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### The second sex

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## REFERENCES

## A

- Ablard, K.M., Schaefer, P.W., and Gries, G. (2013). An alternative reproductive tactic: a parasitoid wasp gathers and guards a harem by pheromone-tagging virgins. *Behav Processes* 94, 32–40.
- Adams, E.M., and Wolfner, M.F. (2007). Seminal proteins but not sperm induce morphological changes in the *Drosophila melanogaster* female reproductive tract during sperm storage. *J Insect Physiol* 53, 319–331.
- Ah-King, M., Barron, A.B., and Herberstein, M.E. (2014). Genital evolution: why are females still understudied? *PLoS Biol* 12, e1001851.
- Alonzo, S.H., and Pizzari, T. (2013). Selection on female remating interval is influenced by male sperm competition strategies and ejaculate characteristics. *Philos Trans R Soc B Biol Sci* 368, 20120044–20120044.
- Aigaki, T., Fleischmann, I., Chen, P.-S., and Kubli, E. (1991). Ectopic expression of sex peptide alters reproductive behavior of female *D. melanogaster*. *Neuron* 7, 557–563.
- Amitin, E.G., and Pitnick, S. (2007). Influence of developmental environment on male- and female-mediated sperm precedence in *Drosophila melanogaster*. *J Evol Biol* 20, 381–391.
- Anderson, R.C. (1945). A study of the factors affecting fertility of lozenge females of *Drosophila melanogaster*. *Genetics* 30, 280-296.
- Angoa-Pérez, M., and Kuhn, D.M. (2015). Neuroanatomical dichotomy of sexual behaviors in rodents: a special emphasis on brain serotonin. *Behav Pharmacol* 26, 595–606.
- Arnqvist, G., and Nilsson, T. (2000). The evolution of polyandry: multiple mating and female fitness in insects. *Anim Behav* 60, 145–164.
- Arthur, B., Hauschteck-Jungen, E., Nöthiger, R., and Ward, P.I. (1998). A female nervous system is necessary for normal sperm storage in *Drosophila melanogaster*: a masculinized nervous system is as good as none. *Proc Natl Acad Sci USA* 265 1749-1753.

## References

Avila, F.W., and Wolfner, M.F. (2009). Acp36DE is required for uterine conformational changes in mated *Drosophila* females. *Proc Natl Acad Sci USA* *106*, 15796–15800.

Avila, F.W., Mattei, A.L., and Wolfner, M.F. (2015). *J Insect Physiol* *76*, 1–6.

Avila, F.W., Bloch Qazi, M.C., Rubinstein, C.D., and Wolfner, M.F. (2012). A requirement for the neuromodulators octopamine and tyramine in *Drosophila melanogaster* female sperm storage. *Proc Natl Acad Sci USA* *109*, 4562–4567.

Avila, F.W., Ravi Ram, K., Bloch Qazi, M.C., and Wolfner, M.F. (2010). Sex peptide is required for the efficient release of stored sperm in mated *Drosophila* females. *Genetics* *186*, 595–600.

Avila, F.W., Sirot, L.K., Laflamme, B.A., Rubinstein, C.D., and Wolfner, M.F. (2011). Insect seminal fluid proteins: identification and function. *Annu Rev Entomol* *56*, 21–40.

## B

Baker, B.S., and Belote, J.M. (1983). Sex determination and dosage compensation in *Drosophila melanogaster*. *Ann Rev Genet* *17*, 345–393.

Balfanz, S., Strünker, T., Frings, S., and Baumann, A. (2005). A family of octopamine receptors that specifically induce cyclic AMP production or Ca<sup>2+</sup> release in *Drosophila melanogaster*. *J Neurochem* *93*, 440–451.

Bangham, J., Chapman, T., Smith, H.K., and Partridge, L. (2003). Influence of female reproductive anatomy on the outcome of sperm competition in *Drosophila melanogaster*. *Proc Natl Acad Sci USA* *270*, 523–530.

Barnes, A.I., Boone, J.M., Partridge, L., and Chapman, T. (2007). A functioning ovary is not required for sex peptide to reduce receptivity to mating in *D. melanogaster*. *J Insect Physiol* *53*, 343–348.

Barnes, A.I., Wigby, S., Boone, J.M., Partridge, L., and Chapman, T. (2008). Feeding, fecundity and lifespan in female *Drosophila melanogaster*. *Proc Biol Sci* *275*, 1675–1683.

Bartelt, R. J., Schaner, A. M. & Jackson, L. L. (1985). Cis-Vaccenyl acetate as an aggregation pheromone in *Drosophila melanogaster*. *J Chem Ecol* *11*, 1747–1756.

- Bateman, A.J. (1948). Intra-sexual selection in *Drosophila*. *Heredity* 2, 349–368.
- Becnel, J., Johnson, O., Luo, J., Nässel, D.R., and Nichols, C.D. (2011). The serotonin 5-HT7Dro receptor is expressed in the brain of *Drosophila*, and is essential for normal courtship and mating. *PLoS ONE* doi: 10.1371/journal.pone.0020800.
- Begun, D.J., Whitley, P., Todd, B.L., Waldrip-Dail, H.M., and Clark, A.G. (2000). Molecular population genetics of male accessory gland proteins in *Drosophila*. *Genetics* 156, 1879–1888.
- Belgacem, Y.H., and Martin, J.-R. (2002). Neuroendocrine control of a sexually dimorphic behavior by a few neurons of the pars intercerebralis in *Drosophila*. *Proc Natl Acad Sci USA* 99, 15154–15158.
- Bellen, H.J., and Kiger, J.A. (1987). Sexual hyperactivity and reduced longevity of dunce females of *Drosophila melanogaster*. *Genetics* 115, 153–160.
- Billeter, J.-C., Atallah, J., Krupp, J. J., Millar, J. G. & Levine, J. D. (2009). Specialized cells tag sexual and species identity in *Drosophila melanogaster*. *Nature* 461, 987–991.
- Billeter, J.-C., Jagadeesh, S., Stepek, N., Azanchi, R., and Levine, J.D. (2012). *Drosophila melanogaster* females change mating behaviour and offspring production based on social context. *P Roy Soc Lond B Bio* 279, 2417–2425.
- Billeter, J.-C., and Goodwin, S.F. (2004). Characterization of *Drosophila* fruitless-gal4 transgenes reveals expression in male-specific fruitless neurons and innervation of male reproductive structures. *J Comp Neurol* 475, 270–287.
- Billeter, J. C. & Levine, J. (2015). The role of cVA and the Odorant binding protein Lush in social and sexual behavior in *Drosophila melanogaster*. *Front Ecol Evol* 3, 75.
- Birkhead, T.R., and Møller, A.P. (1998). Sperm competition and sexual selection. (London: Academic Press).
- Birkhead, T.R., and Pizzari, T. (2002). Postcopulatory sexual selection. *Nat Rev Genet* 3, 262–273.
- Bischof, J., Maeda, R.K., Hediger, M., Karch, F., and Basler, K. (2007). An optimized transgenesis system for *Drosophila* using germ-line-specific phiC31 integrases. *Proc Natl Acad Sci USA* 104, 3312–3317.

## References

- Bloch Qazi, M.C., and Wolfner, M.F. (2003). An early role for the *Drosophila melanogaster* male seminal protein Acp36DE in female sperm storage. *J Exp Biol* 206, 3521–3528.
- Bloch Qazi, M.C., Aprille, J.R., and Lewis, S.M. (1998). Female role in sperm storage in the red flour beetle, *Tribolium castaneum*. *Comp Biochem A* 120, 641–647.
- Bono, J.M., Matzkin, L.M., Kelleher, E.S., and Markow, T.A. (2011). Postmating transcriptional changes in reproductive tracts of con- and heterospecifically mated *Drosophila mojavensis* females. *Proc Natl Acad Sci USA* 108, 7878–7883.
- Boorman, E., and Parker, G.A. (1976). Sperm (ejaculate) competition in *Drosophila melanogaster*, and the reproductive value of females to males in relation to female age and mating status. *Ecol Entomol* 1, 145–155.
- Boulétreau-Merle, J. (1976). Destruction of the pars intercerebralis in *Drosophila melanogaster*: effect on the fecundity and the stimulation through copulation. *J Insect Physiol* 22, 933–940.
- Boulétreau-Merle, J., Terrier, O., and Fouillet, P. (1989). Chromosomal analysis of initial retention capacity in virgin *Drosophila melanogaster* females. *Heredity* 62 (Pt 2), 145–151.
- Brand, A.H., and Perrimon, N. (1993). Targeted gene expression as a means of altering cell fates and generating dominant phenotypes. *Development* 118, 401–415.
- Bretman, A., Fricke, C., and Chapman, T. (2009). Plastic responses of male *Drosophila melanogaster* to the level of sperm competition increase male reproductive fitness. *Proc Biol Sci* 276, 1705–1711.
- Bretman, A., Lawniczak, M.K.N., Boone, J., and Chapman, T. (2010). A mating plug protein reduces early female remating in *Drosophila melanogaster*. *J Insect Physiol* 56, 107–113.
- Bretman, A., Westmancoat, J.D., and Chapman, T. (2013). Male control of mating duration following exposure to rivals in fruitflies. *J Insect Physiol* 59, 824–827.
- Brieger, G. & Butterworth, F. M. (1970). *Drosophila melanogaster*: identity of male lipid in reproductive system. *Science* 167, 1262–1262.
- Brown, W.D., Bjork, A., Schneider, K., and Pitnick, S. (2004). No evidence that polyandry benefits females in *Drosophila melanogaster*. *Evolution* 58, 1242–1250.

