

BIOGRAPHICAL SKETCH

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NAME Dykstra, Linda A.	POSITION TITLE William Rand Kenan Jr. Professor		
eRA COMMONS USER NAME dykstra	Depts. Psychology; Pharmacology; Curriculum in Neurobiology		
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
Hope College, Holland, MI	B.A.	1966	Mathematics/Psychology
University of Chicago, Chicago, IL	M.A.	1968	English Literature
University of Chicago, Chicago, IL	Ph.D.	1972	Psychopharmacology
University of North Carolina, Chapel Hill, NC	Postdoctoral	1973	Pharmacology

A. Positions and Honors.**Positions and Employment**

1970-1972 NIMH Predoctoral Research Fellow, Univ. of Chicago
 1972-1973 NIDA Postdoctoral Research Fellow, Univ. of North Carolina, Dept of Pharmacology
 1973-1984 Assistant/Associate/Full Professor of Psychology and Pharmacology, Univ. North Carolina
 1984-present William Rand Kenan Jr. Professor of Psychology and Pharmacology, Univ. North Carolina
 1996-2008 Dean of Graduate School, Univ. North Carolina

Visiting Appointments:

1979 Assistant Professor, Harvard University, Laboratory of Psychobiology
 1985/06 Professor, University of Michigan, Dept. Pharmacology
 2001/02 Professor, Duke University, Dept. of Cell Biology

President or Chair of Professional Groups

1988 Chair, Psychopharmacology Division, American Psychological Association
 1997/98 President, College on Problems of Drug Dependence
 2005/06 Chair, Behavioral Pharmacology Division, American Society of Pharmacology & Experimental Therapeutics
 2006/07 President, Association of Graduate Schools; American Association Universities
 2007/09 Chair, Board of Directors, North Carolina Association Biomedical Research
 2008/10 Sec/Treasurer, Neuropharmacology Division, American Society of Pharmacology & Experimental Therapeutics

Membership on Advisory Committees

1983/87 NIH Clinical and Behavioral Review Group
 1991/94 National Advisory Council on Drug Abuse
 2002-current Scientific Advisory Board, New England Regional Primate Research Center
 2002-current Executive Board, North Carolina Association Biomedical Research
 2004-2008 Advisory Board, Graduate Record Exam, Educational Testing Services;

Honors

1967-1968 Ford Foundation Fellowship in the Humanities
 1977-1987 Research Scientist Development Award, NIH
 1988-1998 Research Scientist Award, NIH
 1988-1998 NIH/NIDA MERIT Award
 1991 Elected Member, American College of Neuropsychopharmacology
 1991 Appointed: William Rand Kenan Jr. Professor
 2004 Mentorship Award, CPDD
 2005 Marian W. Fischman Lectureship Award

B. Selected peer-reviewed publications

(Publications selected from over 150 peer-reviewed publications)

