

Curriculum Vitae

Robert Dudley
Department of Integrative Biology
University of California, Berkeley
Berkeley, CA 94720 U.S.A.
510-642-1555; FAX 510-643-6264
wings@socrates.berkeley.edu

Personal

Date/place of birth: 14 September 1961; Edinburgh, Scotland
Passports: U.K., U.S.A.
Married to Junqiao Han

Education

1987. Ph.D. in Zoology, University of Cambridge, United Kingdom
1983. B.S. *summa cum laude*, Duke University, North Carolina. Graduation with Distinction
in Zoology

Professional Appointments

2003 - present: Professor, Department of Integrative Biology, University of California, Berkeley
2003 - present: Research Morphologist, Museum of Vertebrate Zoology, UC-Berkeley
2003 - present: Curator, Essig Museum of Entomology, University of California, Berkeley
1997 - 2002: Associate Professor, Section of Integrative Biology, University of Texas at Austin
1992 - 1997: Assistant Professor, Department of Zoology, University of Texas at Austin
1992 - present. Research Associate, Smithsonian Tropical Research Institute, Panama

Research Interests

1. Biomechanics, functional morphology, and evolution of animal flight
2. Physiological ecology of tropical insects, particularly flight energetics and migration
3. Bioacoustic and physiological mechanisms of vocalization in anuran amphibians
4. Evolutionary origins of human alcoholism in primate frugivory

Fellowships, Research Grants, and Awards

2008 - 2009. National Geographic Society Research Grant: "Toward a biogeography of salt", Co-Investigator with M. Kaspari and S. Yanoviak (\$21,700; 12 months)
2007 - 2012. John and Mary Gompertz Chair in Integrative Biology, University of California, Berkeley (\$210,000; five years)
2007 - 2008. National Geographic Society Research Grant: "Flight into thin air: the physiology and diversity of alpine bumblebees", Co-Investigator with M. Dillon (\$16,200; 12 months)
2006 - 2009. NSF DEB-0543556 and REU Supplement: "Phylogenetic and biogeographic history of high-altitude adaptation in hummingbirds", Co-Investigator with J.A. McGuire (\$478,218; 36 months)
2005 - 2006. National Geographic Society Research Grant: "Gliding flight in rainforest canopy ants", Co-Investigator with S.P. Yanoviak and M. Kaspari (\$20,000; 12 months)
2004 - 2005. NSF IOB-0437613: "SICB Symposium: Adaptation for life at high elevation"

(\$3000; 12 months), co-organized with D. Altshuler

2003 - 2004. NSF IBN-0335585: "SICB Symposium: The coevolution of frugivorous animals with the natural occurrence of ethanol in fermenting fruit" (\$11,550; 12 months), co-organized with M. Dickinson

2003 - 2005. National Geographic Society Research Grant: "Optimal migration in butterflies: quantifying the aerodynamic power curves for flight", Co-Investigator with R.B. Srygley (\$30,585; 24 months)

2002 - 2003. United States - Israel Binational Science Foundation: "Role of ethanol in the nutritional and sensory physiology of frugivores", Co-Investigator with C. Korine and B. Pinshow (\$50,000; 12 months)

2002 - 2004. Texas Advanced Research/Technology Program: "Dynamic models for flapping wing micro-air vehicles derived from hummingbird flight", Co-Investigator with M. Akella (\$241,340; 24 months)

2001 - 2005. NSF DEB-0108555: "Evolution of flight performance and the phylogeny of hummingbirds", Co-Investigator with J.A. McGuire (\$303,760; 48 months)

2001. National Geographic Society Research Grant: "Do migrating Neotropical butterflies use a magnetic compass to orient?", Co-Investigator with R.B. Srygley and E. Oliveira (\$22,680)

2000. Association of American Publishers Award for Best Professional/Scholarly Book in Biological Science for *The Biomechanics of Insect Flight: Form, Function, Evolution*

