

## DEVIN L. JINDRICH

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Arizona State University  
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### EDUCATION

2001	Ph. D.	University of California, Berkeley	Integrative Biology
		(Emphasis on comparative biomechanics and physiology).	
1993	B.A.	University of California, Berkeley	Integrative Biology

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### HONORS

2002	World Congress of Biomechanics Calgary Award finalist.
1996	National Science Foundation Graduate Research Fellowship awardee.
1996	Department of Defense Graduate Fellowship Honorable Mention.
1995	Acceptance to the Santa Fe Institute's Complex Systems Summer School, full funding (attended).
1990	Pacific Rim Scholarship to attend the University of California's Education Abroad field biology course in Monteverde, Costa Rica.

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### PROFESSIONAL POSITIONS

01/07-present      **Assistant Professor**      **Arizona State University**

- \* **Director, The Laboratory for Integrative Motor Behavior.** Discovering fundamental principles of biomechanics and motor control, interpreting these principles in the context of the physical and occupational environment, and applying basic research discoveries to problems in biomedicine and public health.

04/04-12/06      **Assistant Researcher**      **UCLA**

- \* **Understanding neuromuscular plasticity towards restoring function after spinal cord injury.** Research in musculoskeletal biomechanics, motor control, and neural plasticity towards improving rehabilitation treatments and developing neural prostheses for improved function after spinal cord injury. V. Reggie Edgerton, P.I.

06/01-10/03      **Research Fellow**      **Harvard School of Public Health**

- \* **Finger mechanics during typing: towards improved keyboard and workstation design to prevent musculoskeletal disorders.** Conducted experiments to measure forces of tendons, muscles and bones in the hand as a function of computer keyswitch design and posture to estimate musculoskeletal exposure during computer keyboard and workstation use. Funded by the Whitaker foundation, Jack Dennerlein, P.I.

8/95-05/01      **Graduate Research Assistant**      **University of California at Berkeley**

- \* **Locomotion biomechanics and biological inspiration of robot design.** Initiated, designed, implemented and published original research on the stability, maneuverability and control of rapid running in insects. Worked with team of scientists and engineers on a multidisciplinary computational neuromechanics project sponsored by the Defense Advanced Research Project Agency (DARPA) Controlled Biological Systems Program and the Office of Naval Research (ONR). Developed two experimental techniques new to biology that allowed measurements previously impossible using existing methods. These experiments developed and verified of new analytical and mathematical models of stability and maneuverability during rapid locomotion. Worked with engineers to apply these findings to robot design (prototypes were built at McGill University and Stanford University, and subjects of current study at more than six research laboratories).
- \* **Dynamic computer simulation.** With engineers at M.I.T. and The University of Michigan, and mathematicians at Princeton and Cornell, developed 2-D mathematical models of animal locomotion and 3-D, dynamic computer simulations using MATLAB, ADAMS and Boston Dynamics (implemented in C using SD-FAST) packages.

8/95-8/97      **Representative**      **UCB Instructional Technologies**

- \* **Instructional technology.** Represented graduate students from the biological sciences to the U.C. Berkeley Instructional Technologies Program. Designed and implemented websites for poly-pedal lab and several courses in the Integrative

Biology department. Initiated a project to develop a 'Virtual Classroom Kit', and contributed to the development of a 'Shared Discoveries' program to facilitate the use of current research in instruction.

- \* **Scientific visualization.** Contributed to structuring the Department of Integrative Biology's Scientific Visualization Center ([ib.berkeley.edu/bioaape/index.html](http://ib.berkeley.edu/bioaape/index.html)). Advised purchase of over \$1.3 million in equipment and software. Set up and maintained the center six months before permanent staff were hired. Sought collaboration with companies interested in biological data through presentation and booth at 1996 ACM SIGGRAPH.

6/93-7/95

Research Assistant

University of California at Berkeley

- \* **Experimental design.** Contributed to the development of a novel technique using photoelastic gelatin to make the first simultaneous measurements of single-leg ground-reaction forces in arthropods.
- \* **Physiological ecology.** Tested hypothesis that nocturnal lizards exhibit lower metabolic cost of transport (energy per unit distance) than diurnal lizards.
- \* **Technology support.** Maintained a heterogeneous computing environment of Apple Macintoshes, Windows 98 and NT machines, and Silicon Graphics workstations.