- Dykstra, L.A., Schoenbaum, G.M., Yarbrough, J., McNutt, R. and Chang, K.J. (1993) A novel delta opioid agonist, BW 373U86, in squirrel monkeys responding under a schedule of shock titration. J. Pharmacol. Exp. Ther. 267: 875-882.
- Hughes, C.E., Picker, M.J. and Dykstra, L.A. (1995) Tolerance and cross-tolerance to the response-rate decreasing effects of mu opioids in morphine-maintained squirrel monkeys. Behav. Pharmacol.6: 776-784
- Powell, K. R. and Dykstra, L.A. (1995) The role of serotonin in the effects of opioids in squirrel monkeys responding under a titration procedure. I. Kappa opioids. J. Pharmacol. Exp. Ther.274: 1305-1316
- Pitts, R. and Dykstra, L. A. (1994) Kappa-opioid agonists, spiradolone, CI-977, and U69, 593, alone and in combination with opioid antagonists in squirrel monkeys. J. Pharmacol. Exp. Ther. 271:1501-1508
- Lysle, D.T., Hoffman, K.E., and Dykstra, L.A. (1996) Evidence for the involvement of the caudal region of the periaqueductal gray in a subset of morphine-induced alterations of immune status. J. Pharmacol. Exp. Ther. 277: 1533-1540.
- Allen, R.M., Powell, K.R., and Dykstra, L.A. (1996) Effects of morphine and 8-OH-DPAT in a squirrel monkey tail-withdrawal procedure. Analgesia 2: 145-149.
- Powell, K.R., and Dykstra, L.A. (1996) The role of serotonin in the effects of opioids in squirrel monkeys responding under a titration procedure.II. Mu Opioids. Psychopharmacol. 126: 42-49.
- Pitts, R.C., West, J.P., Hapke, D.M., Morgan, D., Dykstra, L.A., and Picker, M.J. (1996) Opioids and rate of positively reinforced behavior: Antagonism by *B*-funaltrexamine. Exp. Clin. Psychopharm. 4: 389-395
- West, J.P., Lysle, D.T., & Dykstra, L.A. (1997). Tolerance development to morphine-induced alterations of immune status. Drug and Alc. Dep., 46, 147-157.
- Nelson, C.J., Dykstra, L.A., & Lysle, D.T. (1997). Comparison of the time course of morphine's analgesic and immunologic effects. Anesth. Analg. 85, 620-626.
- Dykstra, L.A., Preston, K.L., and Bigelow, G.E. (1997) Discriminative stimulus effects of opioids with kappa activity: Data from Laboratory Animals and Human Subjects. Psychopharmacol. 130: 14-27.
- Hughes, C.E. and Dykstra, L.A. (1997) Antagonism of the response rate-decreasing effects of meperidine and morphine by *B*-funaltrexamine and naltrexone in squirrel monkeys. Drug and Alc. Dep. 45: 197-206.
- Pitts, R.C., Allen, R.M., Walker, E.A., and Dykstra, L.A. (1998) Cloceinnamox antagonism of the antinociceptive effects of micro-opioids in squirrel monkeys. J. Pharmacol. Exp. Ther. 285: 1997-1206
- Tiano, M.J., Walker, E.A., and Dykstra, L.A. (1998) Cross-tolerance to etorphine differentiates *u*-opioid agonists in a rat tail withdrawal assay. Analgesia 3:251-257.
- Allen, R.M. and Dykstra, L.A. (1999) The competitive NMDA receptor antagonist LY235959 modulates the progression of morphine tolerance in rats. Psychopharmacol. 142:209-214
- West, J.P., Dykstra, L.A., and Lysle, D.T. (1999) Immunomodulatory effects of morphine withdrawal in the rat are time-dependent and reversible by clonidine. Psychopharmacol. 146:320-327.
- Walker, E.A., Tiano, M.J., Benyas, S.I., Dykstra, L.A., and Picker, M.J. (1999) Naltrexone and *B*-funaltrexamine antagonism of the antinociceptive and response rate-decreasing effects of morphine, dezocine, and *d*-propoxyphene. Psychopharmacol. 144:45-53.
- Walker, E.A., Hawkins, E.R., Tiano, M.J., Picker, M.J., and Dykstra, L.A. (1999) Discriminative-stimulus effects of nalbuphine in nontreated and morphine-treated pigeons. Pharmacol Biochem Behav. 64(2):445-448
- Allen, R.M. and Dykstra, L.A. (2000) Attenuation of mu-opioid tolerance and cross-tolerance by the competitive NMDA receptor antagonist, LY23595, is related to tolerance and cross-tolerance magnitude. J. Pharmacol. Exp. Ther. 295:1012-1021
- Allen, R.M. and Dykstra, L.A. (2000) NMDA receptor antagonists potentiate the antinociceptive effects of morphine in squirrel monkeys. J. Pharmacol. Exp. Ther. 298: 1-10
- Allen, R.M. and Dykstra, L.A. (2000) Role of morphine maintenance dose in the development of tolerance and its attenuation by an NMDA receptor antagonist. Psychopharmacol. 148: 59-65.
- Allen, R.M. and Dykstra, L.A. (2001) N-methyl-D-aspartate receptor antagonists potentiate the antinociceptive effects of morphine in squirrel monkeys. J. Pharmacol. Exp. Ther.298: 288-297
- Walker, E.A., Picker, M.J. and Dykstra, L.A. (2001) Three-choice discrimination in pigeons is based on relative efficacy differences among opioids. Psychopharmacol. 155:389-398