2000 - 2003. NSF OPP-9980360: "Temperature compensation in Antarctic pteropods: an integrative approach" (\$174,180/36 months)

1999 - 2002. NSF IBN-9817138: "Limits to hummingbird flight performance: ecological and comparative perspectives" (\$325,000/36 months)

1999 - 2001. NSF IBN-9902155: "Hummingbird morphology and its influence on flight performance, competitive ability, and foraging behavior", Dissertation Improvement Grant with D. Altshuler (\$9880/24 months)

1999. Invited participant, NSF Antarctic Biology Training Course (McMurdo)

1999. Study Visit, Deutscher Akademischer Austauschdienst, Erlangen Universität: "Hovering in glossophagine phyllostomid bats" (\$3100)

1998 - 2000. Earthwatch Institute: "Physiology and ecology of hummingbirds along an altitudinal gradient", Co-Investigator with D. Altshuler (\$58,145/24 months)

1998. Short Term Visitor Award, Smithsonian Institution (\$1925)

1997 - 1999. NSF IBN-9601089: "Biomechanical and physiological limits to animal flight performance" (\$110,000/24 months)

1997 - 1999. NIH NRSA MH11703: "Evolution of communication in anuran amphibians", (postdoctoral fellowship for W. Martin; \$74,024/24 months)

1997. Short Term Visitor Award, Smithsonian Institution (\$1875)

1996 - 1999. National Geographic Society Research Grant: "Flying lizards (Genus *Draco*) and the evolution of vertebrate flight", Co-investigator with J.A. McGuire (\$40,765)

1996. Short Term Visitor Award, Smithsonian Institution (\$1875)

1994 - 1997. National Geographic Society Research Grant: "Orientation of butterflies migrating across the Caribbean Sea and Panama", Co-Investigator with R.B. Srygley (\$59,500)

1994 - 1996. NIH NRSA AR008331: "Energetic limits to hummingbird flight performance" (postdoctoral fellowship for P. Chai; \$69,100/24 months)

1994. Short Term Visitor Award, Smithsonian Institution (\$2000)

1993. National Academy of Sciences Project Development Grant (\$2000)

1993. Short Term Visitor Award, Smithsonian Institution (\$1900)
1991 - 1992. Whitehall Foundation Grant-in-Aid (\$15,000)
1988 - 1991. Smithsonian Institution Three-year Postdoctoral Fellowship for research at the Smithsonian Tropical Research Institute (\$75,000)
1987 - 1988. Smithsonian Institution Postdoctoral Fellowship, STRI (\$21,000)
1983 - 1987. Marshall Scholarship for doctoral studies at the University of Cambridge
1983. Olney Fellowship at the Cold Spring Harbor Laboratory, Long Island
1983. Horn Memorial Prize for Excellence in Zoology, Duke University

Teaching and Training Activities

Undergraduate courses: Biomotion, Comparative Physiology, Mechanics of Organisms

Graduate courses: Air & Water, Animal Locomotion, Biomechanics seminar

Graduate student supervision:

Mariska Batavia (2007 - present; co-advisor with S. Glickman)

Yu Zeng (2007 - present; co-advisor with D. Wake)

Yonatan Munk (2004 - present; co-advisor with M. Koehl)

Jose Maria Fernandez (2004 - present)

Greg Byrnes (2003 - present)

Chris Clark (2003 - present)

Ryan Hill (2003 - present)

Matt Medeiros (2003 - present)

Brendan Borrell (Ph.D., 2006); freelance science writer, New York City

Travis LaDuc (Ph.D., 2003; co-advisor with D. Cannatella); Assistant Curator of Herpetology, Texas Memorial Museum, University of Texas at Austin

Jen Yeh (Ph.D., 2001; co-advisor with D. Cannatella); freelance science writer, San Francisco

Doug Altshuler (Ph.D., 2001); Assistant Professor, University of California, Riverside

