How can we understand persistent pain?

Acute pain evoked by tissue injury makes biologic sense and can be explained mechanistically in great detail. It is much more difficult to understand why pain so often persists after healing of an injury, or even arises and persists without any obvious bodily cause. A necessary condition for the feeling of pain seems to be synchronized, oscillatory activity in distributed neural networks – regardless the cause of the pain (e.g. tissue injury, interruption of sensory inputs, or suggestion during hypnosis). However, the networks related to persistent pain seem to differ from the those related to acute pain and show a more individually varied pattern of activations. The brain's "pain network" may not be specific to pain since it shares its most consistent nodes with the so-called "salience network" – that is, a network that processes information about all kinds of salient events. Indeed, pain may be regarded as one among several salient feelings (fear, fatigue, dizziness...) that alert us to threats to our bodily and mental integrity. Figure 1 gives a highly simplified overview of the many factors that can drive the pain networks, and thus evoke the feeling of pain.

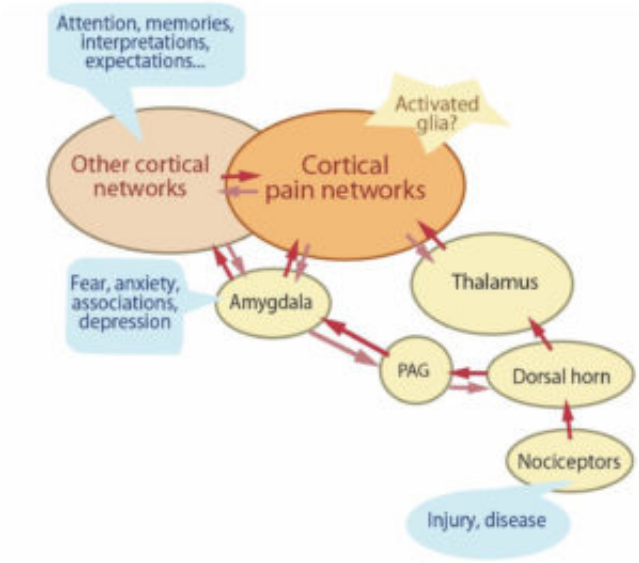

Fig. 1. The cortical pain networks and modes of activation. Schematic to show how quite different inputs can activate the network – from peripheral nociceptors triggered by tissue injury to purely mental processes. From Brodal P. The Central Nervous System 5th Ed. New York: Oxford University Press; 2016. With permission.

Basic properties of the "pain system" may help to explain why it so often goes awry, leading to persistent pain. Thus, the system must be highly sensitive not to miss important threats, it cannot be very specific, and it must quickly learn important associations. Indeed, learning and memory processes play an important role in persistent pain. Thus, behavior with the goal of avoiding pain provocation is quickly learned and often persists despite healing of an injury. There is suggestive

evidence that the hippocampal formation is involved in the development and maintenance of persistent pain.

In many instances persistent pain may be understood as the result of an interpretation of the organism's state of health. Any abnormal pattern of sensory information (e.g. due to nerve damage, amputation or immobilization) as well as lack of expected correspondence between motor commands and sensory feedback may be interpreted as bodily threats and evoke pain. Accordingly, many patients with persistent pain show evidence of a distorted body image.

Another approach to understanding why the "pain system" so often goes awry comes from knowledge of the dynamic and nonlinear behavior of neuronal networks. In real life the emergence of persistent pain probably depends on the simultaneous occurrence of numerous challenges (Fig. 1), and just one extra (however small) might put the network into an inflexible state with heightened sensitivity to normally innocuous inputs.

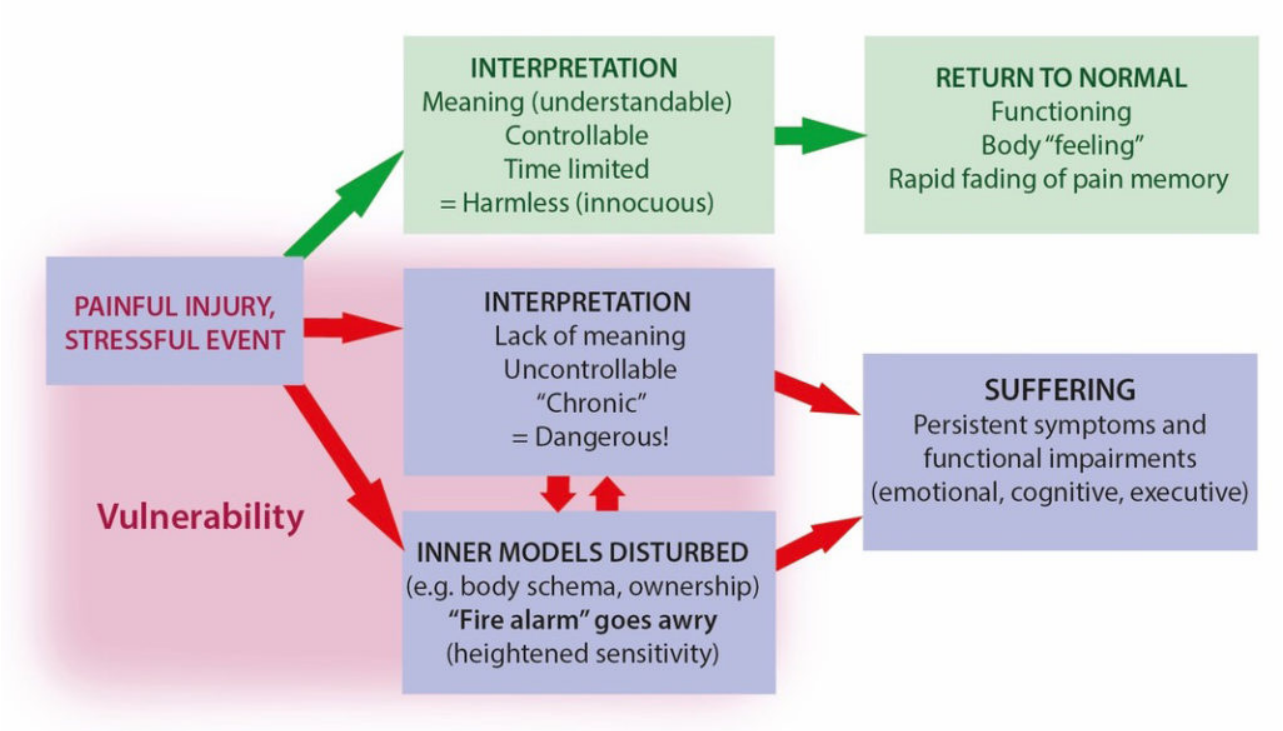

Fig. 2. Persistent pain and meaning. Possible steps and factors that may differentiate the normal situation, in which pain abates in pace with the healing, from situations with development of persistent pain. From Brodal P. The Central Nervous System 5th Ed. New York: Oxford University Press; 2016. With permission.

Finally, the importance of seeking the meaning the patient attributes to his/her pain is emphasized

(Fig. 2). Only then can we understand why a particular person suffers so much more than another with very similar pathology, and subsequently be able to help the person to alter the meaning of the situation.

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