



Universiteit
Leiden

The Netherlands

Rhythms of resilience: individual differences in genetic and environmental effects on brain development

Drunen, L. van

Citation

Drunen, L. van. (2024, June 18). *Rhythms of resilience: individual differences in genetic and environmental effects on brain development*. Retrieved from <https://hdl.handle.net/1887/3762979>

Version: Publisher's Version

License: [Licence agreement concerning inclusion of doctoral thesis in the Institutional Repository of the University of Leiden](#)

Downloaded from: <https://hdl.handle.net/1887/3762979>

Note: To cite this publication please use the final published version (if applicable).

ACKNOWLEDGMENTS

(DANKWOORD)

Het voltooien van dit proefschrift markeert het einde van een boeiende en intense academische reis, en ik ben dankbaar voor de vele mensen die me hebben geïnspireerd en gesteund gedurende deze periode. Mijn dank gaat eerst uit naar de leden van de leescommissie, **Prof. Dr. Serge Rombouts, Prof. Dr. Christian Tammes, Dr. Marieke Bos, en Dr. Barbara Braams.**

Daarnaast een grote waardering voor mijn begeleidingsteam. Ik begin bij mijn promotor **Eveline** bij wie ik enorm geïnspireerd ben geraakt door haar visionaire blik op de wetenschap, positieve aanmoediging, en unieke bijdragen om wetenschap met maatschappij te verbinden. Ik verliet onze afspraken altijd met grote motivatie om nieuwe uitdagingen aan te gaan. Jouw toewijding aan mijn academische groei heeft mijn onderzoeksreis enorm verrijkt. **Lara**, jou wil ik bedanken voor je bovenmaatse wijsheid en vermogen om in de diepte te duiken van mijn studies. Of het nu ging om scripten in R of het uitdenken van onderzoeksvragen, jij bracht de wetenschap altijd naar een hoger niveau. Als laatste wil ik mijn co-auteurs bedanken, in het bijzonder **Rebecca**, met wie ik een inspirerende samenwerking ben aangegaan om muzikaliteit in kinderen te meten.

Ook een speciale waardering voor mijn paranimfen. **Simone**, ik kan me geen betere ‘wetenschapstweeling’ op ons tweelingproject indenken. Het was echt fantastisch om met jou 600 kinderen in de MRI-scanner te meten, congressen te ervaren, te relativeren, te filosoferen, en onze passie voor de wetenschap te beleven. Vaak ging dit gepaard met een grote lach waarbij ons teamgevoel altijd standhield, ook wanneer er wetenschapsperikelen boven kwamen drijven. **Daniel**, bijzonder dat je naast me staat tijdens het verdedigen van mijn proefschrift. Wij vonden onze gelijkenissen in ondernemen en onderzoeken, waarbij jij mij strijdlustig verstand hebt weten bij te leren tijdens uitdagende momenten.

Ik ben dankbaar voor de steun van mijn collega’s. **Michelle en Mara**, door jullie benaderbaarheid, betrokkenheid, en enthousiasme konden ik en Simone het stokje overnemen om het project af te ronden. **Olga en Sjoerd**, jullie bijdragen aan de dataverzameling, organisatie, en altijd leuke werksfeer was enorm. Jullie zorgden voor het juiste teamgevoel. Maar ook **Jana, Lisanne, Judith, Simone, Stephan, Saskia, Bianca, Veronica, en Bram**, bedankt voor al jullie fantastische inzet en bijdragen aan een stimulerende onderzoeksomgeving.

Binnen het SYNC lab: **Yara**, sinds je komst in het lab heb ik genoten van onze fijne samenwerking en passie voor het analyseren van innovatieve modellen. Bij jou is nooit een vraag te veel en je inspireert mij in je manier van

‘team science’ uitoefenen om samen hogere doelen te bereiken. **Kayla**, we zijn samen de eindsprint van het schrijven van ons proefschrift ingegaan. Hierdoor heb ik ervaren hoeveel positieve steun en aanmoediging je iemand zowel binnen als buiten de wetenschap kunt bieden. Dit heeft mijn motivatie gevoed om door te blijven schrijven. **Ilse**, na onze gesprekken voelde ik me geïnspireerd en had ik nieuwe ideeën voor aanvullingen op mijn projecten. We deelden vaak onze gedachten over de implicaties van onze bevindingen en ik heb echt genoten van onze gedeelde interesse in innovatieve datavisualisaties. **Karlijn**, binnen jouw postdoc rol zorgde je voor een innovatieve blik op het delen van kennis tussen wetenschap en maatschappij. Dit doet het veld verder ontwikkelen en ik heb veel gehad aan jouw nieuwe aanpak hierin. En ook bedankt alle overige (oud)collega’s uit Rotterdam en Leiden, ik heb veel geleerd van jullie talenten om professioneel te groeien als wetenschapper: **Renske, Suzanne, Sophie, Mark, Ties, Jochem, Laura, Philip, Eduard, Andrik, Lysanne, Fabienne, Yolijn, Nienke, Eleni, Iris, Sanne, Bianca, Berna, Annelinde, Ili, Jorien, Kiki, Lisa, Marieke, Neeltje B.**

Mijn diepe waardering gaat ook uit naar mijn lieve vrienden en familie. In het bijzonder, **Yuna**, een zeer creatieve vriendin die de kaft van mijn proefschrift heeft geïllustreerd. Daarnaast voor mijn vader en moeder, **Bert en Saskia**, jullie onvoorwaardelijke steun heeft mijn successen waardevoller gemaakt en de academische reis lichter. Jullie leerden me dat de echte vreugde schuilt in het proces van ontwikkeling, eerder dan in het uiteindelijke resultaat. Deze waardevolle les heeft bijgedragen aan een bescheiden blik op zowel mezelf als de wereld om me heen. **Loes en Reinier** mijn aanvullende familie: jullie warme betrokkenheid, aanmoediging, en bovenal de veilige haven die jullie op woensdagen bieden voor Dunya, vervullen mij met grote dankbaarheid.

Sicco, jouw onmisbare bijdrage verdient alle lof. Je voelt altijd feilloos aan wat ik nodig heb, of het nu gaat om het vieren van successen of het aangaan van uitdagingen. De timing van jouw unieke humor en luchtigheid stelt me in staat om te relativeren te midden van commotie. Als ik aan ons denk, zie ik een dream-team voor me, met als kers op de taart de toevoeging van Dunya aan ons gezin. **Dunya**, het stralende middelpunt in ons huis. De combinatie van moederschap en wetenschappelijke toewijding geeft me het vertrouwen dat ik elke uitdaging aankan. Door jou verzet ik alle bergen.

REFERENCES

REFERENCES

A

- Achterberg, M., & van der Meulen, M. (2019a). Genetic and environmental influences on MRI scan quantity and quality. *Developmental Cognitive Neuroscience*. <https://doi.org/10.1016/j.dcn.2019.100667>
- Achterberg, M., & van der Meulen, M. (2019b). Genetic and environmental influences on MRI scan quantity and quality. *Developmental Cognitive Neuroscience*, *38*, 100667.
- Achterberg, M., van Duijvenvoorde, A. C. K., Bakermans-Kranenburg, M. J., & Crone, E. A. (2016). Control your anger! The neural basis of aggression regulation in response to negative social feedback. *Social Cognitive and Affective Neuroscience*, *11*(5), 712–720.
- Achterberg, M., Van Duijvenvoorde, A. C. K., van der Meulen, M., Bakermans-Kranenburg, M. J., & Crone, E. A. (2018). Heritability of aggression following social evaluation in middle childhood: An fMRI study. *Human Brain Mapping*, *39*(7), 2828–2841.
- Achterberg, M., Van Duijvenvoorde, A. C. K., van IJzendoorn, M. H., Bakermans-Kranenburg, M. J., & Crone, E. A. (2020). Longitudinal changes in DLPFC activation during childhood are related to decreased aggression following social rejection. *Proceedings of the National Academy of Sciences*, *117*(15), 8602–8610.
- Akaike, H. (1974). A new look at the statistical model identification. *IEEE Transactions on Automatic Control*, *19*(6), 716–723. <https://doi.org/10.1109/TAC.1974.1100705>
- Altenmüller, E., & Furuya, S. (2016). Brain plasticity and the concept of metaplasticity in skilled musicians. *Progress in Motor Control*, 197–208.
- Amodio, D. M., & Frith, C. D. (2006). Meeting of minds: the medial frontal cortex and social cognition. *Nature Reviews Neuroscience*, *7*(4), 268–277.
- Andrews, J. L., Foulkes, L., & Blakemore, S.-J. (2020). Peer influence in adolescence: Public-health implications for COVID-19. *Trends in Cognitive Sciences*, *24*(8), 585–587.

- Aubert-Broche, B., Fonov, V. S., García-Lorenzo, D., Mouiha, A., Guizard, N., Coupé, P., Eskildsen, S. F., & Collins, D. L. (2013). A new method for structural volume analysis of longitudinal brain MRI data and its application in studying the growth trajectories of anatomical brain structures in childhood. *Neuroimage*, *82*, 393–402.
- Austin, M. K., Chen, E., Ross, K. M., McEwen, L. M., Maclsaac, J. L., Kobor, M. S., & Miller, G. E. (2018). Early-life socioeconomic disadvantage, not current, predicts accelerated epigenetic aging of monocytes. *Psychoneuroendocrinology*, *97*, 131–134.

B

- Badre, D., & Wagner, A. D. (2007). Left ventrolateral prefrontal cortex and the cognitive control of memory. *Neuropsychologia*, *45*(13), 2883–2901.
- Baer, L. H., Park, M. T. M., Bailey, J. A., Chakravarty, M. M., Li, K. Z. H., & Penhune, V. B. (2015). Regional cerebellar volumes are related to early musical training and finger tapping performance. *Neuroimage*, *109*, 130–139.
- Bailey, J. A., & Penhune, V. (2013). The relationship between the age of onset of musical training and rhythm synchronization performance: validation of sensitive period effects. *Frontiers in Neuroscience*, *7*, 227.
- Bailey, J. A., & Penhune, V. B. (2010). Rhythm synchronization performance and auditory working memory in early- and late-trained musicians. *Experimental Brain Research*, *204*(1), 91–101.
- Bailey, J. A., Zatorre, R. J., & Penhune, V. B. (2014). Early musical training is linked to gray matter structure in the ventral premotor cortex and auditory–motor rhythm synchronization performance. *Journal of Cognitive Neuroscience*, *26*(4), 755–767.
- Bailey, J., & Penhune, V. B. (2012). A sensitive period for musical training: contributions of age of onset and cognitive abilities. *Annals of the New York Academy of Sciences*, *1252*(1), 163–170.
- Ballantine, J., Stuber, J., & Everitt, J. (2021). *The sociology of education: A systematic analysis*. Routledge.
- Bangert, M., & Schlaug, G. (2006). Specialization of the specialized in features of external human brain morphology. *European Journal of Neuroscience*, *24*(6), 1832–1834.

- Barendse, M. E. A., Cosme, D., Flournoy, J. C., Vijayakumar, N., Cheng, T. W., Allen, N. B., & Pfeifer, J. H. (2020). Neural correlates of self-evaluation in relation to age and pubertal development in early adolescent girls. *Developmental Cognitive Neuroscience, 44*, 100799.
- Baroncelli, L., Braschi, C., Spolidoro, M., Begenisic, T., Sale, A., & Maffei, L. (2010). Nurturing brain plasticity: impact of environmental enrichment. *Cell Death & Differentiation, 17*(7), 1092–1103.
- Bates, D., Mächler, M., Bolker, B., & Walker, S. (2014). Fitting linear mixed-effects models using lme4. *ArXiv Preprint ArXiv:1406.5823*.
- Baum, A., Garofalo, J. P., & Yali, A. M. (1999). Socioeconomic status and chronic stress: does stress account for SES effects on health? *Annals of the New York Academy of Sciences, 896*(1), 131–144.
- Becht, A. I., Wierenga, L. M., Mills, K. L., Meuwese, R., van Duijvenvoorde, A., Blakemore, S.-J., Güroğlu, B., & Crone, E. A. (2021). Beyond the average brain: individual differences in social brain development are associated with friendship quality. *Social Cognitive and Affective Neuroscience, 16*(3), 292–301.
- Belsky, J. (2019). Early-life adversity accelerates child and adolescent development. *Current Directions in Psychological Science, 28*(3), 241–246.
- Bermudez, P., Lerch, J. P., Evans, A. C., & Zatorre, R. J. (2009). Neuroanatomical correlates of musicianship as revealed by cortical thickness and voxel-based morphometry. *Cerebral Cortex, 19*(7), 1583–1596.
- Bethlehem, R. A. I., Seidlitz, J., White, S. R., Vogel, J. W., Anderson, K. M., Adamson, C., Adler, S., Alexopoulos, G. S., Anagnostou, E., & Areces-Gonzalez, A. (2022). Brain charts for the human lifespan. *Nature, 604*(7906), 525–533.
- Birkmayer, W., & Riederer, P. (1975). Biochemical post-mortem findings in depressed patients. *Journal of Neural Transmission, 37*, 95–109.
- Blakemore, S.-J. (2008). The social brain in adolescence. *Nature Reviews Neuroscience, 9*(4), 267–277.
- Blakemore, S.-J., & Mills, K. L. (2014). Is adolescence a sensitive period for sociocultural processing? *Annual Review of Psychology, 65*, 187–207.
- Blankenstein, N. E., Telzer, E. H., Do, K. T., Van Duijvenvoorde, A. C. K., & Crone, E. A. (2020). Behavioral and neural pathways supporting the development of prosocial and risk-taking behavior across adolescence. *Child Development, 91*(3), e665–e681.

