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In Reply—We have much sympathy for Riopelle's views, for we too have been touched by the suffering of amputees with intractable phantom limb pain. We have been frustrated by our inability to relieve their anguish and distress, and we are disillusioned with our colleagues who do not take seriously the reports of amputees who continue to suffer with phantom limb pain that is identical to the pain they experienced in their limb before amputation. That animals show behavioral evidence of persistent injury-induced central neural activity in the absence of any experience of the injury in the awake state strongly suggests that, among amputees, the similarity in the sensory component of pain before and after amputation does not depend on conscious awareness at the time of injury.

The ethical and moral boundaries involved in studying chronic pain in animals have been debated in the past and continue to be a source of concern for the scientific community as well as the public at large.1-3 The International Association for the Study of Pain (IASP) has outlined ethical guidelines for investigations of pain in conscious animals.4 The autotomy model falls within IASP guidelines and is commonly used as an animal model of phantom limb pain and anesthesia dolorosa.

Our use of this procedure was based not only on its appropriateness as an animal model of neuropathic pain, but also on the degree to which it is ethically acceptable. It is important to note that the rats do not feel pain as a result of their biting, because the entire paw has been denervated and therefore is insensitive to stimulation. Furthermore, the rats do not show signs of severe suffering; they eat, gain weight, groom, and engage in sexual behavior in a normal manner. It has been suggested that in this model, rats are not subjected to severe prolonged pain, but rather to mild dysesthesias combined with occasional brief attacks of more intense pain.5 The lack of behavioral signs of severe suffering, combined with the potential benefits of such research to our understanding of pain mechanisms and therapy, points to the justification of such investigations from an ethical standpoint. As an additional ethical consideration, and as described in the paper, the rats were killed within 5 days of autotomy onset. We cannot advance our understanding of these disorders and improve available treatments for chronic pain sufferers without appropriate animal models.

Our decision to submit the paper to ANESTHESIOLOGY was motivated by a desire to address anesthesiologists—specialists who have much to offer patients about to undergo amputation. The clinical implications of our study are clear. First, pain should be relieved prior to amputation. If there is pain in the limb before amputation, there is a good chance that it will persist after amputation (or at least contribute to increased phantom limb pain intensity). Second, just as a preamputation lesion may persist as a phantom pain "memory" and cause the patient continued suffering and distress, the effects of cutting tissue, nerve, and bone during the amputation may persist as well. The use of a general anesthetic does not protect the patient adequately from the surgical trauma because these effects are independent of conscious awareness. Preoperative regional anesthesia should block the surgically induced central neural changes from contributing to postoperative phantom limb pain and stump pain.

JOEL KATZ, PH.D.
TERENCE J. CORDERRE, PH.D.
ANTHONY L. VACCARINO, PH.D.
RONALD MELZACK, PH.D.
Department of Psychology
The Toronto Hospital
Toronto General Division
200 Elizabeth Street, CW2-306
Toronto, Ontario Canada M5G 2C4

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