Segmental duplications as a source of innovation in brain development

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Chapter 8

Curriculum Vitae

Acknowledgements

About the author

Curriculum Vitae

Publications:

Gerrald A. Lodewijk, Diana P. Fernandes, Iraklis Vretzakis, Jeanne E. Savage, Frank M.J. Jacobs. **Evolution of human brain-size associated *NOTCH2NL* genes proceeds towards reduced protein levels.** Molecular Biology and Evolution, 2020. DOI: 10.1093/molbev/msaa104

Grace Farmiloe*, **Gerrald A. Lodewijk***, Stijn F. Robben*, Elisabeth J. van Bree, Frank M.J. Jacobs. **Widepread correlation of KRAB zinc finger protein binding with brain-developmental gene expression patterns.** Philosophical Transactions of the Royal Society B, 2020. DOI: 10.1098/rstb.2019.0333 **Shared first authors.*

Ian T. Fiddes*, **Gerrald A. Lodewijk***, Meghan Mooring, Colleen M. Bosworth, Adam D. Ewing, Gary L. Mantalas, Adam M. Novak, Anouk van den Bout, Alex Bishara, Jimi L. Rosenkrantz, Ryan Lorig-Roach, Andrew R. Field, Maximilian Haeussler, Lotte Russo, Aparna Bhaduri, Tomasz J. Nowakowski, Alex A. Pollen, Max L. Dougherty, Xander Nuttle, Marie-Claude Addor, Simon Zwolinski, Sol Katzman, Arnold Kriegstein, Evan E. Eichler, Sofie R. Salama, Frank M.J. Jacobs, David Haussler. **Human-specific *NOTCH2NL* genes affect Notch signaling and cortical neurogenesis.** Cell, 2018, Vol 173, Issue 6, pp: 1356-1369. DOI: 10.1016/j.cell.2018.03.051 **Shared first authors.*

Michael E. Coulter*, Cristina Dorobantu*, **Gerrald A. Lodewijk***, François Delalande, Sarah Cianferani, Vijay Ganesh, Richard Smith, Elaine T. Lim, C. Shan Xu, Song Pang, Eric T. Wong, Hart G.W. Lidov, Monica L. Calicchio, Edward Yang, Dilenny M. Gonzalez, Thorsten Schlaeger, Ganesh Mochida, Harald Hess, Wei-Chung Allen Lee, Maria K. Lehtinen, Tomas Kirchhausen, David Haussler, Frank M.J. Jacobs, Raphael Gaudin, Christopher A. Walsh. **The ESCRT-III protein CHMP1A mediates secretion of sonic hedgehog on a novel class of extracellular vesicles.** Cell Reports, 2018, Vol 24, Issue 4, pp:973-986. DOI: 10.1016/j.celrep.2018.06.100 **Shared first authors.*

Manuscripts in preparation:
Gerrald A. Lodewijk, Matthijs de Geus, Rita L.F.P. Guimarães, Frank M.J. Jacobs. **A novel KRAB zinc finger gene has changed the balance of *HES1* autoregulation during primate evolution.** In preparation.

Presentations & Awards:
2019 – Oral presentation (**top paper award**): Dutch Neuroscience Meeting (Lunteren, The Netherlands)
2019 – Oral presentation: SILS Research Day (Amsterdam, The Netherlands)
2018 – Oral presentation (**best presentation award**): SILS Research Day (Amsterdam, The Netherlands)
2018 – Poster presentation: Cortical Evolution Conference (Las Palmas de Gran Canaria, Spain).
2018 – Poster presentation: Keystone Mobile Genetic Elements & Genome Plasticity (Santa Fe, USA).
2017 – Poster presentation: Amsterdam Neuroscience annual meeting (The Netherlands).
2016 – Poster presentation: American Society for Human Genetics conference (Vancouver, Canada).
2016 – Poster presentation (**best poster award**): Amsterdam Neuroscience kick-off meeting (The Netherlands).
2016 – Oral presentation: Dutch Neuroscience meeting (Lunteren, The Netherlands).
2013 – Awarded study / travel grants for internship at University of California Santa Cruz:

Hendrik Muller Fonds
Fundatie van Renswoude
Stichting de Korinthiërs
David de Wied stichting
Prinses Beatrix spierfonds (respectfully declined)

Education & Research Experience:

2014 – 2019: PhD student at University of Amsterdam, Swammerdam Institute for Life Sciences.

