

**BIOGRAPHICAL SKETCH**

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NAME Clifford John Woolf		POSITION TITLE Richard J. Kitz Professor of Anesthesia Research, Harvard Medical School and Mass.General Hospital	
eRA COMMONS USER NAME cjwoolf			
EDUCATION/TRAINING <i>(Begin with baccalaureate or other initial professional education, such as nursing, and include postdoctoral training.)</i>			
INSTITUTION AND LOCATION	DEGREE <i>(if applicable)</i>	YEAR(s)	FIELD OF STUDY
University of Witwatersrand, South Africa	BSc	1972	Physiology
University of Witwatersrand, South Africa	MB, BCh	1977	Medicine
University of Witwatersrand, South Africa	PhD	1979	Physiology
Royal College of Physicians, London	MRCP	1981	Medicine

**A. Positions and Honors:**

**Positions and Employment:** **1978** Intern in Medicine and Surgery, Johannesburg General Hospital, South Africa; **1979-81** Lecturer, Middlesex Hospital Medical School, London, UK; **1981-97** Lecturer/Senior Lecturer/Professor of Neurobiology, University College London, UK; **1997-** Professor of Anesthesia Research, Harvard Medical School and Director Neural Plasticity Research Group Massachusetts General Hospital

**Other Experience and Professional Memberships:** Member Society for Neuroscience and International Association for the Study of Pain, Chairman of panel to advise the Directors of NIDCR and NINDS on the re-organization of the NIH intramural pain program 1998; Member, Arthritis Advisory Committee, FDA 2002, Pfizer Scholars Grants in Pain Medicine Advisory Board 2005-7, National Institute for Dental and Craniofacial Research, Pain and Neuroscience Working Group 2005; Chair NIH Trigeminal Pain RFA Review.

**Honors:** **1977** South African Medical Association Medal for most distinguished Medical graduate; **1987** Distinguished Young Investigator Award International Association for the Study of Pain; **1991** Bristol-Myers Squibb Pain Research Award; **2001** Spine Society of Europe Medal; **2002** Bonica Medal; **2004** American Society of Anesthesia Award for Excellence in Research.

**B. Selected peer-reviewed publications (in chronological order)**

Woolf CJ. Evidence for a central component of post-injury pain hypersensitivity. **Nature** 1983;306:686-83.

Cook AJ, Woolf CJ, Wall PD, McMahon SB. Dynamic receptive field plasticity in the dorsal horn of the rat spinal cord following C-primary afferent input. **Nature** 1987;325:151-3

Woolf CJ, Shortland P, Coggeshall RE. Peripheral nerve injury triggers central sprouting of myelinated afferents. **Nature**. 1992;355:75-7

Richmond CE, Bromley LM, Woolf CJ. Preoperative morphine pre-empts postoperative pain. **Lancet** 1993;342:73-5

Neumann S, Doubell TP, Leslie T, Woolf CJ. Inflammatory pain hypersensitivity mediated by phenotypic switch in myelinated primary sensory neurones. **Nature** 1996; 384:360-364.

Tate S, Benn S, Hick C, Trezise D, John V, Mannion RJ, Costigan M, Plumpton C, Grose D, Gladwell G, Kendall G, Dale K, Bountra C, Woolf CJ. Two distinct sodium ion channels contribute to the tetrodotoxin-resistant sodium current in primary sensory neurons. **Nature Neuroscience** 1998 1:653-655

Mannion, R.J., Costigan, M., Decosterd, I., Amaya, F., Ma, Q.P., Holstege, J.C., Ji, R.R., Acheson, A., Lindsay, R.M., Wilkinson, G.A., and Woolf, C.J. Neurotrophins: Peripherally and centrally acting modulators of tactile stimulus-induced inflammatory pain hypersensitivity. **Proc Natl Acad Sci U S A** 1999;96, 9385-9390