Postdoctoral sponsorship:

Dr. Michael Dillon (NSF Minority Postdoctoral Research Fellowship, 2007 - present)

Dr. Rob Buchwald (NSF Minority Postdoctoral Research Fellowship, 2006 - present)

Dr. Stacey Combes (UC-Berkeley Miller Fellow, 2004 - 2007); Assistant Professor, Department of Organismic & Evolutionary Biology, Harvard University

Dr. Chris Witt (NSF, 2004 - 2006; co-sponsor with J. McGuire); Assistant Professor, Department of Biology, University of New Mexico

Dr. Sagiri Horisawa (Texas Advanced Research Program, 2001 - 2004); freelance science writer, Tokyo

Dr. William Martin (NIH NRSA, 1997 - 1999); deceased

Dr. Peng Chai (NIH NRSA, 1994 - 1998); statistical consultant, MDS Harris Laboratories

Reviewing Activities

Journals: *Aerospace Science & Technology*, *American Naturalist* (Associate Editor, 2005 - 2008), *Animal Behaviour*, *Annals of the Entomological Society of America*, *Austral Ecology*, *Biological Journal of the Linnean Society*, *Biological Reviews of the Cambridge Philosophical Society*, *Biotropica*, *Brain*, *Behavior and Evolution*, *Condor*, *Comparative Biochemistry and Physiology*, *Ecology*, *Evolution*, *Functional Ecology*, *Geology*, *Integrative and Comparative Biology*, *Journal of Animal Ecology*, *Journal of Comparative Physiology B*, *Journal of Experimental Biology*, *Journal of Experimental Zoology*, *Journal of Fluids*

Engineering, Journal of Insect Physiology, Journal of Mammalogy, Journal of Morphology, Journal of Neuroscience Methods, Journal of the Kansas Entomological Society, Journal of Theoretical Biology, Nature, Naturwissenschaften, Oecologia, Paleobiology, Philosophical Transactions of the Royal Society of London B, Physiological Entomology, Physiological and Biochemical Zoology, PLoS ONE, Proceedings of the Royal Society of London B, Proceedings of the National Academy of Sciences USA, Quarterly Review of Biology, Science, Wilson Bulletin, Zoologica Scripta

Publishers: Johns Hopkins University Press, Oxford University Press, Princeton University Press, Rutgers University Press

Funding agencies: Academia Europaea, Biotechnology and Biological Sciences Research Council (U.K.), Israel Science Foundation, National Geographic Society Research Grants, National Environment Research Council (U.K.), National Science Foundation, National University of Singapore Academic Research Fund, USDA SBIR Program

Foreign Languages

Deutsch als Fremdsprache certificate, Friedrich-Alexander-Universität, Erlangen
reading and conversational knowledge of French and Spanish
survival conversational Mandarin

Membership in Professional Societies

American Ornithologists' Union, Association for Tropical Biology, Association of Marshall Scholars, Entomological Society of America, International Canopy Network, Phi Beta Kappa, Sigma Xi, Society for Integrative and Comparative Biology, Society for the Study of Evolution

Invited Presentations (last five years)

2008: Flight Symposium, XIII International Congress of Entomology (Durban); Dept. of Biology, Univ. of Miami; Dept. of Zoology, Univ. of Oklahoma; Dept. of Biology, Univ. of Arkansas, Little Rock.

2007: Hopkins Marine Station, Stanford Univ.; Gallo Clinic & Research Center, UCSF; Dept. of Biology, Humboldt State Univ. (two seminars); SICB Annual Meeting (Phoenix); Dept. of Ecology and Evolutionary Biology, Univ. of Kansas (two seminars); Organization for Tropical Studies Resource Person (three lectures, Corcovado National Park, Costa Rica); Romberg Tiburon Center, SFSU; School of Integrative Biology, Univ. of Illinois; Acadia Summer Art Program (Bar Harbor).

