Stanford

Giles W Plant

Associate Professor of Neurosurgery

NIH Biosketch available Online

CONTACT INFORMATION

- **Alternate Contact**

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Bio

BIO

Dr. Plant is the director of basic science for the Stanford Partnership for Spinal Cord Injury and Repair, which brings together researchers and clinicians to collaborate on translational research aimed at spinal cord regeneration and repair and improving the quality of life of people paralyzed by spinal cord injury through rehabilitation and restoration of function. As research director, he co-leads the partnership, which includes spinal cord injury units at the VA Palo Alto Health Care System and the Santa Clara Valley Medical Center.

Dr. Plant's current research interests are spinal cord injury, human mesenchymal and induced pluripotent stem cell transplantation, olfactory ensheathing glia, Schwann cell biology and transplantation, peripheral nerve and optic nerve injury.

After receiving his PhD from the University of Western Australia, Dr. Plant completed his postdoctoral training at the Miami Project , University of Miami Miller School of Medicine under the mentorship of Professor Mary Bunge. He was also an inaugural member of the Christopher and Dana Reeve Foundation Research Consortium from 1996-2000. He then returned to Australia as director of the Eileen Bond Spinal Research Center and faculty member in the School of Anatomy and Human Biology, University of Western Australia. He joined the Neurosurgery faculty at Stanford in 2010.

ACADEMIC APPOINTMENTS

- Associate Professor, Neurosurgery
- Member, Bio-X
- Member, Maternal & Child Health Research Institute (MCHRI)
- Member, Wu Tsai Neurosciences Institute

ADMINISTRATIVE APPOINTMENTS

- West Australian Council Representative, Australian Neuroscience Society, (2006-2008)
- Curriculum committee, Stanford Neuroscience PhD program, (2017- present)
- Steering Committee Member, Australian and New Zealand Spinal Cord Injury Network (ANZSCIN), (2006-2008)
- Scientific Advisor, Spinal Cord Society of New Zealand, (2007- present)

- Program Committee, Stanford Neuroscience PhD Program, (2012-2017)

HONORS AND AWARDS

- Centennial Service Award for Professional Excellence, Rotary International (2005)
- Raine Visiting Professor, University of Western Australia (Feb 2015)
- RD Wright Research Fellow, Australian National Health and Medical Research Council (2004-2008)

BOARDS, ADVISORY COMMITTEES, PROFESSIONAL ORGANIZATIONS

- Ad Hoc BNVT Merit Review Panel Member, National Institute of Health (2017 - present)
- Ad Hoc CNNT Merit Review Panel Member, National Institute of health (2017 - present)
- Editorial Board, Frontiers in Neurology (2018 - present)
- Editorial Board Member, Cells (2018 - present)
- Editorial Board Member, Cell Transplantation (Neuroscience and Tissue Engineering) (2015 - present)
- Editorial Board Member, Neural Regeneration Research (NRR) (2012 - present)
- Editorial Board Member, Annals of Neurology and Neuroscience (2015 - present)
- Editorial Board Member, JSM Neurosurgery & Spine (2013 - present)

PROFESSIONAL EDUCATION

- PhD, University of Western Australia, Perth, Australia , Neuroscience (1995)
- BSc (Hons), University of Greenwich, London, United Kingdom , Applied Biology (1990)

LINKS

- CAP School of Medicine: http://med.stanford.edu/profiles/Giles_Plant

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

The laboratory' research focus is on the repair of the injured spinal cord using human induced pluripotent stem cells (HiPSCs), mesenchymal stem cells and glial cell transplantation. We utilize animal cervical and thoracic spinal cord injury models (mouse and rat), neuroanatomy, immunocytochemistry, confocal microscopy, viral gene therapy, cell culture and molecular biology techniques in investigating the following areas:

- Stem cell transplantation (adult, embryonic and iPSC) and spinal cord injury

Differentiation of human iPSC to corticospinal lineages for analysis in vitro and in vivo transplantation. We are currently using small molecule differentiation, multi-electrode recordings, wireless and tethered optogenetic stimulations and recordings.

