

CURRICULUM VITAE

Personal Information

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Current positions

Since 2020	Professor at College de France, “Neurobiology and Immunity” Chair, Paris (France).
Since 2023	Group leader “Neuroimmune interactions in brain development” Team at the CIRB, College de France, Paris (France).
Since 2008	Group leader “Brain Development and Plasticity” Team (INSERM CR1/DR2/DR1) at the IBENS, Ecole Normale Supérieure, Paris (France).

Past Appointments

2010-2017	Associate professor at the Ecole Polytechnique (Palaiseau, France).
2003-2007	Independent Young Investigator (INSERM CR2), Ecole Normale Supérieure, Paris (France).
1999-2002	Postdoctoral fellow with John Rubenstein, UCSF, San Francisco, (USA).
1994-1999	Ph.D. with Patrick Charnay, Ecole Normale Supérieure, Paris (France).

Education

2008	Habilitation to supervise graduate students (HDR), University of Paris, France.
1999	Ph.D. in Molecular and Cellular Neurobiology, Sorbonne University, France.
1994	Master in Molecular and Cellular Neurobiology, Sorbonne University, France.
1994	Engineer of the Institut National Agronomique (AgroParisTech), France.

Awards and Honors

2024	Fondation Roger de Spoelberch Prize
2022	Elected to the French Academy of Sciences
2021	Discoverer award from the Cajal Club
2020	Grand Prix Fondation NRJ for Neuroscience – Institut de France
2019	Prix Brixham for Brain Research (FRM)
2019	Fondation Schlumberger pour l’Education et la Recherche (FSER) laureate
2018	Elected EMBO member
2016	Chevalière de l’ordre national du Mérite
2014	Antoine Lacassagne Prize from the College de France
2014	ERC consolidator grant
2012	EMBO YIP (Young Investigator Program)
2007	European Young Investigator Award (EURYI)- eq. ERC starting grant
2007	Silver medal of the City of Paris
2007	Avenir program from INSERM
2005	Career development Award (CDA) from HSFP
2000	Human Frontier Science Program (HFSP) long-term post-doctoral fellowship

Teaching Activities

Since 2021	Professor at College de France, “Neurobiology and Immunity” Chair, Paris, France Inaugural lecture, yearly courses and symposiums can be found at: https://www.youtube.com/playlist?list=PLOj9pZ2YNGZ_7PPE-d5e2fWAH46zLUzjC
2010-2017	Professor at the Ecole Polytechnique, Palaiseau, France (70h per year) Master classes in Neuroscience, Cell Biology and Developmental Biology
Since 2007	Master courses at ENS, Curie Institute, PSL, Sorbonne university (10h per year)

National and international instances

- Member of the French Academy of Sciences
- Member of the PSL Academic Senate (since 2021)
- Member of the Scientific Council of the City of Paris (2020-2022)
- ERC Consolidator panel member LS5 (2019, 2021)
- EMBO member (since 2018)
- Member of the SAB of INMED (Institut des Neurosciences de la Méditerranée), Luminy, France
- Member of the SAB of IBPS (Sorbonne University), Paris, France
- Member of the scientific council of the French Society for Neuroscience (2016-2019)
- Member of the scientific council of the Fyssen Foundation (2012- 2020)
- Member of the Conseil de la Recherche PSL Université Paris (2015-2019)
- Member of the scientific council of FRC (Federation pour la Recherche sur le Cerveau (2014-2017)
- Member of the Bureau of the “Neural Network Development” Club (2005-2013)

Outreach activities

- Participation to Declic days organized by FSER to meet with highschool students and their teachers – « what is research and what is a scientific fact », every year since 2017
- Participation to the program « Research apprentice »
Host in the laboratory one Wednesday afternoon per month of a highschool/junior student- “introduction to experimental research in biology”, every two years since 2014
- Member of the IBENS committee for Women in Science (X2Y committee) (2019-2021)