Molecular Neuroscience lab under supervision of Associate Professor Dr. Frank Jacobs (co-promotor, daily supervisor) and Professor Dr. Marten Smidt (promotor).

> Tracing the origins of specific gene duplications in primate genomes. Functional characterization of several new genes acquired during primate evolution, via organoid models and cell / molecular assays.

2011 – 2014: MSc Neuroscience & Cognition, Experimental and Clinical Neuroscience track.

Utrecht University

2013: Internship, 6 months: Examination of autism genes in cortical organoid models of human and rhesus monkey stem cells.

> Group of Professor Dr. David Haussler, Center for Biomolecular Science and Engineering, University of California Santa Cruz.

2012: Internship, 10 months: Characterization of the autism-linked genes Contactin Associated Protein-Like 2 and Contactin-6.

> Group of Professor Dr. Peter Burbach, Brain Center Rudolf Magnus, University Medical Center Utrecht.

2008 – 2011: BSc Biomedical Sciences.

Utrecht University

2011: Internship, 4 months: Identification of heteroclite RNA genomes in the Porcine Respiratory and Reproductive Syndrome Virus.

> Group of Professor Dr. P.J.M. Rottier, Virology Division, Faculty of Veterinary Sciences, Utrecht University.

Trainees:
Matthijs de Geus, MSc student, 04/2019 – 12/2019. Investigating DNA sequences required for KRAB zinc-finger proteins binding to degenerate DNA motifs. Regulatory effects of ZNF675 binding on the *HES1* promoter.

Violeta Méndez Ovares, MSc, 11/2018 – 12/2018. Regulatory elements in the *HES1* promoter.

Iraklis Vretzakis, MSc student. 02/2018 – 07/2018. Characterization of *NOTCH2NL* genes in Neanderthals, Denisovans and archaic humans.

Rita Guimarães, MSc student. 09/2017 – 07/2018. The impact of KZNF and transposon evolution on gene promoter regulation.

Stijn Robben, BSc student. 02/2017 – 06/2017. The evolution of C2H2 zinc fingers and their role in shaping primate-specific gene regulatory pathways.

Lotte Russo, MSc student. 01/2017 – 10/2017. Protein-protein interactions of *NOTCH2NL*.

Judith Roels, MSc student. 12/2016 – 10/2017. Targeted activation and silencing of specific retrotransposon-derived lncRNAs using dCas9 epigenome editing.

Diana Pereira Fernandes, MSc student. 01/2016 – 10/2016. The role of primate-specific retrotransposons in regulating disease-associated gene expression in the human brain

Cristina Delgado Sallent, BSc student. 02/2016 – 06/2016. Differentiation of NTERA2 cells into neurons as a model for aging neurons

Anouk van den Bout, MSc student. 12/2014 – 10/2015. Evolutionary genetics of *NOTCH2NL* genes in humans and primates.

Teaching:
2018 – Guest lecture for Human Genome Biology and Evolution, MSc course
2017 – Guest lecture for Human Genome Biology and Evolution, MSc course
2016 – Teaching assistant for 1 month. Molecular Techniques, BSc course
2015 – Teaching assistant for 1 month. Molecular Techniques, BSc course

Other activities:
2014 – 2018: Member of the SILS PhD - Postdoc council at University of Amsterdam
2017 – 2018: Chair
2014 – 2018: Organization events and seminars

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First of all, **Frank**, this journey started in 2013 when I first joined you as an intern during your postdoctoral work at UCSC. Despite some initial struggles, where I may have enjoyed Santa Cruz student life a bit more rather than working on my internship, I feel like I became fully involved when I became part of the NOTCH2NL project in the last 2 months. Shortly after this you invited me to become a PhD student in your starting lab in Amsterdam. While I wasn't sure about jumping into a PhD program right away, you convinced me to join and I think that was a great decision. On the scientific part, we were able to do some incredible work and spent many days and nights discussing our results and future directions. I still remember the excitement finding out about the weird chimp/gorilla NOTCH2NL fusion genes in a midnight email conversation, the initial ZNF675 reporter assay results and their link with DNA motifs found in retrotransposons, as well as the rollercoaster ride that was the NOTCH2NL follow-up story, which ended up quite different from our initial plans. You have always been very supportive and involved in my personal development in a professional way. My outlook on life has changed quite dramatically in the first years of my PhD and with the help of you and other lab members (who will be mentioned below) I was able to overcome some of the personal hardships that I was struggling with. Over time, the lab expanded and you managed to attract a number of diverse, excellent PhD students and interns, which resulted in the expansion of research lines. We were also able to go on many lab outings and adventures, although I'm not quite sure why you missed out on the first unofficial Jacobs lab trip. There are too many moments to describe here, but some that stand out are camping by natural hot springs in the backcountry of Los Padres National Forest, taking the whole lab to a conference in Santa Fe, NM, the many campfire gatherings, and getting offered a 20 euro donation for our research by a random drunk person at a night on Terschelling. You also offered me plenty of advice for the next steps in my career and helped me get connected for several potential postdoc positions. I ended up in Santa Cruz again, joining another starting lab. Now that I've experienced a bit of the academic work life and making my first steps in my postdoctoral work, I see the many challenges a starting lab faces and

