Stanford

Joan Kendig

Professor of Biology in the Department of Anesthesia, Emeritus

Anesthesiology, Perioperative and Pain Medicine

Bio

ACADEMIC APPOINTMENTS

- Emeritus Faculty, Acad Council, Anesthesiology, Perioperative and Pain Medicine

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

My laboratory tries to find out how pharmacologic agents used in the practice of anesthesia (general anesthetic and analgesic agents) lead to therapeutically desireable endpoints including unconsciousness, immobility and absence of pain. The old idea that general anesthetics are uniformly non-specific "membrane stabilizers" has given way to the realization that these agents exert specific actions on particular ion channels and intracellular signalling systems. Currently we are identifying anesthetic effects on ligand-gated and second messenger-operated ion channels in mammalian neurons, using both receptor-specific evoked potentials from isolated superfused spinal cord and whole cell patch clamp of neurons in situ in spinal cord slices. The goal of the research program is to construct a manageable set of actions which alone or in combination are both necessary and sufficient to bring about an anesthetic state.Most recently we have focused attention on mechanisms of spinal sensitization that contribute to chronic pain following injury and also to the development of tolerance to anesthetic and analgesic agents. We have described and partially characterized long term potentiation (LTP) in isolated spinal cord. We have also discovered long-lasting increases in spinal cord excitability following exposure to opioids such as morphine and to ethanol; these changes may be related to mechanisms of tolerance, dependence, and withdrawal.

Publications

PUBLICATIONS

- **Hyperresponsiveness on washout of volatile anesthetics from isolated spinal cord compared to withdrawal from ethanol** *ANESTHESIA AND ANALGESIA*
  Wong, S. M., Sweitzer, S. M., Peters, M. C., Kendig, J. J.
  2005; 100 (2): 413-418
- **Protein kinase C gamma mediates ethanol withdrawal hyper-responsiveness of NMDA receptor currents in spinal cord motor neurons** *BRITISH JOURNAL OF PHARMACOLOGY*
  Li, H. F., Mochly-Rosen, D., Kendig, J. J.
  2005; 144 (3): 301-307
- **Acute and chronic ethanol exacerbates formalin pain in neonatal rats** *NEUROSCIENCE LETTERS*
  Shumilla, J. A., Sweitzer, S. M., Kendig, J. J.
  2004; 367 (1): 29-33
- **Acute and chronic ethanol does not affect incisional pain in neonatal rats** *NEUROSCIENCE LETTERS*
  Shumilla, J. A., Sweitzer, S. M., Kendig, J. J.
  2004; 366 (3): 332-335
- **Mechanical allodynia and thermal hyperalgesia upon acute opioid withdrawal in the neonatal rat** *PAIN*
  Sweitzer, S. M., Allen, C. P., Zissen, M. H., Kendig, J. J.
  2004; 110 (1-2): 269-280

- **Exaggerated nociceptive responses on morphine withdrawal: roles of protein kinase C epsilon, and gamma** *PAIN*
  Sweitzer, S. M., Wong, S. M., Tjolsen, A., Allen, C. P., Mochly-Rosen, D., Kendig, J. J.
  2004; 110 (1-2): 281-289

- **Inhibition of spinal protein kinase C-epsilon or -gamma isozymes does not affect halothane minimum alveolar anesthetic concentration in rats** *ANESTHESIA AND ANALGESIA*
  Shumilla, J. A., Sweitzer, S. M., Eger, E. I., Laster, M. J., Kendig, J. J.
  2004; 99 (1): 82-84

- **Protein kinase C epsilon and gamma: Involvement in formalin-induced nociception in neonatal rats** *JOURNAL OF PHARMACOLOGY AND EXPERIMENTAL THERAPEUTICS*
  Sweitzer, S. M., Wong, S. M., Peters, M. C., Mochly-Rosen, D., Yeomans, D. C., Kendig, J. J.
  2004; 309 (2): 616-625

- **Ethanol withdrawal hyper-responsiveness mediated by NMDA receptors in spinal cord motor neurons** *BRITISH JOURNAL OF PHARMACOLOGY*
  Li, H. F., Kendig, J. J.
  2003; 139 (1): 73-80

- **Enflurane decreases glutamate neurotransmission to spinal cord motor neurons by both pre- and postsynaptic actions** *ANESTHESIA AND ANALGESIA*
  Cheng, G., Kendig, J. J.
  2003; 96 (5): 1354-1359

- **Ethanol tachyphylaxis in spinal cord motorneurons: role of metabotropic glutamate receptors** *BRITISH JOURNAL OF PHARMACOLOGY*
  Li, H. F., Wang, M. Y., Knape, J., Kendig, J. J.
  2003; 138 (8): 1417-1424

- **Pre- and postsynaptic volatile anaesthetic actions on glycinergic transmission to spinal cord motor neurons** *BRITISH JOURNAL OF PHARMACOLOGY*
  Cheng, G., Kendig, J. J.
  2002; 136 (5): 673-684