Invited Seminars

I am regularly invited to prestigious **international conferences** including Gordon Research Conferences (2024, 2023, 2020, 2018, 2017, 2014), Keystone Conferences (2025, 2021, 2018, 2017, 2016), Cold Spring Harbor Laboratory Meetings (2022, 2018, 2014), International Meeting of Societies (EMDS 2022, ISNI 2021, ISDN 2018, IBAGS 2020, Swiss Neuroscience Meeting 2017, etc...), EMBO meetings and workshops (2x2024, 2023, 2020, 2019, 2018, 2016, 2015, 2014), FENS (2020, 2018, 2014, 2012), Cell Symposium (2017) and European Glia meeting (2017, 2021). I am also invited to participate to **FENS or EMBO schools** and to give **seminars** in worldwide-recognized institutions over the past 10 years (Columbia University, VIB Leuven, Harvard University, Neurocenter Geneva, FMI Basel, Biozentrum Basel, UNIL Lausanne, Humanitas University Milan, ETH Zurich, Cambridge University, King’s College London, ULB Brussels, GIGA Neurosciences Liège, Mainz University, CIP Edinburgh, INA Alicante, Pasteur institute, Curie Institute, ICM, IFM, INM etc...).

I gave several **plenary lectures** including at EMBO Microglia Meeting (2024), FENS (2020), the European Glial Meeting (2021) and French Neuroscience Society (2021).

Meeting Organization

- Since 2021, yearly 1-to 2-day symposium organized at the Collège de France in Paris (<https://www.college-de-france.fr/fr/chaire/sonia-garel-neurobiologie-et-immunite-chaire-statutaire/events>)

- Virtual EMBO workshop « Microglia 2021 » rescheduled from 2020, EMBL, Heidelberg, Germany
- Fyssen Foundation Symposium 2018 «New insights into neuroglial communication», Paris
- EMBO workshop « Microglia 2018 », EMBL, Heidelberg, Germany
- Meeting of the French Society for Neuroscience, Bordeaux, 2017
- Meeting « Neural Network Development » Club, Yearly meeting from 2006 to 2013

Scientific Review

Peer-reviewing activity:

Biological Psychiatry, Cerebral Cortex, Development, eLife, Glia, Immunity, Journal of Comparative Neurology, Journal of Neuroscience, Molecular Psychiatry, Nature, Nature Communications, Nature Neuroscience, Neuron, PNAS, Science....

Editorial Board member:

Glia (since 2019), eLife (2019-2021), Life Science Alliance (since 2018), Journal of comparative Neurology (2012-2016).

Grant agencies: ANR, ERC, EMBO fellowships, FRC, Fyssen Foundation, Horizon 2020, NSF, ISF, PSL.

Career Breaks

Three maternity leaves in 2003, 2005 and 2009.

Research Statement and Achievements

Our laboratory investigates the development of cortical circuits, a process driven by a dynamic cellular choreography in which neurons migrate, extend axons, and establish connections in a precisely coordinated manner. This intricate sequence of events unfolds over multiple developmental steps, integrating genetic programs with local cellular interactions and broader physiological signals. Disruptions at any stage of this process—whether due to genetic mutations, prenatal infections, or environmental factors—can profoundly alter circuit formation and contribute to neurodevelopmental disorders such as autism spectrum disorders or schizophrenia. To understand how cerebral circuits are built, we have developed a systemic approach that considers not only the intrinsic programs guiding neuronal development but also the local interactions between different cell types, as well as influences from the body and external environment.

Over the years, we have shown that neuronal migration not only serves to position neurons but also plays an active role in shaping axonal trajectories by dynamically positioning guidance cues. We further contributed to demonstrating that prenatal neuronal activity plays a role in neuronal positioning and elimination, highlighting an additional layer of control in circuit assembly. Expanding our approach to neuroimmune interactions, we identified microglia, the resident immune cells of the brain, as key players in early brain wiring. Our research has revealed fundamental new functions for microglia in the construction of cerebral circuits, demonstrating that they actively shape morphogenesis by preserving tissue integrity and regulating neuronal migration and integration. We further uncovered that, beyond their sensitivity to inflammation, microglia also respond to maternal microbiota signals in a sexually dimorphic manner, placing these cells at a crucial interface between the developing brain and systemic signals. Our work uncovers novel roles for microglia in early brain development, highlighting key neuroimmune interactions that shape normal circuit formation and provide insight into how immune challenges or other perturbations can contribute to neurodevelopmental disorders.

Selection of 10 publications

Main and corresponding author in all the listed publications (* and ° indicate co-authors)

1. Lawrence AR, Canzi° A, Bridlance° C, Olivie N, Lansonneur C, Catale C, Pizzamiglio L, Kloeckner B, Silvin A, Munro DA, Fortoul A, Boido D, Zehani F, Cartonnet H, Viguier S, Oller G, Suqarzoni P, Candat A, Helft J, Allet C, Watrin F, Manent JB, Paoletti P, Thieffry D, Cantini L, Pridans C, Priller J, Gélot A, Giacobini P, Ciobanu L, Ginhoux F, Thion MS*, Lokmane L* and Garel S* (2024) Microglia maintain structural integrity during fetal brain morphogenesis. **Cell**, 187:962-980.