- Butterworth, F.M. (1969). Lipids of *Drosophila*: a newly detected lipid in the male. *Science* *163*, 1356–1357.
- Bussière, L. F., Hunt, J., Jennions, M. D. & Brooks, R. (2006). Sexual conflict and cryptic female choice in the black field cricket, *Teleogryllus commodus*. *Evolution* *60*, 792–800.
- Byrne, P.G., and Rice, W.R. (2005). Remating in *Drosophila melanogaster*: an examination of the trading-up and intrinsic male-quality hypotheses. *J Evol Biol* *18*, 1324–1331.

## C

- Calleja, M., Moreno, E., Pelaz, S., and Morata, G. Visualization of gene expression in living adult *Drosophila*. *Science* *274*, 252-255.
- Cameron, E., Day, T., and Rowe, L. (2007). Sperm competition and the evolution of ejaculate composition. *Amer Nat* *169*, E158–E172.
- Carvalho, G.B., Kapahi, P., Anderson, D.J., and Benzer, S. (2006). Allocrine modulation of feeding behavior by the sex peptide of *Drosophila*. *Curr Biol* *16*, 692–696.
- Chapman, T., and Partridge, L. (1996). Female fitness in *Drosophila melanogaster*: an interaction between the effect of nutrition and of encounter rate with males. *P Roy Soc Lond B Bio* *263*, 755–759.
- Chapman, T., Arnqvist, G., Bangham, J., and Rowe, L. (2003a). Sexual conflict. *Trends Ecol Evol* *18*, 41–47.
- Chapman, T., Liddle, L.F., Kalb, J.M., Wolfner, M.F., and Partridge, L. (1995). Cost of mating in *Drosophila melanogaster* females is mediated by male accessory gland products. *Nature* *373*, 241–244.
- Chapman, T., Neubaum, D.M., Wolfner, M.F., and Partridge, L. (2000). The role of male accessory gland protein Acp36DE in sperm competition in *Drosophila melanogaster*. *Proc Biol Sci* *267*, 1097–1105.
- Chapman, T. (2006). Evolutionary conflicts of interest between males and females. *Curr Biol* *16*, R744–R754.

## References

Chapman, T., Bangham, J., Vinti, G., Seifried, B., Lung, O., Wolfner, M.F., Smith, H.K., and Partridge, L. (2003b). The sex peptide of *Drosophila melanogaster*: female post-mating responses analyzed by using RNA interference. *Proc Natl Acad Sci USA* *100*, 9923–9928.

Chapman, T., Choffat, Y., Lucas, W.E., Kubli, E., and Partridge, L. (1996). Lack of response to sex-peptide results in increased cost of mating in dunce *Drosophila melanogaster* females. *J Insect Physiol* *42*, 1007–1015.

Chaudhary, D.D., Mishra, G., and Omkar (2016). Last male wins the egg fertilization fight: A case study in ladybird, *Menochilus sexmaculatus*. *Behav Processes* *131*, 1–8.

Chen, P.S. (1984). The functional morphology and biochemistry of insect male accessory glands and their secretions. *Annu Rev Entomol* *29*, 233–255.

Chen, P.S., Stumm-Zollinger, E., Aigaki, T., Balmer, J., Bienz, M., and Böhlen, P. (1988). A male accessory gland peptide that regulates reproductive behavior of female *D. melanogaster*. *Cell* *54*, 291–298.

Chow, C.Y., Wolfner, M.F., and Clark, A.G. (2010). The genetic basis for male x female interactions underlying variation in reproductive phenotypes of *Drosophila*. *Genetics* *186* 1355-1365.

Chow, C.Y., Wolfner, M.F., and Clark, A.G. (2012). Large neurological component to genetic differences underlying biased sperm use in *Drosophila*. *Genetics* *193*, 177–185.

Chuang-Dobbs, H.C. (2001). The effectiveness of mate guarding by male blackthroated blue warblers. *Behav Ecol* *12*, 541–546.

Cirera, S., and Aguadé, M. (1997). Evolutionary history of the sex-peptide (*Acp70A*) gene region in *Drosophila melanogaster*. *Genetics* *147*, 189–197.

Civetta, A., and Clark, A.G. (2000). Chromosomal effects on male and female components of sperm precedence in *Drosophila*. *Genet Res* *75*, 143–151.

Civetta, A., and Finn, S. (2014). Do candidate genes mediating conspecific sperm precedence affect sperm competitive ability within species? A test case in *Drosophila*. *Genetics* *4*, 1701–1707.

Civetta, A., Rosing, K.R., and Fisher, J.H. (2008). Differences in sperm competition and sperm competition avoidance in *Drosophila melanogaster*. *Anim Behav* *75* 1739-1746.

- Clark, A.G., and Begun, D.J. (1998). Female genotypes affect sperm displacement in *Drosophila*. *Genetics* *149*, 1487–1493.
- Clark, A.G., Aguadé, M., Prout, T., Harshman, L.G., and Langley, C.H. (1995). Variation in sperm displacement and its association with accessory gland protein loci in *Drosophila melanogaster*. *Genetics* *139*, 189–201.
- Clark, A.G., Begun, D.J., and Prout, T. (1999). Female x male interactions in *Drosophila* sperm competition. *Science* *283*, 217–220.
- Clark, S.C.A., Sharp, N.P., Rowe, L., and Agrawal, A.F. (2012). Relative effectiveness of mating success and sperm competition at eliminating deleterious mutations in *Drosophila melanogaster*. *PLoS ONE* *7*, e37351.
- Clowney, E. J., Iguchi, S., Bussell, J. J., Scheer, E. & Ruta, V. (2015). Multimodal chemosensory circuits controlling male courtship in *Drosophila*. *Neuron* *87*, 1–15.
- Cognigni, P., Bailey, A.P., and Miguel-Aliaga, I. (2011). Enteric neurons and systemic signals couple nutritional and reproductive status with intestinal homeostasis. *Cell Metab* *13*, 92–104.
- Cole, S.H., Carney, G.E., McClung, C.A., Willard, S.S., Taylor, B.J., and Hirsh, J. (2005). Two functional but noncomplementing *Drosophila* tyrosine decarboxylase genes: distinct roles for neural tyramine and octopamine in female fertility. *J Biol Chem* *280*, 14948–14955.
- Connolly, K. & Cook, R. (1973). Rejection responses by female *Drosophila melanogaster*: their ontogeny, causality and effects upon the behaviour of the courting male. *Behaviour* *44*, 142–166.
- Couto, A., Alenius, M. & Dickson, B. J. (2005). Molecular, anatomical, and functional organization of the *Drosophila* olfactory system. *Curr Biol* *15*, 1535–1547.

## D

- Daniels, R.W., Gelfand, M.V., Collins, C.A., and DiAntonio, A. (2008). Visualizing glutamatergic cell bodies and synapses in *Drosophila* larval and adult CNS. *J Comp Neurol* *508*, 131-152.



## References

- Darwin, C. (1871). The descent of man, and selection in relation to sex.
- Datta, S.R., Vasconcelos, M.L., Ruta, V., Luo, S., Wong, A., Demir, E., Flores, J., Balonze, K., Dickson, B.J., and Axel, R. (2008). The *Drosophila* pheromone cVA activates a sexually dimorphic neural circuit. *Nature* *452*, 473–477.
- Davis, R.L., and Kiger, J.A. (1981). Dunce mutants of *Drosophila melanogaster*: mutants defective in the cyclic AMP phosphodiesterase enzyme system. *J Cell Biol* *90*, 101–107.
- Degner, E.C., and Harrington, L.C. (2016). A mosquito sperm's journey from male ejaculate to egg: mechanisms, molecules, and methods for exploration. *Mol Reprod Dev* *83*, 897–911.
- del Valle Rodríguez, A., Didiano, D., and Desplan, C. (2012). Power tools for gene expression and clonal analysis in *Drosophila*. *Nat Methods* *9*, 47–55.
- Dietzl, G., Chen, D., Schnorrer, F., Su, K.-C., Barinova, Y., Fellner, M., Gasser, B., Kinsey, K., Oettel, S., Scheiblaue, S., et al. (2007). A genome-wide transgenic RNAi library for conditional gene inactivation in *Drosophila*. *Nature* *448*, 151–156.
- Ding, Z., Haussmann, I., Ottiger, M., and Kubli, E. (2003). Sex-peptides bind to two molecularly different targets in *Drosophila melanogaster* females. *J Neurobiol* *55*, 372–384.
- Domanitskaya, E.V., Liu, H., Chen, S., and Kubli, E. (2007). The hydroxyproline motif of male sex peptide elicits the innate immune response in *Drosophila* females. *Febs J* *274*, 5659–5668.
- Drummond-Barbosa, D., and Spradling, A.C. (2001). Stem cells and their progeny respond to nutritional changes during *Drosophila* oogenesis. *Dev Biol* *231*, 265–278.
- Drnevich, J.M. (2003). Number of mating males and mating interval affect last-male sperm precedence in *Tenebrio molitor* L. *Anim Behav* *66*, 349–357.
- Duménil, C., Woud, D., Pinto, F., Alkema, J.T., Jansen, I., Van Der Geest, A.M., Roessingh, S., and Billeter, J.-C. (2016). Pheromonal cues deposited by mated females convey social information about egg-laying sites in *Drosophila melanogaster*. *J Chem Ecol* *42*, 259–269.

## E

Eberhard, W.G. (1996). *Female control: sexual selection by cryptic female choice*. (Princeton: Princeton University Press).

Ejima, A., Smith, B.P.C., Lucas, C., der Goes van Naters, van, W., Miller, C.J., Carlson, J.R., Levine, J.D., and Griffith, L.C. (2007). Generalization of courtship learning in *Drosophila* is mediated by cis-vaccenyl acetate. *Curr Biol* *17*, 599–605.