- Blasco-Magraner, J. S., Bernabe-Valero, G., Marín-Liébana, P., & Moret-Tatay, C. (2021). Effects of the educational use of music on 3-to 12-year-old children's emotional development: a systematic review. *International Journal of Environmental Research and Public Health*, *18*(7), 3668.
- Bolger, K. E., Patterson, C. J., & Kupersmidt, J. B. (1998). Peer relationships and self-esteem among children who have been maltreated. *Child Development*, *69*(4), 1171–1197.
- Bong, M., & Skaalvik, E. M. (2003). Academic self-concept and self-efficacy: How different are they really? *Educational Psychology Review*, *15*(1), 1–40.
- Bos, M. G. N., Peters, S., van de Kamp, F. C., Crone, E. A., & Tamnes, C. K. (2018). Emerging depression in adolescence coincides with accelerated frontal cortical thinning. *Journal of Child Psychology and Psychiatry*, *59*(9), 994–1002.
- Bowlby, J. (1982). Attachment and loss: retrospect and prospect. *American Journal of Orthopsychiatry*, *52*(4), 664.
- Bracken, B. A. (2009). Positive self-concepts. *Handbook of Positive Psychology in Schools*, 89–106.
- Bradley, R. H., Corwyn, R. F., McAdoo, H. P., & García Coll, C. (2001). The home environments of children in the United States part I: Variations by age, ethnicity, and poverty status. *Child Development*, *72*(6), 1844–1867.
- Brainard, M. S., & Knudsen, E. I. (1998). Sensitive periods for visual calibration of the auditory space map in the barn owl optic tectum. *Journal of Neuroscience*, *18*(10), 3929–3942.
- Bramen, J. E., Hranilovich, J. A., Dahl, R. E., Forbes, E. E., Chen, J., Toga, A. W., Dinov, I. D., Worthman, C. M., & Sowell, E. R. (2011). Puberty influences medial temporal lobe and cortical gray matter maturation differently in boys than girls matched for sexual maturity. *Cerebral Cortex*, *21*(3), 636–646.
- Brans, R. G. H., van Haren, N. E. M., van Baal, G. C. M., Schnack, H. G., Kahn, R. S., & Pol, H. E. H. (2008). Heritability of changes in brain volume over time in twin pairs discordant for schizophrenia. *Archives of General Psychiatry*, *65*(11), 1259–1268.
- Brett, M., Anton, J.-L., Valabregue, R., & Poline, J.-B. (2002). Region of interest analysis using the MarsBar toolbox for SPM 99. *Neuroimage*, *16*(2), S497.

- Brouwer, R. M., Panizzon, M. S., Glahn, D. C., Hibar, D. P., Hua, X., Jahanshad, N., Abramovic, L., De Zubicaray, G. I., Franz, C. E., & Hansell, N. K. (2017). Genetic influences on individual differences in longitudinal changes in global and subcortical brain volumes: results of the ENIGMA plasticity working group. *Human Brain Mapping, 38*(9), 4444–4458.
- Brown, T. T., & Jernigan, T. L. (2012). Brain development during the preschool years. *Neuropsychology Review, 22*, 313–333.
- Byrne, M. L., Whittle, S., Vijayakumar, N., Dennison, M., Simmons, J. G., & Allen, N. B. (2017). A systematic review of adrenarche as a sensitive period in neurobiological development and mental health. *Developmental Cognitive Neuroscience, 25*, 12–28.

C

- Callaghan, B. L., & Tottenham, N. (2016a). The neuro-environmental loop of plasticity: A cross-species analysis of parental effects on emotion circuitry development following typical and adverse caregiving. *Neuropsychopharmacology, 41*(1), 163–176.
- Callaghan, B. L., & Tottenham, N. (2016b). The stress acceleration hypothesis: Effects of early-life adversity on emotion circuits and behavior. *Current Opinion in Behavioral Sciences, 7*, 76–81.
- Carstens, K. E., Phillips, M. L., Pozzo-Miller, L., Weinberg, R. J., & Dudek, S. M. (2016). Perineuronal nets suppress plasticity of excitatory synapses on CA2 pyramidal neurons. *Journal of Neuroscience, 36*(23), 6312–6320.
- Carstensen, L. L., Shavit, Y. Z., & Barnes, J. T. (2020). Age advantages in emotional experience persist even under threat from the COVID-19 pandemic. *Psychological Science, 31*(11), 1374–1385.
- Casey, B. J., Tottenham, N., Liston, C., & Durston, S. (2005). Imaging the developing brain: what have we learned about cognitive development? *Trends in Cognitive Sciences, 9*(3), 104–110.
- Choudhury, S., Blakemore, S.-J., & Charman, T. (2006). Social cognitive development during adolescence. *Social Cognitive and Affective Neuroscience, 1*(3), 165.
- Chung, J. M., Robins, R. W., Trzesniewski, K. H., Nofhle, E. E., Roberts, B. W., & Widaman, K. F. (2014). Continuity and change in self-esteem during emerging adulthood. *Journal of Personality and Social Psychology, 106*(3), 469.

- Clarkson, M. J., Cardoso, M. J., Ridgway, G. R., Modat, M., Leung, K. K., Rohrer, J. D., Fox, N. C., & Ourselin, S. (2011). A comparison of voxel and surface based cortical thickness estimation methods. *Neuroimage*, *57*(3), 856–865.
- Cocosco, C. A., Kollokian, V., Kwan, R. K.-S., Pike, G. B., & Evans, A. C. (1997). Brainweb: Online interface to a 3D MRI simulated brain database. *NeuroImage*.
- Cohen-Cory, S., Kidane, A. H., Shirkey, N. J., & Marshak, S. (2010). Brain-derived neurotrophic factor and the development of structural neuronal connectivity. *Developmental Neurobiology*, *70*(5), 271–288.
- Colich, N. L., Rosen, M. L., Williams, E. S., & McLaughlin, K. A. (2020). Biological aging in childhood and adolescence following experiences of threat and deprivation: A systematic review and meta-analysis. *Psychological Bulletin*, *146*(9), 721.
- Crone, E. A. (2009). Executive functions in adolescence: inferences from brain and behavior. *Developmental Science*, *12*(6), 825–830.
- Crone, E. A., Achterberg, M., Dobbelaar, S., Euser, S., van den Bulk, B., van der Meulen, M., van Drunen, L., Wierenga, L., Bakermans-Kranenburg, M. J., & van IJzendoorn, M. H. (2020). Neural and behavioral signatures of social evaluation and adaptation in childhood and adolescence: The Leiden Consortium on Individual Development (L-CID). *Developmental Cognitive Neuroscience*, 100805.
- Crone, E. A., & Dahl, R. E. (2012). Understanding adolescence as a period of social-affective engagement and goal flexibility. *Nature Reviews Neuroscience*, *13*(9), 636–650.
- Crone, E. A., & Fuligni, A. J. (2020). Self and others in adolescence. *Annual Review of Psychology*, *71*, 447–469.
- Crone, E. A., & Steinbeis, N. (2017). Neural perspectives on cognitive control development during childhood and adolescence. *Trends in Cognitive Sciences*, *21*(3), 205–215.
- D**
- Dale, A. M. (1999). Optimal experimental design for event-related fMRI. *Human Brain Mapping*, *8*(2-3), 109–114.

- Davey, C. G., Pujol, J., & Harrison, B. J. (2016). Mapping the self in the brain's default mode network. *Neuroimage*, *132*, 390–397.
- de Leeuw, R. N. H., van Woudenberg, T. J., Green, K. H., Sweijen, S. W., van de Groep, S., Kleemans, M., Tamboer, S. L., Crone, E. A., & Buijzen, M. (2022). Moral Beauty During the COVID-19 Pandemic: Prosocial Behavior Among Adolescents and the Inspiring Role of the Media. *Communication Research*, 00936502221112804.
- de Manzano, Ö., & Ullén, F. (2018). Same genes, different brains: neuroanatomical differences between monozygotic twins discordant for musical training. *Cerebral Cortex*, *28*(1), 387–394.
- Deary, I. J., Johnson, W., & Houlihan, L. M. (2009). Genetic foundations of human intelligence. *Human Genetics*, *126*(1), 215–232.
- Del Giudice, M., Angeleri, R., & Manera, V. (2009). The juvenile transition: A developmental switch point in human life history. *Developmental Review*, *29*(1), 1–31.
- Delgado, J. M. R. (1976). Animal models for brain research. In *Animal models in human psychobiology* (pp. 203–218). Springer.
- Delgado, M. R. (2007). Reward-related responses in the human striatum. *Annals of the New York Academy of Sciences*, *1104*(1), 70–88.
- DelGiudice, M. (2018). Middle childhood: An evolutionary-developmental synthesis. In *Handbook of life course health development* (pp. 95–107). Springer, Cham.
- Denny, B. T., Kober, H., Wager, T. D., & Ochsner, K. N. (2012). A meta-analysis of functional neuroimaging studies of self- and other judgments reveals a spatial gradient for mentalizing in medial prefrontal cortex. *J Cogn Neurosci*, *24*(8), 1742–1752. https://doi.org/10.1162/jocn_a_00233
- Desikan, R. S., Ségonne, F., Fischl, B., Quinn, B. T., Dickerson, B. C., Blacker, D., Buckner, R. L., Dale, A. M., Maguire, R. P., & Hyman, B. T. (2006). An automated labeling system for subdividing the human cerebral cortex on MRI scans into gyral based regions of interest. *Neuroimage*, *31*(3), 968–980.
- Dobbelaar, S., Achterberg, M., van Duijvenvoorde, A. C. K., van IJzendoorn, M. H., & Crone, E. A. (2023). Developmental patterns and individual differences in responding to social feedback: A longitudinal fMRI study from childhood to

adolescence. *Developmental Cognitive Neuroscience*, 101264.

- Drewing, K., Aschersleben, G., & Li, S.-C. (2006). Sensorimotor synchronization across the life span. *International Journal of Behavioral Development*, 30(3), 280–287.
- Duffy, S. N., Craddock, K. J., Abel, T., & Nguyen, P. V. (2001). Environmental enrichment modifies the PKA-dependence of hippocampal LTP and improves hippocampus-dependent memory. *Learning & Memory*, 8(1), 26–34.
- Duncan, C. E., Webster, M. J., Rothmond, D. A., Bahn, S., Elashoff, M., & Weickert, C. S. (2010). Prefrontal GABAA receptor α -subunit expression in normal postnatal human development and schizophrenia. *Journal of Psychiatric Research*, 44(10), 673–681.
- Durston, S., Nederveen, H., van Dijk, S., van Belle, J., de Zeeuw, P., Langen, M., & van Dijk, A. (2009). Magnetic resonance simulation is effective in reducing anxiety related to magnetic resonance scanning in children. *Journal of the American Academy of Child & Adolescent Psychiatry*, 2(48), 206–207.

E

- Eisenberg, N., Spinrad, T. L., & Knafo-Noam, A. (2015). Handbook of child psychology and developmental science: Socioemotional processes, chap. *Prosocial Development*, 610–656.
- Elliott, M. L., Knodt, A. R., Ireland, D., Morris, M. L., Poulton, R., Ramrakha, S., Sison, M. L., Moffitt, T. E., Caspi, A., & Hariri, A. R. (2020). What Is the Test-Retest Reliability of Common Task-Functional MRI Measures? New Empirical Evidence and a Meta-Analysis. *Psychological Science*, 0956797620916786.
- Eriksson, P. S., Perfilieva, E., Björk-Eriksson, T., Alborn, A.-M., Nordborg, C., Peterson, D. A., & Gage, F. H. (1998). Neurogenesis in the adult human hippocampus. *Nature Medicine*, 4(11), 1313–1317.
- Euser, S., Bakermans-Kranenburg, M. J., van den Bulk, B. G., Linting, M., Damsteegt, R. C., Vrijhof, C. I., van Wijk, I. C., Crone, E. A., & van IJzendoorn, M. H. (2016). Efficacy of the Video-feedback Intervention to promote Positive Parenting and Sensitive Discipline in Twin Families (VIPP-Twins): Study protocol for a randomized controlled trial. *BMC Psychology*, 4(1), 1–11.

