

**Self-reinforcing expectancy effects on pain: Behavioral and brain  
mechanisms**

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**Abstract**

2 Beliefs and expectations often persist despite disconfirming evidence. We  
3 examine two potential mechanisms underlying such 'self-reinforcing' expectancy  
4 effects in the pain domain: Modulation of perception and biased learning. In two  
5 experiments, cues previously associated with symbolic representations of high or  
6 low temperatures preceded painful heat. We examined trial-to-trial dynamics in  
7 participants' expected pain, reported pain, and brain activity. Subjective and  
8 neural pain responses assimilated towards cue-based expectations, and pain  
9 responses in turn predicted subsequent expectations, creating a positive dynamic  
10 feedback loop. Furthermore, we found evidence for a confirmation bias in  
11 learning: Higher- and lower-than-expected pain triggered greater expectation  
12 updating for high- and low-pain cues, respectively. Individual differences in this  
13 bias were reflected in the updating of pain-anticipatory brain activity.  
14 Computational modeling provided converging evidence that expectations  
15 influence both perception and learning. Together, these effects promote self-  
16 reinforcing expectations, helping to explain why beliefs can be resistant to  
17 change.

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