Ejima, A., Tsuda, M., Takeo, S., Ishii, K., Matsuo, T., and Aigaki, T. (2004). Expression level of *sarah*, a homolog of DSCR1, is critical for ovulation and female courtship behavior in *Drosophila melanogaster*. *Genetics* *168*, 2077–2087.

Elias, D. O., Sivalingham, S., Mason, A. C., Andrade, M. C. B. & Kasumovic, M. Mate-guarding courtship behaviour: tactics in a changing world. *Anim Behav* *97*, 25–33 (2014).

Estrada, C., Schulz, S., Yildizhan, S. & Gilbert, L. E. (2011). Sexual selection drives the evolution of antiaphrodisiac pheromones in butterflies. *Evolution* *65*, 2843–2854.

Everaerts, C., Farine, J.-P., Cobb, M. & Ferveur, J.-F. (2010). *Drosophila* cuticular hydrocarbons revisited: mating status alters cuticular profiles. *PLoS ONE* *5*, e9607.

## F

Farine, J.-P., Ferveur, J.-F. & Everaerts, C. (2012). Volatile *Drosophila* cuticular pheromones are affected by social but not sexual experience. *PLoS ONE* *7*, e40396.

Fedorka, K.M., Linder, J.E., Winterhalter, W., and Promislow, D. (2007). Post-mating disparity between potential and realized immune response in *Drosophila melanogaster*. *Proc Biol Sci* *274*, 1211–1217.

Fedorka, K.M., Winterhalter, W.E., and Ware, B. (2011). Perceived sperm competition intensity influences seminal fluid protein production prior to courtship and mating. *Evolution* *65*, 584–590.

## References

- Feng, K., Palfreyman, M.T., Hasemeyer, M., Talsma, A., and Dickson, B.J. (2014). Ascending SAG neurons control sexual receptivity of *Drosophila* females. *Neuron* *83*, 135–148.
- Finley, K.D., Taylor, B.J., Milstein, M., and McKeown, M. (1997). dissatisfaction, a gene involved in sex-specific behavior and neural development of *Drosophila melanogaster*. *Proc Natl Acad Sci USA* *94*, 913–918.
- Fishilevich, E. & Vosshall, L. B. (2005). Genetic and functional subdivision of the *Drosophila* antennal lobe. *Curr Biol* *15*, 1548–1553 (2005).
- Fiumera, A.C., Dumont, B.L., and Clark, A.G. (2005). Sperm competitive ability in *Drosophila melanogaster* associated with variation in male reproductive proteins. *Genetics* *169*, 243–257.
- Fiumera, A.C., Dumont, B.L., and Clark, A.G. (2006). Natural variation in male induced “cost-of-mating” and allele-specific association with male reproductive genes in *Drosophila melanogaster*. *Philos Trans R Soc Lond B Biol Sci* *361*, 355–361.
- Fiumera, A.C., Dumont, B.L., and Clark, A.G. (2007). Associations between sperm competition and natural variation in male reproductive genes on the third chromosome of *Drosophila melanogaster*. *Genetics* *176*, 1245–1260.
- Flatt, T., Min, K.-J., D'Alterio, C., Villa-Cuesta, E., Cumbers, J., Lehmann, R., Jones, D.L., and Tatar, M. (2008). *Drosophila* germ-line modulation of insulin signaling and lifespan. *Proc Natl Acad Sci USA* *105*, 6368–6373.
- Fleischmann, I., Cotton, B., Choffat, Y., Spengler, M., and Kubli, E. (2001). Mushroom bodies and post-mating behaviors of *Drosophila melanogaster* females. *J Neurogenet* *15*, 117–144.
- Fricke, C., Bretman, A., and Chapman, T. (2010). Female nutritional status determines the magnitude and sign of responses to a male ejaculate signal in *Drosophila melanogaster*. *J Evol Biol* *23*, 157–165.
- Fricke, C., Wigby, S., Hobbs, R., and Chapman, T. (2009). The benefits of male ejaculate sex peptide transfer in *Drosophila melanogaster*. *J Evol Biol* *22*, 275–286.
- Fuyama, Y. (1995). Genetic evidence that ovulation reduces sexual receptivity in *Drosophila melanogaster* females. *Behav Genet* *25*, 581–587.

## G

- Galipaud, M., Dechaume-Moncharmont, F.-X., Oughadou, A. & Bollache, L. (2011). Does foreplay matter? *Gammarus pulex* females may benefit from long-lasting precopulatory mate guarding. *Biol Lett* *7*, 333–335.
- Garbaczewska, M., Billeter, J.-C., and Levine, J.D. (2012). *Drosophila melanogaster* males increase the number of sperm in their ejaculate when perceiving rival males. *J Insect Physiol* *59*, 306–310.
- Gasque, G., Conway, S., Huang, J., Rao, Y., and Vosshall, L.B. (2013). Small molecule drug screening in *Drosophila* identifies the 5HT<sub>2A</sub> receptor as a feeding modulation target. *Sci Rep* *3*, doi: 10.1038/srep02120.
- Gems, D., and Riddle, D.L. (1996). Longevity in *Caenorhabditis elegans* reduced by mating but not gamete production. *Nature* *379*, 723–725.
- Giardina, T.J., Beavis, A., Clark, A.G., and Fiumera, A.C. (2011). Female influence on pre- and post-copulatory sexual selection and its genetic basis in *Drosophila melanogaster*. *Mol Ecol* *20*, 4098–4108.
- Gilbert, D.G., and Richmond, R.C. (1981). Studies of esterase 6 in *Drosophila melanogaster*. VI. ejaculate competitive abilities of males having null or active alleles. *Genetics* *97*, 85–94.
- Gilchrist, A.S., and Partridge, L. (2000). Why it is difficult to model sperm displacement in *Drosophila melanogaster*: the relation between sperm transfer and copulation duration. *Evolution* *54*, 534–542.
- Gioti, A., Wigby, S., Wertheim, B., Schuster, E., Martinez, P., Pennington, C.J., Partridge, L., and Chapman, T. (2012). Sex peptide of *Drosophila melanogaster* males is a global regulator of reproductive processes in females. *Proc R Soc B Biol* *279*, 4423–4432.
- Gorter, J.A., Jagadeesh, S., Gahr, C., Boonekamp, J.J., Levine, J.D., and Billeter, J.-C. (2016). The nutritional and hedonic value of food modulate sexual receptivity in *Drosophila melanogaster* females. *Sci Rep* *6*, 19441.
- Gowaty, P.A. (1994). Architects of sperm competition. *Trends Ecol Evol* *9*, 160–162.

## References

- Gowaty, P.A. (1997). Sexual dialectics, sexual selection, and variation in reproductive behavior. In *feminism and evolutionary biology*, (Boston: Springer) 351–384.
- Gowaty, P.A. (2012). The evolution of multiple mating: Costs and benefits of polyandry to females and of polygyny to males. *Fly* 6, 3–11.
- Gowaty, P.A., Kim, Y.K., and Anderson, W.W. (2012). No evidence of sexual selection in a repetition of Bateman's classic study of *Drosophila melanogaster*. *Proc Natl Acad Sci USA* 109, 11740–11745.
- Gowaty, P.A., Kim, Y.K., Rawlings, J., and Anderson, W.W. (2010). Polyandry increases offspring viability and mother productivity but does not decrease mother survival in *Drosophila pseudoobscura*. *Proc Natl Acad Sci USA* 107, 13771–13776.
- Grafen, A., and Ridley, M. (1983). A model of mate guarding. *J Theor Biol* 102, 549–567.
- Gromko, M., and Markow, T.A. (1993). Courtship and remating in field populations of *Drosophila*. *Anim Behav* 45, 253–262.
- Gromko, M., and Newport, M. (1988). Genetic-basis for remating in *drosophila-melanogaster* .2. response to selection based on the behavior of one sex. *Behav Genet* 18, 621–632.
- Grueber, W.B., Ye, B., Moore, A.W., Jan, L.Y., and Jan, Y.N. (2003). Dendrites of distinct classes of *Drosophila* sensory neurons show different capacities for homotypic repulsion. *Curr Biol* 13, 618–626.
- Guiraudie-Capraz, G., Pho, D. B. & Jallon, J.-M. (2007). Role of the ejaculatory bulb in biosynthesis of the male pheromone cis-vaccenyl acetate in *Drosophila melanogaster*. *Integr Zool* 2, 89–99.

## H

- Ha, T. S. & Smith, D. P. (2006). A pheromone receptor mediates 11-cis-vaccenyl acetate-induced responses in *Drosophila*. *J Neurosci* 26, 8727–8733 (2006).
- Hamada, F.N., Rosenzweig, M., Kang, K., Pulver, S.R., Ghezzi, A., Jegla, T.J., and Garrity, P.A. (2008). An internal thermal sensor controlling temperature preference in *Drosophila*. *Nature* 454, 217–220.

