Auditory repetition and dyslexia

Some dyslexic individuals have trouble encoding regularities in repeated sets of sounds, report Merav Ahissar and colleagues on page 1558 of this issue. Developmental dyslexia is a common condition characterized by difficulty in the acquisition of reading skills. The root cause of dyslexia remains controversial, but is believed to involve impairments in processing the sounds that make up language, known as phonology. Although reading takes visually presented letters as input, and might therefore seem to be primarily a visual task, deriving meaning from these letters seems to necessitate the formation of phonological representations as an intermediate step. Consistent with this hypothesis, dyslexics perform poorly compared to non-dyslexics on tasks involving phonology. Their performance is often found to be poor on many other auditory tasks as well, however, and the link between these general performance deficits and reading difficulties remains largely unexplained.

Merav Ahissar and colleagues now report that a subpopulation of dyslexics, those with learning disabilities, cannot use sound repetition to their advantage in auditory tasks, a deficit that seems to account for many prior reports of poor psychoacoustic performance. Dyslexic subjects performed as well as control subjects on two auditory discrimination tasks when the sound stimuli were drawn from a large set. When the stimulus sets were small, the performance of the control subjects improved, presumably because they could use the regularities to help them perform the task. For instance, when asked to judge which of two tones was higher in pitch, control subjects performed much better when one of the tones was always at the same frequency, perhaps because they formed an internal representation of the standard tone that they could compare to the other tone when making the judgment. Dyslexic subjects, in contrast, failed to benefit from small stimulus sets involving sound repetitions, performing much worse than control subjects under those conditions. The authors suggest that this might be because dyslexics are unable to form a memory trace of the repeated stimuli, suggesting that a problem with sensory memory could underlie many previous reports of abnormal performance by dyslexics on basic sensory tasks. Whether this impairment generalizes to dyslexics who are not learning disabled, and whether it is causally related to reading difficulties, remains to be seen.

Josh McDermott

Opioid, cheating on its receptors, exacerbates pain

Christophe Altier & Gerald W Zamponi

Opioids are commonly thought of as compounds that alleviate pain. A new study finds that elevated levels of the opioid dynorphin can unexpectedly activate bradykinin receptors, contributing to the maintenance of neuropathic pain.

Endogenous opioid peptides are efficient analgesics that bind to opioid receptors and typically are produced by the body to counteract chronic pain, while sparing the acute pain signals that alert us to impending injury[1]. Clinically this is relevant to the use of morphine and other exogenous opioids to achieve analgesia. In this issue, however, Lai and colleagues[2] have uncovered a new action of the opioid dynorphin A, which, by virtue of its promiscuous action on bradykinin receptors, causes increased rather than decreased pain.

The dorsal root ganglia (DRG) are key relay centers transmitting peripheral pain signals by way of afferent (C and Aδ) nerve fibers into the dorsal horn of the spinal cord. Action potentials traveling along these afferent fibers cause the opening of presynaptically localized N-type calcium channels, which triggers the release of neurotransmitters such as substance P, CGRP and glutamate[3]. These transmitters then activate postsynaptic receptors on neurons projecting to the higher brain centers that allow us to perceive pain. Excessive neurotransmitter release from DRG neurons elevates postsynaptic excitation, resulting in increased pain, as is observed following activation of bradykinin receptors[4,5]. Conversely, inhibition of neurotransmitter release can reduce pain, as evident from the actions of endogenous opioids such as enkephalins and endorphins, which activate opioid receptor signaling to produce inhibition of N-type calcium channels and thus of evoked neurotransmitter release[6]. Elevated levels of dynorphin A are observed under certain chronic pain conditions, which, given the typical action of opioids, would be expected to have beneficial (that is, analgesic) effects[7]. This does not seem to be the case, however, as intrathecal administration of the opioid dynorphin A triggers an increased pain response (allodynia and hyperalgesia)—stimulating rather than inhibiting the release of excitatory neurotransmitters[8]. Thus dynorphin A may be targeting another cellular mechanism besides the activation of opioid receptors.

The authors are at the Hotchkiss Brain Institute, Department of Physiology and Biophysics, University of Calgary, 3330 Hospital Drive NW, Calgary, Alberta T2N 4N1, Canada.
e-mail: zamponi@ucalgary.ca