Eyler, L. T., Chen, C.-H., Panizzon, M. S., Fennema-Notestine, C., Neale, M. C., Jak, A., Jernigan, T. L., Fischl, B., Franz, C. E., & Lyons, M. J. (2012). A comparison of heritability maps of cortical surface area and thickness and the influence of adjustment for whole brain measures: a magnetic resonance imaging twin study. *Twin Research and Human Genetics*, *15*(3), 304–314.

F

Favuzzi, E., Marques-Smith, A., Deogracias, R., Winterflood, C. M., Sánchez-Aguilera, A., Mantoan, L., Maeso, P., Fernandes, C., Ewers, H., & Rico, B. (2017). Activity-dependent gating of parvalbumin interneuron function by the perineuronal net protein brevican. *Neuron*, *95*(3), 639–655.

Feinstein, L., & Bynner, J. (2004). The importance of cognitive development in middle childhood for adulthood socioeconomic status, mental health, and problem behavior. *Child Development*, *75*(5), 1329–1339.

Feldman, A. F., & Matjasko, J. L. (2007). Profiles and portfolios of adolescent school-based extracurricular activity participation. *Journal of Adolescence*, *30*(2), 313–332.

Feldman, R., Magori-Cohen, R., Galili, G., Singer, M., & Louzoun, Y. (2011). Mother and infant coordinate heart rhythms through episodes of interaction synchrony. *Infant Behavior and Development*, *34*(4), 569–577.

Ferschmann, L., Bos, M. G. N., Herting, M. M., Mills, K. L., & Tamnes, C. K. (2022). Contextualizing adolescent structural brain development: Environmental determinants and mental health outcomes. *Current Opinion in Psychology*, *44*, 170–176.

Fink, G. R., Markowitsch, H. J., Reinkemeier, M., Bruckbauer, T., Kessler, J., & Heiss, W.-D. (1996). Cerebral representation of one's own past: neural networks involved in autobiographical memory. *Journal of Neuroscience*, *16*(13), 4275–4282.

Fischl, B., Salat, D. H., Busa, E., Albert, M., Dieterich, M., Haselgrove, C., Van Der Kouwe, A., Killiany, R., Kennedy, D., & Klaveness, S. (2002). Whole brain segmentation: automated labeling of neuroanatomical structures in the human brain. *Neuron*, *33*(3), 341–355.

- Fischl, B., Salat, D. H., Van Der Kouwe, A. J. W., Makris, N., Ségonne, F., Quinn, B. T., & Dale, A. M. (2004). Sequence-independent segmentation of magnetic resonance images. *Neuroimage*, *23*, S69–S84.
- Fischl, B., Van Der Kouwe, A., Destrieux, C., Halgren, E., Ségonne, F., Salat, D. H., Busa, E., Seidman, L. J., Goldstein, J., & Kennedy, D. (2004). Automatically parcellating the human cerebral cortex. *Cerebral Cortex*, *14*(1), 11–22.
- Forde, N. J., Jeyachandra, J., Joseph, M., Jacobs, G. R., Dickie, E., Satterthwaite, T. D., Shinohara, R. T., Ameis, S. H., & Voineskos, A. N. (2020). Sex differences in variability of brain structure across the lifespan. *Cerebral Cortex*, *30*(10), 5420–5430.
- Foster, N. E. V., & Zatorre, R. J. (2010). Cortical structure predicts success in performing musical transformation judgments. *Neuroimage*, *53*(1), 26–36.
- Foulkes, L., & Blakemore, S.-J. (2018). Studying individual differences in human adolescent brain development. *Nature Neuroscience*, *21*(3), 315–323.
- Fox, S. E., Levitt, P., & Nelson III, C. A. (2010). How the timing and quality of early experiences influence the development of brain architecture. *Child Development*, *81*(1), 28–40.
- Frith, C. D., & Frith, U. (2007). Social cognition in humans. *Current Biology*, *17*(16), R724–R732.
- Frith, U., & Frith, C. D. (2003). Development and neurophysiology of mentalizing. *Philosophical Transactions of the Royal Society of London. Series B: Biological Sciences*, *358*(1431), 459–473.
- Fuhrmann, D., Madsen, K. S., Johansen, L. B., Baaré, W. F. C., & Kievit, R. A. (2022). The midpoint of cortical thinning between late childhood and early adulthood differs between individuals and brain regions: Evidence from longitudinal modelling in a 12-wave neuroimaging sample. *NeuroImage*, *261*, 119507.

G

- Gabard-Durnam, L., & McLaughlin, K. A. (2020). Sensitive periods in human development: Charting a course for the future. *Current Opinion in Behavioral Sciences*, *36*, 120–128.

- Gaser, C., & Schlaug, G. (2003). Brain structures differ between musicians and non-musicians. *Journal of Neuroscience*, *23*(27), 9240–9245.
- Gebel, B., Braun, C., Kaza, E., Altenmüller, E., & Lotze, M. (2013). Instrument specific brain activation in sensorimotor and auditory representation in musicians. *Neuroimage*, *74*, 37–44.
- Genon, S., Eickhoff, S. B., & Kharabian, S. (2022). Linking interindividual variability in brain structure to behaviour. *Nature Reviews Neuroscience*, *23*(5), 307–318.
- Germine, L. T., Duchaine, B., & Nakayama, K. (2011). Where cognitive development and aging meet: Face learning ability peaks after age 30. *Cognition*, *118*(2), 201–210.
- Gerver, W. J. M., & De Bruin, R. (2003). Growth velocity: a presentation of reference values in Dutch children. *Hormone Research*, *60*(4), 181–184.
- Giedd, J. N., Blumenthal, J., Jeffries, N. O., Castellanos, F. X., Liu, H., Zijdenbos, A., Paus, T., Evans, A. C., & Rapoport, J. L. (1999). Brain development during childhood and adolescence: a longitudinal MRI study. *Nature Neuroscience*, *2*(10), 861–863.
- Giedd, J. N., Raznahan, A., Alexander-Bloch, A., Schmitt, E., Gogtay, N., & Rapoport, J. L. (2015). Child psychiatry branch of the National Institute of Mental Health longitudinal structural magnetic resonance imaging study of human brain development. *Neuropsychopharmacology*, *40*(1), 43–49.
- Giedd, J. N., Vaituzis, A. C., Hamburger, S. D., Lange, N., Rajapakse, J. C., Kaysen, D., Vauss, Y. C., & Rapoport, J. L. (1996). Quantitative MRI of the temporal lobe, amygdala, and hippocampus in normal human development: ages 4–18 years. *Journal of Comparative Neurology*, *366*(2), 223–230.
- Gilmore, J. H., Knickmeyer, R. C., & Gao, W. (2018). Imaging structural and functional brain development in early childhood. *Nature Reviews Neuroscience*, *19*(3), 123–137.
- Glahn, D. C., Thompson, P. M., & Blangero, J. (2007). Neuroimaging endophenotypes: strategies for finding genes influencing brain structure and function. *Human Brain Mapping*, *28*(6), 488–501.
- Glahn, D. C., Winkler, A. M., Kochunov, P., Almasy, L., Duggirala, R., Carless, M. A., Curran, J. C., Olvera, R. L., Laird, A. R., & Smith, S. M. (2010). Genetic control over the resting brain. *Proceedings of the National Academy of Sciences*, *107*(3), 1223–1228.

- Glowiak, M., & Mayfield, M. A. (2016). Middle childhood: Physical and cognitive development. *Human Growth and Development across the Lifespan: Applications for Counselors*, 251–275.
- Goddings, A.-L., Mills, K. L., Clasen, L. S., Giedd, J. N., Viner, R. M., & Blakemore, S.-J. (2014). The influence of puberty on subcortical brain development. *Neuroimage*, 88, 242–251.
- Goff, B., Gee, D. G., Telzer, E. H., Humphreys, K. L., Gabard-Durnam, L., Flannery, J., & Tottenham, N. (2013). Reduced nucleus accumbens reactivity and adolescent depression following early-life stress. *Neuroscience*, 249, 129–138.
- Gogtay, N., Giedd, J. N., Lusk, L., Hayashi, K. M., Greenstein, D., Vaituzis, A. C., Nugent, T. F., Herman, D. H., Clasen, L. S., & Toga, A. W. (2004). Dynamic mapping of human cortical development during childhood through early adulthood. *Proceedings of the National Academy of Sciences*, 101(21), 8174–8179.
- Goodway, J. D., Ozmun, J. C., & Gallahue, D. L. (2019). *Understanding motor development: Infants, children, adolescents, adults*. Jones & Bartlett Learning.
- Gordon, R. L., Jacobs, M. S., Schuele, C. M., & McAuley, J. D. (2015). Perspectives on the rhythm–grammar link and its implications for typical and atypical language development. *Annals of the New York Academy of Sciences*, 1337, 16.
- Goriounova, N. A., Heyer, D. B., Wilbers, R., Verhoog, M. B., Giugliano, M., Verbist, C., Obermayer, J., Kerkhofs, A., Smeding, H., & Verberne, M. (2018). Large and fast human pyramidal neurons associate with intelligence. *Elife*, 7.
- Gotlib, I. H., Miller, J. G., Borchers, L. R., Coury, S. M., Costello, L. A., Garcia, J. M., & Ho, T. C. (2022). Effects of the COVID-19 Pandemic on Mental Health and Brain Maturation in Adolescents: Implications for Analyzing Longitudinal Data. *Biological Psychiatry: Global Open Science*. <https://doi.org/10.1016/j.bpsgos.2022.11.002>
- Grasby, K. L., Jahanshad, N., Painter, J. N., Colodro-Conde, L., Bralten, J., Hibar, D. P., Lind, P. A., Pizzagalli, F., Ching, C. R. K., & McMahon, M. A. B. (2020). The genetic architecture of the human cerebral cortex. *Science*, 367(6484), eaay6690.

- Green, K. H., van de Groep, S., Sweijen, S. W., Becht, A. I., Buijzen, M., de Leeuw, R. N. H., Remmerswaal, D., van der Zanden, R., Engels, R. C. M. E., & Crone, E. A. (2021). Mood and emotional reactivity of adolescents during the COVID-19 pandemic: short-term and long-term effects and the impact of social and socioeconomic stressors. *Scientific Reports*, *11*(1), 1–13.
- Greene, D. J., Koller, J. M., Hampton, J. M., Wesevich, V., Van, A. N., Nguyen, A. L., Hoyt, C. R., McIntyre, L., Earl, E. A., & Klein, R. L. (2018). Behavioral interventions for reducing head motion during MRI scans in children. *Neuroimage*, *171*, 234–245.
- Greifzu, F., Kalogeraki, E., & Löwel, S. (2016). Environmental enrichment preserved lifelong ocular dominance plasticity, but did not improve visual abilities. *Neurobiology of Aging*, *41*, 130–137.
- Greifzu, F., Pielecka-Fortuna, J., Kalogeraki, E., Krempler, K., Favaro, P. D., Schlüter, O. M., & Löwel, S. (2014). Environmental enrichment extends ocular dominance plasticity into adulthood and protects from stroke-induced impairments of plasticity. *Proceedings of the National Academy of Sciences*, *111*(3), 1150–1155.
- Groussard, M., La Joie, R., Rauchs, G., Landeau, B., Chetelat, G., Viader, F., Desgranges, B., Eustache, F., & Platel, H. (2010). When music and long-term memory interact: effects of musical expertise on functional and structural plasticity in the hippocampus. *PloS One*, *5*(10), e13225.
- Gusnard, D. A., Akbudak, E., Shulman, G. L., & Raichle, M. E. (2001). Medial prefrontal cortex and self-referential mental activity: relation to a default mode of brain function. *Proceedings of the National Academy of Sciences*, *98*(7), 4259–4264.
- Gusnard, D. A., & Raichle, M. E. (2001). Searching for a baseline: functional imaging and the resting human brain. *Nature Reviews Neuroscience*, *2*(10), 685–694.

