

Sebastian Marquardt  
Associate Professor - Promotion Programme  
Section for Molecular Plant Biology  
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## Short presentation

### Languages of the Non-coding Genome

Genomes are the blueprints of life: the genomic DNA sequences contain the instructions for the formation of a given species. DNA sequence polymorphisms between individuals of the same species offer a hypothesis to understand the molecular bases of fitness differences. However, many polymorphisms are located in parts of the genome that we poorly understand: **the non-coding genome**. While polymorphisms that change the protein sequence offer a sufficiently clear path forward, my seminar outlines approaches and solutions to understand the non-coding genome. Results from my laboratory illustrate different molecular mechanisms of how the non-coding genome promotes organismal fitness. We developed methods that reveal where the non-coding genome is transcribed by RNA polymerase II (Pol II) into RNAs. Here, a particular focus is on thousands of RNAs that are missed by many transcriptomics approaches even when located in important regions. While we find some cases of trans-acting RNAs, a common theme resulting from our functional characterization of specific non-coding loci is that the act of Pol II transcription explains the function of non-coding region, rather than the resulting RNA product. Essentially, chromatin-based signaling during Pol II transcription in the non-coding genome represses mRNA initiation when the transcription units overlap. Efforts to characterize non-coding RNA isoforms overlapping with genes involved a new class of non-coding RNAs: short promoter-proximal RNAs (sppRNAs). sppRNAs result from transcriptional termination at sites of promoter-proximal Pol II stalling and are positively correlated with gene expression. In conclusion, our results highlight different ways of how the non-coding genome communicates functional information, with intriguing implications for current models explaining non-coding genome conservation and function.

## Qualifications

Biological Sciences, PhD, University of East Anglia  
Award Date: 16 Jul 2010

Postdoc in non-coding transcription, postdoctoral researcher, Harvard Medical School  
2010 → 2014

## Employment

### Associate Professor - Promotion Programme

Section for Molecular Plant Biology

Frederiksberg C  
31 Dec 2014 → nu

### Assistant Professor

Copenhagen Plant Science Center

Frederiksberg C  
1 Jan 2015 → 6 May 2015

## Publications

### A ribose world: current status and future challenges of plant RNA biology

Marquardt, Sebastian & Manavella, P. A., 2023, In: *Journal of Experimental Botany*. 74, 7, p. 2203-2207 5 p.

### Cotranscriptional RNA processing and modification in plants

Marquardt, Sebastian, Petrillo, E. & Manavella, P. A., 2023, In: *The Plant Cell*. 35, 6, p. 1654-1670

### Functional Variation in the Non-Coding Genome: Molecular Implications for Food Security

Gullotta, Giorgio, Korte, A. & Marquardt, Sebastian, 2023, In: *Journal of Experimental Botany*. 74, 7, p. 2338-2351 14 p.

**LncRNA FLAIL affects alternative splicing and represses flowering in *Arabidopsis***

Jin, Yu, Ivanov, M., Dittrich, A. N., Nelson, A. D. L. & Marquardt, Sebastian, 2023, In: EMBO Journal. 42, 11, 21 p., e110921.

**Histone chaperone ASF1 mediates H3.3-H4 deposition in *Arabidopsis***

Zhong, Z., Wang, Y., Wang, M., Yang, F., Thomas, Quentin, Xue, Y., Zhang, Y., Liu, W., Jami-Alahmadi, Y., Xu, L., Feng, S., Marquardt, Sebastian, Wohlschlegel, J. A., Ausin, I. & Jacobsen, S. E., 2022, In: Nature Communications. 13, 15 p., 6970.

**R-loops at microRNA encoding loci promote co-transcriptional processing of pri-miRNAs in plants**

Gonzalo, L., Tossolini, I., Gulanicz, T., Cambiagno, D. A., Kasproicz-Maluski, A., Smolinski, D. J., Mammarella, M. F., Ariel, F. D., Marquardt, Sebastian, Szweykowska-Kulinska, Z., Jarmolowski, A. & Manavella, P. A., 2022, In: Nature Plants. 8, 4, p. 402-418 17 p.

**From Single Cells to Flowers – Biological Complexity Driving Plant Reproductive Development**

Schwarz, Isabel Aimée, Neumann, M., Vega, R., Xu, X., Cornaro, L., Colombo, L., Vernoux, T., Xu, J., Marquardt, Sebastian & Kaufmann, K., 2021, Preprints.org.