Analysis of corticospinal lineage will use in situ hybridization , qPCR and RNA seq applications . In addition we are using proteomic analysis using mass spec.

-Schwann cell/Biomaterials transplantation and spinal cord injury

The methods being investigated are using novel peptide hydrogels for delivery to the injured spinal cord. Analysis involves the incorporation within the materials, cell survival , hypoxic challenges and possible differentiation and inducement of axonal regeneration after transplantation into the cervical spinal cord.

The laboratory aims to develop new cellular treatments and translational protocols for human treatments, which will one day help improve the quality of life for patients with spinal cord injuries.

PROJECTS

- Cervical Spinal Cord Circuitry following human cortical transplants - Stanford University (10/10/2018)

Teaching

COURSES

2019-20

- Neurosciences Anatomy Core: NEPR 205 (Aut)

2018-19

- Neurosciences Anatomy Core: NEPR 205 (Spr)

2017-18

- Neurosciences Anatomy Core: NEPR 205 (Spr)

GRADUATE AND FELLOWSHIP PROGRAM AFFILIATIONS

- Bioengineering (Phd Program)
- Neurosciences (Phd Program)
- Stem Cell Biology and Regenerative Medicine (Phd Program)

Publications

PUBLICATIONS

- **Human iPSC-Derived Corticospinal Neuronal Grafts To Repair Cervical Spinal Cord Injury**
  Doulames, V., Weimann, J., Plant, G. W.
  SAGE PUBLICATIONS INC.2019: 492
- **Sensory and descending motor circuitry during development and injury.** *Current opinion in neurobiology*
  Plant, G. W., Weinrich, J. A., Kaltschmidt, J. A.
  2018; 53: 156–61
- **Viral Transduction of Schwann Cells for Peripheral Nerve Repair.** *Methods in molecular biology (Clifton, N.J.)*
  Plant, C. D., Plant, G. W.
  2018; 1739: 455–66
- **Wnt/#-catenin signaling regulates ependymal cell development and adult homeostasis.** *Proceedings of the National Academy of Sciences of the United States of America*
  Xing, L., Anbarchian, T., Tsai, J. M., Plant, G. W., Nusse, R.
  2018
- **Schwann Cell Transplantation Methods Using Biomaterials.** *Methods in molecular biology (Clifton, N.J.)*
  Plant, C. D., Plant, G. W.
  2018; 1739: 439–53
- **Recombinant biomaterials for treatment of spinal cord injuries**
  Dubbin, K., Marquardt, L., Plant, G., Heilshorn, S.
  AMER CHEMICAL SOC.2017
- **Intravenous Transplantation of Mesenchymal Progenitors Distribute Solely to the Lungs and Improve Outcomes in Cervical Spinal Cord Injury** *STEM CELLS*
  White, S. V., Czisch, C. E., Han, M. H., Plant, C. D., Harvey, A. R., Plant, G. W.
  2016; 34 (7): 1812-1825
- **Induced Pluripotent Stem Cell Therapies for Cervical Spinal Cord Injury.** *International journal of molecular sciences*

Doulames, V. M., Plant, G. W.
2016; 17 (4)

- **Deficiency in matrix metalloproteinase-2 results in long-term vascular instability and regression in the injured mouse spinal cord.** *Experimental neurology*
  Trivedi, A., Zhang, H., Ekeledo, A., Lee, S., Werb, Z., Plant, G. W., Noble-Haeusslein, L. J.
  2016; 284 (Pt A): 50–62

- **Neural Placode Tissue Derived From Myelomeningocele Repair Serves as a Viable Source of Oligodendrocyte Progenitor Cells.** *Neurosurgery*
  Mitra, S. S., Feroze, A. H., Gholamin, S., Richard, C., Esparza, R., Zhang, M., Azad, T. D., Alrfaei, B., Kahn, S. A., Hutter, G., Guzman, R., Creasey, G. H., Plant, et al
  2015; 77 (5): 794-802