- Han, K.-A., Millar, N.S., and Davis, R.L. (1998). A novel octopamine receptor with preferential expression in *Drosophila* mushroom bodies. *J Neurosci* *18*, 3650-3658.
- Harshman, L.G., and Clark, A.G. (1998). Inference of sperm competition from broods of field-caught *Drosophila*. *Evolution* *52*, 1334.
- Harshman, L.G., Hoffmann, A.A., and Prout, T. (1988). Environmental effects on remating in *Drosophila melanogaster*. *Evolution* *42*, 312–321.
- Harshman, L.G., and Prout, T. (1994). Sperm displacement without sperm transfer. *Evolution* *48*, 758-766.
- Hasemeyer, M., Yapici, N., Heberlein, U., and Dickson, B.J. (2009). Sensory neurons in the *Drosophila* genital tract regulate female reproductive behavior. *Neuron* *61*, 511–518.
- Hartbauer, M., and Römer, H. (2016). Rhythm generation and rhythm perception in insects: the evolution of synchronous choruses. *Front Neurosci* *10*, 223.
- Hausmann, I.U., Hemani, Y., Wijesekera, T., Dauwalder, B., and Soller, M. (2013). Multiple pathways mediate the sex-peptide-regulated switch in female *Drosophila* reproductive behaviours. *P Roy Soc Lond B Bio* *280*, 20131938.
- Heifetz, Y., Lung, O., Frongillo, E.A., and Wolfner, M.F. (2000). The *Drosophila* seminal fluid protein Acp26Aa stimulates release of oocytes by the ovary. *Curr Biol* *10*, 99–102.
- Heifetz, Y., and Rivlin, P.K. (2010). Beyond the mouse model: Using *Drosophila* as a model for sperm interaction with the female reproductive tract. *Theriogenology* *73*, 723–739.
- Heifetz, Y., Lindner, M., Garini, Y., and Wolfner, M.F. (2014). Mating regulates neuromodulator ensembles at nerve termini innervating the *Drosophila* reproductive tract. *Curr Biol* *24*, 731–737.
- Heifetz, Y., and Wolfner, M.F. (2004). Mating, seminal fluid components, and sperm cause changes in vesicle release in the *Drosophila* female reproductive tract. *Proc Natl Acad Sci USA* *101*, 6261–6266.
- Heifetz, Y., Vandenberg, L.N., Cohn, H.I., and Wolfner, M.F. (2005). Two cleavage products of the *Drosophila* accessory gland protein ovulin can independently induce ovulation. *Proc Natl Acad Sci* *102*, 743–748.

## References

- Hellriegel, B., and Bernasconi, G. (2000). Female-mediated differential sperm storage in a fly with complex spermathecae, *Scatophaga stercoraria*. *Anim Behav* 59, 311–317.
- Herndon, L.A., and Wolfner, M.F. (1995). A *Drosophila* seminal fluid protein, Acp26Aa, stimulates egg laying in females for 1 day after mating. *Proc Natl Acad Sci* 92, 10114–10118.
- Hodgson, D.J., and Hosken, D.J. (2006). Sperm competition promotes the exploitation of rival ejaculates. *J Theor Biol* 243, 230–234.
- Holman, L., and Kokko, H. (2013). The consequences of polyandry for population viability, extinction risk and conservation. *Philos Trans R Soc B Biol* 368, 20120053–20120053.
- Holt, W.V., and Lloyd, R.E. (2010). Sperm storage in the vertebrate female reproductive tract: how does it work so well? *Theriogenology* 73, 713–722.
- Holt, W.V., and Fazeli, A. (2016). Sperm storage in the female reproductive tract. *Annu Rev Anim Biosci* 4, 291–310.
- Hughes, K.A. (1997). Quantitative genetics of sperm precedence in *Drosophila melanogaster*. *Genetics* 145, 139–151.
- Hull, E.M. (2011). Sex, drugs and gluttony: how the brain controls motivated behaviors. *Physiol Behav* 104, 173–177.

## I

- Iida, K., and Cavener, D.R. (2004). Glucose dehydrogenase is required for normal sperm storage and utilization in female *Drosophila melanogaster*. *J Exp Biol* 207, 675–681.
- Ikeya, T., Galic, M., Belawat, P., Nairz, K., and Hafen, E. (2002). Nutrient-dependent expression of insulin-like peptides from neuroendocrine cells in the CNS contributes to growth regulation in *Drosophila*. *Curr Biol* 12, 1293–1300.
- Imhof, M., Harr, B., Brem, G., and Schlötterer, C. (1998). Multiple mating in wild *Drosophila melanogaster* revisited by microsatellite analysis. *Mol Ecol* 7, 915–917.

Innocenti, P., and Morrow, E.H. (2009). Immunogenic males: a genome-wide analysis of reproduction and the cost of mating in *Drosophila melanogaster* females. *J Evol Biol* 22, 964–973.

Isaac, R.E., Li, C., Leedale, A.E., and Shirras, A.D. (2010). *Drosophila* male sex peptide inhibits siesta sleep and promotes locomotor activity in the post-mated female. *Proc R Soc B Biol* 277, 65–70.

Itskov, P.M., and Ribeiro, C. (2013). The dilemmas of the gourmet fly: the molecular and neuronal mechanisms of feeding and nutrient decision making in *Drosophila*. *Front Neurosci* 7, 12.

Iyengar, A., Imoehl, J., Ueda, A., Nirschl, J. & Wu, C.-F. (2012). Automated quantification of locomotion, social interaction, and mate preference in *Drosophila* mutants. *J Neurogenet* 26, 306–316.

## J

Jallon, J.-M. (1984). A few chemical words exchanged by *Drosophila* during courtship and mating. *Behav Genet* 14, 441-478.

Jallon, J.-M., and Hotta, Y. (1979). Genetic and behavioral studies of female sex appeal in *Drosophila*. *Behav Genet* 9, 257–275.

Janett, A., et al. (2012). A Gal4-driver line resource for *Drosophila* neurobiology. *Cell Reports* 2, 991-1001.

Janicke, T., Häderer, I.K., Lajeunesse, M.J., and Anthes, N. (2016). Darwinian sex roles confirmed across the animal kingdom. *Sci Adv* 2, e1500983.

Jennions, M.D., and Petrie, M. (2000). Why do females mate multiply? A review of the genetic benefits. *Biol Rev Camb Philos Soc* 75, 21–64.

Jayaramaiah Raja, S., and Renkawitz-Pohl, R. (2005). Replacement by *Drosophila melanogaster* protamines and Mst77F of histones during chromatin condensation in late spermatids and role of sesame in the removal of these proteins from the male pronucleus. *Mol Cell Biol* 25, 6165–6177.



## K

Kalb, J.M., DiBenedetto, A.J., and Wolfner, M.F. (1993). Probing the function of *Drosophila melanogaster* accessory glands by directed cell ablation. *Proc Nat Acad Sci USA* *90*, 8093–8097.

Kallman, B. R., Kim, H., Scott, K. & Ramaswami, M. (2015). Excitation and inhibition onto central courtship neurons biases *Drosophila* mate choice. *Elife* *4*, e11188.

Kamimura, Y. (2007). Twin intromittent organs of *Drosophila* for traumatic insemination. *Biol Lett* *3*, 401–404.

Kapelnikov, A., Rivlin, P.K., Hoy, R.R., and Heifetz, Y. (2008). Tissue remodeling: a mating-induced differentiation program for the *Drosophila* oviduct. *BMC Dev Biol* *8*, 114.

Kehl, T., Karl, I., and Fischer, K. (2013). Old-male paternity advantage is a function of accumulating sperm and last-male precedence in a butterfly. *Mol Ecol* *22*, 4289–4297.

Keleman, K., Vrontou, E., Krüttner, S., Yu, J.Y., Kurtovic-Kozaric, A., and Dickson, B.J. (2012). Dopamine neurons modulate pheromone responses in *Drosophila* courtship learning. *Nature* *489*, 145–149.

Kelly, C.D., and Jennions, M.D. (2011). Sexual selection and sperm quantity: metaanalyses of strategic ejaculation. *Biol Rev Camb Philos Soc* *86*, 863–884.

Kent, C., Azanchi, R., Smith, B., Formosa, A., and Levine, J.D. (2008). Social context influences chemical communication in *D. melanogaster* males. *Curr Biol* *18*, 1384–1389.

Kim, Y.-J., Bartalska, K., Audsley, N., Yamanaka, N., Yapici, N., Lee, J.-Y., Kim, Y.-C., Markovic, M., Isaac, E., Tanaka, Y., et al. (2010). MIPs are ancestral ligands for the sex peptide receptor. *Proc Natl Acad Sci USA* *107*, 6520–6525.

Kimura, K.-I., Sato, C., Koganezawa, M. & Yamamoto, D. (2015). *Drosophila* ovipositor extension in mating behavior and egg deposition involves distinct sets of brain interneurons. *PLoS ONE* *10*, e0126445.

- Kitamoto, T. (2001). Conditional modification of behavior in *Drosophila* by targeted expression of a temperature-sensitive shibire allele in defined neurons. *J Neurobiol* *47*, 81–92.
- Kock, D., and Sauer, K.P. (2007). High variation in sperm precedence and last male advantage in the scorpionfly *Panorpa germanica* L. (Mecoptera, Panorpidae): possible causes and consequences. *J Insect Physiol* *53*, 1145–1150.
- Kohl, J., Ostrovsky, A.D., Frechter, S., and Jefferis, G.S.X.E. (2013). A bidirectional circuit switch reroutes pheromone signals in male and female brains. *Cell* *155*, 1610–1623.
- Krashes, M.J., DasGupta, S., Vreede, A., White, A., Armstrong, J.D., and Waddell, S. (2009). A neural circuit mechanism integrating motivational state with memory expression in *Drosophila*. *Cell* *139*, 416–427.
- Krstic, D., Boll, W. & Noll, M. (2009). Sensory integration regulating male courtship behavior in *Drosophila*. *PLoS ONE* *4*, e4457.
- Krupp, J.J., Kent, C., Billeter, J.-C., Azanchi, R., So, A.K.-C., Schonfeld, J.A., Smith, B.P., Lucas, C., and Levine, J.D. (2008). Social experience modifies pheromone expression and mating behavior in male *Drosophila melanogaster*. *Curr Biol* *18*, 1373–1383.
- Kubli, E. (2003). Sex-peptides: seminal peptides of the *Drosophila* male. *Cell Mol Life Sci* *60*, 1689–1704.
- Kuijper, B., and Morrow, E. (2009). Direct observation of female mating frequency using time-lapse photography. *Fly* *3*, 1–3.
- Kuijper, B., Stewart, A., and Rice, W. (2006). The cost of mating rises nonlinearly with copulation frequency in a laboratory population of *Drosophila melanogaster*. *J Evol Biol* *19*, 1795–1802.
- Kurtovic, A., Widmer, A., and Dickson, B.J. (2007). A single class of olfactory neurons mediates behavioural responses to a *Drosophila* sex pheromone. *Nature* *446*, 542–546.