- Dykstra, L.A., Granger, A.L., Allen, R.M. Xiaoyan Zhang and Kenner C. Rice (2002) Antinociceptive effects of the selective delta opioid agonist, SNC 80, alone and in combination with mu opioids in the squirrel monkey titration procedure. *Psychopharmacology* 163; 420-429
- Allen, R.M. and Dykstra, L.A. (2002) Dextromethorphan Potentiates the Antinociceptive Effects of Morphine and the Delta-Opioid Agonists SNC80 in Squirrel Monkeys. *J. Pharmacol. Exp. Ther.* 300:435-441
- Bohn, L.M., Gainetdinov, R.R., Sotnikova, T.D., Lefkowitz, R.J., Dykstra, L.A. and Caron, M.G. (2003) Enhanced Rewarding Properties of Morphine, but not Cocaine, in β arrestin-2 Knockout Mice. *J. Neurosci.* 23: 10265-10273
- Allen, R.M., Granger, A.L. and Dykstra, L.A. (2003) The competitive NMDA receptor antagonist, LY235959, potentiates the antinociceptive effects of opioids that vary in efficacy at the mu-opioid receptor. *J. Pharmacol. Exp. Ther.* 307: 785-792
- Carroll, F.I., Thomas, J.B., Dykstra, L.A., Granger, A.L., Allen, R.M., Howard, J.L., Pollard, G.T., Aceto, M.D. and Harris, L.S. (2004) Pharmacological properties of JDTC: A novel μ opioid receptor antagonist. *Eur. J. Pharmacol.* 501: 111-119
- Sotnikova, T.D., Budygin, E.A., Jones, S.R., Dykstra, L.A., Caron, M.G., Gainetdinov, R.R. (2004) Dopamine transporter-dependent and -independent actions of trace amine beta-phenylethylamine. *J. Neurochemistry* 91:362-373
- Bohn, L.M., Dykstra, L.A., Lefkowitz, R.J., Caron, M.G. and Barak, L.S. (2004) Relative efficacy is determined by the complements of the G protein-coupled receptor desensitization machinery. *Mol. Pharm.* 66:106-112
- Walker, E.A., Picker, M.J., Granger, A. and Dykstra, L.A. (2004) Effects of opioids in morphine-treated pigeons trained to discriminate among morphine, the low-efficacy agonist nalbuphine and saline. *J. Pharmacol. Exp. Ther.* 310: 150-158
- Ward, S.J. and Dykstra, L.A. (2005) The role of endogenous cannabinoids in sweet versus fat reinforcement: effect of CB1 receptor deletion, CB1 receptor antagonism (SR141716A), and CB1 receptor agonism (CP-55940). *Behav Pharmacol.* 16: 381-388.
- Allen, R.M., Carelli, R.M., Dykstra, L.A., Suchey, T.L., Everett, C.V. (2005) Effects of the competitive NMDA receptor antagonists, (-)-6-phosphonomethyl-deca-hydroisoquinoline-3-carboxylic acid (LY235959), on responding for cocaine under both fixed and progressive ratio schedules of reinforcement. *J. Pharmacol. Exp. Ther.* 315: 449-457
- Fischer, B.D., Carrigan, K.A. and Dykstra, L.A. (2005) Effects of N-methyl-D-aspartate receptor antagonists on acute morphine- and l-methadone-induced antinociception in mice. *J. Pain* 6: 425-433
- Hughes, C.E., Sigmon, S.C., Pitts, R.C. and Dykstra, L.A. (2005) Morphine tolerance as a function of ratio schedule: response requirement or unit price? *J. Exp. Anal. Behav.* 83: 281-296
- Medvedev, I.O., Bohn, L.M., Gainetdinov, R.R., Caron, M.G. and Dykstra, L.A. (2005) Characterization of conditioned place preference to cocaine in isogenic dopamine transporter knockout mice. *Psychopharmacology* 180: 408-413
- Fischer, B.D. and Dykstra, L.A. (2006) Interactions between an NMDA antagonist and low-efficacy opioid receptor agonists in assays of schedule-controlled responding and thermal nociception. *J. Pharmacol. Exp. Ther.* 318:1300-1306.
- Allen, R.M., Dykstra, L.A. and Carelli, R.M. (2007) Continuous exposure to a competitive NMDA receptor antagonist facilitates escalation of cocaine consumption in rats. *Psychopharmacology* 191: 341-351.
- Ward, S.J., Walker, E.A. and Dykstra, L.A. (2007) Effect of cannabinoid CB1 receptor antagonist SR141716A and CB1 receptor knockout on cue-induced reinstatement of Ensure and corn-oil seeking in mice. *Neuropsychopharmacology* 32(12):2592-600.
- Carrigan, K. A. and Dykstra, L.A. (2007) Behavioral effects of morphine and cocaine in M1 muscarinic acetylcholine receptor-deficient mice. *Psychopharmacology* 191: 985-993.
- Miller, L.L., Ward, S.J. and Dykstra, L.A. (2008) Chronic unpredictable stress enhances cocaine conditioned place preference in CB1 receptor knockout mice. *Behavioral Pharmacology*, 19:575-581
- Fischer, B.D., Miller, L.L., Henry, F., Picker, M.J. and Dykstra, L.A. (2008) Increased efficacy of mu-opioid agonist-induced antinociception by metabotropic glutamate receptor antagonists in C57BL/6 mice: Comparison with (-)-6-phosphonomethyl-deca-hydroisoquinoline-3-carboxylic acid (LY235959). *Psychopharmacol.* 198: 271-278