- **Geometrical versus Random beta-TCP Scaffolds: Exploring the Effects on Schwann Cell Growth and Behavior** *PLOS ONE*
  Sweet, L., Kang, Y., Czisch, C., Witek, L., Shi, Y., Smay, J., Plant, G. W., Yang, Y.
  2015; 10 (10)

- **Large animal and primate models of spinal cord injury for the testing of novel therapies** *EXPERIMENTAL NEUROLOGY*
  Kwon, B. K., Streijger, F., Hill, C. E., Anderson, A. J., Bacon, M., Beattie, M. S., Blesch, A., Bradbury, E. J., Brown, A., Bresnahan, J. C., Case, C. C., Colburn, R. W., David, et al
  2015; 269: 154-168

- **Hierarchical Patterning of Multifunctional Conducting Polymer Nanoparticles as a Bionic Platform for Topographic Contact Guidance** *ACS NANO*
  Ho, D., Zou, J., Chen, X., Munshi, A., Smith, N. M., Agarwal, V., Hodgetts, S. I., Plant, G. W., Bakker, A. J., Harvey, A. R., Luzinov, I., Iyer, K. S.
  2015; 9 (2): 1767-1774

- **Changes in expression of Class 3 Semaphorins and their receptors during development of the rat retina and superior colliculus** *BMC DEVELOPMENTAL BIOLOGY*
  Sharma, A., LeVaillant, C. J., Plant, G. W., Harvey, A. R.
  2014; 14

- **Systematic Review of Induced Pluripotent Stem Cell Technology as a Potential Clinical Therapy for Spinal Cord Injury** *CELL TRANSPLANTATION*
  Kramer, A. S., Harvey, A. R., Plant, G. W., Hodgetts, S. I.
  2013; 22 (4): 571-617

- **Tissue sparing, behavioral recovery, supraspinal axonal sparing/regeneration following sub-acute glial transplantation in a model of spinal cord contusion.** *BMC neuroscience*
  Barbour, H. R., Plant, C. D., Harvey, A. R., Plant, G. W.
  2013; 14: 106-?

- **Immunohistochemical, Ultrastructural and Functional Analysis of Axonal Regeneration through Peripheral Nerve Grafts Containing Schwann Cells Expressing BDNF, CNTF or NT3.** *PloS one*
  Godinho, M. J., Teh, L., Pollett, M. A., Goodman, D., Hodgetts, S. I., Sweetman, I., Walters, M., Verhaagen, J., Plant, G. W., Harvey, A. R.
  2013; 8 (8)

- **Human Mesenchymal Precursor Cells (Stro-1(+)) From Spinal Cord Injury Patients Improve Functional Recovery and Tissue Sparing in an Acute Spinal Cord Injury Rat Model** *CELL TRANSPLANTATION*
  Hodgetts, S. I., Simmons, P. J., Plant, G. W.
  2013; 22 (3): 393-412

- **Magnetic field directed fabrication of conducting polymer nanowires.** *Chemical communications (Cambridge, England)*
  Ho, D., Peerzade, S. A., Becker, T., Hodgetts, S. I., Harvey, A. R., Plant, G. W., Woodward, R. C., Luzinov, I., St Pierre, T. G., Iyer, K. S.
  2013; 49 (64): 7138–40

- **A comparison of the behavioral and anatomical outcomes in sub-acute and chronic spinal cord injury models following treatment with human mesenchymal precursor cell transplantation and recombinant decorin.** *Experimental neurology*
  Hodgetts, S. I., Simmons, P. J., Plant, G. W.
  2013

- **Changes in mRNA Expression of Class 3 Semaphorins and Their Receptors in the Adult Rat Retino-Collicular System after Unilateral Optic Nerve Injury** *INVESTIGATIVE OPHTHALMOLOGY & VISUAL SCIENCE*
  Sharma, A., Pollett, M. A., Plant, G. W., Harvey, A. R.