## References

### L

Lacaille, F. et al. (2007). An inhibitory sex pheromone tastes bitter for *Drosophila* males. *PLoS ONE* 2, e661.

LaMunyon, C.W., and Eisner, T. (1993). Postcopulatory sexual selection in an arctiid moth (*Utetheisa ornatrix*). *Proc Natl Acad Sci USA* 90, 4689–4692.

Lanikea, B.K., Koch, M., Murphy, K.R., Velazquez, Y., Ja, W.W., and Tomchik, S.M. (2016). Neurofibromin loss of function drives excessive grooming in *Drosophila*. *G3 (Bethesda)* 6, 1083-1093.

Larsson, M. C., Domingos, A.I., Jones, W.D., Chiappe, M.E., Amrein, H., and Vosshall, L.B. (2004). Or83b encodes a broadly expressed odorant receptor essential for *Drosophila* olfaction. *Neuron* 43, 703–714.

Laturney, M., and Billeter, J.-C. (2014). Neurogenetics of female reproductive behaviors in *Drosophila melanogaster*. *Adv Genet* 85, 1-108.

Laturney, M., and Billeter, J.-C. (2016). *Drosophila melanogaster* females restore their attractiveness after mating by removing male anti-aphrodisiac pheromones. *Nat Comm* 7, 1–11.

Laturney, M., and Moehring, A.J. (2012). The genetic basis of female mate preference and species isolation in *Drosophila*. *Int J Evol Biol*: 328392.

Lawniczak, M.K.N., and Begun, D.J. (2005). A QTL analysis of female variation contributing to refractoriness and sperm competition in *Drosophila melanogaster*. *Genet Res* 86, 107–114.

Lee, K.-M., Daubnerová, I., Isaac, R.E., Zhang, C., Choi, S., Chung, J., and Kim, Y.-J. (2015). A neuronal pathway that controls sperm ejection and storage in female *Drosophila*. *Curr Biol* 25, 790–797.

Lee, T., and Luo, L. (1999). Mosaic analysis with a repressible cell marker for studies of gene function in neuronal morphogenesis. *Neuron* 22, 451–461.

Lee, H.-G., Rohila, S., and Han, K.-A. (2009). The octopamine receptor OAMB mediates ovulation via Ca<sup>2+</sup>/Calmodulin-dependent protein kinase II in the *Drosophila* oviduct epithelium. *PLoS ONE* 4, e4716.

- Lee, H.-G., Seong, C.-S., Kim, Y.-C., Davis, R.L., and Han, K.-A. (2003). Octopamine receptor OAMB is required for ovulation in *Drosophila melanogaster*. *Dev Biol* 264, 179–190.
- Lefevre, G., and Jonsson, U.B. (1962). Sperm transfer, storage, displacement, and utilization in *Drosophila melanogaster*. *Genetics* 47, 1719–1736.
- Leonard, J., and Córdoba-Aguilar, A. (2010). The evolution of primary sexual characters in animals (New York: Oxford University Press).
- Li, H., Chaney, S., Roberts, I.J., Forte, M., and Hirsh, J. (2000). Ectopic G-protein expression in dopamine and serotonin neurons blocks cocaine sensitization in *Drosophila melanogaster*. *Curr Biol* 10, 211–214.
- Lilly, M., Kreber, R., Ganetzky, B., and Carlson, J.R. (1994). Evidence that the *Drosophila* olfactory mutant smellblind defines a novel class of sodium channel mutation. *Genetics* 136, 1087–1096.
- Linder, J.E., and Rice, W.R. (2005). Natural selection and genetic variation for female resistance to harm from males. *J Evol Biol* 18, 568–575.
- Linley, J.R., and Simmons, K.R. (1981). Sperm motility and spermathecal filling in lower diptera. *Int J Invertebr Repr* 4, 137–145.
- Liu, H., and Kubli, E. (2003). Sex-peptide is the molecular basis of the sperm effect in *Drosophila melanogaster*. *Proc Natl Acad Sci USA* 100, 9929–9933.
- Lodi, M., and Koene, J.M. (2016). On the effect specificity of accessory gland products transferred by the love-dart of land snails. *BMC Evol Biol* 16, 104.
- Long, T. A. F., Pischedda, A., Nichols, R. V. & Rice, W. R. (2010). The timing of mating influences reproductive success in *Drosophila melanogaster*: implications for sexual conflict. *J Evol Biol* 23, 1024–1032.
- Loughney, K., Kreber, R., and Ganetzky, B. (1989). Molecular analysis of the para locus, a sodium channel gene in *Drosophila*. *Cell* 58, 1143–1154.
- Lundgren, S.E., Callahad, C.A., Thor, S. and Thomas, J.B. (1995). Control of neuronal pathway selection by the *Drosophila* LIM homeodomain gene apterous. *Development* 121, 1769–1773.
- Lung, O., and Wolfner, M.F. (2001). Identification and characterization of the major *Drosophila melanogaster* mating plug protein. *Insect Biochem Mol Biol* 31, 543–551.

## References

Lüpold, S., Manier, M.K., Berben, K.S., Smith, K.J., Daley, B.D., Buckley, S.H., Belote, J.M., and Pitnick, S. (2012). How multivariate ejaculate traits determine competitive fertilization success in *Drosophila melanogaster*. *Curr Biol* 22, 1667–1672.

Lüpold, S., Pitnick, S., Berben, K.S., Blengini, C.S., Belote, J.M., and Manier, M.K. (2013). Female mediation of competitive fertilization success in *Drosophila melanogaster*. *Proc Natl Acad Sci USA* 110, 10693–10698.

## M

Mack, P.D., Kapelnikov, A., Heifetz, Y., and Bender, M. (2006). Mating-responsive genes in reproductive tissues of female *Drosophila melanogaster*. *Proc Natl Acad Sci USA* 103, 10358–10363.

Mack, P.D., Priest, N.K., and Promislow, D.E.L. (2003). Female age and sperm competition: last-male precedence declines as female age increases. *Proc Biol Sci* 270, 159–165.

Malouines, C. (2016). Counter-perfume: using pheromones to prevent female remating. *Biol Rev Camb Philos Soc* doi:10.1111/brv.12296 (Epub ahead of print).

Mane, S.D., Tompkins, L., and Richmond, R.C. (1983). Male esterase 6 catalyzes the synthesis of a sex pheromone in *Drosophila melanogaster* females. *Science* 222, 419–421.

Manier, M.K., Belote, J.M., Berben, K.S., Novikov, D., Stuart, W.T., and Pitnick, S. (2010). Resolving mechanisms of competitive fertilization success in *Drosophila melanogaster*. *Science* 328, 354–357.

Manier, M.K., Lüpold, S., Pitnick, S., and Starmer, W.T. (2013). An analytical framework for estimating fertilization bias and the fertilization set from multiple sperm-storage organs. *Amer Nat* 182, 552–561.

Manning, A. (1967). The control of sexual receptivity in female *Drosophila*. *Anim Behav* 15, 239–250.

Markow, T.A. (2002). Perspective: female remating, operational sex ratio, and the arena of sexual selection in *Drosophila* species. *Evolution* 56, 1725–1734.

Markow, T.A. (2011). “Cost” of virginity in wild *Drosophila melanogaster* females. *Ecol Evol* 1, 596–600.

- Markow, T.A., and O'Grady, P. (2008). Reproductive ecology of *Drosophila*. *Funct Ecol* 22, 747–759.
- Martin, J.R., Ernst, R., and Heisenberg, M. (1999). Temporal pattern of locomotor activity in *Drosophila melanogaster*. *J Comp Physiol a Neuroethol Sens Neural Behav Physiol* 184, 73–84.
- McGraw, L.A., Clark, A.G., and Wolfner, M.F. (2008). Post-mating gene expression profiles of female *Drosophila melanogaster* in response to time and to four male accessory gland proteins. *Genetics* 179 1395-1408.
- McGraw, L.A., Gibson, G., Clark, A.G., and Wolfner, M.F. (2004). Genes regulated by mating, sperm, or seminal proteins in mated female *Drosophila melanogaster*. *Curr Biol* 14, 1509–1514.
- Middleton, C.A., Nongthomba, U., Parry, K., Sweeney, S.T., Sparrow, J.C., and Elliott, C.J.H. (2006). Neuromuscular organization and aminergic modulation of contractions in the *Drosophila* ovary. *BMC Biology* 4, 17.
- Milam, E.L. (2010). Looking for a few good males: female choice in evolutionary biology (Baltimore: The John Hopkins University Press).
- Milkmann, R., and Zeitler, R.R. (1974). Concurrent multiple paternity in natural and laboratory populations of *Drosophila melanogaster*. *Genetics* 78, 1191–1193.
- Miller, G.T., and Pitnick, S. (2002). Sperm-female coevolution in *Drosophila*. *Science* 298, 1230–1233.
- Miller, G.T., and Pitnick, S. (2003). Functional significance of seminal receptacle length in *Drosophila melanogaster*. *J Evol Biol* 16, 114-126.
- Misra, S., Kumar, A., Ratnasekhar, C., Sharma, V., Mudiam, M.K.R., and Ravi Ram, K. (2014). Exposure to endosulfan influences sperm competition in *Drosophila melanogaster*. *Sci Rep* 4, 7433.
- Miyamoto, T., and Amrein, H. (2008). Suppression of male courtship by a *Drosophila* pheromone receptor. *Nat Neurosci* 11, 874–876.
- Moatt, J.P., Dytham, C., and Thom, M.D.F. (2014). Sperm production responds to perceived sperm competition risk in male *Drosophila melanogaster*. *Physiol Behav* 131, 111–114.