- **In vitro networks: subcortical mechanisms of anaesthetic action** *BRITISH JOURNAL OF ANAESTHESIA*
  Kendig, J. J.
  2002; 89 (1): 91-101

- **Acetylcholine receptors do not mediate isoflurane's actions on spinal cord in vitro** *ANESTHESIA AND ANALGESIA*
  Wong, S. M., Sonner, J. M., Kendig, J. J.
  2002; 94 (6): 1495-1499

- **Enflurane actions on spinal cords from mice that lack the beta(3) subunit of the GABA(A) receptor** *Annual Meeting of the Assocication-of-University-Anesthesiologists*
  Wong, S. M., Cheng, G., Homanics, G. E., Kendig, J. J.
  LIPPINCOTT WILLIAMS & WILKINS.2001: 154–64

- **Enflurane directly depresses glutamate AMPA and NMDA currents in mouse spinal cord motor neurons independent of actions on GABA(A) or glycine receptors** *ANESTHESIOLOGY*
  Cheng, G., Kendig, J. J.
  2000; 93 (4): 1075-1084

- **Patch clamp studies of motor neurons in spinal cord slices: a tool for high-resolution analysis of drug actions** *ACTA PHARMACOLOGICA SINICA*
  Wang, M. Y., Kendig, J. J.
  2000; 21 (6): 507-515

- **Ethanol directly depresses AMPA and NMDA glutamate currents in spinal cord motor neurons independent of actions on GABA(A) or glycine receptors** *JOURNAL OF PHARMACOLOGY AND EXPERIMENTAL THERAPEUTICS*
  Wang, M. Y., Rampil, I. J., Kendig, J. J.
  1999; 290 (1): 362-367

- **Differential sensitivities of TTX-resistant and TTX-sensitive sodium channels to anesthetic concentrations of ethanol in rat sensory neurons** *JOURNAL OF NEUROSCIENCE RESEARCH*
  Wu, J. V., Kendig, J. J.

1998; 54 (4): 433-443

- **Glutamate receptor-mediated hyperexcitability after ethanol exposure in isolated neonatal rat spinal cord** *JOURNAL OF PHARMACOLOGY AND EXPERIMENTAL THERAPEUTICS*
  Wong, S. M., Tauck, D. L., Fong, E. G., Kendig, J. J.
  1998; 285 (1): 201-207
- **Ethanol as a general anesthetic: Actions in spinal cord** *EUROPEAN JOURNAL OF PHARMACOLOGY*
  Wong, S. M., Fong, E., Tauck, D. L., Kendig, J. J.
  1997; 329 (2-3): 121-127
- **Propofol potentiates the depressant effect of alfentanil in isolated neonatal rat spinal cord and blocks naloxone-precipitated hyperresponsiveness** *NEUROSCIENCE LETTERS*
  Feng, J. Q., Kendig, J. J.
  1997; 229 (1): 9-12
- **Synergistic interactions between midazolam and alfentanil in isolated neonatal rat spinal cord** *BRITISH JOURNAL OF ANAESTHESIA*
  Feng, J., Kendig, J. J.
  1996; 77 (3): 375-380
- **The NMDA receptor antagonist MK-801 differentially modulates mu and kappa opioid actions in spinal cord in vitro** *PAIN*
  Feng, J. Q., Kendig, J. J.
  1996; 66 (2-3): 343-349
- **ANESTHETIC ACTIONS WITHIN THE SPINAL-CORD - CONTRIBUTIONS TO THE STATE OF GENERAL-ANESTHESIA** *TRENDS IN NEUROSCIENCES*
  Collins, J. G., Kendig, J. J., Mason, P.
  1995; 18 (12): 549-553
- **LONG-TERM POTENTIATION IN AN ISOLATED PERIPHERAL NERVE-SPINAL CORD PREPARATION** *JOURNAL OF NEUROPHYSIOLOGY*
  Lozier, A. P., Kendig, J. J.
  1995; 74 (3): 1001-1009
- **SELECTIVE EFFECTS OF ALFENTANIL ON NOCICEPTIVE-RELATED NEUROTRANSMISSION IN NEONATAL RAT SPINAL-CORD** *BRITISH JOURNAL OF ANAESTHESIA*
  Feng, J., Kendig, J. J.
  1995; 74 (6): 691-696
- **N-METHYL-D-ASPARTATE RECEPTORS ARE IMPLICATED IN HYPERRESPONSIVENESS FOLLOWING NALOXONE REVERSAL OF ALFENTANIL IN ISOLATED RAT SPINAL-CORD** *NEUROSCIENCE LETTERS*
  Feng, J. Q., Kendig, J. J.
  1995; 189 (2): 128-130
- **SELECTIVE EFFECTS OF KETAMINE ON AMINO ACID-MEDIATED PATHWAYS IN NEONATAL RAT SPINAL-CORD** *BRITISH JOURNAL OF ANAESTHESIA*
  BROCKMEYER, D. M., Kendig, J. J.
  1995; 74 (1): 79-84
- **CORRELATES OF ANESTHETIC PROPERTIES IN ISOLATED SPINAL-CORD - CYCLOBUTANES** *EUROPEAN JOURNAL OF PHARMACOLOGY*
  Kendig, J. J., Kodde, A., Gibbs, L. M., Ionescu, P., Eger, E. I.
  1994; 264 (3): 427-436
- **PROPOFOL AND BARBITURATE DEPRESSION OF SPINAL NOCICEPTIVE NEUROTRANSMISSION** *1991 ANNUAL MEETING OF THE AMERICAN PAIN SOC*
  Jewett, B. A., Gibbs, L. M., Tarasiuk, A., Kendig, J. J.
  LIPPINCOTT-RAVEN PUBL.1992: 1148–54
- **SUBSTANCE-P AND NMDA RECEPTOR-MEDIATED SLOW POTENTIALS IN NEONATAL RAT SPINAL-CORD - AGE-RELATED-CHANGES** *BRAIN RESEARCH*
  Gibbs, L. M., Kendig, J. J.
  1992; 595 (2): 236-241