This article uncovers a novel neuroprotective role of prenatal microglia, which prevents the formation of cavitory lesions due to morphogenetic tensions. Our study highlights that microglia, in a specific 'repair-promoting' neuroprotective state, were coopted to ensure proper cortical morphogenesis, with major implications for our understanding of brain wiring in health and disease.

2. Sinclair-Wilson A, Lawrence A, Ferezou I, Cartonnet H, Mailhes C, Garel° S, Lokmane° L (2023) Plasticity of thalamocortical axons is regulated by serotonin levels modulated by preterm birth. **PNAS**, 120(33):e2301644120.

This study shows that early preterm birth can limit neuroplasticity and rewiring required for the rescuing of prenatal wiring deficits, providing a novel framework onto how preterm birth may constitute a risk factor for neurodevelopmental disorders.

3. Thion MS, Ginhoux F and Garel S (2018). Microglia and early brain development: an intimate journey. **Science**; 362: 185-189.

In this landmark review, we delineate a framework to explore and assess the contributions of microglia in brain development in health and disease, putting this process in the context of neuroimmune interactions, brain/body interface and influences of environmental factors, such as infections and inflammation.

4. Tinterri A, Menardy F, Diana M, Lokmane L, Keita M, Couplier F, Lemoine S, Mailhes C, Mathieu B, Merchan-Sala P, Campbell K, Gyory I, Grosschedl R, Popa D and Garel S (2018) Active intermixing of indirect and direct neurons builds the striatal mosaic. **Nature Com.**, 9:4725.

In this article, we show that inter-twinning cell migration processes are key for the building of a major brain structure, the striatum, with key implications for our understanding of brain wiring in health and disease.

5. Thion° MS, Low° D, Silvin A, Chen J, Grisel P, Schulte-Schrepping J, Blecher R, Ulas T, Squarzoni P, Hoeffel G, Couplier F, Siopi E, David FS, Scholz C, Shihui F, Lum J, Amoyo AA, Larbi A, Poidinger M, Buttgerit A, Lledo PM, Greter M, Chan JKY, Amit I, Beyer M, Schultze JL, Schlitzer A, Pettersson S, Ginhoux* F, Garel* S (2018) Microbiome influences prenatal and adult microglia in a sex-specific manner. **Cell**, 172: 500-516.

This article reveals that microglia are modulated by the microbiota from prenatal stages up to adulthood. This effect is sexually dimorphic, with a high impact on embryonic microglia in males and adult microglia in females, highlighting sexually dimorphic environmental-sensitive time periods. This work puts microglia at a key environment/brain circuit interface and has potential major implications for pathology, since neurodevelopmental disorders have a higher prevalence in males, whereas some neurodegenerative diseases linked to microglial dysfunction have a higher prevalence in women.

6. De Frutos CA, Bouvier G, Arai Y, Thion MS, Lokmane L, Keita M, Garcia-Dominguez M, Charnay P, Hirata T, Riethmacher D, Grove EA, Tissir F, Casado M, Pierani A, Garel S (2016) Reallocation of olfactory Cajal-Retzius cells shapes neocortex architecture. **Neuron**, 92:435-448.

Here, we reveal that the transient guidepost Cajal-Retzius cells, in addition to their key roles in cortical lamination orchestrate the functional wiring of layer 1, through a unique remigration during fetal cortex morphogenesis. This study shows that in sharp contrast to the preexisting dogma, transient neurons can exert multiple sequential functions, through a reentry into migratory mode.

7. Squarzoni P, Oller G, Hoeffel G, Pont-Lezica L, Rostaing P, Low D, Bessis[°] A, Ginhoux[°] F, Garel[°] S (2014) Microglia modulate wiring of the embryonic forebrain. **Cell Reports**, 8:1271-9.

In this landmark highly cited paper, we show that microglia, play also key roles in prenatal brain wiring in relationship to their distribution, before their established postnatal roles in synaptic pruning.

8. Deck M, Mailhes C, Chauvet S, Keita M, Niquille M, Lebrand C, Yoshida M, Yoshida Y, Mann F, Grove E, Garel S (2013) Pathfinding of corticothalamic axons relies on a rendezvous with thalamic projections. **Neuron**, 77: 472-84.