2012; 53 (13): 8367-8377

- **Scaffolds to promote spinal cord regeneration.** *Handbook of clinical neurology*
  Sakiyama-Elbert, S., Johnson, P. J., Hodgetts, S. I., Plant, G. W., Harvey, A. R.
  2012; 109: 575-594
- **Embryonic-derived olfactory ensheathing cells remyelinate focal areas of spinal cord demyelination more efficiently than neonatal or adult derived cells.** *Cell transplantation*
  Coutts, D. J., Humphries, C. E., Zhao, C., Plant, G. W., Franklin, R. J.
  2012
- **Olfactory ensheathing glia: Repairing injury to the mammalian visual system** *EXPERIMENTAL NEUROLOGY*
  Plant, G. W., Harvey, A. R., Leaver, S. G., Lee, S. V.
  2011; 229 (1): 99-108
- **Lack of fibulin-3 alters regenerative tissue responses in the primary olfactory pathway** *MATRIX BIOLOGY*
  Vukovic, J., Marmorstein, L. Y., McLaughlin, P. J., Sasaki, T., Plant, G. W., Harvey, A. R., Ruitenberg, M. J.
  2009; 28 (7): 406-415
- **The Glycoprotein Fibulin-3 Regulates Morphology and Motility of Olfactory Ensheathing Cells In Vitro** *GLIA*
  Vukovic, J., Ruitenberg, M. J., Roet, K., Franssen, E., Arulpragasam, A., Sasaki, T., Verhaagen, J., Harvey, A. R., Busfield, S. J., Plant, G. W.
  2009; 57 (4): 424-443
- **Use of GFP to analyze morphology, connectivity, and function of cells in the central nervous system.** *Methods in molecular biology (Clifton, N.J.)*
  Harvey, A. R., Ehlert, E., de Wit, J., Drummond, E. S., Pollett, M. A., Ruitenberg, M., Plant, G. W., Verhaagen, J., Levelt, C. N.
  2009; 515: 63-95
- **CX3CL1/fractalkine regulates branching and migration of monocyte-derived cells in the mouse olfactory epithelium** *JOURNAL OF NEUROIMMUNOLOGY*
  Ruitenberg, M. J., Vukovic, J., Blomster, L., Hall, J. M., Jung, S., Filgueira, L., Mcmenamin, P. G., Plant, G. W.
  2008; 205 (1-2): 80-85
- **The importance of transgene and cell type on the regeneration of adult retinal ganglion cell axons within reconstituted bridging grafts** *EXPERIMENTAL NEUROLOGY*
  Hu, Y., Arulpragasam, A., Plant, G. W., Hendriks, W. T., Cui, Q., Harvey, A. R.
  2007; 207 (2): 314-328
- **Culture conditions affect proliferative responsiveness of olfactory ensheathing glia to neuregulins** *GLIA*
  De Mello, T. R., Busfield, S., Dunlop, S. A., Plant, G. W.
  2007; 55 (7): 734-745
- **The chemokine receptorCX(3)CR1 mediates homing of MHC class II - Positive cells to the normal mouse corneal epithelium** *INVESTIGATIVE OPHTHALMOLOGY & VISUAL SCIENCE*
  Chinnery, H. R., Ruitenberg, M. J., Plant, G. W., Pearlman, E., Jung, S., McMenamin, P. G.
  2007; 48 (4): 1568-1574
- **Influence of adult Schwann cells and olfactory ensheathing glia on axon-target cell interactions in the CNS: a comparative analysis using a retinotectal co-graft model** *NEURON GLIA BIOLOGY*
  Vukovic, J., Plant, G. W., Ruitenberg, M. J., Harvey, A. R.
  2007; 3: 105-117
- **AAV-mediated expression of CNTF promotes long-term survival and regeneration of adult rat retinal ganglion cells** *GENE THERAPY*
  Leaver, S. G., Cui, Q., Plant, G. W., Arulpragasam, A., Hisheh, S., Verhaagen, J., Harvey, A. R.
  2006; 13 (18): 1328-1341
- **Gene therapy and transplantation in CNS repair: The visual system** *PROGRESS IN RETINAL AND EYE RESEARCH*
  Harvey, A. R., Hu, Y., Leaver, S. G., Mellough, C. B., Park, K., Verhaagen, J., Plant, G. W., Cui, Q.
  2006; 25 (5): 449-489
- **Adult olfactory ensheathing glia promote the long-distance growth of adult retinal ganglion cell neurites in vitro** *GLIA*
  Leaver, S. G., Harvey, A. R., Plant, G. W.