I think you did a great job in the last few years to get your lab up and running, working on a range of research lines. In my opinion, your enthusiasm for science and ability to motivate people for exciting research topics are your biggest strengths. Leveraging this, together with a supportive work environment in the lab, I am sure you will be able to continue doing cool and exciting stuff in science.

Marten, as my promotor, this work could not have made it without you. Although I was mainly supervised by Frank (maybe I should have asked your advice more often too), we have discussed research at the coffee table or during lab meetings many times. Being part of your research group has shown me early on the importance of building a team of scientists that work well together. You value lab and institute social events and your involvement in drinks and lab outings were always great fun.

Thanks to the committee who read and evaluated this thesis.

Next, all fellow Jacobs lab members:

Nina, you joined a few months after me and managed to get your degree before me. I could not have asked for a better partner in crime in our PhD journey. Your support has been invaluable to my success and personal development. I felt secure sharing things with you and you were always there for me when I needed it the most. I enjoyed the many coffee/tea breaks, dinners together talking about science and non-science topics. I admire your ability to communicate on both a personal and professional level. You always are able to ask the right questions in a direct but respectful way. Also, you were great to work with in the lab and I think you did many experiments with care and precision. I wish all the best to you and your family and hope you will enjoy your new career choice.

Anouk, the first student and together with Nina we formed the Jacobs lab 1.0. Together we have worked on solving some of the mysteries regarding NOTCH2NL gene evolution. These good early days were characterized by the occasional late night drinks and next day breakfast. With Jacobs lab 1.0 we also had a fun trip to Terschelling and barely making it back in my breaking down car. After this you went to UCSC (twice) and worked for some time at the AMC. Despite your busy and

unpredictable schedule, I appreciate the times we were able to meet up. It was always fun to catch up again, usually together with Nina too, over dinner or drinks.

Diana, the second student under my supervision and you have done so much work during your internship. I was also impressed by how much you involved thinking about project directions and new ideas. Your many questions kept me on the top of my game too, so I feel like I also made some important steps in my academic development during this time. Naturally, I was very happy to hear you were joining the lab again as a PhD student. You have the mindset and skills to become an excellent scientist and I hope to see a lot of cool and exciting stuff from your current and future work. If in the odd case the academic career doesn't work out, that tequila-taco bar with alpaca farm in Mexico sounds like a very good plan B.

Cristina, Erasmus student and macumba party aficionado who joined us for a couple months. Though I heard most of the party gossip via Diana, including your kleptomaniac relationship with inflatable decorations at the macumba events, I remember running into each other during a random night in the city, making the wise choice to move our next-day morning meeting into the afternoon.

Elise, the first intern to become Jacobs lab PhD student (no.3), you were assigned with the difficult task to tackle some new bioinformatics and genetics questions. You have taken big steps in your professional development and I hope to see your PhD work finished soon too. You also were there to provide a listening ear and to help people with anything problems they were facing. Thanks for also giving us plenty of tips to stay physically fit, like suggesting to do push-ups during incubation steps, but also in joining more practical efforts such as the summer ultimate frisbee, running motivation and bouldering nights.

Elias, it was good to have someone else coming from the rural parts of The Netherlands in the lab. Together we could annoy the lab by playing some classic Dutch songs from the pirate radio Olympia and requested some of our personal favorites (later joined by Matthijs too). You let me use the VW van for an amazing post-PhD trip to Portugal, ending with meeting up in Porto for a weekend (also with Stephanie). You were able to present your work (including alternative DNA structures) in a catchy way, and besides the science also an overall enthusiastic person with diverse interests.