## References

Monastirioti, M. (2003). Distinct octopamine cell population residing in the CNS abdominal ganglion controls ovulation in *Drosophila melanogaster*. *Dev Biol* 264, 38–49.

Moore, A.J., and Pizzari, T. (2005). Quantitative genetic models of sexual conflict based on interacting phenotypes. *Am Nat* 165 *Suppl* 5, S88–S97.

Morrow, E.H., and Innocenti, P. (2012). Female postmating immune responses, immune system evolution and immunogenic males. *Biol Rev Camb Philos Soc* 87, 631–638.

Morrow, E.H., Stewart, A.D., and Rice, W.R. (2005). Patterns of sperm precedence are not affected by female mating history in *Drosophila melanogaster*. *Evolution* 59, 2608–2615.

Moshitzky, P., Fleischmann, I., Chaimov, N., Saudan, P., Klauser, S., Kubli, E., and Applebaum, S.W. (1996). Sex-peptide activates juvenile hormone biosynthesis in the *Drosophila melanogaster* corpus allatum. *Arch Insect Biochem Physiol* 32, 363–374.

Mueller, J.L., Page, J.L., and Wolfner, M.F. (2007). An ectopic expression screen reveals the protective and toxic effects of *Drosophila* seminal fluid proteins. *Genetics* 175, 777–783.

## N

Nakayama, S., Kaiser, K., and Aigaki, T. (1997). Ectopic expression of sex-peptide in a variety of tissues in *Drosophila* females using the P[GAL4] enhancer-trap system. *Mol Gen Genet* 254, 449–455.

Neubaum, D.M., and Wolfner, M.F. (1999). Mated *Drosophila melanogaster* females require a seminal fluid protein, Acp36DE, to store sperm efficiently. *Genetics* 153, 845–857.

Nighorn, A., Healy, M.J., and Davis, R.L. (1991). The cyclic AMP phosphodiesterase encoded by the *Drosophila dunce* gene is concentrated in the mushroom body neuropil. *Neuron* 6, 455–467.

## O

Ochando, M.D., Reyes, A., and Ayala, F.J. (1996). Multiple paternity in two natural populations (orchard and vineyard) of *Drosophila*. *Proc Nat Acad Sci USA* *93*, 11769–11773.

Ottiger, M., Soller, M., Stocker, R.F., and Kubli, E. (2000). Binding sites of *Drosophila melanogaster* sex peptide pheromones. *J Neurobiol* *44*, 57–71.

Otti, O. (2015). Genitalia-associated microbes in insects. *Insect Sci* *22*, 325–339.

## P

Parada-Bustamante, A., Oróstica, M.L., Reuquen, P., Zuñiga, L.M., Cardenas, H., and Orihuela, P.A. (2016). The role of mating in oviduct biology. *Mol Reprod Dev* *83*, 875–883.

Parker, G.A. (1970). Sperm competition and its evolutionary consequences in the insects. *Biol Rev Camb Philos Soc* *45*, 525–567.

Parker, G.A., and Birkhead, T.R. (2013). Polyandry: the history of a revolution. *Philos Trans R Soc B Biol Sci* *368*, 20120355.

Partridge, L., Green, A., and Fowler, K. (1987). Effects of egg-production and of exposure to males on female survival in *Drosophila melanogaster*. *J Insect Physiol* *33*, 745–749.

Peinert, M., Wipfler, B., Jetschke, G., Kleinteich, T., Gorb, S.N., Beutel, R.G., and Pohl, H. (2016). Traumatic insemination and female counter-adaptation in Strepsiptera (Insecta). *Sci Rep* *6*, 25052.

Peng, J., Chen, S., Büsser, S., Liu, H., Honegger, T., and Kubli, E. (2005a). Gradual release of sperm bound sex-peptide controls female postmating behavior in *Drosophila*. *Curr Biol* *15*, 207–213.

Peng, J., Zipperlen, P., and Kubli, E. (2005b). *Drosophila* sex-peptide stimulates female innate immune system after mating via the Toll and Imd pathways. *Curr Biol* *15*, 1690–1694.



## References

- Perkins, L.A., Holderbaum, L., Tao, R., Hu, Y., Sopko, R., McCall, K., Yang-Zhou, D., Flockhart, I., Binari, R., Shim, H.-S., et al. (2015). The transgenic RNAi project at Harvard Medical School: resources and validation. *Genetics* *201*, 843–852.
- Pischedda, A., and Rice, W.R. (2012). Partitioning sexual selection into its mating success and fertilization success components. *Proc Natl Acad Sci USA* *109*, 2049–2053.
- Pitmon, E., Stephens, G., Parkhurst, S.J., Wolf, F.W., Kehne, G., Taylor, M., and Lebestky, T. (2016). The D1 family dopamine receptor, DopR, potentiates hind leg grooming behavior in *Drosophila*. *Genes Brain Behav* *15*, 327–334.
- Pitnick, S., Wolfner, M.F., and Suarez, S.S. (2009). *Sperm biology: an evolutionary perspective* (Oxford: Academic Press).
- Pitnick, S., Markow, T., and Spicer, G.S. (1999). Evolution of multiple kinds of female sperm-storage organs in *Drosophila*. *Evolution* *53*, 1804.
- Pizzari, T., and Birkhead, T.R. (2000). Female feral fowl eject sperm of subdominant males. *Nature* *405*, 787–789.
- Poels, J., Van Loy, T., Vandersmissen, H.P., Van Hiel, B., Van Soest, S., Nachman, R.J., and Vanden Broeck, J. (2010). Myoinhibiting peptides are the ancestral ligands of the promiscuous *Drosophila* sex peptide receptor. *Cell Mol Life Sci* *67*, 3511–3522.
- Pooryasin, A., and Fiala, A. (2015). Identified serotonin-releasing neurons induce behavioral quiescence and suppress mating in *Drosophila*. *J Neurosci* *35*, 12792–12812.
- Popov, A.V., Peresleni, A.I., Ozerskii, P.V., Shchekanov, E.E., and Savvateeva-Popova, E.V. (2005). The role of the flabellar and ellipsoid bodies of the central complex of the brain of *Drosophila melanogaster* in the control of courtship behavior and communicative sound production in males. *Neurosci Behav Physiol* *35*, 741–750.
- Priest, N.K., Roach, D.A., and Galloway, L.F. (2008). Cross-generational fitness benefits of mating and male seminal fluid. *Biol Lett* *4*, 6–8.
- Price, C., Dyer, K.A., and Coyne, J.A. (1999). Sperm competition between *Drosophila* males involves both displacement and incapacitation. *Nature* *400*, 449–452.

- Prokupek, A.M., Kachman, S.D., and Ladunga, I. (2009). Transcriptional profiling of the sperm storage organs of *Drosophila melanogaster*. *Insect Mol Biol* *18*, 465–475.
- Prokupek, A., Hoffmann, F., Eyun, S.-I., Moriyama, E., Zhou, M., and Harshman, L. (2008). An evolutionary expressed sequence tag analysis of *Drosophila* spermathecae genes. *Evolution* *62*, 2936–2947.
- Prout, T., and Bundgaard, J. (1977). The population genetics of sperm displacement. *Genetics* *85*, 95–124.
- Pyle, D., and Gromko, M. (1981). Genetic bases for repeated mating in *Drosophila melanogaster*. *Amer Nat* *117*, 133–146.

## R

- Ravi Ram, K., and Wolfner, M. (2007a). Sustained post-mating response in *Drosophila melanogaster* requires multiple seminal fluid proteins. *PLoS Genet* *3*, e238.
- Ravi Ram, K., and Wolfner, M.F. (2007b). Seminal influences: *Drosophila* acps and the molecular interplay between males and females during reproduction. *Integr Comp Biol* *47*, 427–445.
- Ravi Ram, K., and Wolfner, M.F. (2009). A network of interactions among seminal proteins underlies the long-term postmating response in *Drosophila*. *Proc Natl Acad Sci USA* *106*, 15384–15389.
- Reinhardt, K., Anthes, N., and Lange, R. (2015). Copulatory wounding and traumatic insemination. *Cold Spring Harb Perspect Biol* *7*, doi:10.1101/cshperspect.a017582.
- Reinhart, M., Carney, T., and Clark, A.G. (2015). Characterizing male–female interactions using natural genetic variation in *Drosophila melanogaster*. *J Hered* *106*, 67–79.
- Rexhepaj, A., Liu, H., Peng, J., Choffat, Y., and Kubli, E. (2003). The sex-peptide DUP99B is expressed in the male ejaculatory duct and in the cardia of both sexes. *Eur J Biochem* *270*, 4306–4314.