2006: Dept. of Zoology, Univ. of British Columbia; Dept. of Biological Science, Florida State Univ.; Dept. of Biological Sciences, Univ. of Nevada, Las Vegas; Allometry Symposium (Annual Meeting of the Society for Experimental Biology, Canterbury); Dept. of Physics, Duke University; Animal Models of Alcohol Consumption Symposium (2006 World Congress on Alcohol Research, Sydney).

2005: Division of Ecology and Evolution, UC-Davis; Department of Biological Sciences, Stanford University; Dept. of Biology, Univ. of Utah; Dept. of Desert Ecology, Ben-Gurion Univ.; Dept. of Biology, Univ. of Portland; Dept. of Behavioral Neuroscience, Oregon Health & Science Univ.; Division of Biological Sciences, Univ. of Montana; Institute of Aeronautics and Astronautics (Beijing).

2004: Biomechanics Symposium, XII International Congress of Entomology (Brisbane); Ethanol Symposium, SICB Annual Meeting (New Orleans); Dept. of Biology, University of Missouri-

Columbia; Acadia Summer Art Program (Bar Harbor); Smithsonian Tropical Research Institute (Panama).

Publications

- Dudley, R. and R.B. Srygley. (2008). Airspeed adjustment and lipid reserves in migratory Neotropical butterflies. *Functional Ecology*, in press.
- Mazeh, S., Korine, C., Pinshow, B. and R. Dudley. (2008). Does ethanol in fruit influence feeding in the Yellow-vented Bulbul (*Pycnonotus xanthopygos*)? *Behavioural Processes*, in press.
- McGuire, J.A., Witt, C.C., Remsen, J.V., Dudley, R. and D.L. Altshuler. (2008). A higher-level taxonomy for hummingbirds. *Journal of Ornithology*, in press.
- Srygley, R.B. and R. Dudley. (2008). Optimal strategies for insects migrating in the flight boundary layer: mechanisms and consequences. *Integrative and Comparative Biology*, in review.
- Yanoviak, S.P., Kaspari, M., Dudley, R. and G. Poinar. (2008). Parasite-induced fruit mimicry in a tropical ant. *American Naturalist*, in press.
- Dudley, R. (2007). Air. In: *Encyclopedia of Tidepools and Rocky Shores* (eds. M.W. Denny and S.D. Gaines), pp. 8 - 10. Berkeley: University of California Press.
- Dudley, R., Byrnes, G., Yanoviak, S.P., Borrell, B.J., Brown, R., and J.A. McGuire. (2007). Gliding and the functional origins of flight: biomechanical novelty or necessity? *Annual Review of Ecology, Evolution, and Systematics* **38**:179-201.
- Altshuler, D.L. and R. Dudley. (2006a). Adaptations to life at high elevation: an introduction to the symposium. *Integrative and Comparative Biology* **46**:3-4.
- Altshuler, D.L. and R. Dudley. (2006b). The physiology and biomechanics of avian flight across elevational gradients. *Integrative and Comparative Biology* **46**:62-71.
- Srygley, R.B., Dudley, R., Oliveira, E.G., and A. Riveros. (2006). Experimental evidence for a magnetic sense in Neotropical migrating butterflies (Lepidoptera: Pieridae). *Animal Behaviour* **71**:183-191.
- Sánchez, F., Korine, C., Steeghs, M., Laarhoven, L.-J., Harren, F.J.M., Cristescu, S.M., Dudley, R. and B. Pinshow. (2006). Ethanol and methanol as possible odor cues for Egyptian fruit bats (*Rousettus aegyptiacus*). *Journal of Chemical Ecology* **32**:1289-1300.
- Dudley, R., Huey, R.B., and D.R. Carrier. (2006). Living History of Physiology: Carl Gans. *Advances in Physiology Education* **30**:102-107.
- Dillon, M., Frazier, M.R. and R. Dudley. (2006). Into thin air: physiology and evolution of alpine insects. *Integrative and Comparative Biology* **46**:49-61.
- Yanoviak, S.P. and R. Dudley. (2006). The role of visual cues in directed aerial descent of *Cephalotes atratus* workers (Hymenoptera: Formicidae). *Journal of Experimental Biology* **209**:1777-1783.
- Dudley, R. (2005). Evolutionary and historical aspects of ethanol ingestion. In: *Comprehensive Handbook of Alcohol-Related Pathology, Volume 1. General aspects of alcohol and mechanisms of disease* (eds. V.R. Preedy and R.R. Watson), pp. 3-13. London: Academic Press.
- McGuire, J.A. and R. Dudley. (2005). The cost of living large: comparative gliding performance in flying lizards (Agamidae: *Draco*). *American Naturalist* **166**:93-106.
- Borrell, B.J., Goldbogen, J. and R. Dudley. (2005). Flapping aquatic propulsion at low Reynolds numbers: swimming kinematics of the Antarctic pteropod, *Clione antarctica*. *Journal of*