Grace, the new zinc finger army master. It was refreshing to have someone with a different academic background in the lab. Thanks for taking the time and effort to improve and complete the now published zinc finger paper. I'm excited for the follow-up work that will be coming out. As a fellow boulderer, it was very helpful to learn from someone with a skill level just above mine and going for the occasional pre-lab meeting or evening climb was a great way to wind down from the always busy science part.

Judith, with you (and Lotte) around, I was always fearful of an unexpected glitter or cinnamon attack after the events of the christmas lunch party. In the lab, you continued in part on a project where Diana left off and did an excellent job teasing out some of the remaining questions. You are now also a PhD student in the Jacobs lab working on a very interesting project.

Lotte, part of the duo (with Judith) who were always looking for me and asking questions. I honestly don't think I actively tried to hide / avoid you (as displayed in the excellent movie you made for me at the end of your internships), but thanks for being patient as I was maybe taking on a bit more than I should have at the time. Thanks for your contribution to the NOTCH2NL work on which you became co-author. Also including Stijn, we were running our mini lab within the Jacobs lab and it was a great learning experience to juggle around supervising each of your projects.

Stijn, You came at exactly the right time when we needed to delve deeper into some computational approaches for sequencing data analysis. It was great to instruct you in a small part of the day and you would be able to continue working and problem solving on your own, while I had my hands full with my other student interns working in the lab at the same time (Judith, Lotte). Your objective look on the questions and results, and your calm demeanor made it very pleasant to work with you. It was also nice to see you getting fully involved in this project and as a result you are now a well-deserved co-first author on the publication that incorporated much of your work. Although you have taken a step away from fundamental science, I'm confident your talents will be appreciated in your new career directions too.

Rita, we spent a lot of time hanging out around the lab, with a beer or wine, usually with some other people too. I will cherish the koala hugs and chin photos. Many of these were received at the NOTCH2NL paper celebration party and those became common things throughout events after this. You have also contributed a lot of excellent work to the zinc finger chapter using a wide variety of methods. Thanks for naming me the best supervisor in the world (in the universe). #notthebeer.

Iraklis, you have worked on the initial experiments of the NOTCH2NL follow-up story. We couldn't believe some of the weird results we were seeing using specific gene variants, so we made you repeat and double check a lot of experiments. You were in the lab around the same time as Rita and I fondly think back to the amazing summer time we have experienced. You also got me a free ticket / tour to the Amsterdam lookout resulting in a great photo memory (with Rita too). Thanks for being an overall chill, patient and kind-hearted person, and thanks for your contribution to the first steps in this now published story.

Violeta, you joined us for gaining more experience on molecular biology techniques while also looking for a new position. Although you left a bit earlier than expected, for the good reason to see family again after a couple years, you are a very social person and it was nice to have you around.

Matthijs. Returning to Molecular Neuroscience after a previous visit during your bachelor's degree. You have done an excellent job working between a computational and a wet lab project. The latter has resulted in some exciting data that we are preparing to publish. Part of that you were doing while I was staying in an apartment in the foothills of Valais, Switzerland, working on finishing this thesis. I'm grateful you continued to work in a very independent way to complete the necessary replication experiments, which are now an important part of our paper. You were also a great fit with people in the lab and I'm sure we all remember your cheesy / dad jokes, country music and general shenanigans.

Gonzalo, finally the Jacobs lab got its own technician. It was a long time coming, but it finally happened. Though I didn't have much time to make use of your skills, I'm confident your work will be a useful addition to the lab.

Miranda, the first Jacobs lab postdoc. Too bad you weren't able to stick around for longer, but thanks for all your contributions intellectually to our research projects and in general being a social, supportive person.

The original Molecular Neuroscience people. You have been around since the start and welcomed me to the lab. Unfortunately that also meant many of you finished your PhD within the first 2 years after I joined. Nonetheless I feel like we shared some good times and I was able to learn a lot from you. **Ricardo** a.k.a. de Paap and lab Casanova. You introduced me to the SILS PhD council and taught me the ways of organizing the seminar drinks / snacks. A highly regarded position, as people generally like the person who brings them free beer and snacks. Besides being a party animal in the early days, we also had some fun board game nights to mix that up a little. **Willemieke**, probably the biggest fan of club Nasty and I'm happy to have taken part in several nights out there. You also provided me with a temporary housing solution (actually a stone's throw from the Rembrandt square) when I moved out of my first Amsterdam house. I had some more trouble finding housing after and it still a running joke me being homeless or sleeping under the bridge. **Erik**, likely one of the most creative and most talking people I met in science. We've had some great discussions over dinner at Maslow or Oerknal in the prime time lab work days. Your monkey dance is unequaled. **Iris**, you have always taken such good care of lab members (including me) and provided a lot of mental support. You also brightened up the lab with random weird stuff. Thanks for taking me out to various concerts and dinners (many times also including Lars v O too). **Simone**, part of the early morning crew and showing me a lesson in planning and efficiency. Glad to see you can continue doing science at the UvA with your new position there. **Lars v O**, without you the lab would soon be in a general state of dysfunction. Besides taking care of some essential equipment and reagents, fixing things that the interns broke again, you also (tried) to make sure people wouldn't make a mess and keep things organized. As mentioned before, I joined you on several concerts and dinners with other lab mates. I appreciate the helpful and social nature you maintained, as so many people come and go during their PhD or internship programs.