**Light-Dependent Translation Change of *Arabidopsis* psbA Correlates with RNA Structure Alterations at the Translation Initiation Region**

Gawroński, P., Enroth, Christel Hougård, Kindgren, P., Marquardt, Sebastian, Karpiński, S., Leister, D., Jensen, Poul Erik, Vinther, Jeppe & Scharff, L. B., 2021, In: Cells. 10, 2, 22 p., 322.

**The Hda1 histone deacetylase limits divergent non-coding transcription and restricts transcription initiation frequency**

Gowthaman, U., Ivanov, M., Schwarz, Isabel Aimée, Patel, H. P., Müller, N. A., Garcia Pichardo, Desire, Lenstra, T. L. & Marquardt, Sebastian, 2021, In: EMBO Journal. 40, 23, 16 p., 108903.

**TranscriptomeReconstructor: data-driven annotation of complex transcriptomes**

Ivanov, M., Sandelin, Albin Gustav & Marquardt, Sebastian, 2021, In: BMC Bioinformatics. 22, 15 p., 290.

**Winter fields antisense RNAs to kick off flowering**

Jin, Yu & Marquardt, Sebastian, 2021, In: Genes and Development. 38, 11-12, p. 785-786 2 p.

**A G(enomic)P(ositioning)S(ystem) for Plant RNAPII Transcription**

Leng, Xueyuan, Thomas, Quentin, Rasmussen, S. H. & Marquardt, Sebastian, 2020, In: Trends in Plant Science. 25, 8, p. 744-764

**DNA Processing in the Context of Noncoding Transcription**

Gowthaman, U., Garcia Pichardo, Desire, Jin, Yu, Schwarz, Isabel Aimée & Marquardt, Sebastian, 2020, In: Trends in Biochemical Sciences. 45, 12, p. 1009-1021

**Dual sgRNA-based Targeted Deletion of Large Genomic Regions and Isolation of Heritable *Cas9*-free Mutants in *Arabidopsis***

Jin, Yu & Marquardt, Sebastian, 2020, In: Bio-protocol. 10, 20, 17 p., 3796.

**Native elongation transcript sequencing reveals temperature dependent dynamics of nascent RNAPII transcription in *Arabidopsis***

Kindgren, P., Ivanov, M. & Marquardt, Sebastian, 2020, In: Nucleic Acids Symposium Series. 48, 5, p. 2332-2347 16 p.

**Organismal benefits of transcription speed control at gene boundaries**

Leng, Xueyuan, Ivanov, M., Kindgren, P., Malik, I., Thieffry, A., Brodersen, Peter, Sandelin, Albin Gustav, Kaplan, C. D. & Marquardt, Sebastian, 2020, In: EMBO Reports. 21, 4, 16 p., e49315.

**Transcript isoform sequencing reveals widespread promoter-proximal transcriptional termination in Arabidopsis**

Thomas, Quentin, Ard, R., Liu, J., Li, B., Wang, J., Pelechano, V. & Marquardt, Sebastian, 2020, In: Nature Communications. 11, 1, p. 1-15

**Transcription-driven chromatin repression of Intragenic transcription start sites**

Nielsen, M., Ard, R., Leng, Xueyuan, Ivanov, M., Kindgren, P. R., Pelechano, V. & Marquardt, Sebastian, 1 Feb 2019, In: PLOS Genetics. 15, 2, p. 1-33 e1007969.

**Efficient termination of nuclear lncRNA transcription promotes mitochondrial genome maintenance**

du Mee, D. J. M., Ivanov, M., Parker, J. P., Buratowski, S. & Marquardt, Sebastian, 5 Mar 2018, In: eLife. 7, e31989.

**Transcriptional read-through of the long non-coding RNA SValka governs plant cold acclimation**

Kindgren, P. R., Ard, R., Ivanov, M. & Marquardt, Sebastian, 2018, In: Nature Communications. 9, p. 1-11 4561.

**Emerging properties and functional consequences of noncoding transcription**

Ard, R., Allshire, R. C. & Marquardt, Sebastian, 2017, In: Genetics (Print). 207, 2, p. 357-367 11 p.