2006; 53 (5): 467-476

- **Olfactory ensheathing cells: Characteristics, genetic engineering, and therapeutic potential** *JOURNAL OF NEUROTRAUMA*
  Ruitenberg, M. J., Vukovic, J., Sarich, J., Busfield, S. J., Plant, G. W.
  2006; 23 (3-4): 468-478
- **Lentiviral-mediated transfer of CNTF to Schwann cells within reconstructed peripheral nerve grafts enhances adult retinal ganglion cell survival and axonal regeneration** *MOLECULAR THERAPY*
  Hu, Y., Leaver, S. G., Plant, G. W., Hendriks, W. T., Niclou, S. P., Verhaagen, J., Harvey, A. R., Cui, Q.
  2005; 11 (6): 906-915
- **NT-3 expression from engineered olfactory ensheathing glia promotes spinal sparing and regeneration** *BRAIN*
  Ruitenberg, M. J., Levison, D. B., Lee, S. V., Verhaagen, J., Harvey, A. R., Plant, G. W.
  2005; 128: 839-853
- **Ex vivo adenoviral vector-mediated neurotrophin gene transfer to olfactory ensheathing glia: Effects on rubrospinal tract regeneration, lesion size, and functional recovery after implantation in the injured rat spinal cord** *JOURNAL OF NEUROSCIENCE*
  Ruitenberg, M. J., Plant, G. W., Hamers, F. P., Wortel, J., Blits, B., Dijkhuizen, P. A., Gispen, W. H., Boer, G. J., Verhaagen, J.
  2003; 23 (18): 7045-7058
- **Delayed transplantation of olfactory ensheathing glia promotes sparing/regeneration of supraspinal axons in the contused adult rat spinal cord** *JOURNAL OF NEUROTRAUMA*
  Plant, G. W., Christensen, C. L., Oudega, M., Bunge, M. B.
  2003; 20 (1): 1-16
- **A new approach to CNS repair using chimeric peripheral nerve grafts** *JOURNAL OF NEUROTRAUMA*
  Cui, Q., Pollett, M. A., Symons, N. A., Plant, G. W., Harvey, A. R.
  2003; 20 (1): 17-31
- **Purified adult ensheathing glia fail to myelinate axons under culture conditions that enable Schwann cells to form myelin** *JOURNAL OF NEUROSCIENCE*
  Plant, G. W., Currier, P. F., Cuervo, E. P., Bates, M. L., Pressman, Y., Bunge, M. B., Wood, P. M.
  2002; 22 (14): 6083-6091
- **Viral vector-mediated gene expression in olfactory ensheathing glia implants in the lesioned rat spinal cord** *GENE THERAPY*
  Ruitenberg, M. J., Plant, G. W., Christensen, C. L., Blits, B., Niclou, S. P., Harvey, A. R., Boer, G. J., Verhaagen, J.
  2002; 9 (2): 135-146
- **Mitogenic response of adult rat olfactory ensheathing glia to four growth factors** *GLIA*
  Yan, H., Bunge, M. B., Wood, P. M., Plant, G. W.
  2001; 33 (4): 334-342
- **Inhibitory proteoglycan immunoreactivity is higher at the caudal than the rostral Schwann cell graft-transected spinal cord interface** *MOLECULAR AND CELLULAR NEUROSCIENCE*
  Plant, G. W., Bates, M. L., Bunge, M. B.
  2001; 17 (3): 471-487
- **A new type of biocompatible bridging structure supports axon regrowth after implantation into the lesioned rat optic tract** *CELL TRANSPLANTATION*
  Plant, G. W., Harvey, A. R.
  2000; 9 (6): 759-772
- **Poly(alpha-hydroxyacids) for application in the spinal cord: Resorbability and biocompatibility with adult rat Schwann cells and spinal cord** *JOURNAL OF BIOMEDICAL MATERIALS RESEARCH*
  Gautier, S. E., Oudega, M., Fragoso, M., Chapon, P., Plant, G. W., Bunge, M. B., Parel, J. M.
  1998; 42 (4): 642-654
- **Implantation of collagen IV Poly(2-hydroxyethyl methacrylate) hydrogels containing schwann cells into the lesioned rat optic tract** *CELL TRANSPLANTATION*
  Plant, G. W., Chirila, T. V., Harvey, A. R.
  1998; 7 (4): 381-391
- **Long-distance axonal regeneration in the transected adult rat spinal cord is promoted by olfactory ensheathing glia transplants** *JOURNAL OF NEUROSCIENCE*