7/91-8/92

Research Assistant

InfoUse, Emeryville, CA

- \* **Public health research.** Research on nutrition and cancer for Phase I interactive computer program. Implemented a pilot Expert System using the Level V language to assist vocational rehabilitation case workers.

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## TEACHING EXPERIENCE

- 1996 Integrative Biology 150 – *Physiological Ecology*. Professor Robert J. Full.
- 1996 Integrative Biology 150L – *Physiological Ecology Laboratory*. Professor Robert J. Full.
- 1995 Integrative Biology 160 – *Evolution*. Professor David Wake.

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## ACADEMIC SERVICE

Ad-Hoc reviewer for: *Journal of Experimental Biology*, *Journal of Biomechanics*, *Exercise and Sport Sciences Reviews*, *Integrative and Comparative Biology*, *Journal of Neurophysiology*, *Medical Engineering and Physics*, *Transactions on Neural Systems & Rehabilitation Engineering*, *IEEE Transactions on Biomedical Engineering*, *Journal of Experimental Zoology*, *Journal of Theoretical Biology*

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## PUBLICATIONS

1. R.M. Ichiyama, Y. Gerasimenko, **D. L. Jindrich**, H. Zhong, R. R. Roy, V. R. Edgerton. (*Neuroscience Letters*, in press). **Combining epidural stimulation and the 5-HT agonist quipazine induces acute plantar stepping after a complete spinal cord transection in adult rats.**
2. **D.L. Jindrich**, G. Courtine, H.L. McKay, R. Moseanko, T.J. Bernot, R.R. Roy, H. Zhong, J.J. Liu, M.H. Tuszynski, V.R. Edgerton. (*Journal of Neurophysiology*, submitted). **Dynamics of unconstrained three-dimensional reaching movements by Rhesus monkeys.**
3. D. L. Lee, P-L. Kuo, J. N. Katz, **D.L. Jindrich**, J. T. Dennerlein. (*Clinical Biomechanics*, submitted). **Influence of Finger Posture on Intrinsic and Extrinsic Muscle Activity Patterns During a Keystroke.**
4. D. L. Lee, P-L. Kuo, **D.L. Jindrich**, J. T. Dennerlein. (*Journal of Electromyography and Kinesiology*, in revision). **Computer Keyswitch Force-Displacement Characteristics Affect Muscle Activity Patterns During Index Finger Tapping.**
5. **D.L. Jindrich**, V.R. Edgerton (*Journal of Neurophysiology*, submitted). **Objective methods for assessing rat locomotion kinematics.**
6. Johnson, W.L., **Jindrich, D.L.**, Roy, R.R., Edgerton, V.R. (2008) **A musculoskeletal model of the rat hindlimb.** *Journal of Biomechanics*, **41**:610-619.
7. M.D. Kubasak, **D.L. Jindrich**, Zhong H, Takeoka, A, McFarland, KC, Munoz-Quiles, C, Roy RR, Edgerton VR, Ramón-Cueto A, Phelps PE. (2008) **Step training enhances improvements in hindlimb plantar stepping and step kinematics promoted by OEG transplantation in adult paraplegic rats.** *Brain*, **131**(1):264-76.
8. Petruska, J.C., Ichiyama, R.M., **Jindrich, D.L.**, Crown, E.D., Tansey, K.E., Roy, R.R., Edgerton, V.R., Mendell, L.M. (2007). **Changes in Motoneuron Properties and Synaptic Inputs Related to Step Training Following Spinal Cord Transection in Rats.** *Journal of Neuroscience*. **27**(16):4460-4471.
9. **Jindrich, D. L.**, Smith, N., Jespers, K., and Wilson, A.M. (2007). **Mechanics of cutting maneuvers by ostriches (*Struthio camelus*).** *Journal of Experimental Biology* **210**: 1378-1390.