Principal Investigator/Program Director (Last, First, Middle): Dykstra, Linda

- Ramsey, A.J., Laakso, A., Cyr, M., Sotnikova, T.D., Salahpour, A., Medvedev, I.O., Dykstra, L.A., Gainetdinov, R.R. and Caron, M.G. (2008) Genetic NMDA receptor deficiency disrupts acute and chronic effects of cocaine but not amphetamine. *Neuropsychopharmacology* 33(11): 2701-2714
- Fischer, B.D., Zimmerman, E.I., Picker, M.J. and Dykstra, L.A. (2008) Morphine in combination with metabotropic glutamate receptor antagonists on schedule-controlled responding and thermal nociception. *J. Pharmacol. Exp. Ther.* 324: 732-739.

C. Current Research Support

R01-DA02749-31 Dykstra, L. (PI) 01/01/05 – 12/31/10

Opioid Analgesics: Pharmacological and Behavioral Factors

The specific research goals of this grant are based on evidence that the effects of opioid analgesics can be modulated by interactions between opioid and N-methyl-D-aspartate (NMDA) and/or metabotropic glutamate (mGlu) receptor systems. The experiments proposed in this application explore the mechanisms underlying these effects further by investigating interactions between these systems using an integrative strategy that combines genetic, pharmacological and behavioral approaches. The genetic approach employs an animal model of NMDA deficiency that consists of partial deletion of the gene encoding the essential NR1 subunit of the NMDA receptor (NR1^{-/-} mice).

T32-DA 07244-19 Dykstra, Linda A. (PI) 08/01/05 – 7/31/10

Predocutorial Training in Interdisciplinary Research on Drug Abuse

This program provides interdisciplinary, graduate training in areas related to drug and alcohol abuse for predoctoral students pursuing careers either in basic biomedical research or in more clinically-related research on drug abuse. This training grant is currently in its 4th, 5-year period.

K12 GM00678-08 Dykstra, Linda A. (PI) 09/01/08 – 08/31/12

SPIRE (Seeding Postdoctoral Innovators in Research & Education)

The SPIRE program is an Institutional Research and Academic Career Development Award (IRACDA) for postdoctoral fellows in the biomedical sciences. It is delivered through the University of North Carolina at Chapel Hill in partnership with five historically minority universities within the state of North Carolina. The program provides postdoctoral fellows with research training as well as professional development and a year of hands-on teaching experience at minority-serving undergraduate institutions.

NSF SES-0548858 Dykstra, Linda A. (co-PI) 10/01/05 – 09/30/10

National Sciences Foundation Alliance for Graduate Education for the Professorate (AGEP) Program

This project is a collaborative effort among five of the leading producers of doctoral degrees for underrepresented minority students, including the University of North Carolina at Chapel Hill, along with Howard University, The University of Florida, The University of Maryland, College Park and the University of Miami. The goal of the project is to increase the number of underrepresented groups in science, technology, engineering and mathematics (STEM) fields.

RECENTLY COMPLETED PROJECTS:

Co-Investigator, Functional Genomics of Stress and Substance Abuse, Core 2: P20 MD00175 (EXPORT, Center of Excellence; Minority Health & Health Disparities)

The goal of this research core is to investigate the influence of prior drug exposure or stress on the antinociceptive effects of opioid drugs as a function of the genomic differences in mice deficient in the CB1 cannabinoid receptor.

Director, Partner of Underrepresented Scientists United for Education (PURSUE), R25 GM62010

The Pursue program is one of the NIH/NIGMS Bridge programs designed to encourage Hispanic and African American students to pursue doctoral training in the biomedical sciences. This program supported students from two Historically-Black Universities in North Carolina, North Carolina Central University and North Carolina A&T State University.