- Neumann S, Woolf CJ. Regeneration of dorsal column fibers into and beyond the lesion site following adult spinal cord injury. **Neuron** 1999 23:83-91.
- Ji RR, Baba H, Brenner JG, Woolf CJ. Nociceptive-specific activation of ERK in spinal neurons contributes to pain hypersensitivity. **Nature Neuroscience** 1999. 2:1114-1119.
- Woolf CJ, Salter MW (2000) Neuronal plasticity -increasing the gain in pain. **Science** 288:1765-1768.
- Samad, T., Moore, K., Sapirstein, A., Billet, S., Allchorne, A., Poole, S., Bonventre, J.V. and Woolf, C.J. An interleukin-1 $\beta$ -mediated induction of Cox-2 in the central nervous system contributes to inflammatory pain hypersensitivity **Nature** 2001 410:471-475.
- Ji RR, Samad TA, Jin SX, Schmolz R, Woolf CJ. p38 MAPK activation by NGF in primary sensory neurons after inflammation increases TRPV1 levels and maintains heat hyperalgesia. **Neuron**. 2002 36:57-68.
- Moore KA, Kohno T, Karchewski LA, Scholz J, Baba H, Woolf CJ. Partial peripheral nerve injury promotes a selective loss of GABAergic inhibition in the superficial dorsal horn of the spinal cord. **J Neurosci**. 2002 22:6724-31
- Benn SC, Perrelet D, Kato A, Scholz J, Decosterd I, Mannion RJ, Bakowska JC, Woolf CJ. Hsp27 upregulation and phosphorylation is required for injured sensory and motor neuron survival. **Neuron**. 2002 36:45-56.
- Costigan M, Befort K, Karchewski L, Griffin RS, Da'Urso D, Allchorne A, Sitarski J, Mannion JW, Pratt RE, Woolf CJ. Replicate high-density rat genome oligonucleotide microarrays reveal hundreds of regulated genes in the dorsal root ganglion after peripheral nerve injury. **BMC Neurosci**. 2002 3:16.
- Chen S, Rio C, Ji RR, Dikkes P, Coggeshall RE, Woolf CJ, Corfas G. Disruption of ErbB receptor signaling in adult non-myelinating Schwann cells causes progressive sensory loss. **Nature Neurosci**. 2003 6:1186-93.
- Costigan M, Samad TA, Allchorne A, Lanoue C, Tate S, Woolf CJ. High basal expression and injury-induced down regulation of two regulator of G-protein signaling transcripts, RGS3 and RGS4 in primary sensory neurons. **Mol Cell Neurosci**. 2003 24:106-16.
- Baba H, Ji RR, Kohno T, Moore KA, Ataka T, Wakai A, Okamoto M, Woolf CJ. Removal of GABAergic inhibition facilitates polysynaptic A fiber-mediated excitatory transmission to the superficial spinal dorsal horn. **Mol Cell Neurosci**. 2003 24:818-30
- Samad TA, Srinivasan A, Karchewski LA, Jeong SJ, Campagna JA, Ji RR, Fabrizio DA, Zhang Y, Lin HY, Bell E, Woolf CJ. DRAGON: a member of the repulsive guidance molecule-related family of neuronal- and muscle-expressed membrane proteins is regulated by DRG11 and has neuronal adhesive properties. **J Neurosci**. 2004 24:2027-36.
- Kawasaki Y, Kohno T, Zhuang ZY, Brenner GJ, Wang H, Van Der Meer C, Befort K, Woolf CJ, Ji RR. Ionotropic and metabotropic receptors, PKA, PKC, and Src contribute to C-fiber-induced ERK activation and CREB phosphorylation in dorsal horn neurons leading to central sensitization. **J Neurosci**. 2004 24:8310-21.
- Woolf CJ Pain: moving from symptom control toward mechanism-specific pharmacologic management. **Ann Intern Med**. 2004 140:441-51
- Samad TA, Rebbapragada A, Bell E, Zhang Y, Sidis Y, Jeong SJ, Campagna JA, Perusini S, Fabrizio DA, Schneyer AL, Lin HY, Brivanlou AH, Attisano L, Woolf CJ. DRAGON: a bone morphogenetic protein co-receptor. **J Biol Chem**. 2005 280:14122-9.
- Zhuang ZY, Gerner P, Woolf CJ, Ji RR. ERK is sequentially activated in neurons, microglia, and astrocytes by spinal nerve ligation and contributes to mechanical allodynia in this neuropathic pain model. **Pain**. 2005 114:149-59.

Babitt JL, Zhang Y, Samad TA, Xia Y, Tang J, Campagna JA, Schneyer AL, Woolf CJ, Lin HY. Repulsive guidance molecule (RGMa), a DRAGON homologue, is a bone morphogenetic protein co-receptor. **J Biol Chem**. 2005 280:29820-7.

Scholz J, Broom DC, Youn DH, Mills CD, Kohno T, Suter MR, Moore KA, Decosterd I, Coggeshall RE, Woolf CJ. Blocking caspase activity prevents transsynaptic neuronal apoptosis and the loss of inhibition in lamina II of the dorsal horn after peripheral nerve injury. **J Neurosci**. 2005 25:7317-23.

Kohno T, Ji RR, Ito N, Allchorne AJ, Befort K, Karchewski LA, Woolf CJ. Peripheral axonal injury results in reduced mu opioid receptor pre- and post-synaptic action in the spinal cord. **Pain**. 2005 117:77-87.

Mills CD, Bitler JL, Woolf CJ. Role of the peripheral benzodiazepine receptor in sensory neuron regeneration. **Mol Cell Neurosci**. 2005 30: 228-237.

Wang H, Kohno T, Amaya F, Brenner GJ, Ito N, Allchorne A, Ji RR, Woolf CJ. Bradykinin produces pain hypersensitivity by potentiating spinal cord glutamatergic synaptic transmission. **J Neurosci**. 2005 25:7986-92

McCampbell A, Truong D, Broom DC, Allchorne A, Gable K, Cutler RG, Mattson MP, Woolf CJ, Frosch MP, Harmon JM, Dunn TM, Brown RH Jr. Mutant SPTLC1 dominantly inhibits serine palmitoyltransferase activity in vivo and confers an age-dependent neuropathy. **Hum Mol Genet**. 2005 14:3507-21.