10. Kuo, P-L., Lee, D.L., **Jindrich, D. L.** and Dennerlein, J.T. (2006). **Finger joint coordination during tapping.** *Journal of Biomechanics*, **39**(16):2934-42.
11. Balakrishnan, A.D.\* , **Jindrich, D. L.** and Dennerlein, J.T. (2006). **Horizontal force components can reduce finger joint torques during tapping on a computer keyswitch.** *Human Factors*. **48**(1):121-9.
12. **Jindrich, D. L.**, Besier, T. F. and Lloyd, D. G. (2006). **A hypothesis for the function of braking forces during running turns.** *Journal of Biomechanics*, **39**: 1611-1620.
13. **Jindrich, D. L.**, Balakrishnan, A.D. and Dennerlein, J.T. (2004) **Keyswitch design and finger posture affect finger joint impedance during tapping on a computer keyswitch.** *Clinical Biomechanics*, **19**:600-608.
14. **Jindrich, D. L.**, Balakrishnan, A.D. and Dennerlein, J.T. (2004) **Finger joint impedance during voluntary tapping on a computer keyswitch.** *Journal of Biomechanics*, **37**: 1589-1596.
15. **Jindrich, D.L.**, Zhou, Y., Becker, T. and Dennerlein, J.T. (2003) **Fingertip pulp mechanics during voluntary tapping.** *Journal of Biomechanics*. **36**(4) 497-503.
16. **Jindrich, D. L.** and Full, R. J. (2002). **Dynamic stabilization of rapid hexapedal locomotion.** *Journal of Experimental Biology*. **205**,2803-2823.
17. **Jindrich, D.L.** and Full, R. J. (1999) **Many-legged maneuverability: dynamics of turning in hexapods.** *Journal of Experimental Biology*. **202**, 1603-1623.
18. Autumn, K., **Jindrich, D.L.**, deNardo, D., and Mueller, R. (1999) **Locomotor performance at low temperature and the evolution of nocturnality in geckos.** *Evolution*. **53**(2), 580-599.
19. Full, R. J., Yamauchi, A. and **Jindrich, D. L.** (1995) **Maximum single leg force production: cockroaches righting on photoelastic gelatin.** *Journal of Experimental Biology*, **198**, 2441-2452.

#### Publications in preparation

- D.L. Jindrich**, C.K. Ootshi , S. Joseph, R.Y. Wei, H. Zhong, N.J. Ali, N.J.K Tillakaratne., V.R. Edgerton (in preparation for *Journal of Neuroscience Methods*). **Spinal learning in the adult mouse using the Horridge Paradigm.**
- D.L. Jindrich**, G. Courtine, H.L. McKay, R. Moseanko, T.J. Bernot, R.R. Roy, H. Zhong, J.J. Liu, H. Yang, L.A. Havton, M.H. Tuszynski, V.R. Edgerton. (in preparation for *Journal of Neuroscience*). **Recovery from spinal lesions in Rhesus monkeys part I: Motor control of grasping.**
- G. Courtine, **D.L. Jindrich**, H.L. McKay, R. Moseanko, T.J. Bernot, R.R. Roy, H. Zhong, J.J. Liu, H. Yang, L.A. Havton, M.H. Tuszynski, V.R. Edgerton. (in preparation for *Journal of Neuroscience*). **Recovery from spinal lesions in Rhesus monkeys part II: Motor control of locomotion.**
- D. L. Jindrich**, R. J. Full (in preparation for *Journal of Comparative Physiology*). **Control of leg movements in response to perturbations of rapid running in the cockroach, *Blaberus discoidalis*.**

\*Mentored undergraduate.