In this article, we established that reciprocal thalamic and cortical axonal tracts guide each other by interactions along their path, interactions which are timely coordinated by environmental cues, thereby providing unequivocal support for the 'handshake hypothesis' of reciprocal tract formation.

9. Bielle F, Marcos-Mondejar P, Keita M, Mailhes C, Verney C, Nguyen Ba-Charvet K, Tessier-Lavigne M, Lopez-Bendito G, Garel S (2011) Slit2 activity in the migration of Guidepost neurons shapes thalamic projections during development and evolution. **Neuron**, 69:1085-1098.

Here we showed that the positioning of migrating corridor guidepost neurons acts as a switch between an external and internal trajectory of thalamocortical projections during development. This work reveals that minor changes in the positioning of guidepost neurons induce large-scale long-range modifications in the pathfinding of a major brain connection, thereby opening novel perspective for brain wiring and evolution.

10. Lopez-Bendito* G, Cautinat* A, Sanchez JA, Bielle F, Flames N, Garrat AN, Talmage D, Role LW, Charnay P, Marin[°] O, Garel[°] S (2006) Tangential neuronal migration controls axon guidance: a role for neuregulin-1 in thalamocortical axon navigation. **Cell**, 125:127-42.

In this study, we showed that cell migration is not only involved in distributing neurons in the developing brain, but also acts as a dynamic system to display guidance cues required for the pathfinding of a major axonal connection. This work reveals that cell migration can act in a previously unexpected manner during brain wiring, thereby providing novel perspectives on normal and pathological cerebral morphogenesis.

Full Publication list

Google scholars - citations 9012 / H index 42 - ih10 54 / Web of science – citations 7186 / H index 40

Lawrence AR, Canzi^o A, Bridlance^o C, Olivie^o N, Lansonneur C, Catale C, Pizzamiglio L, Kloeckner B, Silvin A, Munro DA, Fortoul A, Boido D, Zehani F, Cartonnet H, Viguier S, Oller G, Suqarzoni P, Candat A, Helft J, Allet C, Watrin F, Manent JB, Paoletti P, Thieffry D, Cantini L, Pridans C, Priller J, Gélot A, Giacobini P, Ciobanu L, Ginhoux F, Thion MS*, Lokmane L* and Garel S* (2024) Microglia maintain structural integrity during fetal brain morphogenesis. **Cell**, 187:962-980.

Sinclair-Wilson A, Lawrence A, Ferezou I, Cartonnet H, Mailhes C, Garel^o S, Lokmane^o L (2023) Plasticity of thalamocortical axons is regulated by serotonin levels modulated by preterm birth. **PNAS**, 120(33):e2301644120.

Silvin A, Uderhardt S, Piot C, Da Mesquita S, Yang K, Geirsdottir L, Mulder K, Eyal D, Liu Z, Bridlance C, Thion MS, Zhang XM, Kong WT, Fontes V, Weiner A, Ee R, Dress R, Hang JW, Balachander A, Chakarov S, Malleret B, Dunsmore G, Cexus O, Chen J, Garel S, Dutertre CA, Amit I, Kipnis J, Ginhoux F (2022) Dual ontogeny of disease-associated microglia and disease inflammatory macrophages in aging and neurodegeneration. **Immunity**, 55:1448-1465.

Paolicelli RC, Sierra A, Stevens B, Tremblay ME, Aguzzi A, Ajami B, Amit I, Audinat E, Bechmann I, Bennett M, Bennett F, Bessis A, Biber K, Bilbo S, Blurton-Jones M, Boddeke E, Brites D, Brône B, Brown GC, Butovsky O, Carson MJ, Castellano B, Colonna M, Cowley SA, Cunningham C, Davalos D, De Jager PL, de Strooper B, Denes A, Eggen BJL, Eyo U, Galea E, Garel S, Ginhoux F, Glass CK, Gokce O, Gomez-Nicola D, González B, Gordon S, Graeber MB, Greenhalgh AD, Gressens P, Greter M, Gutmann DH, Haass C, Heneka MT, Heppner FL, Hong S, Hume DA, Jung S, Kettenmann H, Kipnis J, Koyama R, Lemke G, Lynch M, Majewska A, Malcangio M, Malm T, Mancuso R, Masuda T, Matteoli M, McColl BW, Miron VE, Molofsky AV, Monje M, Mracsko E, Nadjar A, Neher JJ, Neniskyte U, Neumann H, Noda M, Peng B, Peri F, Perry VH, Popovich PG, Pridans C, Priller J, Prinz M, Ragozzino D, Ransohoff RM, Salter MW, Schaefer A, Schafer DP, Schwartz M, Simons M, Smith CJ, Streit WJ, Tay TL, Tsai LH, Verkhratsky A, von Bernhardi R, Wake H, Wittamer V, Wolf SA, Wu LJ, Wyss-Coray T (2022) Microglia states and nomenclature: A field at its crossroads. **Neuron**, 110:3458-83.