- Experimental Biology* **208**:2939-2949.
- Borrell, B.J., LaDuc, T.J. and R. Dudley. (2005). Respiratory cooling in rattlesnakes. *Comparative Biochemistry and Physiology A* **140**:471-476.
- Stiles, F.G., Altshuler, D.L. and R. Dudley. (2005). On the wing morphology and flight behavior of some North American hummingbird species. *The Auk* **122**:872-886.
- Yanoviak, S.P., Dudley, R. and M. Kaspari. (2005). Directed aerial descent in arboreal ants. *Nature* **433**:624-626.
- Altshuler, D.L., Dudley, R. and J.A. McGuire. (2004). Resolution of a paradox: hummingbird flight at high elevation does not come without a cost. *Proceedings of the National Academy of Sciences USA* **101**:17731-17736.
- Altshuler, D.L., Stiles, F.G., and R. Dudley. (2004). Of hummingbirds and helicopters: hovering costs, competitive ability and foraging strategies. *American Naturalist* **163**:16-25.
- Dudley, R. (2004). Ethanol, fruit ripening, and the historical origins of human alcoholism in primate frugivory. *Integrative and Comparative Biology* **44**:315-323.
- Dudley, R. and M.H. Dickinson. (2004). The comparative biology of ethanol consumption: an introduction to the symposium. *Integrative and Comparative Biology* **44**:267-268.
- Altshuler, D.L., Dudley, R. and C.P. Ellington. (2004). Aerodynamic forces of revolving hummingbird wings and wing models. *Journal of Zoology, London* **264**:327-332.
- Childress, S. and R. Dudley. (2004). Transition between ciliary to flapping mode in a swimming mollusc: flapping flight as a bifurcation in Re_{ω} . *Journal of Fluid Mechanics* **498**:257-288.
- Dillon, M.E. and R. Dudley. (2004). Allometry of maximum vertical force production during hovering flight of Neotropical orchid bees (Apidae: Euglossini). *Journal of Experimental Biology* **207**:417-425.
- Roberts, S.P., Harrison, J.F., and R. Dudley. (2004). Allometry of kinematics and energetics in Carpenter Bees (*Xylocopa varipuncta*) hovering in variable-density gases. *Journal of Experimental Biology* **207**:993-1004.
- Sánchez, F., Korine, C., Pinshow, B. and R. Dudley. (2004). Frugivory in bats and the possible roles of ethanol in fruit localization and appetitive stimulation. *Integrative and Comparative Biology* **44**:290-294.
- Stephens, D. and R. Dudley. (2004). The drunken monkey hypothesis. *Natural History* **113**(10):40-44.
- Altshuler, D.L., and R. Dudley. (2003). Kinematics of hummingbird hovering flight along simulated and natural elevational gradients. *Journal of Experimental Biology* **206**:3139-3147.
- Berner, R.A., Beerling, D.J., Dudley, R., Robinson, J.M. and R.A. Wildman. (2003). Phanerozoic atmospheric oxygen. *Annual Review of Earth and Planetary Sciences* **31**:105-134.
- Dickinson, M.H. and R. Dudley. (2003). Flight. In: *Encyclopedia of Insects* (ed. V. Resh and R. Cardé), pp. 416-426. San Diego: Academic Press.
- Altshuler, D.L. and R. Dudley. (2002). The ecological and evolutionary interface of hummingbird flight physiology. *Journal of Experimental Biology* **205**:2325-2336.
- Dudley, R. (2002a). Fermenting fruit and the historical ecology of ethanol ingestion: is alcoholism in modern humans an evolutionary hangover? *Addiction* **97**:381-388.
- Dudley, R. (2002b). Mechanisms and implications of animal flight maneuverability. *Integrative and Comparative Biology* **42**:135-140.
- Dudley, R. and Y. Winter. (2002). Hovering flight mechanics of Neotropical flower bats (Phyllostomidae: Glossophaginae) in normo- and hypodense gas mixtures. *Journal of Experimental Biology* **205**:3669-3677.