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#### ABSTRACTS

- Jindrich, D.L.**. Objective methods for assessing rat locomotor kinematics. *Society for Neuroscience Annual Meeting*, (November 3-7 2007), San Diego, CA.
- E. S. rosenzweig, M. D. Culbertson, J. H. Brock, L. Lu, T. Bernot, R. Moseanko, G. Courtine, **D. L. Jindrich**, J. J. Liu, V. R. Edgerton, L. A. Havton, M. H. Tuszynski. Spontaneous plasticity of corticospinal projections after primate spinal cord injury. *Society for Neuroscience Annual Meeting*, (November 3-7 2007), San Diego, CA.
- D. C. Dunbar, **D. jindrich**, N. Hamouda, R. Roy, H. Zhong, G. Courtine, J. Liu, T. Bernot, R. Moseanko, M. Tuszynski, V. Edgerton. Manual prehension strategies in rhesus monkeys before and after cervical hemisection. *Society for Neuroscience Annual Meeting*, (November 3-7 2007), San Diego, CA.
- Jindrich, D.L.**. Mechanics of Bipedal Running Turns. *American Society of Biomechanics Annual Meeting*, (August 2007), Stanford, CA.
- Jafari, R., **Jindrich, D.L.**, Edgerton, V.R., Sarrafzadeh, M. CMAS: Clinical Movement Assessment System for Neuromotor Disorders. *IEEE Biomedical Circuits and Systems Conference (BioCAS)*, (November-December 2006), London, UK.
- Ootshi, C.K., **Jindrich, D.L.**, Wei, R.Y., Fong, A.J. Cai, L.L., Ali, N.J., Zhong, H. Tillakaratne, N.J.K., Roy, R.R., Edgerton, V.R. Application of the Horridge Paradigm in the Adult Spinal Mouse. *Society for Neuroscience Annual Meeting (October 14-18, 2006)*.
- Jindrich, D.L.**, Courtine, G. McKay, H.L., Bernot, T., Moseanko, R., Roy, R.R., Zhong, H., Rosenzweig, E., Havton, L.A., Tuszynski, M.H., Edgerton, V.R. Effects of cervical hemisection on locomotion and prehension in Rhesus monkeys. *Society for Neuroscience Annual Meeting (October 14-18, 2006)*.
- Jafari, R., **Jindrich, D.L.**, Edgerton, V.R., Sarrafzadeh, M. Quantitative Assessment of Neuromotor Disorders Using a Wearable Sensor Network. *Society for Neuroscience Annual Meeting (October 14-18, 2006)*.

- Johnson, W.L., **Jindrich, D.L.**, Roy, R.R., Edgerton, V.R. Muscle origin and insertion coordinates relative to bone landmarks in the rat hindlimb – toward a musculoskeletal model. *Society for Neuroscience Annual Meeting (October 14-18, 2006)*.
- Jafari, R., **Jindrich, D.L.**, Edgerton, V.R., Sarrafzadeh, M. CMAS: Clinical Movement Assessment System for Neuromotor Disorders. *Tenth International Symposium on Wearable Computers (October 11-14, 2006)*.
- Jindrich, D.L.**, Courtine, G. McKay, H.L., Betts, S.L., Bernot, T., Roy, R.R., Zhong, H., Liu, J.J. Gupta, R.K. Yang, H., Havton, L.A., Tuszynski, M.H., Edgerton, V.R. **Effects of cervical hemisection on prehension in Rhesus monkeys.** *Society for Neuroscience 2005 meeting* (November 2005).
- Jindrich, D.L.**, Kuo, P-L, Balakrishnan, A.D. and Dennerlein, J.T. (2003) **Keyswitch design and finger posture affect joint impedance when tapping on computer keyswitches.** *Proc. Amer. Soc. Biomech.* 243.
- Jindrich, D.L.** (2002) **Dynamic stabilization of rapid hexapodal locomotion.** *Proc. Fourth World Congress of Biomechanics.* 878.
- Jindrich, D.L.** and Dennerlein, J.T. (2002) **Impedance models of finger joints during typing.** *Proc. Fourth World Congress of Biomechanics.* 5263.
- Jindrich, D.L.**, Becker, T. and Dennerlein, J.T. (2002) **Fingertip pulp mechanics during voluntary tapping.** *Proc. Fourth World Congress of Biomechanics.* 866.
- Jindrich, D. L.** and Full, R. J. (2000) **Dynamic stabilization of rapid hexapodal locomotion.** *Am. Zool.* **40**(6), 1077-1077.
- Jindrich, D. L.** and Full, R. J. (1999) **Kinematic variability during constant average speed running in cockroaches.** *Am. Zool.* **38**:81A.
- Jindrich, D. L.** and Full, R. J. (1998) **Requirements for self-stabilizing running in 3D hexapods.** *Am. Zool.* **37**:176A.
- Full, R.J. and **Jindrich, D. L.** (1996) **AAPE: 3D data acquisition, analysis, presentation and exchange.** *ACM SIGGRAPH 96 Visual Proceedings.* 108.
- Jindrich, D. L.** and Full, R. J. (1995) **Mechanics of turning in hexapods.** *Proc. Amer. Soc. Biomech.* **19**: 105-106.
- Jindrich, D. L.** and Full, R. J. (1995) **Dynamics of turning in a running cockroach.** *Physiol. Zool.* **68**: 57.
- Jindrich, D.L.** and Full, R.J. (1994). **Turning behavior of cockroaches.** *Amer. Zool.* **34**: 38A.
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## INVITED PRESENTATIONS