## References

- Rezával, C., Nojima, T., Neville, M.C., Lin, A.C., and Goodwin, S.F. (2014). Sexually dimorphic octopaminergic neurons modulate female postmating behaviors in *Drosophila*. *Curr Biol* *24*, 725–730.
- Rezával, C., Pavlou, H.J., Dornan, A.J., Chan, Y.-B., Kravitz, E.A., and Goodwin, S.F. (2012). Neural circuitry underlying *Drosophila* female postmating behavioral responses. *Curr Biol* *22* 1155-1165.
- Ribeiro, C., and Dickson, B.J. (2010). Sex peptide receptor and neuronal TOR/S6K signaling modulate nutrient balancing in *Drosophila*. *Curr Biol* *20*, 1000–1005.
- Rice, W.R., Stewart, A.D., Morrow, E.H., Linder, J.E., Orteiza, N., and Byrne, P.G. (2006). Assessing sexual conflict in the *Drosophila melanogaster* laboratory model system. *Philos Trans R Soc Lond B Biol Sci* *361*, 287–299.
- Rideout, E.J., Dornan, A.J., Neville, M.C., Eadie, S., and Goodwin, S.F. (2010). Control of sexual differentiation and behavior by the doublesex gene in *Drosophila melanogaster*. *Nat Neurosci* *13*, 458–466.
- Ringo, J., Werczberger, R., Altaratz, M., and Segal, D. (1991). Female sexual receptivity is defective in juvenile hormone-deficient mutants of the apterous gene of *Drosophila melanogaster*. *Behav Genet* *21*, 453-469.
- Rodríguez-Valentín, R., López-González, I., Jorquera, R., Labarca, P., Zurita, M., and Reynaud, E. (2006). Oviduct contraction in *Drosophila* is modulated by a neural network that is both, octopaminergic and glutamatergic. *J Cell Physiol* *209*, 183–198.
- Ronderos, D.S., and Smith, D.P. (2010). Activation of the T1 neuronal circuit is necessary and sufficient to induce sexually dimorphic mating behavior in *Drosophila melanogaster*. *J Neurosci* *30*, 2595–2599.
- Rowe, L. (1992). Convenience polyandry in a water strider: foraging conflicts and female control of copulation frequency and guarding duration. *Anim Behav* *44*, 189-202.
- Rubinstein, C.D., and Wolfner, M.F. (2013). *Drosophila* seminal protein ovulin mediates ovulation through female octopamine neuronal signaling. *Proc Natl Acad Sci USA*. *110*, 17420-17425.
- Ruta, V., Datta, S.R., Vasconcelos, M.L., Freeland, J., Looger, L.L., and Axel, R. (2010). A dimorphic pheromone circuit in *Drosophila* from sensory input to descending output. *Nature* *468*, 686–690.

## S

- Saad, M., Game, A.Y., Healy, M.J., and Oakeshott, J.G. (1994). Associations of esterase 6 allozyme and activity variation with reproductive fitness in *Drosophila melanogaster*. *Genetica* *94*, 43–56.
- Sakai, T., and Ishida, N. (2001). Circadian rhythms of female mating activity governed by clock genes in *Drosophila*. *Proc Natl Acad Sci USA* *98*, 9221–9225.
- Salmon, A.B., Marx, D.B., and Harshman, L.G. (2001). A cost of reproduction in *Drosophila melanogaster*: stress susceptibility. *Evolution* *55*, 1600–1608.
- Salvaterra, P.M., and Kitamoto, T. (2001). *Drosophila* cholinergic neurons and processes visualized with Gal4/UAS-GFP. *Brain Res Gene Expr Patterns* *1*, 73–82.
- Santel, A., Winhauer, T., Blümer, N., and Renkawitz-Pohl, R. (1997). The *Drosophila* don juan (dj) gene encodes a novel sperm specific protein component characterized by an unusual domain of a repetitive amino acid motif. *Mech Dev* *64*, 19–30.
- Santiago Moreno, J., Castaño, C., Toledano Díaz, A., Estes, M.C., López Sebastián, A., Dávila, S.G., and Campo, J.L. (2014). Role of sperm velocity variables associated with poultry breed in “last male precedence.” *Reprod Domestic Anim* *49*, 134–139.
- Saudan, P., Hauck, K., Soller, M., Choffat, Y., Ottiger, M., Spörri, M., Ding, Z., Hess, D., Gehrig, P.M., Klauser, S., et al. (2002). Ductus ejaculatorius peptide 99B (DUP99B), a novel *Drosophila melanogaster* sex-peptide pheromone. *Eur J Biochem* *269*, 989–997.
- Schmidt, T., Choffat, Y., Klauser, S., and Kubli, E. (1993). The *Drosophila melanogaster* sex-peptide: A molecular analysis of structure-function relationships. *J Insect Physiol* *39*, 361–368.
- Schnakenberg, S.L., Matias, W.R., and Siegal, M.L. (2011). Sperm-storage defects and live birth in *Drosophila* females lacking spermathecal secretory cells. *PLoS Biol* *9*, e1001192.
- Schnakenberg, S.L., Siegal, M.L., and Bloch Qazi, M.C. (2012). Oh, the places they'll go: Female sperm storage and sperm precedence in *Drosophila melanogaster*. *Spermatogenesis* *2*, 224–235.

## References

- Schulz, S., Estrada, C., Yildizhan, S., Boppre', M. & Gilbert, L. E. (2007). An antiaphrodisiac in *Heliconius melpomene* butterflies. *J Chem Ecol* *34*, 82–93.
- Scott, D. (1986). Sexual mimicry regulates the attractiveness of mated *Drosophila melanogaster* females. *Proc Natl Acad Sci USA* *83*, 8429–8433.
- Scott, D. & Richmond, R. C. Evidence against an antiaphrodisiac role for cis-vaccenyl acetate in *Drosophila melanogaster*. *J. Insect Physiol.* *33*, 363–369 (1987).
- Scolari, F., Yuval, B., Gomulski, L.M., Schetelig, M.F., Gabrieli, P., Bassetti, F., Wimmer, E.A., Malacrida, A.R., and Gasperi, G. (2014). Polyandry in the medfly-shifts in paternity mediated by sperm stratification and mixing. *BMC Genet* *15 Suppl 2*, S10.
- Seeds, A.M., Ravbar, P., Chung, P., Hampel, S., Midgley, F.M., Mensh, B.D., and Simpson, J.H. (2014). A suppression hierarchy among competing motor programs drives sequential grooming in *Drosophila*. *Elife* *3*, e02951.
- Seidelmann, K. & Ferenz, H.-J. (2002). Courtship inhibition pheromone in desert locusts, *Schistocerca gregaria*. *J Insect Physiol* *48*, 991–996.
- Shankar, S., Chua, J.Y., Tan, K.J., Calvert, M.E., Weng, R., Ng, W.C., Mori, K., and Yew, J.Y. (2015). The neuropeptide tachykinin is essential for pheromone detection in a gustatory neural circuit. *Elife* *4*, e06914.
- Short, S.M., and Lazzaro, B.P. (2013). Reproductive status alters transcriptome response to infection in female *Drosophila melanogaster*. *G3 (Bethesda)* *3*, 827–840.
- Siddiqi, O., and Benzer, S. (1976). Neurophysiological defects in temperature-sensitive paralytic mutants of *Drosophila melanogaster*. *Proc Natl Acad Sci USA* *73*, 3253–3257.
- Silbering, A. F., Rytz, R., Grosjean, Y., Abuin, L., Ramdya, P., Jerreri, G.S., and Benton, R. (2011). Complementary function and integrated wiring of the evolutionarily distinct *Drosophila* olfactory subsystems. *J Neurosci* *31*, 13357–13375.
- Simmons, L.W. (2001). Sperm competition and its evolutionary consequences in the insects (Princeton: Princeton University Press).
- Simpson, J.H. (2009). Mapping and manipulating neural circuits in the fly brain. *Adv Genet* *65*, 79–143.

- Siroto, L.K., Wolfner, M.F., and Wigby, S. (2011). Protein-specific manipulation of ejaculate composition in response to female mating status in *Drosophila melanogaster*. *Proc Natl Acad Sci USA* *108*, 9922–9926.
- Sivanantharajah, L., and Zhang, B. (2015). Current techniques for high-resolution mapping of behavioral circuits in *Drosophila*. *J Comp Physiol A*, 1–15.
- Slatyer, R.A., Mautz, B.S., Backwell, P.R.Y., and Jennions, M.D. (2011). Estimating genetic benefits of polyandry from experimental studies: a meta-analysis. *Biol Rev* *87*, 1–33.
- Smith, D.T., Hosken, D.J., French-Constant, R.H., and Wedell, N. (2009). Variation in sex peptide expression in *D. melanogaster*. *Genet Res* *91*, 237–242.
- Smith, D.T., Siroto, L.K., Wolfner, M.F., Hosken, D.J., and Wedell, N. (2012). The consequences of genetic variation in sex peptide expression levels for egg laying and retention in females. *Heredity* *109*, 222–225.
- Snook, R.R., and Hosken, D.J. (2004). Sperm death and dumping in *Drosophila*. *Nature* *428*, 939–941.
- Soller, M., Bownes, M., and Kubli, E. (1999). Control of oocyte maturation in sexually mature *Drosophila* females. *Dev Biol* *208*, 337–351.
- Soller, M., Haussmann, I.U., Hollmann, M., Choffat, Y., White, K., Kubli, E., and Schäfer, M.A. (2006). Sex-peptide-regulated female sexual behavior requires a subset of ascending ventral nerve cord neurons. *Curr Biol* *16*, 1771–1782.
- Söderberg, J.A.E., Carlsson, M.A., and Nässel, D.R. (2012). Insulin-producing cells in the *Drosophila* brain also express satiety-inducing cholecystokinin-like peptide, Drosulfakinin. *Front Endocrinol (Lausanne)* *3*, 109.
- Spieth, H.T. (1974). Courtship behavior in *Drosophila*. *Annu Rev Entomol* *19*, 385–405.
- Spieth, H. T. (1966). *Drosophilid* mating behaviour: the behaviour of decapitated females. *Anim Behav* *14*, 226–235 (1966).
- St Johnston, D. (2002). The art and design of genetic screens: *Drosophila melanogaster*. *Nat Rev Genet* *3*, 176–188.

## References

Swanson, W.J. (2004). Evolutionary expressed sequence tag analysis of *Drosophila* female reproductive tracts identifies genes subjected to positive selection. *Genetics* *168*, 1457–1465.