H

- Habibi, A., Damasio, A., Ilari, B., Veiga, R., Joshi, A. A., Leahy, R. M., Haldar, J. P., Varadarajan, D., Bhushan, C., & Damasio, H. (2018). Childhood music training induces change in micro and macroscopic brain structure: results from a longitudinal study. *Cerebral Cortex*, *28*(12), 4336–4347.

- Haines, D. E. (2012). *Fundamental Neuroscience for Basic and Clinical Applications E-Book: with STUDENT CONSULT Online Access*. Elsevier Health Sciences.
- Hammock, E. A. D., & Levitt, P. (2006). The discipline of neurobehavioral development: the emerging interface of processes that build circuits and skills. *Human Development, 49*(5), 294–309.
- Hannon, E. E., Nave-Blodgett, J. E., & Nave, K. M. (2018). The developmental origins of the perception and production of musical rhythm. *Child Development Perspectives, 12*(3), 194–198.
- Hanson, J. L., Nacewicz, B. M., Sutterer, M. J., Cayo, A. A., Schaefer, S. M., Rudolph, K. D., Shirlcliff, E. A., Pollak, S. D., & Davidson, R. J. (2015). Behavioral problems after early life stress: contributions of the hippocampus and amygdala. *Biological Psychiatry, 77*(4), 314–323.
- Harbaugh, W. T., Mayr, U., & Burghart, D. R. (2007). Neural responses to taxation and voluntary giving reveal motives for charitable donations. *Science, 316*(5831), 1622–1625.
- Harter, S. (1988). *Self-perception profile for adolescents*. University of Denver.
- Harter, S. (2012). The construction of the self: Developmental and sociocultural foundations, 2nd ed. In *The construction of the self: Developmental and sociocultural foundations, 2nd ed.* The Guilford Press.
- Hasan, A., Galea, J. M., Casula, E. P., Falkai, P., Bestmann, S., & Rothwell, J. C. (2013). Muscle and timing-specific functional connectivity between the dorsolateral prefrontal cortex and the primary motor cortex. *Journal of Cognitive Neuroscience, 25*(4), 558–570.
- Haworth, C. M. A., Wright, M. J., Luciano, M., Martin, N. G., de Geus, E. J. C., van Beijsterveldt, C. E. M., Bartels, M., Posthuma, D., Boomsma, D. I., & Davis, O. S. P. (2010). The heritability of general cognitive ability increases linearly from childhood to young adulthood. *Molecular Psychiatry, 15*(11), 1112–1120.
- Herholz, S. C., Boh, B., & Pantev, C. (2011). Musical training modulates encoding of higher-order regularities in the auditory cortex. *European Journal of Neuroscience, 34*(3), 524–529.
- Herholz, S. C., & Zatorre, R. J. (2012). Musical training as a framework for brain plasticity: behavior, function, and structure. *Neuron, 76*(3), 486–502.

- Herringa, R. J., Burghy, C. A., Stodola, D. E., Fox, M. E., Davidson, R. J., & Essex, M. J. (2016). Enhanced prefrontal-amygdala connectivity following childhood adversity as a protective mechanism against internalizing in adolescence. *Biological Psychiatry: Cognitive Neuroscience and Neuroimaging*, *1*(4), 326–334.
- Herting, M. M., Gautam, P., Spielberg, J. M., Dahl, R. E., & Sowell, E. R. (2015). A longitudinal study: changes in cortical thickness and surface area during pubertal maturation. *PLoS One*, *10*(3), e0119774.
- Herting, M. M., Johnson, C., Mills, K. L., Vijayakumar, N., Dennison, M., Liu, C., Goddings, A.-L., Dahl, R. E., Sowell, E. R., & Whittle, S. (2018). Development of subcortical volumes across adolescence in males and females: A multisample study of longitudinal changes. *NeuroImage*, *172*, 194–205.
- Herting, M. M., & Sowell, E. R. (2017). Puberty and structural brain development in humans. *Frontiers in Neuroendocrinology*, *44*, 122–137.
- Hudziak, J. J., Albaugh, M. D., Ducharme, S., Karama, S., Spottswood, M., Crehan, E., Evans, A. C., Botteron, K. N., & Group, B. D. C. (2014). Cortical thickness maturation and duration of music training: health-promoting activities shape brain development. *Journal of the American Academy of Child & Adolescent Psychiatry*, *53*(11), 1153–1161.
- Huizinga, M., Dolan, C. V., & Van der Molen, M. W. (2006). Age-related change in executive function: Developmental trends and a latent variable analysis. *Neuropsychologia*, *44*(11), 2017–2036.
- Hur, Y.-M., McGue, M., & Iacono, W. G. (1998). The structure of self-concept in female preadolescent twins: A behavioral genetic approach. *Journal of Personality and Social Psychology*, *74*(4), 1069.
- Hutton, C., Draganski, B., Ashburner, J., & Weiskopf, N. (2009). A comparison between voxel-based cortical thickness and voxel-based morphometry in normal aging. *Neuroimage*, *48*(2), 371–380.
- Hyde, K., Lerch, J., Norton, A., Forgeard, M., Winner, E., Evans, A., & Schlaug, G. (2009). The effects of musical training on structural brain development. *Annals of the New York Academy of Sciences*, *1169*(1), 182–186.
- Hyde, L. W., Gard, A. M., Tomlinson, R. C., Burt, S. A., Mitchell, C., & Monk, C. S. (2020). An ecological approach to understanding the developing brain: Examples linking poverty, parenting, neighborhoods, and the brain. *American Psychologist*, *75*(9), 1245.

I

Ikemoto, S., & Panksepp, J. (1999). The role of nucleus accumbens dopamine in motivated behavior: a unifying interpretation with special reference to reward-seeking. *Brain Research Reviews*, *31*(1), 6–41.

J

Ireland, K., Parker, A., Foster, N., & Penhune, V. (2018). Rhythm and melody tasks for school-aged children with and without musical training: Age-equivalent scores and reliability. *Frontiers in Psychology*, *9*, 426.

Jäncke, L. (2009). Music drives brain plasticity. *F1000 Biology Reports*, *1*.

Jankowski, K. F., Moore, W. E., Merchant, J. S., Kahn, L. E., & Pfeifer, J. H. (2014). But do you think I'm cool?: Developmental differences in striatal recruitment during direct and reflected social self-evaluations. *Developmental Cognitive Neuroscience*, *8*, 40–54.

Jansen, A. G., Mous, S. E., White, T., Posthuma, D., & Polderman, T. J. C. (2015). What twin studies tell us about the heritability of brain development, morphology, and function: a review. *Neuropsychology Review*, *25*(1), 27–46.

Jha, S. C., Xia, K., Ahn, M., Girault, J. B., Li, G., Wang, L., Shen, D., Zou, F., Zhu, H., & Styner, M. (2019). Environmental influences on infant cortical thickness and surface area. *Cerebral Cortex*, *29*(3), 1139–1149.

Jung, T., & Wickrama, K. A. S. (2008). An introduction to latent class growth analysis and growth mixture modeling. *Social and Personality Psychology Compass*, *2*(1), 302–317.

K

Kanai, R., & Rees, G. (2011). The structural basis of inter-individual differences in human behaviour and cognition. *Nature Reviews Neuroscience*, *12*(4), 231–242.

Karpati, F. J., Giacosa, C., Foster, N. E. V., Penhune, V. B., & Hyde, K. L. (2016). Sensorimotor integration is enhanced in dancers and musicians. *Experimental Brain Research*, *234*, 893–903.

- Keller, M. C., Medland, S. E., Duncan, L. E., Hatemi, P. K., Neale, M. C., Maes, H. H. M., & Eaves, L. J. (2009). Modeling extended twin family data I: description of the Cascade model. *Twin Research and Human Genetics*, *12*(1), 8–18.
- Khundrakpam, B., Choudhury, S., Vainik, U., Al-Sharif, N., Bhutani, N., & Evans, A. (2019). Non-linear effects of socioeconomic status on brain development: associations between parental occupation, cortical thickness and language skills in childhood and adolescence. *BioRxiv*, 575993.
- Khundrakpam, B., Choudhury, S., Vainik, U., Al-Sharif, N., Bhutani, N., Jeon, S., Gold, I., & Evans, A. (2020). Distinct influence of parental occupation on cortical thickness and surface area in children and adolescents: Relation to self-esteem. *Human Brain Mapping*, *41*(18), 5097–5113.
- Kim, E. J., Pellman, B., & Kim, J. J. (2015). Stress effects on the hippocampus: a critical review. *Learning & Memory*, *22*(9), 411–416.
- Kim, J., & Cicchetti, D. (2010). Longitudinal pathways linking child maltreatment, emotion regulation, peer relations, and psychopathology. *Journal of Child Psychology and Psychiatry*, *51*(6), 706–716.
- Kim, J. J., & Diamond, D. M. (2002). The stressed hippocampus, synaptic plasticity and lost memories. *Nature Reviews Neuroscience*, *3*(6), 453–462.
- Kim, J. J., & Yoon, K. S. (1998). Stress: metaplastic effects in the hippocampus. *Trends in Neurosciences*, *21*(12), 505–509.
- Kirschner, S., & Tomasello, M. (2009). Joint drumming: Social context facilitates synchronization in preschool children. *Journal of Experimental Child Psychology*, *102*(3), 299–314.
- Klapwijk, E. T., Van De Kamp, F., Van Der Meulen, M., Peters, S., & Wierenga, L. M. (2019). Qoala-T: A supervised-learning tool for quality control of FreeSurfer segmented MRI data. *Neuroimage*, *189*, 116–129.
- Klinedinst, R. E. (1991). Predicting performance achievement and retention of fifth-grade instrumental students. *Journal of Research in Music Education*, *39*(3), 225–238.
- Koelsch, S. (2014). Brain correlates of music-evoked emotions. *Nature Reviews Neuroscience*, *15*(3), 170–180.
- Koelsch, S., & Skouras, S. (2014). Functional centrality of amygdala, striatum and hypothalamus in a “small-world” network underlying joy: An fMRI study with music. *Human Brain Mapping*, *35*(7), 3485–3498.

Kringelbach, M. L., & Rolls, E. T. (2004). The functional neuroanatomy of the human orbitofrontal cortex: evidence from neuroimaging and neuropsychology. *Progress in Neurobiology*, *72*(5), 341–372.

L

Lakhani, B., Borich, M. R., Jackson, J. N., Wadden, K. P., Peters, S., Villamayor, A., MacKay, A. L., Vavasour, I. M., Rauscher, A., & Boyd, L. A. (2016). Motor skill acquisition promotes human brain myelin plasticity. *Neural Plasticity*, *2016*.

Legrand, D., & Ruby, P. (2009). What is self-specific? Theoretical investigation and critical review of neuroimaging results. *Psychological Review*, *116*(1), 252.

Lenroot, R. K., Gogtay, N., Greenstein, D. K., Wells, E. M., Wallace, G. L., Clasen, L. S., Blumenthal, J. D., Lerch, J., Zijdenbos, A. P., & Evans, A. C. (2007). Sexual dimorphism of brain developmental trajectories during childhood and adolescence. *Neuroimage*, *36*(4), 1065–1073.

Lenroot, R. K., Schmitt, J. E., Ordaz, S. J., Wallace, G. L., Neale, M. C., Lerch, J. P., Kendler, K. S., Evans, A. C., & Giedd, J. N. (2009). Differences in genetic and environmental influences on the human cerebral cortex associated with development during childhood and adolescence. *Human Brain Mapping*, *30*(1), 163–174.

Li, X., Beuckelaer, A. De, Guo, J., Ma, F., Xu, M., & Liu, J. (2014). The gray matter volume of the amygdala is correlated with the perception of melodic intervals: A voxel-based morphometry study. *PLoS One*, *9*(6), e99889.

Lieberman, M. D., Straccia, M. A., Meyer, M. L., Du, M., & Tan, K. M. (2019). Social, self, (situational), and affective processes in medial prefrontal cortex (MPFC): Causal, multivariate, and reverse inference evidence. *Neuroscience & Biobehavioral Reviews*, *99*, 311–328.

Lindenberger, U., & Lövdén, M. (2019). Brain plasticity in human lifespan development: the exploration–selection–refinement model. *Annual Review of Developmental Psychology*, *1*, 197–222.

Linnemann, A., Strahler, J., & Nater, U. M. (2016). The stress-reducing effect of music listening varies depending on the social context. *Psychoneuroendocrinology*, *72*, 97–105.

Luna, B., Marek, S., Larsen, B., Tervo-Clemmens, B., & Chahal, R. (2015). An integrative model of the maturation of cognitive control. *Annual Review of Neuroscience*, *38*, 151.