- Jindrich, D. L.** **Functional recovery following spinal cord injury in Rhesus Monkeys.** UCLA Neural Repair Seminar Series. (Los Angeles, CA. 28 April 2006).
- Jindrich, D. L.** **Strategies for restoring function following spinal cord injury.** Institute for Neuromorphic Engineering Workshop. (Zurich, Switzerland, 21-25 August 2005).
- Jindrich, D. L.** **Unsteady Locomotion.** Society for Experimental Biology Annual Meeting Symposium. (Barcelona, Spain, 11-15 July 2005).
- Jindrich, D. L.** **Stability and maneuverability of locomotion, with applications.** Harvey Mudd College Biology Department seminar. (Claremont, CA., 17 November 2004).
- Jindrich, D. L.** **Stability and maneuverability.** University of Southern California seminar series. (Los Angeles, CA., 7,11 October 2004).
- Jindrich, D. L.** **Unsteady locomotion in bipeds and polypeds.** Royal Veterinary College seminar series. (Brookman's Park, U.K. 19 July 2004).
- Jindrich, D. L.** **Running Roaches and Repetitive Motions: Studying the Mechanics of Movement.** Stanford University Biomechanical Engineering Seminar. (Palo Alto, CA. 02 May 2003).
- Jindrich, D. L.** **Stability, maneuverability, and control of rapid cockroach locomotion.** M.I.T. Computational Motor Control seminar. (Boston, MA. 28 August 2002).
- Jindrich, D. L.** **Stability, maneuverability, and control of rapid cockroach locomotion.** Harvard School of Public Health Work in Progress seminar. (Boston, MA. 05 March 2002).
- Jindrich, D. L.** and Full, R. J. **Stability and maneuverability: theoretical models and empirical correlates.** 1998 DARPA Michigan Site Visit. (Ann Arbor, MI. 9 December 1998).
- Jindrich, D.L.** **Control strategies for dynamic locomotion.** Workshop on Modeling and Simulation of Biomechanical Systems. (Bielefeld, Germany. 5-6 June, 1997).
- Jindrich, D. L.** **Preflexes and stability during rapid locomotion.** Office of Naval Research Legged Locomotion Workshop. (Cambridge, MA. 28-31 May, 1997).
- Jindrich, D.L.** **Using internet information servers to provide resources for research, instruction, and community outreach programs.** Colloquium on Using the Internet for Instruction and Outreach. (Berkeley, CA. 1997).
- Jindrich, D. L.** **The AAPE center at U. C. Berkeley: using data acquisition, analysis, presentation, and exchange to address biological complexity.** ACM SIGGRAPH. (New Orleans, LA, 1996).
- Jindrich, D. L.** **Locomotor behavior of the cockroach: mechanics and nervous organization.** Santa Fe Institute's Complex Systems Summer Program. (Santa Fe, NM. 1995).