Marco, we have had plenty of discussions regarding brain development and evolution. While generally supportive and trying to think along with others' research lines, you also have the skill to annoy virtually anybody. You too were part of the

2018 USA wilderness and hot springs camping adventure, as well as the cortical evolution meeting in the same year.

Lars vd H, always great to see another coffee addict. Your down to earth nature was a refreshing experience in the sometimes crazy academic world. You aim to train your lab members in a very meticulous way and I respect the attention to detail in your research. It was nice to see you around often at drinks and your dark humor was great entertainment.

Newer Molecular Neuroscience people. **Cindy**, your energetic character can make anyone smile. It was so nice when you came in early and made the morning coffee, so I could enjoy a cup right away. Also, together with Lars v O, you were important for general upkeep of the lab and getting people together for social events. **Swip**, a.k.a. the Walking Wikipedia, Discodip and The Flash (when there is food nearby). Also my across the desk neighbor in the office. Your weird humor and kind personality were greatly appreciated. Thanks also for assisting me and Mathijs in important experiments at the end of my PhD. **Eddy**, the Molecular Neuroscience western blot master. I've tried many times and mine still never come out as good. We share a passion for snacks (plenty of Facebook tags finding the best snack creations) and Dutch rap songs of questionable taste (de leven, het land van). You also look too good dressed up as a woman. The best worst moment was the struggle getting back at the cold night from a party, through the snow on only one bike, which probably took almost 2 hours instead of 30 minutes. **Jesse**, your name got the best theme song (along the tune of atje voor de sfeer or KC & the sunshine band, depending on your musical taste). **Erik**, the local guy and together with Jesse the Macrobian duo. The three of you in the protein lab (with Eddy and Jesse) make a very interesting group with quite diverse personalities and interests. With the recent addition of **Reinofke**, I have no doubt that will continue.

Everyone from the SILS PhD / Postdoc council. We have been able to organize many seminars, symposia and other events. Special shout out to **Anoeska** for being a great chair and promoting and taking part in social events. You also were important for our lab in pioneering and sharing CRISPR-Cas9 methods. Your current role as an assistant manager should be a good way to keep council and administration connections close.

Members from the other Neuroscience groups, who were usually well-represented during post-seminar drinks, a quick shout out to everyone there. From the Lucassen lab: **Gideon**, **Niek**, **Jorine**, **Janssen**, **Kitty, Sylvie R, Maralinde, Kit-Yi, Hui, Pascal, Sylvie L, Eva, Lianne H and Marijn.** Pennartz lab: **Conrado, Jean, Tom, Julien, Guido, Matthijs, Lianne K, Judith, Angelica, Paul, Reinder and Mariel**. Wadman lab: **Janske, Cato, Dmitri, Tamar and Lana**. Kessels lab: **Daniel, Aile, Niels R**. Also from the other departments within SILS: **Ruy, Till, Rachid, Niels N, Edward, Daphne, Terrens, Eike, Elisa, Katrin, Yorick** and I'm sure I may have missed out on quite some people on this list. Thanks all for making the SILS a fun and social working environment. We have done so many fun things in and outside of the lab and I will miss you all.

The first mentors who taught me a wide variety of experimental techniques during my 2012 internship: **Peter**, **Amila** and the rest of the lab at the RMI in Utrecht, you were foundational in my passion for studying brain development and my first real footsteps into science.

My high school friends (VWO bier), **Freek**, **Merijn**, **Jelle**, **Wessel**, **Jan-Willem**, **Folkert** & co. We have been meeting regularly for drinks on various occasions and it is great to see everyone progressing in their life on different routes and the challenges you have overcome. The annual carbide-shooting event on December 31st has become quite notorious with the city people in Amsterdam. I hope we can keep this tradition going and continue to keep up with each other for many years to come.