M

Mancini, V., Sandini, C., Padula, M. C., Zöllner, D., Schneider, M., Schaer, M., & Eliez, S. (2020). Positive psychotic symptoms are associated with divergent developmental trajectories of hippocampal volume during late adolescence in patients with 22q11DS. *Molecular Psychiatry*, *25*(11), 2844–2859.

Markham, J. A., & Greenough, W. T. (2004). Experience-driven brain plasticity: beyond the synapse. *Neuron Glia Biology*, *1*(4), 351–363.

Marquand, A. F., Kia, S. M., Zabihi, M., Wolfers, T., Buitelaar, J. K., & Beckmann, C. F. (2019). Conceptualizing mental disorders as deviations from normative functioning. *Molecular Psychiatry*, *24*(10), 1415–1424.

Marsh, H. W., & Ayotte, V. (2003). Do Multiple Dimensions of Self-Concept Become More Differentiated With Age? The Differential Distinctiveness Hypothesis. *Journal of Educational Psychology*, *95*(4), 687.

Marsh, H. W., & Martin, A. J. (2011). Academic self-concept and academic achievement: Relations and causal ordering. *British Journal of Educational Psychology*, *81*(1), 59–77.

Martinelli, P., Sperduti, M., & Piolino, P. (2013). Neural substrates of the self-memory system: New insights from a meta-analysis. *Human Brain Mapping*, *34*(7), 1515–1529.

Mason, M. F., Norton, M. I., Van Horn, J. D., Wegner, D. M., Grafton, S. T., & Macrae, C. N. (2007). Wandering minds: the default network and stimulus-independent thought. *Science*, *315*(5810), 393–395.

Masten, A. S., & Motti-Stefanidi, F. (2020). Multisystem resilience for children and youth in disaster: Reflections in the context of COVID-19. *Adversity and Resilience Science*, *1*(2), 95–106.

Masten, C. L., Morelli, S. A., & Eisenberger, N. I. (2011). An fMRI investigation of empathy for ‘social pain’ and subsequent prosocial behavior. *Neuroimage*, *55*(1), 381–388.

- McCormick, E. M. (2021). Multi-Level Multi-Growth Models: New opportunities for addressing developmental theory using advanced longitudinal designs with planned missingness. *Developmental Cognitive Neuroscience, 51*, 101001.
- McCormick, E. M., Byrne, M. L., Flournoy, J. C., Mills, K. L., & Pfeifer, J. H. (2023). The hitchhiker's guide to longitudinal models: A primer on model selection for repeated-measures methods. *Developmental Cognitive Neuroscience, 63*, 101281.
- McEwen, B. S. (1998). Stress, adaptation, and disease: Allostasis and allostatic load. *Annals of the New York Academy of Sciences, 840*(1), 33–44.
- McGaugh, J. L. (2004). The amygdala modulates the consolidation of memories of emotionally arousing experiences. *Annu. Rev. Neurosci., 27*, 1–28.
- McLaughlin, K. A., Sheridan, M. A., & Lambert, H. K. (2014). Childhood adversity and neural development: Deprivation and threat as distinct dimensions of early experience. *Neuroscience & Biobehavioral Reviews, 47*, 578–591.
- McLoughlin, G., Ronald, A., Kuntsi, J., Asherson, P., & Plomin, R. (2007). Genetic support for the dual nature of attention deficit hyperactivity disorder: Substantial genetic overlap between the inattentive and hyperactive–impulsive components. *Journal of Abnormal Child Psychology, 35*, 999–1008.
- Menyuk, P., Brisk, M. E., Menyuk, P., & Brisk, M. E. (2005). Language Development in Middle Childhood: Ages 9–13. *Language Development and Education: Children with Varying Language Experiences*, 118–141.
- Mezick, E. J., Matthews, K. A., Hall, M., Strollo Jr, P. J., Buysse, D. J., Kamarck, T. W., Owens, J. F., & Reis, S. E. (2008). Influence of race and socioeconomic status on sleep: Pittsburgh Sleep SCORE project. *Psychosomatic Medicine, 70*(4), 410.
- Miall, R. C., & Jenkinson, E. W. (2005). Functional imaging of changes in cerebellar activity related to learning during a novel eye–hand tracking task. *Experimental Brain Research, 166*, 170–183.
- Miller, E. K., & Cohen, J. D. (2001). An integrative theory of prefrontal cortex function. *Annual Review of Neuroscience, 24*(1), 167–202.
- Miller, G. E., Chen, E., & Parker, K. J. (2011). Psychological stress in childhood and susceptibility to the chronic diseases of aging: moving toward a model of behavioral and biological mechanisms. *Psychological Bulletin, 137*(6), 959.

- Mills, K. L., Goddings, A.-L., Herting, M. M., Meuwese, R., Blakemore, S.-J., Crone, E. A., Dahl, R. E., Güroğlu, B., Raznahan, A., & Sowell, E. R. (2016). Structural brain development between childhood and adulthood: Convergence across four longitudinal samples. *Neuroimage, 141*, 273–281.
- Mills, K. L., Lalonde, F., Clasen, L. S., Giedd, J. N., & Blakemore, S.-J. (2014). Developmental changes in the structure of the social brain in late childhood and adolescence. *Social Cognitive and Affective Neuroscience, 9*(1), 123–131.
- Mills, K. L., Siegmund, K. D., Tamnes, C. K., Ferschmann, L., Wierenga, L. M., Bos, M. G. N., Luna, B., Li, C., & Herting, M. M. (2021). Inter-individual variability in structural brain development from late childhood to young adulthood. *Neuroimage, 242*, 118450.
- Mitchell, C., Hobcraft, J., McLanahan, S. S., Siegel, S. R., Berg, A., Brooks-Gunn, J., Garfinkel, I., & Notterman, D. (2014). Social disadvantage, genetic sensitivity, and children's telomere length. *Proceedings of the National Academy of Sciences, 111*(16), 5944–5949.
- Mitchell, J. P., Macrae, C. N., & Banaji, M. R. (2006). Dissociable medial prefrontal contributions to judgments of similar and dissimilar others. *Neuron, 50*(4), 655–663.
- Molinari, M., Leggio, M. G., & Thaut, M. H. (2007). The cerebellum and neural networks for rhythmic sensorimotor synchronization in the human brain. *The Cerebellum, 6*(1), 18–23.
- Moore, E., Schaefer, R. S., Bastin, M. E., Roberts, N., & Overy, K. (2014). Can musical training influence brain connectivity? Evidence from diffusion tensor MRI. *Brain Sciences, 4*(2), 405–427.
- Moore, T. M., Martin, I. K., Gur, O. M., Jackson, C. T., Scott, J. C., Calkins, M. E., Ruparel, K., Port, A. M., Nivar, I., & Krinsky, H. D. (2016). Characterizing social environment's association with neurocognition using census and crime data linked to the Philadelphia Neurodevelopmental Cohort. *Psychological Medicine, 46*(3), 599–610.
- Moran, J. M., Macrae, C. N., Heatherton, T. F., Wyland, C. L., & Kelley, W. M. (2006). Neuroanatomical evidence for distinct cognitive and affective components of self. *Journal of Cognitive Neuroscience, 18*(9), 1586–1594.

- Mosing, M. A., Madison, G., Pedersen, N. L., Kuja-Halkola, R., & Ullén, F. (2014). Practice does not make perfect: no causal effect of music practice on music ability. *Psychological Science, 25*(9), 1795–1803.
- Mottollese, C., Richard, N., Harquel, S., Szathmari, A., Sirigu, A., & Desmurget, M. (2013). Mapping motor representations in the human cerebellum. *Brain, 136*(1), 330–342.
- Mountcastle, V. B. (1997). The columnar organization of the neocortex. *Brain: A Journal of Neurology, 120*(4), 701–722.
- Münste, T. F., Altenmüller, E., & Jäncke, L. (2002). The musician's brain as a model of neuroplasticity. *Nature Reviews Neuroscience, 3*(6), 473–478.
- Muris, P., Meesters, C., & van den Berg, S. (2003). Internalizing and externalizing problems as correlates of self-reported attachment style and perceived parental rearing in normal adolescents. *Journal of Child and Family Studies, 12*(2), 171–183.
- Murphy, K. P. (2012). *Machine learning: a probabilistic perspective*. MIT press.
- Murray, R. J., Schaer, M., & Debbané, M. (2012). Degrees of separation: a quantitative neuroimaging meta-analysis investigating self-specificity and shared neural activation between self-and other-reflection. *Neuroscience & Biobehavioral Reviews, 36*(3), 1043–1059.
- Muthén, B., & Muthén, L. (2017). *Mplus*. Chapman and Hall/CRC.

N

- Natu, V. S., Gomez, J., Barnett, M., Jeska, B., Kirilina, E., Jaeger, C., Zhen, Z., Cox, S., Weiner, K. S., & Weiskopf, N. (2019). Apparent thinning of human visual cortex during childhood is associated with myelination. *Proceedings of the National Academy of Sciences, 116*(41), 20750–20759.
- Neale, M. C., Hunter, M. D., Pritikin, J. N., Zahery, M., Brick, T. R., Kirkpatrick, R. M., Estabrook, R., Bates, T. C., Maes, H. H., & Boker, S. M. (2016). OpenMx 2.0: Extended structural equation and statistical modeling. *Psychometrika, 81*(2), 535–549.
- Neale, M., & Cardon, L. R. (2013). *Methodology for genetic studies of twins and families* (Vol. 67). Springer Science & Business Media.

Neiss, M. B., Sedikides, C., & Stevenson, J. (2002). Self-esteem: a behavioural genetic perspective. *European Journal of Personality, 16*(5), 351–367.

Northoff, G., & Bermpohl, F. (2004). Cortical midline structures and the self. *Trends in Cognitive Sciences, 8*(3), 102–107.

Northoff, G., Heinzl, A., De Greck, M., Bermpohl, F., Dobrowolny, H., & Panksepp, J. (2006). Self-referential processing in our brain—a meta-analysis of imaging studies on the self. *Neuroimage, 31*(1), 440–457.

O

O'Connor, A. M., Burton, T. J., Mansuri, H., Hand, G. R., Leamey, C. A., & Sawatari, A. (2019). Environmental enrichment from birth impacts parvalbumin expressing cells and wisteria floribunda agglutinin labelled peri-neuronal nets within the developing murine striatum. *Frontiers in Neuroanatomy, 13*, 90.

Orben, A., Tomova, L., & Blakemore, S.-J. (2020). The effects of social deprivation on adolescent development and mental health. *The Lancet Child & Adolescent Health, 4*(8), 634–640.

Østby, Y., Tamnes, C. K., Fjell, A. M., Westlye, L. T., Due-Tønnessen, P., & Walhovd, K. B. (2009). Heterogeneity in subcortical brain development: a structural magnetic resonance imaging study of brain maturation from 8 to 30 years. *Journal of Neuroscience, 29*(38), 11772–11782.

P

Panizzon, M. S., Fennema-Notestine, C., Eyler, L. T., Jernigan, T. L., Prom-Wormley, E., Neale, M., Jacobson, K., Lyons, M. J., Grant, M. D., & Franz, C. E. (2009). Distinct genetic influences on cortical surface area and cortical thickness. *Cerebral Cortex, 19*(11), 2728–2735.