Pertin M, Ji R, Berta T, Powell AJ, Karchewski L, Tate SN, Isom LL, Woolf CJ, Gilliard N, Spahn DR, Decosterd I. Upregulation of the voltage-gated sodium channel beta2 subunit in neuropathic pain models: characterization of expression in injured and non-injured primary sensory neurons. **J Neurosci**. 2005 25:10970-80

Allchorne AJ, Broom DC, Woolf CJ. Detection of Cold Pain, Cold Allodynia and Cold Hyperalgesia in Freely Behaving Rats. **Mol Pain**. 2005 1:36

Sarkar S, Woolf CJ, Hobson AR, Thompson DG, Aziz Q. Perceptual wind-up in the human oesophagus is enhanced by central sensitisation. **Gut** 2006 55:920-5.

Kwan KY, Allchorne AJ, Vollrath MA, Christensen AP, Zhang DS, Woolf CJ, Corey DP. TRPA1 Contributes to Cold, Mechanical, and Chemical Nociception but Is Not Essential for Hair-Cell Transduction. **Neuron** 2006 50:277-89

Chen C-L, Broom DC, Liu Y, de Nooij JC, Li Z, Jessell TM, Woolf, Ma Q Runx1 determines nociceptive sensory neuron phenotypes and is required for thermal and neuropathic pain. **Neuron** 2006 49:365-77.

Kehlet H, Jensen TS, Woolf CJ. Persistent postsurgical pain: risk factors and prevention. **Lancet** 2006 367:1618-25

Babitt JL, Huang FW, Wrighting DM, Xia Y, Sidis Y, Samad TA, Campagna JA, Chung RT, Schneyer AL, Woolf CJ, Andrews NC, Lin HY. Bone morphogenetic protein signaling by hemojuvelin regulates hepcidin expression. **Nature Genetics** 2006 38:531-9.

Seiffers R, Allchorne AJ, Woolf CJ. The transcription factor ATF-3 promotes neurite outgrowth. **Mol Cell Neuroscience** 2006 32:143-54.

Lin CR, Amaya F, Barrett LB, Wang H, Samad T, Takada J, Woolf CJ. Prostaglandin E2 receptor EP4 contributes to inflammatory pain hypersensitivity. **J Pharmacol Exp Ther**. 2006 319:1096-103

Tegeder I, Costigan M, Griffin R, Abele A, Belfer I, Schmidt H, Ehnert C, Nejim J, Marian C, Scholz J, Wu T, Allchorne A, Diatchenko L, Binshtok A, Goldman D, Adolph J, Sama S, Atlas S, Carlezon W, Parsegian A, Lotsch J, Fillingim R, Maixner W, Geisslinger G, Max M, Woolf CJ. GTP cyclohydrolase and tetrahydrobiopterin regulate pain sensitivity and persistence. **Nature Medicine** 2006 12:1269-1277.

Amaya F, Wang H, Costigan M, Allchorne AJ, Hatcher JP, Egerton J, Stean T, Morisset V, Grose D, Gunthorpe MJ, Chessell IP, Tate S, Green PJ, Woolf CJ. The voltage-gated sodium channel Na(v)1.9 is an effector of peripheral inflammatory pain hypersensitivity. **J Neurosci**. 2006 26:12852-60

## **C. Research Support**

### **Ongoing Research Support**

**2 R01 NS038253-06-A2 Woolf (PI)** 02/05/05 - 11/30/08  
NIH-NINDS  
Altered Sensibility Following Peripheral Nerve Damage

The aim is to examine factors responsible for the survival and the loss of dorsal root ganglion neurons after peripheral axonal injury.

**1 R01 DE017821-01 Woolf (PI)** 07/01/2006 - 04/30/2011  
NIH-NIDCR  
Microglia, Complement, and Pain

The aim is to study the contribution of the complement system in microglia to pain

**5 P30 NS045776-01 Bhide (PI)** 05/01/03 –04/30/08  
NIH-NINDS  
Core Grant – Interdepartmental Neuroscience Center.

This center provides core facilities to NINDS-funded PI's for viral vector production, monoclonal antibody production, imaging, and quantitative RNA/DNA measurements.

### **Training Grants**

**5 T32GM007592-27 Miller, Keith W**  
BASIC SCIENCE RESEARCH TRAINING FOR ANESTHETISTS

**5 T32GM007753-26 Walsh, Christopher**  
A MEDICAL SCIENTISTS TRAINING PROGRAM

### **Completed Research Support**

**5 R01 NS39518-05 Woolf (PI)** 05/01/01 - 04/30/06  
NIH-NINDS  
Neural Plasticity and Inflammatory Pain.

**5 R01 HD38533-05 Woolf (PI)** 07/01/00 - 04/30/05  
NIH-NICHHD  
Semaphorin Activation and Role in Neuronal Regeneration.

**Muscular Dystrophy Association. Woolf (PI)** 07/01/03 – 06/30/06  
Hsp 27 and Motor Neuron Survival