- Dudley, R., Srygley, R.B., Oliveira, E.G. and P.J. DeVries. (2002). Flight speeds, lipid reserves, and predation of the migratory moth *Urania fulgens* (Uraniidae). *Biotropica* **34**:120-126.
- Moon, B.R., LaDuc, T.J., Dudley, R., and Chang, A. (2002). A twist to the rattlesnake tail. In: *Topics in Functional and Ecological Vertebrate Morphology* (eds. P. Aerts, R. Van Damme, K. D'Août and A. Herrel), pp. 63-76. Shaker Publishing, Maastricht.
- Dudley, R. (2001a). Limits to human locomotor performance: phylogenetic origins and comparative perspectives. *Journal of Experimental Biology* **204**:3235-3240.
- Dudley, R. (2001b). The biomechanics and functional diversity of flight. In: *Insect Movement: Mechanisms and Consequences* (ed. I. Woiwod and D. Reynolds), pp. 19-41. Wallingford: CAB International.
- Dudley, R. (2000a). Evolutionary origins of human alcoholism in primate frugivory. *Quarterly Review of Biology* **75**:3-15.
- Dudley, R. (2000b). *The Biomechanics of Insect Flight: Form, Function, Evolution*. Princeton: Princeton University Press. 476 pp.
- Dudley, R. (2000c). The evolutionary physiology of animal flight: paleobiological and present perspectives. *Annual Review of Physiology* **62**:135-155.
- Vermeij, G.J. and R. Dudley. (2000). Why are there so few evolutionary transitions between aquatic and terrestrial ecosystems? *Biological Journal of the Linnean Society* **70**:541-554.
- Chai, P. and R. Dudley. (1999). Maximum flight performance of hummingbirds: capacities, constraints, and trade-offs. *American Naturalist* **153**:398-411.
- Dudley, R. (1999). Unsteady aerodynamics. [Perspectives: Biomechanics]. *Science* **284**:1937-1938.
- Gans, C., Dudley, R., Aguilar, N.M., and J.B. Graham. (1999a). Late Paleozoic atmospheres and biotic evolution. *Historical Biology* **13**:199-219.
- Gans, C., Dudley, R., Aguilar, N.M., and J.B. Graham. (1999b). The pre-Devonian carbon dioxide crash, the late Paleozoic oxygen pulse, and associated shifts in ventilatory mechanisms. In: *Water/Air Transition in Biology* (ed. A.K. Mittal, F.B. Eddy, and J.S. Datta Munshi), pp. 31-43. New Delhi: Oxford & IBH Publishing Co.
- Chai, P., Chang, A.C., and R. Dudley. (1998). Flight thermogenesis and energy conservation in hovering hummingbirds. *Journal of Experimental Biology* **201**:963-968.
- Dudley, R. (1998). Atmospheric oxygen, giant Paleozoic insects and the evolution of aerial locomotor performance. *Journal of Experimental Biology* **201**:1043-1050.
- Oliveira, E.G., Srygley, R.B., and R. Dudley. (1998). Do neotropical migrant butterflies navigate using a solar compass? *Journal of Experimental Biology* **201**:3317-3331.
- Chai, P., Chen, J.S.C., and R. Dudley. (1997). Transient hovering performance of hummingbirds under conditions of maximal loading. *Journal of Experimental Biology* **200**:921-929.
- Graham, J.B., Aguilar, N., Dudley, R., and C. Gans. (1997). The late Paleozoic atmosphere and the ecological and evolutionary physiology of tetrapods. In: *Amniote Origins: Completing the Transition to Land* (ed. S.S. Sumida and K.L.M. Martin), pp. 141-167. New York: Academic Press.
- Jaramillo, C., Rand, A.S., Ibáñez, R., and R. Dudley. (1997). Elastic structures in the vocalization apparatus of the túngara frog, *Physalaemus pustulosus* (Leptodactylidae). *Journal of Morphology* **233**:287-295.
- Chai, P. and R. Dudley. (1996). Limits to flight energetics of hummingbirds hovering in hypodense and hypoxic gas mixtures. *Journal of Experimental Biology* **199**:2285-2295.
- Chai, P., Harrykisson, R., and R. Dudley. (1996). Hummingbird hovering performance in