Panizzon, M. S., Fennema-Notestine, C., Eyler, L. T., Jernigan, T. L., Prom-Wormley, E., Neale, M., Jacobson, K., Lyons, M. J., Grant, M. D., Franz, C. E., Xian, H., Tsuang, M., Fischl, B., Seidman, L., Dale, A., & Kremen, W. S. (2009). Distinct genetic influences on cortical surface area and cortical thickness. *Cerebral Cortex, 19*(11), 2728–2735. <https://doi.org/10.1093/cercor/bhp026>

- Park, H.-J., & Friston, K. (2013). Structural and functional brain networks: from connections to cognition. *Science*, *342*(6158), 1238411.
- Parker, N., Wong, A. P.-Y., Leonard, G., Perron, M., Pike, B., Richer, L., Veillette, S., Pausova, Z., & Paus, T. (2017). Income inequality, gene expression, and brain maturation during adolescence. *Scientific Reports*, *7*(1), 7397.
- Paus, T., Keshavan, M., & Giedd, J. N. (2008). Why do many psychiatric disorders emerge during adolescence? *Nature Reviews Neuroscience*, *9*(12), 947–957.
- Pekarek, B. T., Hunt, P. J., & Arenkiel, B. R. (2020). Oxytocin and sensory network plasticity. *Frontiers in Neuroscience*, *14*, 30.
- Penhune, V. B. (2020). A gene-maturation-environment model for understanding sensitive period effects in musical training. *Current Opinion in Behavioral Sciences*, *36*, 13–22.
- Penhune, V. B. (2021). Understanding sensitive period effects in musical training. In *Sensitive Periods of Brain Development and Preventive Interventions* (pp. 167–188). Springer.
- Peper, J. S., Brouwer, R. M., Boomsma, D. I., Kahn, R. S., & Hulshoff Pol, H. E. (2007). Genetic influences on human brain structure: a review of brain imaging studies in twins. *Human Brain Mapping*, *28*(6), 464–473.
- Peper, J. S., Schnack, H. G., Brouwer, R. M., Van Baal, G. C. M., Pjetri, E., Szekely, E., van Leeuwen, M., van den Berg, S. M., Collins, D. L., & Evans, A. C. (2009). Heritability of regional and global brain structure at the onset of puberty: A magnetic resonance imaging study in 9-year-old twin pairs. *Human Brain Mapping*, *30*(7), 2184–2196.
- Peretz, I., & Zatorre, R. J. (2005). Brain Organization for Music Processing. *Annual Review of Psychology*, *56*:89-114. <https://doi.org/https://doi.org/10.1146/annurev.psych.56.091103.070225>
- Perneger, T. V. (1998). What's wrong with Bonferroni adjustments. *Bmj*, *316*(7139), 1236–1238.
- Peters, J., & Büchel, C. (2010). Neural representations of subjective reward value. *Behavioural Brain Research*, *213*(2), 135–141.
- Pfefferbaum, A., Mathalon, D. H., Sullivan, E. V., Rawles, J. M., Zipursky, R. B., & Lim, K. O. (1994). A quantitative magnetic resonance imaging study of changes in brain morphology from infancy to late adulthood. *Archives of Neurology*, *51*(9), 874–887.

- Pfeifer, J. H., Lieberman, M. D., & Dapretto, M. (2007). “I know you are but what am I!?”: neural bases of self-and social knowledge retrieval in children and adults. *Journal of Cognitive Neuroscience*, *19*(8), 1323–1337.
- Pfeifer, J. H., & Peake, S. J. (2012). Self-development: integrating cognitive, socioemotional, and neuroimaging perspectives. *Developmental Cognitive Neuroscience*, *2*(1), 55–69.
- Pfister, R., Schwarz, K., Carson, R., & Janczyk, M. (2013). Easy methods for extracting individual regression slopes: Comparing SPSS, R, and Excel. *Tutorials in Quantitative Methods for Psychology*, *9*(2), 72–78.
- Piao, X., Hill, R. S., Bodell, A., Chang, B. S., Basel-Vanagaite, L., Straussberg, R., Dobyns, W. B., Qasrawi, B., Winter, R. M., & Innes, A. M. (2004). G protein-coupled receptor-dependent development of human frontal cortex. *Science*, *303*(5666), 2033–2036.
- Piccolo, L. R., Merz, E. C., He, X., Sowell, E. R., Noble, K. G., & Pediatric Imaging Genetics Study, N. (2016). Age-related differences in cortical thickness vary by socioeconomic status. *PloS One*, *11*(9), e0162511.
- Preschool, W. D. W. (2002). Primary Scale of Intelligence. *San Antonio, TX: Psychological Corporation*.

Q

- Qin, P., & Northoff, G. (2011). How is our self related to midline regions and the default-mode network? *Neuroimage*, *57*(3), 1221–1233.

R

- Ragert, P., Schmidt, A., Altenmüller, E., & Dinse, H. R. (2004). Superior tactile performance and learning in professional pianists: evidence for meta-plasticity in musicians. *European Journal of Neuroscience*, *19*(2), 473–478.
- Raju, H., & Tadi, P. (2020). *Neuroanatomy, somatosensory cortex*.
- Rakic, P. (1988). Specification of cerebral cortical areas. *Science*, *241*(4862), 170–176.
- Ramnani, N., & Owen, A. M. (2004). Anterior prefrontal cortex: insights into function from anatomy and neuroimaging. *Nature Reviews Neuroscience*, *5*(3), 184–194.

- Ray, R. D., Shelton, A. L., Hollon, N. G., Michel, B. D., Frankel, C. B., Gross, J. J., & Gabrieli, J. D. E. (2009). Cognitive and neural development of individuated self-representation in children. *Child Development, 80*(4), 1232–1242.
- Reinecke, J. (2006). Longitudinal analysis of adolescents' deviant and delinquent behavior: Applications of latent class growth curves and growth mixture models. *Methodology: European Journal of Research Methods for the Behavioral and Social Sciences, 2*(3), 100.
- Reiss, A. L., Abrams, M. T., Singer, H. S., Ross, J. L., & Denckla, M. B. (1996). Brain development, gender and IQ in children: a volumetric imaging study. *Brain, 119*(5), 1763–1774.
- Repp, B. H. (2005). Sensorimotor synchronization: a review of the tapping literature. *Psychonomic Bulletin & Review, 12*(6), 969–992.
- Repp, B. H. (2006). Musical synchronization. *Music, Motor Control, and the Brain, 55–76*.
- Repp, B. H., & Su, Y.-H. (2013). Sensorimotor synchronization: a review of recent research (2006–2012). *Psychonomic Bulletin & Review, 20*(3), 403–452.
- Reuter, M., & Fischl, B. (2011). Avoiding asymmetry-induced bias in longitudinal image processing. *Neuroimage, 57*(1), 19–21.
- Reuter, M., Rosas, H. D., & Fischl, B. (2010). Highly accurate inverse consistent registration: a robust approach. *Neuroimage, 53*(4), 1181–1196.
- Reuter, M., Schmansky, N. J., Rosas, H. D., & Fischl, B. (2012). Within-subject template estimation for unbiased longitudinal image analysis. *Neuroimage, 61*(4), 1402–1418.
- Riedel, G., & Micheau, J. (2001). Function of the hippocampus in memory formation: desperately seeking resolution. *Progress in Neuro-Psychopharmacology and Biological Psychiatry, 25*(4), 835–853.
- Rochat, P., & Striano, T. (2002). Who's in the mirror? Self-other discrimination in specular images by four- and nine-month-old infants. *Child Dev, 73*(1), 35–46. <https://doi.org/10.1111/1467-8624.00390>
- Rodriguez-Gomez, D. A., & Talero-Gutiérrez, C. (2022). Effects of music training in executive function performance in children: A systematic review. *Frontiers in Psychology, 13*, 968144.

- Rolls, E. T. (2014). Emotion and decision-making explained: a précis. *Cortex*, *59*, 185–193.
- Rolls, E. T. (2019). The cingulate cortex and limbic systems for emotion, action, and memory. *Brain Structure and Function*, *224*(9), 3001–3018.
- Rosa, M. G. P., & Tweedale, R. (2005). Brain maps, great and small: lessons from comparative studies of primate visual cortical organization. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *360*(1456), 665–691.
- Rosen, M. L., Sheridan, M. A., Sambrook, K. A., Meltzoff, A. N., & McLaughlin, K. A. (2018). Socioeconomic disparities in academic achievement: A multi-modal investigation of neural mechanisms in children and adolescents. *NeuroImage*, *173*, 298–310.
- Rosenkranz, K., Kacar, A., & Rothwell, J. C. (2007). Differential modulation of motor cortical plasticity and excitability in early and late phases of human motor learning. *Journal of Neuroscience*, *27*(44), 12058–12066.
- Rosenzweig, M. R., & Bennett, E. L. (1996). Psychobiology of plasticity: effects of training and experience on brain and behavior. *Behavioural Brain Research*, *78*(1), 57–65.
- Rubin, K. H., Bukowski, W. M., Parker, J. G., & Bowker, J. C. (2008). Peer interactions, relationships, and groups. *Child and Adolescent Development: An Advanced Course*, 141–180.
- Rupert, D. D., & Shea, S. D. (2022). Parvalbumin-positive interneurons regulate cortical sensory plasticity in adulthood and development through shared mechanisms. *Frontiers in Neural Circuits*, *16*, 886629.

S

- Sanders, A. F. P., Baum, G. L., Harms, M. P., Kandala, S., Bookheimer, S. Y., Dapretto, M., Somerville, L. H., Thomas, K. M., Van Essen, D. C., & Yacoub, E. (2022). Developmental trajectories of cortical thickness by functional brain network: The roles of pubertal timing and socioeconomic status. *Developmental Cognitive Neuroscience*, *57*, 101145.
- Sanes, J. N., & Donoghue, J. P. (2000). Plasticity and primary motor cortex. *Annual Review of Neuroscience*, *23*(1), 393–415.

- Sankoh, A. J., Huque, M. F., & Dubey, S. D. (1997). Some comments on frequently used multiple endpoint adjustment methods in clinical trials. *Statistics in Medicine*, *16*(22), 2529–2542.
- Satterthwaite, F. E. (1946). An Approximate Distribution of Estimates of Variance Components. *Biometrics Bulletin*, *2*(6), 110–114. <https://about.jstor.org/terms>
- Schmaal, L. (2019). Cortical surface area: a potential biological marker for depression onset and poor clinical outcomes? *The Lancet Psychiatry*, *6*(4), 277–279.
- Schmithorst, V. J., & Holland, S. K. (2003). The effect of musical training on music processing: a functional magnetic resonance imaging study in humans. *Neuroscience Letters*, *348*(2), 65–68.
- Schmitt, J. E., Wallace, G. L., Rosenthal, M. A., Molloy, E. A., Ordaz, S., Lenroot, R., Clasen, L. S., Blumenthal, J. D., Kendler, K. S., & Neale, M. C. (2007). A multivariate analysis of neuroanatomic relationships in a genetically informative pediatric sample. *Neuroimage*, *35*(1), 70–82.
- Schnack, H. G., Van Haren, N. E. M., Brouwer, R. M., Evans, A., Durston, S., Boomsma, D. I., Kahn, R. S., & Hulshoff Pol, H. E. (2015). Changes in thickness and surface area of the human cortex and their relationship with intelligence. *Cerebral Cortex*, *25*(6), 1608–1617.
- Schneider, W., Eschman, A., & Zuccolotto, A. (2002). *E-Prime: User's guide*. Psychology Software Incorporated.
- Schultz, B. G., & van Vugt, F. T. (2016). Tap Arduino: An Arduino microcontroller for low-latency auditory feedback in sensorimotor synchronization experiments. *Behavior Research Methods*, *48*(4), 1591–1607.
- Schwarz, G. (1978). Estimating the dimension of a model. *The Annals of Statistics*, 461–464.
- Sedikides, C., & Skowronski, J. J. (1997). The symbolic self in evolutionary context. *Personality and Social Psychology Review*, *1*(1), 80–102.
- Ségonne, F., Pacheco, J., & Fischl, B. (2007). Geometrically accurate topology-correction of cortical surfaces using nonseparating loops. *IEEE Transactions on Medical Imaging*, *26*(4), 518–529.

- Seither-Preisler, A., Parncutt, R., & Schneider, P. (2014). Size and synchronization of auditory cortex promotes musical, literacy, and attentional skills in children. *Journal of Neuroscience*, *34*(33), 10937–10949.
- Shaw, P., Gogtay, N., & Rapoport, J. (2010). Childhood psychiatric disorders as anomalies in neurodevelopmental trajectories. *Human Brain Mapping*, *31*(6), 917–925.
- Shaw, P., Kabani, N. J., Lerch, J. P., Eckstrand, K., Lenroot, R., Gogtay, N., Greenstein, D., Clasen, L., Evans, A., & Rapoport, J. L. (2008). Neurodevelopmental trajectories of the human cerebral cortex. *Journal of Neuroscience*, *28*(14), 3586–3594.
- Sheridan, M. A., Fox, N. A., Zeanah, C. H., McLaughlin, K. A., & Nelson III, C. A. (2012). Variation in neural development as a result of exposure to institutionalization early in childhood. *Proceedings of the National Academy of Sciences*, *109*(32), 12927–12932.
- Sheridan, M. A., & McLaughlin, K. A. (2014). Dimensions of early experience and neural development: deprivation and threat. *Trends in Cognitive Sciences*, *18*(11), 580–585.
- Sheridan, M. A., Peverill, M., Finn, A. S., & McLaughlin, K. A. (2017). Dimensions of childhood adversity have distinct associations with neural systems underlying executive functioning. *Development and Psychopathology*, *29*(5), 1777–1794.
- Sidman, R. L., & Rakic, P. (1973). Neuronal migration, with special reference to developing human brain: a review. *Brain Research*, *62*(1), 1–35.
- Silvers, J. A., Hubbard, A. D., Biggs, E., Shu, J., Fertuck, E., Chaudhury, S., Grunebaum, M. F., Weber, J., Kober, H., & Chesin, M. (2016). Affective lability and difficulties with regulation are differentially associated with amygdala and prefrontal response in women with Borderline Personality Disorder. *Psychiatry Research: Neuroimaging*, *254*, 74–82.
- Silvers, J. A., & Moreira, J. F. G. (2019). Capacity and tendency: A neuroscientific framework for the study of emotion regulation. *Neuroscience Letters*, *693*, 35–39.
- Sled, J. G., Zijdenbos, A. P., & Evans, A. C. (1998). A nonparametric method for automatic correction of intensity nonuniformity in MRI data. *IEEE Transactions on Medical Imaging*, *17*(1), 87–97.