Cossart R and Garel S (2022) Step by step: cells with multiple functions in cortical circuit assembly. **Nat Rev Neuro**, 23: 395-410.

Genescu I, Anibal-Martinez M, Kouskoff V, Chenouard N, Mailhes-Hamon C, Cartonnet H, Lokmane L, Rijli F, Lopez-Bendito G, Gambino F and Garel S (2022) Dynamic interplay between thalamic activity and Cajal-Retzius cells regulates the wiring of cortical layer1. **Cell Reports**,28:1119-1126.

Utz S, See P, Mildenberger W, Thion MS, Silvin A, Lutz M, Ingelfinger F, Rayan NA, Lelios I, Buttgerit A, Asano K, Prabhakar S, Garel S, Becher B, Ginhoux F and Greter M (2020) Early Fate Defines Microglia and Non-parenchymal Brain Macrophage Development. **Cell**, 18:557-573.

Genescu I and Garel S (2020) Being superficial: a Developmental Perspective on Layer 1 wiring. **Curr Opin Neurobiol**, 66:124-135.

Thion MS and Garel S (2020) Microglial ontogeny, diversity and neurodevelopmental functions. **Curr Op Genes and Dev**, 65:186-194.

Riva* M, Genescu* I, Habermacher* C, Orduz D, Ledonne F, Rijli FM, Lopez-Bendito G, Coppola E, Garel^o S, Angulo^o MC and Pierani^o A (2019) Activity-dependent death of transient Cajal-Retzius neurons is required for functional cortical wiring. **eLife**, 8:e50503.

Thion* MS, Mosser* CA, Ferezou I, Grisel P, Baptista S, Low, D, Ginhoux F, Garel^o S and Audinat^o E (2019) Biphasic impact of prenatal inflammation and macrophage depletion on the wiring of neocortical inhibitory circuits. **Cell Reports**, 28:1119-1126.

Bielle F and Garel S (2019) Neuronal Migration of guidepost cells (Elsevier) **Developmental Neuroscience: Comprehensive Reference**, 2nd edition, chapter 37.

Tinterri A, Menardy F, Diana M, Lokmane L, Keita M, Couplier F, Lemoine S, Mailhes C, Mathieu B, Merchan-Sala P, Campbell K, Gyory I, Grosschedl R, Popa D and Garel S (2018) Active intermixing of indirect and direct neurons builds the striatal mosaic. **Nat. Commun.**, 9:4725.

Thion MS, Ginhoux F and Garel S (2018). Microglia and early brain development: an intimate journey. **Science**; 362: 185-189.

Thion MS and Garel S (2018) (Microbiome and microglia: prenatal and postnatal interactions diverge according to sex). **Med Sci (Paris)**, 34:527-529.

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Thion^o MS, Low^o D, Silvin A, Chen J, Grisel P, Schulte-Schrepping J, Blecher R, Ulas T, Squarzoni P, Hoeffel G, Culpier F, Siopi E, David FS, Scholz C, Shihui F, Lum J, Amoyo AA, Larbi A, Poidinger M, Buttgerit A, Lledo PM, Greter M, Chan JKY, Amit I, Beyer M, Schultze JL, Schlitzer A, Pettersson S, Ginhoux^{*} F, Garel^{*} S (2018) Microbiome influences prenatal and adult microglia in a sex-specific manner. **Cell**, 172: 500-516.

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Thion MS and Garel S (2017) On place and time: microglia in embryonic and perinatal brain development. **Curr Opin Neurobiol**, 47: 121-130.

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Dupin I, Lokmane L, Dahan M, Garel S, Studer V (2015) Subrepellent doses of Slit1 promote Netrin-1 chemotactic responses in subsets of axons. **Neural Dev**, 10:5.

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