- hyperoxic heliox: effects of body mass and sex. *Journal of Experimental Biology* **199**:2745–2755.
- Dudley, R. and G.H. Adler. (1996). Biogeography of milkweed butterflies (Nymphalidae: Danainae) and mimetic patterns on tropical Pacific archipelagos. *Biological Journal of the Linnean Society* **57**:317-326.
- Dudley, R. and P. Chai. (1996). Animal flight mechanics in physically variable gas mixtures. *Journal of Experimental Biology* **199**:1881-1885.
- Grodnitsky, D.L. and R. Dudley. (1996). Vortex visualization during free flight of heliconiine butterflies (Lepidoptera: Nymphalidae). *Journal of the Kansas Entomological Society* **69**:199-203.
- Srygley, R.B., Oliveira, E., and R. Dudley. (1996). Wind drift compensation, flyways, and conservation of diurnal, migrant Neotropical Lepidoptera. *Proceedings of the Royal Society of London B* **263**:1351-1357.
- Adler, G.H., Austin, C.C., and R. Dudley. (1995). Dispersal and speciation of skinks among archipelagos in the tropical Pacific Ocean. *Evolutionary Ecology* **9**:529-541.
- Chai, P. and R. Dudley. (1995). Limits to vertebrate locomotor energetics suggested by hummingbirds hovering in heliox. *Nature* **377**:722-725.
- Dudley, R. (1995a). Aerodynamics, energetics and reproductive constraints of migratory flight in insects. In: *Insect Migration: Tracking Resources Through Space and Time* (ed. V.A. Drake and A.G. Gatehouse), pp. 303-319. Cambridge: Cambridge University Press.
- Dudley, R. (1995b). Extraordinary flight performance of orchid bees (Apidae: Euglossini) hovering in heliox (80% He/20% O₂). *Journal of Experimental Biology* **198**:1065-1070.
- Graham, J.B., Dudley, R., Aguilar, N., and C. Gans. (1995). Implications of the late Palaeozoic oxygen pulse for physiology and evolution. *Nature* **375**:117-120.
- Larimer, J.L. and R. Dudley. (1995). Accelerational implications of hummingbird display dives. *The Auk* **112**:1064-1066.
- Dudley, R. (1994). Aerodynamics of insect dispersal and the constraint of body size. In: *Proceedings of the 13th International Biometeorology Congress* (ed. A.R. Maarouf, N.N. Barthakur and W.O. Haufe), Part 2 (Vol. 3), pp. 1035-1041. Downsview: Environment Canada.
- Dudley, R. and R.B. Srygley. (1994). Flight physiology of Neotropical butterflies: allometry of airspeeds during natural free flight. *Journal of Experimental Biology* **191**:125-139.
- Dudley, R. and G.J. Vermeij. (1994). Energetic constraints of folivory: leaf fractionation by frugivorous bats. *Functional Ecology* **8**:668.
- Adler, G.H. and R. Dudley. (1994). Butterfly biogeography and endemism on tropical Pacific islands. *Biological Journal of the Linnean Society* **51**:151-162.
- Larimer, J.L. and R. Dudley. (1994). Centrifugal force and blood pressure elevation in the wings of flying hummingbirds. *Journal of theoretical Biology* **168**:233-236.
- Rand, A.S. and R. Dudley. (1993). Frogs in helium: the anuran vocal sac is not a cavity resonator. *Physiological Zoology* **66**:793-806.
- Srygley, R.B. and R. Dudley. (1993). Correlations of the position of center of body mass with butterfly escape tactics. *Journal of Experimental Biology* **174**:155-166.
- Dudley, R. (1992). Aerodynamics of flight. In: *Biomechanics (Structures & Systems): A Practical Approach* (ed. A.A. Biewener), pp. 97-121. Oxford: Oxford University Press.
- Dudley, R. and A.S. Rand. (1992). Underwater sound production in a Neotropical anuran, *Physalaemus pustulosus* (Leptodactylidae). *Bioacoustics* **4**:211-216.

