Our laboratory employs a master-yoke paradigm to assess instrumental learning within the isolated spinal cord. During testing transected rats receive shock to one hindlimb whenever the hindlimb is extended. These subjects rapidly learn to maintain the leg in a flexed position, minimizing net shock exposure. However, if shock is given independent of leg position (uncontrollable shock), subjects fail to display an increase in flexion duration. This learning deficit can be induced with as little as 6 minutes of intermittent uncontrollable shock to the leg or the tail, and lasts for up to 24 hours (Crown et al, 2002, Behavioral Neuroscience, 116, 6).

Crown et al. also showed that continuous shock administered to the tail induces a robust antinociception, but not the learning deficit. They found that 15-360s of continuous shock had no effect on spinal plasticity, and that presenting continuous shock in compound with intermittent shock blocked the adverse effects of intermittent shock on spinal learning. Other findings suggest that intermittent and continuous shock may have opposite effects on mechanical/nociceptive reactivity. Only continuous shock inhibits tail withdrawal from radiant heat, while intermittent shock has little effect on thermal threshold but enhances mechanical reactivity (alldynia). These observations led us to hypothesize that intermittent and continuous stimulation have opposing effects on behavioral plasticity and nociceptive reactivity. If so, intermittent shock should attenuate the antinociceptive effects of continuous shock treatment. Rats were spinally transected and exposed to intermittent (80 ms shock pulses spaced 0.2-3.8 s apart) or 3 long (25-s) continuous 1.5 mA tailshocks. Nociceptive reactivity was assessed with the tail-flick test. Results showed 1) that the acute effect of continuous shock was attenuated by intermittent shock, 2) even though intermittent shock affects learning for up to 24 hours, its effect on continuous shock-induced antinociception decayed more rapidly, and 3) intermittent shock did not influence morphine-induced antinociception in spinal rats.