- **SUBSTANCE-P AND NMDA RECEPTORS MEDIATE A SLOW NOCICEPTIVE VENTRAL ROOT POTENTIAL IN NEONATAL RAT SPINAL-CORD** *BRAIN RESEARCH*
  Woodley, S. J., Kendig, J. J.
  1991; 559 (1): 17-21
- **ISOFLURANCE DEPRESSES BOTH GLUTAMATE-MEDIATED AND PEPTIDE-MEDIATED SLOW SYNAPTIC TRANSMISSION IN NEONATAL RAT SPINAL-CORD** *ANNALS OF THE NEW YORK ACADEMY OF SCIENCES*
  SAVOLA, M. K., Woodley, S. J., Kendig, J. J.
  1991; 625: 281-282
- **ANESTHETIC ACTIONS IN THE HIPPOCAMPAL-FORMATION** *ANNALS OF THE NEW YORK ACADEMY OF SCIENCES*
  Kendig, J. J., MacIver, M. B., Roth, S. H.
  1991; 625: 37-53
- **THE ALPHA-2-ADRENOCEPTOR AGONIST DEXMEDETOMIDINE INCREASES THE APPARENT POTENCY OF THE VOLATILE ANESTHETIC ISOFLURANE IN RATS INVIVO AND IN HIPPOCAMPAL SLICE INVITRO** *BRAIN RESEARCH*
  SAVOLA, M. K., MacIver, M. B., Doze, V. A., Kendig, J. J., Maze, M.
  1991; 548 (1-2): 23-28
- **ALPHA-2-ADRENOCEPTORS INHIBIT A NOCICEPTIVE RESPONSE IN NEONATAL RAT SPINAL-CORD** *EUROPEAN JOURNAL OF PHARMACOLOGY*
  Kendig, J. J., SAVOLA, M. K., Woodley, S. J., Maze, M.
  1991; 192 (2): 293-300
- **ANESTHETIC EFFECTS ON RESTING MEMBRANE-POTENTIAL ARE VOLTAGE-DEPENDENT AND AGENT-SPECIFIC** *ANESTHESIOLOGY*
  MacIver, M. B., Kendig, J. J.
  1991; 74 (1): 83-88
- **ENFLURANE-INDUCED BURST DISCHARGE OF HIPPOCAMPAL CA1-NEURONES IS BLOCKED BY THE NMDA RECEPTOR ANTAGONIST APV** *BRITISH JOURNAL OF ANAESTHESIA*
  MacIver, M. B., Kendig, J. J.
  1989; 63 (3): 296-305
- **GENERAL ANESTHETIC MODIFICATION OF SYNAPTIC FACILITATION AND LONG-TERM POTENTIATION IN HIPPOCAMPUS** *BRITISH JOURNAL OF ANAESTHESIA*
  MacIver, M. B., Tauck, D. L., Kendig, J. J.
  1989; 62 (3): 301-310
- **SYNAPTIC INTEGRATIVE PROPERTIES AT HYPERBARIC PRESSURE** *JOURNAL OF NEUROPHYSIOLOGY*
  Grossman, Y., Kendig, J. J.
  1988; 60 (4): 1497-1512
- **PRESSURE REVERSAL OF ANESTHESIA - A SYNAPTIC MECHANISM** *BRITISH JOURNAL OF ANAESTHESIA*
  Kendig, J. J., Grossman, Y., MacIver, M. B.
  1988; 60 (7): 806-816
- **CHOLINERGIC REGULATION OF IMPULSE FREQUENCY IN PERIPHERAL-NERVE** *BRAIN RESEARCH*
  Kendig, J. J., LO, M. V.
  1987; 435 (1-2): 24-28