- Dudley, R. and G.J. Vermeij. (1992). Do the power requirements of flapping flight constrain folivory in flying animals? *Functional Ecology* **6**:101-104.
- Mulkey, S.S., A.P. Smith, S.J. Wright, J.L. Machado, and R. Dudley. (1992). Contrasting leaf phenotypes control seasonal variation in water loss in a tropical forest shrub. *Proceedings of the National Academy of Sciences USA* **89**:9084-9088.
- Dudley, R. (1991a). Biomechanics of flight in Neotropical butterflies: aerodynamics and mechanical power requirements. *Journal of Experimental Biology* **159**:335-357.
- Dudley, R. (1991b). Comparative biomechanics and the evolutionary diversification of flying insect morphology. In: *The Unity of Evolutionary Biology* (ed. E.C. Dudley), pp. 503-514. Portland: Dioscorides Press.
- Dudley, R. (1991c). Thermoregulation in unpalatable danaine butterflies. *Functional Ecology* **5**:503-506.
- Dudley, R. and C. Gans. (1991). A critique of symmorphosis and optimality models in physiology. *Physiological Zoology* **64**:627-637.
- Dudley, R. and A.S. Rand. (1991). Vocal sac inflation and sound production in the túngara frog, *Physalaemus pustulosus* (Leptodactylidae). *Copeia* **1991**:460-470.
- Dudley, R., King, V.A., and R.J. Wassersug. (1991). The implications of shape and metamorphosis for drag forces on a generalized pond tadpole (*Rana catesbeiana*). *Copeia* **1991**:252-257.
- Stern, D.L. and R. Dudley. (1991). Wing buzzing by territorial male orchid bees, *Eulaema meriana* (Hymenoptera: Apidae). *Journal of the Kansas Entomological Society* **64**:88-94.
- DeVries, P.J. and R. Dudley. (1990). Morphometrics, airspeed, thermoregulation and lipid reserves of migrating *Urania fulgens* (Uraniidae) moths in natural free flight. *Physiological Zoology* **63**:235-251.
- Dudley, R. (1990a). Biomechanics of flight in Neotropical butterflies: morphometrics and kinematics. *Journal of Experimental Biology* **150**:37-53.
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