- Snell-Rood, E. C., Davidowitz, G., & Papaj, D. R. (2011). Reproductive tradeoffs of learning in a butterfly. *Behavioral Ecology*, *22*(2), 291–302.
- Snell-Rood, E., & Snell-Rood, C. (2020). The developmental support hypothesis: adaptive plasticity in neural development in response to cues of social support. *Philosophical Transactions of the Royal Society B*, *375*(1803), 20190491.
- Song, C., Sandberg, K., Rutiku, R., & Kanai, R. (2022). Linking human behaviour to brain structure: further challenges and possible solutions. *Nature Reviews Neuroscience*, 1–2.
- Song, C., Schwarzkopf, D. S., Kanai, R., & Rees, G. (2015). Neural population tuning links visual cortical anatomy to human visual perception. *Neuron*, *85*(3), 641–656.
- Sowell, E. R., Thompson, P. M., Leonard, C. M., Welcome, S. E., Kan, E., & Toga, A. W. (2004). Longitudinal mapping of cortical thickness and brain growth in normal children. *Journal of Neuroscience*, *24*(38), 8223–8231.
- Sowiński, J., & Dalla Bella, S. (2013). Poor synchronization to the beat may result from deficient auditory-motor mapping. *Neuropsychologia*, *51*(10), 1952–1963.
- Spinath, B., Freudenthaler, H. H., & Neubauer, A. C. (2010). Domain-specific school achievement in boys and girls as predicted by intelligence, personality and motivation. *Personality and Individual Differences*, *48*(4), 481–486.
- Steele, C. J., Bailey, J. A., Zatorre, R. J., & Penhune, V. B. (2013). Early musical training and white-matter plasticity in the corpus callosum: evidence for a sensitive period. *Journal of Neuroscience*, *33*(3), 1282–1290.
- Steinberg, L. (2005). Cognitive and affective development in adolescence. *Trends in Cognitive Sciences*, *9*(2), 69–74.
- Stewart, L. (2005). A neurocognitive approach to music reading. *Annals of the New York Academy of Sciences*, *1060*(1), 377–386.
- Stiles, J., & Jernigan, T. L. (2010). The basics of brain development. *Neuropsychology Review*, *20*(4), 327–348.
- Storsve, A. B., Fjell, A. M., Yendiki, A., & Walhovd, K. B. (2016). Longitudinal changes in white matter tract integrity across the adult lifespan and its relation to cortical thinning. *PloS One*, *11*(6), e0156770.

- Strelnikov, D., Alijanpourtaghsara, A., Piroska, M., Szalontai, L., Forgo, B., Jokkel, Z., Persely, A., Hernyes, A., Kozak, L. R., & Szabo, A. (2022). Heritability of Subcortical Grey Matter Structures. *Medicina*, *58*(11), 1687.
- Strike, L. T., Hansell, N. K., Couvy-Duchesne, B., Thompson, P. M., de Zubicaray, G. I., McMahon, K. L., & Wright, M. J. (2019). Genetic complexity of cortical structure: differences in genetic and environmental factors influencing cortical surface area and thickness. *Cerebral Cortex*, *29*(3), 952–962.
- Sun, Y., Mensah, F. K., Azzopardi, P., Patton, G. C., & Wake, M. (2017). Childhood social disadvantage and pubertal timing: a national birth cohort from Australia. *Pediatrics*, *139*(6).
- Swagerman, S. C., Brouwer, R. M., de Geus, E. J. C., Hulshoff Pol, H. E., & Boomsma, D. I. (2014). Development and heritability of subcortical brain volumes at ages 9 and 12. *Genes, Brain and Behavior*, *13*(8), 733–742.
- Swaminathan, S., & Schellenberg, E. G. (2018). Musical competence is predicted by music training, cognitive abilities, and personality. *Scientific Reports*, *8*(1), 1–7.

T

- Tamnes, C. K., Herting, M. M., Goddings, A.-L., Meuwese, R., Blakemore, S.-J., Dahl, R. E., Güroğlu, B., Raznahan, A., Sowell, E. R., & Crone, E. A. (2017). Development of the cerebral cortex across adolescence: a multisample study of inter-related longitudinal changes in cortical volume, surface area, and thickness. *Journal of Neuroscience*, *37*(12), 3402–3412.
- Taubert, M., Lohmann, G., Margulies, D. S., Villringer, A., & Ragert, P. (2011). Long-term effects of motor training on resting-state networks and underlying brain structure. *Neuroimage*, *57*(4), 1492–1498.
- Taubert, M., Villringer, A., & Ragert, P. (2012). Learning-related gray and white matter changes in humans: an update. *The Neuroscientist*, *18*(4), 320–325.
- Team, R. C. (2013). R Foundation for Statistical Computing; Vienna, Austria: 2015. *R: A Language and Environment for Statistical Computing*. [Google Scholar].
- Teeuw, J., Brouwer, R. M., Koenis, M. M. G., Swagerman, S. C., Boomsma, D. I., & Hulshoff Pol, H. E. (2019). Genetic influences on the development of cerebral cortical thickness during childhood and adolescence in a Dutch longitudinal twin sample: the brainscale study. *Cerebral Cortex*, *29*(3), 978–993.

- Thijssen, S., Collins, P. F., & Luciana, M. (2020). Pubertal development mediates the association between family environment and brain structure and function in childhood. *Development and Psychopathology*, *32*(2), 687–702.
- Thompson-Schill, S. L., Bedny, M., & Goldberg, R. F. (2005). The frontal lobes and the regulation of mental activity. *Current Opinion in Neurobiology*, *15*(2), 219–224.
- Thompson, P. M., Cannon, T. D., Narr, K. L., Van Erp, T., Poutanen, V.-P., Huttunen, M., Lönngqvist, J., Standertskjöld-Nordenstam, C.-G., Kaprio, J., & Khaledy, M. (2001). Genetic influences on brain structure. *Nature Neuroscience*, *4*(12), 1253–1258.
- Tierney, A. T., & Kraus, N. (2013). The ability to tap to a beat relates to cognitive, linguistic, and perceptual skills. *Brain and Language*, *124*(3), 225–231.
- Tillmann, B., Koelsch, S., Escoffier, N., Bigand, E., Lalitte, P., Friederici, A. D., & von Cramon, D. Y. (2006). Cognitive priming in sung and instrumental music: activation of inferior frontal cortex. *Neuroimage*, *31*(4), 1771–1782.
- Tooley, U. A., Bassett, D. S., & Mackey, A. P. (2021). Environmental influences on the pace of brain development. *Nature Reviews Neuroscience*, *22*(6), 372–384.
- Toth, S. L., Cicchetti, D., MacFie, J., Maughan, A., & Vanmeenen, K. (2000). Narrative representations of caregivers and self in maltreated pre-schoolers. *Attachment & Human Development*, *2*(3), 271–305.
- Tottenham, N., & Sheridan, M. A. (2010). A review of adversity, the amygdala and the hippocampus: a consideration of developmental timing. *Frontiers in Human Neuroscience*, *68*.
- Trainor, L. J. (2005). Are there critical periods for musical development? *Developmental Psychobiology: The Journal of the International Society for Developmental Psychobiology*, *46*(3), 262–278.
- Tregellas, J. R., Davalos, D. B., & Rojas, D. C. (2006). Effect of task difficulty on the functional anatomy of temporal processing. *Neuroimage*, *32*(1), 307–315.
- Trehub, S. E. (2003). The developmental origins of musicality. *Nature Neuroscience*, *6*(7), 669–673.
- Treur, J. L., Boomsma, D. I., Ligthart, L., Willemsen, G., & Vink, J. M. (2016). Heritability of high sugar consumption through drinks and the genetic correlation with substance use. *The American Journal of Clinical Nutrition*, *104*(4), 1144–1150.

Trzesniewski, K. H., Donnellan, M. B., & Robins, R. W. (2003). Stability of self-esteem across the life span. *Journal of Personality and Social Psychology*, *84*(1), 205.

Turner, H. A., Finkelhor, D., & Ormrod, R. (2006). The effect of lifetime victimization on the mental health of children and adolescents. *Social Science & Medicine*, *62*(1), 13–27.

U

Ullén, F., Mosing, M. A., Holm, L., Eriksson, H., & Madison, G. (2014). Psychometric properties and heritability of a new online test for musicality, the Swedish Musical Discrimination Test. *Personality and Individual Differences*, *63*, 87–93.

V

van der Aar, L. P. E., Peters, S., van der Crujisen, R., & Crone, E. A. (2019). The neural correlates of academic self-concept in adolescence and the relation to making future-oriented academic choices. *Trends Neurosci Educ*, *15*, 10–17. <https://doi.org/10.1016/j.tine.2019.02.003>

van der Crujisen, R., Blankenstein, N. E., Spaans, J. P., Peters, S., & Crone, E. A. (2023). Longitudinal self-concept development in adolescence. *Social Cognitive and Affective Neuroscience*, *18*(1), nsac062.

van der Crujisen, R., Peters, S., & Crone, E. A. (2017). Neural correlates of evaluating self and close-other in physical, academic and prosocial domains. *Brain Cogn*, *118*, 45–53. <https://doi.org/10.1016/j.bandc.2017.07.008>

van der Crujisen, R., Peters, S., van der Aar, L. P. E., & Crone, E. A. (2018). The neural signature of self-concept development in adolescence: The role of domain and valence distinctions. *Dev Cogn Neurosci*, *30*, 1–12. <https://doi.org/10.1016/j.dcn.2017.11.005>

van der Meer, L., Costafreda, S., Aleman, A., & David, A. S. (2010). Self-reflection and the brain: a theoretical review and meta-analysis of neuroimaging studies with implications for schizophrenia. *Neuroscience & Biobehavioral Reviews*, *34*(6), 935–946.

- van der Meulen, M., Dobbelaar, S., van Drunen, L., Heunis, S., van IJzendoorn, M. H., Blankenstein, N. E., & Crone, E. A. (2023). Transitioning from childhood into adolescence: A comprehensive longitudinal behavioral and neuroimaging study on prosocial behavior and social inclusion. *NeuroImage*, 120445. <https://doi.org/https://doi.org/10.1016/j.neuroimage.2023.120445>
- van der Meulen, M., Steinbeis, N., Achterberg, M., van IJzendoorn, M. H., & Crone, E. A. (2018). Heritability of neural reactions to social exclusion and prosocial compensation in middle childhood. *Developmental Cognitive Neuroscience*, 34, 42–52.
- van der Meulen, M., Wierenga, L. M., Achterberg, M., Drenth, N., van IJzendoorn, M. H., & Crone, E. A. (2020). Genetic and environmental influences on structure of the social brain in childhood. *Developmental Cognitive Neuroscience*, 44, 100782.
- van Drunen, L., Dobbelaar, S., van der Cruijssen, R., van der Meulen, M., Achterberg, M., Wierenga, L. M., & Crone, E. A. (2021). The nature of the self: Neural analyses and heritability estimates of self-evaluations in middle childhood. *Human Brain Mapping*.
- van Drunen, L., Schultz, B. G., Becht, A. I., Schaefer, R. S., & Wierenga, L. M. (n.d.). How Music Alters Brain Plasticity: A Longitudinal Twin Study on Sensorimotor Synchronization and Brain Developmental Patterns. *Available at SSRN 4415030*.
- van Drunen, L., Toenders, Y. J., Wierenga, L. M., & Crone, E. A. (2023). Effects of COVID-19 pandemic on structural brain development in early adolescence. *Scientific Reports*, 13(1), 5600.
- Van Overwalle, F. (2011). A dissociation between social mentalizing and general reasoning. *Neuroimage*, 54(2), 1589–1599.
- Van Overwalle, F., & Baetens, K. (2009). Understanding others' actions and goals by mirror and mentalizing systems: a meta-analysis. *Neuroimage*, 48(3), 564–584.
- van Soelen, I. L. C., Brouwer, R. M., Peper, J. S., van Leeuwen, M., Koenis, M. M. G., van Beijsterveldt, T. C. E. M., Swagerman, S. C., Kahn, R. S., Pol, H. E. H., & Boomsma, D. I. (2012). Brain SCALE: brain structure and cognition: an adolescent longitudinal twin study into the genetic etiology of individual differences. *Twin Research and Human Genetics*, 15(3), 453–467.