Stockinger, P., Kvitsiani, D., Rotkopf, S., Tirián, L. and Dickson, B.J. (2005). Neural circuitry that governs *Drosophila* male courtship behavior. *Cell* *121*, 795–807.

Swanson, W.J., Clark, A.G., Waldrip-Dail, H.M., Wolfner, M.F., and Aquadro, C.F. (2001). Evolutionary EST analysis identifies rapidly evolving male reproductive proteins in *Drosophila*. *Proc Natl Acad Sci USA* *98*, 7375–7379.

Sweeney, S. T., Broadie, K., Keane, J., Niemann, H. & O’Kane, C. J. (1995). Targeted expression of tetanus toxin light chain in *Drosophila* specifically eliminates synaptic transmission and causes behavioral defects. *Neuron* *14*, 341–351.

Szabad, J., and Fajsz, C. (1982). Control of female reproduction in *Drosophila*: genetic dissection using gynandromorphs. *Genetics* *100*, 61–78.

## T

Takemori, N., and Yamamoto, M.-T. (2009). Proteome mapping of the *Drosophila* melanogaster male reproductive system. *Proteomics* *9*, 2484–2493.

Talevi, R., and Gualtieri, R. (2010). Molecules involved in sperm-oviduct adhesion and release. *Theriogenology* *73*, 796–801.

Tatarnic, N.J., Cassis, G., and Siva-Jothy, M.T. (2014). Traumatic insemination in terrestrial arthropods. *Annu Rev Entomol* *59*, 245–261.

Tauber, E., Roe, H., Costa, R., Hennessy, J.M., and Kyriacou, C.P. (2003). Temporal mating isolation driven by a behavioral gene in *Drosophila*. *Curr Biol* *13*, 140–145.

Taylor, T.D., Pacheco, D.A., Hergarden, A.C., Murthy, M., and Anderson, D.J. (2012). A neuropeptide circuit that coordinates sperm transfer and copulation duration in *Drosophila*. *Proc Natl Acad Sci USA* *109*, 20697–20702.

Telford, S.R., and Jennions, M.D. (1998). Establishing cryptic female choice in 564 animals. *Trends Ecol Evol (Amst.)* *13*, 216–218.

- Tompkins, L. & Hall, J. C. (1981). The different effects on courtship of volatile compounds from mated and virgin *Drosophila* females. *J Insect Physiol* 27, 17–21.
- Tompkins, L., and Hall, J.C. (1983). Identification of brain sites controlling female receptivity in mosaics of *Drosophila melanogaster*. *Genetics* 103, 179–195.
- Tompkins, L., Gross, A.C., Hall, J.C., Gailey, D.A., and Siegel, R.W. (1982). The role of female movement in the sexual behavior of *Drosophila melanogaster*. *Behav Genet* 12, 295–307.
- Trevitt, S., Fowler, K., and Partridge, L. (1988). An effect of egg-deposition on the subsequent fertility and remating frequency of female *Drosophila melanogaster*. *J Insect Physiol* 34, 821–828.

## V

- Van der Goes van Naters, W., and Carlson, J.R. (2007). Receptors and neurons for fly odors in *Drosophila*. *Curr Biol* 17, 606–612.
- Van der Meer, R. K., Obin, M. S., Zawistowski, S., Sheehan, K. B. & Richmond, R. C. (1986). A reevaluation of the role of cis-vaccenyl acetate, cis-vaccenol and esterase 6 in the regulation of mated female sexual attractiveness in *Drosophila melanogaster*. *J Insect Physiol* 32, 681–686.
- Vargas, M.A., Luo, N., Yamaguchi, A., and Kapahi, P. (2010). A role for S6 kinase and serotonin in postmating dietary switch and balance of nutrients in *D. melanogaster*. *Curr Biol* 20, 1006–1011.
- Vergoz, V., Lim, J., Duncan, M., Cabanes, G., and Oldroyd, B.P. (2012). Effects of natural mating and CO<sub>2</sub> narcosis on biogenic amine receptor gene expression in the ovaries and brain of queen honey bees, *Apis mellifera*. *Insect Mol Biol* 21, 558–567.



## References

### W

- Wandall, H.H., Pizette, S., Pedersen, J.W., Eichert, H., Levery, S.B., Mandel, U., Cohen, S.M., and Clausen, H. (2005). Egghead and brainiac are essential for glycosphingolipid biosynthesis in vivo. *J Biol Chem* *280*, 4858–4863.
- Wedell, N. (2007). Sperm competition and ejaculate evolution. *Soc Reprod Fertil Suppl* *65*, 115–135.
- Wertheim, B., Dicke, M. & Vet, L. E. M. (2002). Behavioural plasticity in support of a benefit for aggregation pheromone use in *Drosophila melanogaster*. *Entomol Exp Appl* *103*, 61–71.
- Wicker-Thomas, C., and Hamann, M. (2008). Interaction of dopamine, female pheromones, locomotion and sexual behavior in *Drosophila melanogaster*. *J Insect Physiol* *54*, 1423–1431.
- Wigby, S., and Chapman, T. (2004). Female resistance to male harm evolves in response to manipulation of sexual conflict. *Evolution* *58*, 1028–1037.
- Wigby, S., and Chapman, T. (2005). Sex peptide causes mating costs in female *Drosophila melanogaster*. *Curr Biol* *15*, 316–321.
- Wigby, S., Sirot, L.K., Linklater, J.R., Buehner, N., Calboli, F.C.F., Bretman, A., Wolfner, M.F., and Chapman, T. (2009). Seminal fluid protein allocation and male reproductive success. *Curr Biol* *19*, 751–757.
- Wigby, S., Slack, C., Grönke, S., Martinez, P., Calboli, F.C.F., Chapman, T., and Partridge, L. (2011). Insulin signalling regulates remating in female *Drosophila*. *Proc Biol Sci* *278*, 424–431.
- Wilson, T.G., DeMoor, S., and Lei, J. (2003). Juvenile hormone involvement in *Drosophila melanogaster* male reproduction as suggested by the Methoprene-tolerant(27) mutant phenotype. *Insect Biochem Mol Biol* *33*, 1167–1175.
- Wilson, N., Tubman, S.C., Eady, P.E., and Robertson, G.W. (1997). Female genotype affects male success in sperm competition. *Proc Roy Soc B Biol Sci* *264*, 1491–1495.
- Wolfner, M.F. (1997). Tokens of love: functions and regulation of *Drosophila* male accessory gland products. *Insect Biochem Mol Biol* *27*, 179–192.

- Wolfner, M.F. (2002). The gifts that keep on giving: physiological functions and evolutionary dynamics of male seminal proteins in *Drosophila*. *Heredity* *88*, 85–93.
- Wolfner, M.F. (2009). Battle and ballet: molecular interactions between the sexes in *Drosophila*. *J Hered* *100*, 399–410.
- Wolfner, M.F. (2011). Precious essences: female secretions promote sperm storage in *Drosophila*. *PLoS Biol* *9*, e1001191.
- Wong, A., Albright, S.N., Giebel, J.D., Ram, K.R., Ji, S., Fiumera, A.C., and Wolfner, M.F. (2008). A role for Acp29AB, a predicted seminal fluid lectin, in female sperm storage in *Drosophila melanogaster*. *Genetics* *180*, 921–931.

## X

- Xue, L., and Noll, M. (2000). *Drosophila* female sexual behavior induced by sterile males showing copulation complementation. *Proc Natl Acad Sci USA* *97*, 3272–3275.

## Y

- Yamanaka, N., Hua, Y.-J., Roller, L., Spalovská-Valachová, I., Mizoguchi, A., Kataoka, H., and Tanaka, Y. (2010). Bombyx prothoracicostatic peptides activate the sex peptide receptor to regulate ecdysteroid biosynthesis. *Proc Natl Acad Sci USA* *107*, 2060–2065.
- Yamane, T. (2014). Genetic variation in the effect of monoamines on female mating receptivity and oviposition in the adzuki bean beetle, *Callosobruchus chinensis* (Coleoptera: Bruchidae). *BMC Evol Biol* *14*, 172.
- Yang, C.-H., Rumpf, S., Xiang, Y., Gordon, M.D., Song, W., Jan, L.Y., and Jan, Y.-N. (2009). Control of the postmating behavioral switch in *Drosophila* females by internal sensory neurons. *Neuron* *61*, 519–526.
- Yapici, N., Kim, Y.-J., Ribeiro, C., and Dickson, B.J. (2008). A receptor that mediates the post-mating switch in *Drosophila* reproductive behaviour. *Nature* *451*, 1675–1683.

## References

Yew, J.Y., Dreisewerd, K., Luftmann, H., Müthing, J., Pohlentz, G., and Kravitz, E.A. (2009). A new male sex pheromone and novel cuticular cues for chemical communication in *Drosophila*. *Curr Biol* *19*, 1245–1254.

Yokoi, S. et al. (2015). An essential role of the arginine vasotocin system in mateguarding behaviors in triadic relationships of medaka fish (*Oryzias latipes*). *PLoS Genet* *11*, e1005009.

## Z

Zawistowski, S., and Richmond, R.C. (1986). Inhibition of courtship and mating of *Drosophila melanogaster* by the male-produced lipid, cis-vaccenyl acetate. *J Insect Physiol* *32*, 189-192.

Zeh, J.A., and Zeh, D.W. (1994). Last-male sperm precedence breaks down when females mate with three males. *Proc R Soc (Biol)* *257*, 287–292.

Zhang, S., Liu, Y., and Rao, Y. (2013). Serotonin signaling in the brain of adult female mice is required for sexual preference. *Proc Natl Acad Sci USA* *110*, 9968–9973.