Housemates in Diemen, who I spent about 3-4 living together with: **Rikardo**, **Hugo** and **Anna**. While I did spend many nights in my room working on science things, you were able to draw me out for watching some movies, series or football, as well as the occasional dinner (some great Peruvian and Italian recipes), bbq, restaurant visit and pisco sour events. Hugo and Rikardo, I have fond memories of you playing FIFA together and hearing your curses and laughter throughout the house. Anna, you led a very active lifestyle, which also inspired me to explore new directions in sports / physical training.

Housemates in Santa Cruz: **Scott**, **Stephanie**, **Maria**, **John** and **Tiffany**. You have been such a great company to get through the current challenges in the COVID19

world when I moved to Santa Cruz, while arranging the “final final” bits in the completion of my PhD. The many activities you got me involved in have been so much fun and I’m grateful to be part of such a caring and social house. That also reminds me of my first housemates in Santa Cruz (2013): **Eric**, **Mary** and **Caitie**, who made my original visit a blast.

The Shariati lab. **Ali**, we first met for an initial interview at the end of 2019. When I did an in-person visit in December 2019 I was very excited to come back to Santa Cruz again. Despite having already faced quite some challenges, - including political unrest, student protests, power outages, wildfire evacuation and of course COVID19, which all have influenced our ability to get the lab up and running - you are confident that I “made this best decision in my life” to join your lab. I am sure that together (Ali, Celine, incoming grad students, postdocs and interns) we can get some great work done together.

My parents, **Johan** & **Geertje**, my brother **Dirk** and wife **Wilrieke** & others. It was so nice to visit for the weekend and leave behind Amsterdam and the PhD work for a bit. Although this required some planning every now and then when I had to feed the cattle (stem cell cultures) on a daily basis. Occasionally the question was asked “what do we gain from knowing this”, commenting on some of the very fundamental science I was working on. It was nice to see this perspective and made me think about what was the essence of my projects and how to convey it in a clear and concise way. Who would have thought my life and career would have gone the way it has. Being the first in the family to undertake the academic career came with its challenges, but I’m thankful that you gave me the abilities to follow my dreams. This of course has come with international trips for both work and vacation, which means we sometimes don’t see each other for a long time. Know that I think about you and I’m proud of what you all have achieved in the past years too.

About the author

Gerrit Aalt (Gerrald) Lodewijk was born March 26th 1990 in Zwolle, The Netherlands. He attended elementary school at De Oranjeschool in the town of Wezep. After this, he attended the Carolus Clusius College in Zwolle and received his diploma in 2008. Both his bachelor degree in Biomedical Science (2011) and master degree in Neuroscience & Cognition (2014) were obtained from Utrecht University. During his studies, he did several research internships. First during his bachelor degree in the virology group of the veterinary sciences department at Utrecht University. This was in the group of Paul Rottier, under the supervision of Dr. Martine Vrolijk, and involved work on the porcine respiratory and reproductive syndrome virus.

After enrolling in the Neuroscience & Cognition Master program, he first joined the lab of Professor Dr. Peter Burbach, at the Brain Center Rudolf Magnus in 2012, under supervision of Dr. Amila Zuko, studying the genetics of autism. Here, Gerrald learned many essential cell and molecular biology techniques, and developed interest in using stem cell techniques to model human brain development and disease. He was connected with Dr. Frank Jacobs, at the time in 2013 a postdoctoral researcher at the University of California Santa Cruz, who was using organoid models to investigate human brain evolution. Gerrald was offered an internship in Santa Cruz, where he got experience in stem cell techniques and also worked on deciphering *NOTCH2NL* gene variants in human and chimpanzee.

When Dr. Frank Jacobs started his lab at the University of Amsterdam in 2014, Gerrald joined as a PhD student. Here, he studied gene duplications related to brain evolution. This involved completing and building upon the *NOTCH2NL* project, as well as start of other research lines, like KRAB zinc finger protein mediated gene regulation. Many of this work was done with the help of bachelor and master students, of which Gerrald supervised 10 total during his time as a PhD student. Also, he was an active member of the SILS PhD-postdoc council from 2014-2018, organizing events, seminars and drinks.

In 2020, Gerrald is moving back to the University of California Santa Cruz as a postdoctoral researcher in the lab of Assistant Professor Dr. Ali Shariati, working on evolutionary differences in early embryonic development.