- van Soelen, I. L. C. van, Brouwer, R. M., van Baal, G. C. M., Schnack, H. G., Peper, J. S., Collins, D. L., Evans, A. C., Kahn, R. S., Boomsma, D. I., & Pol, H. E. H. (2012). Genetic influences on thinning of the cerebral cortex during development. *Neuroimage*, *59*(4), 3871–3880.
- van Vugt, F. T. (2020). The TeensyTap Framework for Sensorimotor Synchronization Experiments. *Advances in Cognitive Psychology*, *16*(4), 302.
- Vaquero, L., Hartmann, K., Ripollés, P., Rojo, N., Sierpowska, J., François, C., Càmarà, E., van Vugt, F. T., Mohammadi, B., & Samii, A. (2016). Structural neuroplasticity in expert pianists depends on the age of musical training onset. *Neuroimage*, *126*, 106–119.
- Verhulst, B. (2017). A power calculator for the classical twin design. *Behavior Genetics*, *47*(2), 255–261.
- Verweij, K. J. H., Mosing, M. A., Zietsch, B. P., & Medland, S. E. (2012). Estimating heritability from twin studies. In *Statistical human genetics* (pp. 151–170). Springer.
- Vicente, A. F., Bermudez, M. A., del Carmen Romero, M., Perez, R., & Gonzalez, F. (2012). Putamen neurons process both sensory and motor information during a complex task. *Brain Research*, *1466*, 70–81.
- Vijayakumar, N., Mills, K. L., Alexander-Bloch, A., Tamnes, C. K., & Whittle, S. (2018). Structural brain development: A review of methodological approaches and best practices. *Developmental Cognitive Neuroscience*, *33*, 129–148.
- Voss, P., & Zatorre, R. J. (2012). Occipital cortical thickness predicts performance on pitch and musical tasks in blind individuals. *Cerebral Cortex*, *22*(11), 2455–2465.

W

- Wan, C. Y., & Schlaug, G. (2010). Music making as a tool for promoting brain plasticity across the life span. *The Neuroscientist*, *16*(5), 566–577.
- Watanabe, D., Savion-Lemieux, T., & Penhune, V. B. (2007). The effect of early musical training on adult motor performance: evidence for a sensitive period in motor learning. *Experimental Brain Research*, *176*(2), 332–340.
- Werker, J. F., & Hensch, T. K. (2015). *Critical periods in speech perception: new directions*.

- Whittle, S., Lichter, R., Dennison, M., Vijayakumar, N., Schwartz, O., Byrne, M. L., Simmons, J. G., Yücel, M., Pantelis, C., & McGorry, P. (2014). Structural brain development and depression onset during adolescence: a prospective longitudinal study. *American Journal of Psychiatry*, *171*(5), 564–571.
- Whittle, S., Pozzi, E., Rakesh, D., Kim, J. M., Yap, M. B. H., Schwartz, O. S., Youssef, G., Allen, N. B., & Vijayakumar, N. (2022). Harsh and inconsistent parental discipline is associated with altered cortical development in children. *Biological Psychiatry: Cognitive Neuroscience and Neuroimaging*, *7*(10), 989–997.
- Whittle, S., Vijayakumar, N., Simmons, J. G., & Allen, N. B. (2020). Internalizing and externalizing symptoms are associated with different trajectories of cortical development during late childhood. *Journal of the American Academy of Child & Adolescent Psychiatry*, *59*(1), 177–185.
- Wierenga, L., Langen, M., Ambrosino, S., van Dijk, S., Oranje, B., & Durston, S. (2014). Typical development of basal ganglia, hippocampus, amygdala and cerebellum from age 7 to 24. *Neuroimage*, *96*, 67–72.
- Wierenga, L. M., Bos, M. G. N., Schreuders, E., vd Kamp, F., Peper, J. S., Tamnes, C. K., & Crone, E. A. (2018). Unraveling age, puberty and testosterone effects on subcortical brain development across adolescence. *Psychoneuroendocrinology*, *91*, 105–114.
- Wierenga, L. M., Doucet, G. E., Dima, D., Agartz, I., Aghajani, M., Akudjedu, T. N., Albajes-Eizagirre, A., Alnæs, D., Alpert, K. I., & Andreassen, O. A. (2022). Greater male than female variability in regional brain structure across the lifespan. *Human Brain Mapping*, *43*(1), 470–499.
- Wierenga, L. M., Langen, M., Oranje, B., & Durston, S. (2014). Unique developmental trajectories of cortical thickness and surface area. *Neuroimage*, *87*, 120–126.
- Wierenga, L. M., Ruigrok, A., Aksnes, E. R., Barth, C., Beck, D., Burke, S., Crestol, A., van Drunen, L., Ferrara, M., & Galea, L. A. M. (2023). Recommendations for a better understanding of sex and gender in neuroscience of mental health. *Biological Psychiatry Global Open Science*, 100283.
- Will, G.-J., Crone, E. A., & Güroğlu, B. (2015). Acting on social exclusion: neural correlates of punishment and forgiveness of excluders. *Social Cognitive and Affective Neuroscience*, *10*(2), 209–218.

- Winkler, A. M., Kochunov, P., Blangero, J., Almasy, L., Zilles, K., Fox, P. T., Duggirala, R., & Glahn, D. C. (2010). Cortical thickness or grey matter volume? The importance of selecting the phenotype for imaging genetics studies. *Neuroimage*, *53*(3), 1135–1146.
- Wolff, M., Morceau, S., Folkard, R., Martin-Cortecero, J., & Groh, A. (2021). A thalamic bridge from sensory perception to cognition. *Neuroscience & Biobehavioral Reviews*, *120*, 222–235.
- Woon, F. L., & Hedges, D. W. (2008). Hippocampal and amygdala volumes in children and adults with childhood maltreatment-related posttraumatic stress disorder: A meta-analysis. In *Hippocampus* (Vol. 18, Issue 8, pp. 729–736). Wiley Online Library.

Y

- Ybrandt, H. (2008). The relation between self-concept and social functioning in adolescence. *Journal of Adolescence*, *31*(1), 1–16.
- Yoon, U., Fahim, C., Perusse, D., & Evans, A. C. (2010). Lateralized genetic and environmental influences on human brain morphology of 8-year-old twins. *Neuroimage*, *53*(3), 1117–1125.
- Yoon, U., Perusse, D., Lee, J.-M., & Evans, A. C. (2011). Genetic and environmental influences on structural variability of the brain in pediatric twin: deformation based morphometry. *Neuroscience Letters*, *493*(1–2), 8–13.
- Yuan, M., Li, Y., Yang, Y., Xu, J., Tao, F., Zhao, L., Zhou, H., Pinheiro, J., & Xu, X. S. (2020). A novel quantification of information for longitudinal data analyzed by mixed-effects modeling. *Pharmaceutical Statistics*.

Z

- Zatorre, R. J., Chen, J. L., & Penhune, V. B. (2007). When the brain plays music: auditory–motor interactions in music perception and production. *Nature Reviews Neuroscience*, *8*(7), 547–558.
- Zendel, B. R., Willoughby, K. A., & Rovet, J. F. (2013). Neuroplastic effects of music lessons on hippocampal volume in children with congenital hypothyroidism. *Neuroreport*, *24*(17), 947–950.

Zhou, H.-X., Chen, X., Shen, Y.-Q., Li, L., Chen, N.-X., Zhu, Z.-C., Castellanos, F. X., & Yan, C.-G. (2020). Rumination and the default mode network: Meta-analysis of brain imaging studies and implications for depression. *Neuroimage*, *206*, 116287.

LIST OF PUBLICATIONS
(PUBLICATIE LIST)

LIST OF PUBLICATIONS (PUBLICATIE LIJST)

Published:

Wierenga, L. M., Ruigrok, A., Aksnes, E. R., Barth, C., Beck, D., Burke, S., **van Drunen, L.** ... & Bos, M. G. N. (2023). Recommendations for a better understanding of sex and gender in neuroscience of mental health. *Biological Psychiatry Global Open Science*, 100283.

van Drunen, L., Toenders, Y. J., Wierenga, L. M., & Crone, E. A. (2023). Effects of COVID-19 pandemic on structural brain development in early adolescence. *Scientific Reports*, 13(1), 5600.

van der Meulen, M., Dobbelaar, S., **van Drunen, L.**, Heunis, S., Blankenstein, N. E., & Crone, E. A. (2023). Transitioning from childhood into adolescence: A comprehensive longitudinal behavioral and neuroimaging study on prosocial behavior and social inclusion. *NeuroImage*, 120445.

Dobbelaar, S., Achterberg, M., **van Drunen, L.**, van Duijvenvoorde, A. C., van IJzendoorn, M. H., & Crone, E. A. (2022). Development of social feedback processing and responses in childhood: an fMRI test-replication design in two age cohorts. *Social Cognitive and Affective Neuroscience*, nsac039.

van Drunen, L., Dobbelaar, S., van der Cruijssen, R., van der Meulen, M., Achterberg, M., Wierenga, L. M., & Crone, E. A. (2021). The nature of the self: Neural analyses and heritability estimates of self- evaluations in middle childhood. *Human Brain Mapping*, 42(17), 5609-5625.

Crone, E. A., Achterberg, M., Dobbelaar, S., Euser, S., van den Bulk, B., van der Meulen, M., **van Drunen, L.**, ... & van IJzendoorn, M. H. (2020). Neural and behavioral signatures of social evaluation and adaptation in childhood and adolescence: the Leiden consortium on individual development (L-CID). *Developmental cognitive neuroscience*, 45, 100805.

In revision:

Crone, E.A., & **van Drunen, L.** (2024). Development of self-concept in childhood and adolescence: How neuroscience can inform theory and vice versa.

van Drunen, L., Schultz, B. G., Becht, A. I., Schaefer, R. S., & Wierenga, L. M. (2024). Brain development and musical skills: A longitudinal twin study on brain developmental trajectories and sensorimotor synchronization.

van Drunen, L., Dobbelaar, S., Crone E.A., Wierenga, L.W. (2024). Genetic and environmental influences on structural brain development from childhood to adolescence: A longitudinal twin study on cortical thickness, surface area, and subcortical volume.

Dobbelaar, S., **van Drunen, L.**, van Duijvenvoorde, A.C.K., van IJzendoorn, M.H., Crone, E.A., & Achterberg, M. (2024). Transitions in social adaptation from childhood to adolescence: developmental patterns, neural correlates, and precursors of wellbeing.

Wierenga, L., Zabihi, M., **van Drunen, L.**, van der Meulen, M., Achterberg, M., Rutherford, S., ... & Crone, E. A. (2024). Understanding vulnerability through variability: a longitudinal twin study linking sex differences in neurodiversity, neurodevelopment, and X-linked genetic mechanisms.

CURRICULUM VITAE

CURRICULUM VITAE

Lina van Drunen was born on April 6th, 1992, in Amsterdam, the Netherlands. After graduating from secondary school (Vossius Gymnasium, Amsterdam) in 2010, she went to the University of Amsterdam to study neuroscience. Lina obtained her Bachelor's degree in Psychobiology in 2016 and her Research Master's degree in Cognitive Neurobiology and Clinical Neurophysiology in 2019. During her first Master internship, Lina worked as a research intern at the Clinical Neurophysiology department, Amsterdam University Medical Centre, where she accumulated expertise in employing Deep Brain Stimulation for individuals with Parkinson's Disease. During the second year of her Masters, she joined the Brain and Development Research Center as part of the Leiden Consortium on Individual Development (L-CID) at Leiden University where she acquired her initial experience with developmental neuroscience in children. Pursuing her interest in developmental neuroscience, Lina started her PhD project in 2019 as part of L-CID at Leiden University under supervision of Prof. dr. Eveline Crone and dr. Lara Wierenga. In her project, she focused on individual differences in genetic and environmental effects on brain development in children and early adolescents using a large longitudinal twin-design. Starting in 2020, Lina also became a member of the Youth and Neuroscience Connected (SYNC) lab at Erasmus University Rotterdam. She will continue her research line on developmental neuroscience as a post-doctoral researcher at Erasmus University Rotterdam. Besides feeling the rush of science, she gets her adrenaline from playing several sports on a high level. For years, Lina played as a professional field hockey player on a national and international level including winning the National Championships in 2009 and two times the European Championships under 16 and 18 in 2008 and 2009.