondrocyte hypertrophy is, therefore, crucial for endochondral ossification. On p. 1153, Noriyuki Tsumaki and colleagues identify salt-inducible kinase 3 (SIK3) as an essential factor for chondrocyte hypertrophy in mice. SIK3-deficient mice, the researchers report, exhibit dwarfism, bone malformation and accumulation of chondrocytes in various bones. These phenotypes, they suggest, are due to impaired chondrocyte hypertrophy. Consistent with this suggestion, SIK3 is expressed in prehypertrophic and hypertrophic chondrocytes in the embryonic bones and postnatal growth plates of wild-type mice. Other experiments show that SIK3 anchors histone deacetylase 4 (HDAC4) in the cytoplasm, thereby releasing MEF2C, a transcription factor that facilitates chondrocyte hypertrophy, from suppression by HDAC4 in the nucleus. These results suggest that the regulation of HDAC4 by SIK3 is important for the progression of chondrocyte hypertrophy during skeletal development.

PRMT5 and stem cell function

Stem cells are essential for growth, development, gamete production and tissue homeostasis but what regulates their maintenance and function in vivo? On p. 1083, Phillip Newmark and colleagues report that the conserved protein arginine methyltransferase PRMT5 promotes stem cell function in planarian flatworms. These organisms contain a population of adult stem cells called neoblasts that can regenerate all the worm's tissues. Neoblasts characteristically contain chromatoid bodies, large cytoplasmic ribonucleoprotein (RNP) granules similar to structures that are present in the germline of many organisms. The researchers show that, like germline RNP granules, chromatoid bodies contain proteins bearing symmetrical dimethylarginine (sDMA) modifications, probably including the PIWI family member SMEDWI-3. PRMT5 is responsible for sDMA modification of these proteins, they report, and PRMT5 depletion results in fewer chromatoid bodies, fewer neoblasts, and defects in regeneration, growth and homeostasis. Together, these results identify new chromatoid body components that are involved in neoblast function and add to the evidence that suggests that sDMA modification of proteins stabilises RNP granules.
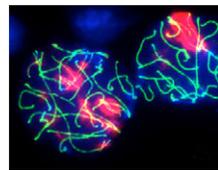
BR(in)G1 on male meiosis

Mammalian germ cell development and gametogenesis involve several genome-wide changes in epigenetic modifications and chromatin structure. Here (p. 1133), Terry Magnuson and co-workers explore the role of the mammalian SWI/SNF chromatin-remodelling complex during spermatogenesis in mice. The researchers report that levels of the SWI/SNF catalytic subunit brahma-related gene 1 (BRG1) peak during the early stages of meiosis. Consistent with this expression pattern, germline ablation of *Brg1* produces germ cells that arrest during prophase 1, the stage of meiosis during which the induction and repair of DNA double-strand breaks generates recombination between homologous chromosomes. In line with the timing of their meiotic arrest, BRG1-depleted spermatocytes accumulate unrepaired DNA and fail to complete synapsis. They also exhibit global alterations to histone modifications and chromatin structure, including alterations that are associated with DNA damage and heterochromatin. The researchers propose, therefore, that BRG1 has an essential role in spermatogenesis and that BRG1-containing complexes function in the programmed recombination and repair events that occur during meiosis.
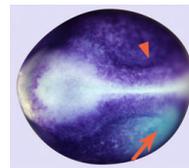
Binary route to (non)-neural competence

During gastrulation, neural crest and cranial placodes originate at the neural plate border and from an adjacent territory, respectively. But do these ectodermal tissues arise from a common precursor or from neural and non-neural ectoderm (the binary competence model)? On p. 1175, Gerhard Schlosser and colleagues use tissue grafting in *Xenopus* embryos to tackle this controversy. They show that, at neural plate stages, competence for induction of neural plate, border and crest markers is restricted to neural ectoderm, whereas competence for induction of panplacodal markers is confined to non-neural ectoderm. The homeobox protein Dlx3 and the transcription factor GATA2 are both required cell-autonomously for panplacodal and epidermal marker expression in non-neural ectoderm, they report. Moreover, the ectopic expression of Dlx3 (but not GATA2) in the neural plate is sufficient to induce non-neural markers, whereas the overexpression of Dlx3 or GATA2 suppresses neural plate, border and crest markers in the neural plate. Together, these results support the binary competence model and implicate Dlx3 in the regulation of non-neural competence.
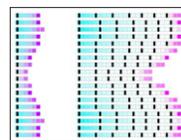
Morphogen-based simulation of fin development

One of the greatest challenges in developmental biology is to understand how shape and size are controlled during development. Interactions between growth and pattern formation mechanisms are key drivers of morphogenesis but are difficult to study experimentally because of the highly dynamic nature of development in space and time. Here (p. 1188), Anne-Gaëlle Rolland-Lagan and co-workers use simulation modelling to explore how mobile signals, such as morphogens, might coordinate growth and patterning during zebrafish caudal fin development and regeneration. The zebrafish fin comprises 16 to 18 bony rays, each of which contains multiple joints along its proximodistal axis that give rise to segments. The researchers propose a model in which the interaction of three postulated morphogens can account for the available experimental data on fin growth and joint patterning and for the regeneration of a properly shaped fin following amputation. This simple, plausible model provides a theoretical framework that could guide future searches for the molecular regulators of fin growth and regeneration.

Jane Bradbury