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## GRANTS AND CONTRACTS

### A. Completed

**TITLE:** Plasticity and Regeneration in the Primate Spinal Cord  
**SOURCE:** National Institutes of Health    **PERIOD:** 2006-2011    **STATUS:** Approved  
**TYPE:** R01    **ROLE:** Co-PI  
**DESCRIPTION:** Continuation of a project to understand the functional and anatomical consequences of spinal cord injury in primates, and evaluate therapeutic strategies.

**TITLE:** Combined OEG transplantation and step training promote regeneration in adult SCI  
**SOURCE:** National Institutes of Health    **PERIOD:** 2006-2010    **STATUS:** Approved  
**TYPE:** R01    **ROLE:** Researcher  
**DESCRIPTION:** Proposal to evaluate the effectiveness of olfactory ensheathing glial cells and step training in improving locomotion following spinal cord injury. This project will also use neurophysiological studies to investigate the mechanisms of improved function following treatment with OEG cells.

**SOURCE:** National Science Foundation    **PERIOD:** 1996-1998    **STATUS:** Completed  
**TYPE:** Graduate Research Fellowship    **COSTS:** Stipend: \$15,000 / year  
**DESCRIPTION:** Fellowship granted for graduate study in Integrative Biology at the University of California, Berkeley.

### B. Submitted

**TITLE:** A biomechanics-based neuoprosthetic controller for locomotion  
**SOURCE:** National Institutes of Health    **PERIOD:** 2008-2010    **STATUS:** In Revision.  
**TYPE:** R21    **BUDGET:** \$274,957 direct costs    **ROLE:** PI  
**DESCRIPTION:** Proposal to develop a neuroprosthetic control system for locomotion that takes advantage of the energy-saving and intrinsically-stabilizing mechanical mechanisms used by humans during locomotion.

**TITLE:** Neuroprosthetic control of locomotion through mechanical tuning  
**SOURCE:** Craig H. Neilsen Foundation    **PERIOD:** 2008-2010    **STATUS:** In Review.  
**TYPE:** Research    **BUDGET:** \$184,969 direct costs    **ROLE:** PI  
**DESCRIPTION:** Proposal to develop a neuroprosthetic control system for locomotion that takes advantage of the energy-saving and intrinsically-stabilizing mechanical mechanisms used by humans during locomotion.

**TITLE:** Neuroprosthetic control of locomotion through mechanical tuning.  
**SOURCE:** Christopher and Dana    **PERIOD:** 2008-2010    **STATUS:** In Review..  
Reeve Foundation  
**TYPE:** Research    **BUDGET:** \$149,985 direct costs    **ROLE:** PI  
**DESCRIPTION:** Proposal to develop a neuroprosthetic control system for locomotion that takes advantage of the energy-saving and intrinsically-stabilizing mechanical mechanisms used by humans during locomotion.

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## STUDENTS SUPERVISED

### A. Graduate

Mu Qiao	Ph.D.	ASU Kinesiology	Dissertation Advisor
Bryan Morrison	Ph.D.	ASU Kinesiology	Committee Member
Cecile Lozano	Ph.D.	ASU Kinesiology	Committee Member
Mallika Fairchild	Ph.D.	ASU Engineering	Committee Member
Brian Hillen	Ph.D.	ASU Engineering	Committee Member
Anne Curzon	M.A.	ASU Kinesiology	Committee Member
Giridar Hegde	M.A.	ASU Kinesiology	Committee Member

### B. Undergraduate

Danielle Protas	ASU	Robert Wei	UCLA
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Elizabeth Drummond  
Brian Brown

ASU  
ASU

Ravi Gupta  
Kathleen (Kat) Yaphockun  
Aristakes Mnatsakanyan  
Aruna Balakrishnan

UCLA  
UCLA  
UCLA  
Harvard

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#### **PATENTS**

“Method and Apparatus for Quantitative Assessment of Neuromotor Disorders.” M. Sarrafzadeh, R. Jafari, V.R. Edgerton, and D.L. Jindrich, inventors. Provisional patent submitted to USPTO, 2007.

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#### **POPULAR PRESS**

Articles about my research have appeared in *Science*, *Scientific American*, *LiveScience*, *Science et Vie*, *Fox News*, and *Wissenschaft-online* among others.