Ramon-Cueto, A., Plant, G. W., Avila, J., Bunge, M. B.
1998; 18 (10): 3803-3815

- **In vitro assessment of the biological activity of basic fibroblast growth factor released from various polymers and biomatrices** *JOURNAL OF BIOMATERIALS APPLICATIONS*
  Davies, M. J., Mitchell, C. A., Maley, M. A., Grounds, M. D., Harvey, A. R., Plant, G. W., Wood, D. J., Hong, Y., Chirila, T. V.
  1997; 12 (1): 31-56

- **Hydrogels containing peptide or aminosugar sequences implanted into the rat brain: Influence on cellular migration and axonal growth** *EXPERIMENTAL NEUROLOGY*
  Plant, G. W., Woerly, S., Harvey, A. R.
  1997; 143 (2): 287-299

- **Cultured rat neuronal and glial cells entrapped within hydrogel polymer matrices: A potential tool for neural tissue replacement** *NEUROSCIENCE LETTERS*
  Woerly, S., Plant, G. W., Harvey, A. R.
  1996; 205 (3): 197-201

- **Neural tissue engineering: From polymer to biohybrid organs** *BIOMATERIALS*
  Woerly, S., Plant, G. W., Harvey, A. R.
  1996; 17 (3): 301-310

- **SCHWANN-CELLS AND FETAL TECTAL TISSUE COGRAFTED TO THE MIDBRAIN OF NEWBORN RATS - FATE OF SCHWANN-CELLS AND THEIR INFLUENCE ON HOST RETINAL INNERVATION OF GRAFTS** *EXPERIMENTAL NEUROLOGY*
  Harvey, A. R., Plant, G. W.
  1995; 134 (2): 179-191

- **SCHWANN-CELLS AND THE REGROWTH OF AXONS IN THE MAMMALIAN CNS - A REVIEW OF TRANSPLANTATION STUDIES IN THE RAT VISUAL-SYSTEM** *1994 Australian-Physiological-and-Pharmacological-Society Symposium on Respiratory Systems*
  Harvey, A. R., Plant, G. W., Tan, M. M.
  BLACKWELL SCIENCE PUBL AUSTR.1995: 569–79

- **AXONAL GROWTH WITHIN POLY(2-HYDROXYETHYL METHACRYLATE) SPONGES INFILTRATED WITH SCHWANN-CELLS AND IMPLANTED INTO THE LESIONED RAT OPTIC TRACT** *BRAIN RESEARCH*
  Plant, G. W., Harvey, A. R., Chirila, T. V.
  1995; 671 (1): 119-130

- **REGROWTH OF AXONS WITHIN SCHWANN CELL-FILLED POLYCARBONATE TUBES IMPLANTED INTO THE DAMAGED OPTIC TRACT AND CEREBRAL-CORTEX OF RATS** *RESTORATIVE NEUROLOGY AND NEUROSCIENCE*
  Harvey, A. R., Chen, M., Plant, G. W., Dyson, S. E.
  1994; 6 (3): 221-237

- **THE DISTRIBUTION OF ASTROCYTES, OLIGODENDROGLIA AND MYELIN IN NORMAL AND TRANSPLANTED RAT SUPERIOR COLLICULUS - AN IMMUNOHISTOCHEMICAL STUDY** *JOURNAL OF NEURAL TRANSPLANTATION & PLASTICITY*
  Harvey, A. R., Plant, G. W., Kent, A. P.
  1993; 4 (1): 1-14