**A chromatin-based mechanism for limiting divergent noncoding transcription**

Marquardt, Sebastian, Escalante-Chong, R., Pho, N., Wang, J., Churchman, L. S., Springer, M. & Buratowski, S., 2014, In: Cell. 157, 7, p. 1712-23 12 p.

**Functional consequences of splicing of the antisense transcript COOLAIR on FLC transcription**

Marquardt, Sebastian, Raitskin, O., Wu, Z., Liu, F., Sun, Q. & Dean, C., 2014, In: Molecular Cell. 54, 1, p. 156-165 10 p.

**Kinetic competition between RNA Polymerase II and Sen1-dependent transcription termination**

Hazelbaker, D. Z., Marquardt, Sebastian, Wlotzka, W. & Buratowski, S., 2013, In: Molecular Cell. 49, 1, p. 55-66 12 p.

**Distinct RNA degradation pathways and 3' extensions of yeast non-coding RNA species**

Marquardt, Sebastian, Hazelbaker, D. Z. & Buratowski, S., May 2011, In: Transcription. 2, 3, p. 145-154 10 p.

**Cullin 4-ring finger-ligase plays a key role in the control of endoreplication cycles in Arabidopsis trichomes**

Roodbarkelari, F., Bramsiepe, J., Weinl, C., Marquardt, Sebastian, Novák, B., Jakoby, M. J., Lechner, E., Genschik, P. & Schnittger, A., 2010, In: Proceedings of the National Academy of Sciences of the United States of America. 107, 34, p. 15275-15280 6 p.

**Targeted 3' processing of antisense transcripts triggers Arabidopsis FLC chromatin silencing**

Liu, F., Marquardt, Sebastian, Lister, C., Swiezewski, S. & Dean, C., 2010, In: Science (New York, N.Y.). 327, 5961, p. 94-7 4 p.

**Altered interactions within FY/AtCPSF complexes required for Arabidopsis FCA-mediated chromatin silencing**

Manzano, D., Marquardt, Sebastian, Jones, A. M. E., Bäurle, I., Liu, F. & Dean, C., 2009, In: Proceedings of the National Academy of Sciences of the United States of America. 106, 21, p. 8772-7 6 p.

**Additional targets of the Arabidopsis autonomous pathway members, FCA and FY**

Marquardt, Sebastian, Boss, P. K., Hadfield, J. & Dean, C., 2006, In: Journal of Experimental Botany. Flowering Newsletter. 57, 13, p. 3379-86 8 p.

**Novel functions of plant cyclin-dependent kinase inhibitors, ICK1/KRP1, can act non-cell-autonomously and inhibit entry into mitosis**

Weinl, C., Marquardt, Sebastian, Kuijt, S. J. H., Nowack, M. K., Jakoby, M. J., Hülskamp, M. & Schnittger, A., Jun 2005, In: Plant Cell. 17, 6, p. 1704-22 19 p.

**Partial loss-of-function alleles reveal a role for GNOM in auxin transport-related, post-embryonic development of Arabidopsis**

Geldner, N., Richter, S., Vieten, A., Marquardt, Sebastian, Torres-Ruiz, R. A., Mayer, U. & Jürgens, G., Jan 2004, In: Development (Cambridge, England). 131, 2, p. 389-400 12 p.

## **Activities**

**EMBO YIP lecture: Languages of the non-coding genome**

Marquardt, Sebastian (Other)

17 Aug 2023

**EMBO Young Investigator Sectoral Meeting: Chromatin & Transcription**

Marquardt, Sebastian (Participant), Messerschmidt, Daniel Martin (Organizer), Schulz, E. (Organizer), Hamon, M. (Organizer) & Cheung, A. (Organizer)

4 Jul 2023 → 7 Jul 2023

**Languages of the non-coding genome**

Marquardt, Sebastian (Other)

20 Jun 2023

**EMBO YIP lecture: Languages of the non-coding genome**

Marquardt, Sebastian (Other)

16 Jun 2023

**EMBO YIP lecture: Languages of the non-coding genome**

Marquardt, Sebastian (Other)

29 Apr 2023

**BSc thesis supervision: Julie Overgaard Hansen**

Marquardt, Sebastian (Participant)

1 Apr 2023 → 15 Jun 2023

**Lucia Gonzalo**

Marquardt, Sebastian (Host)

1 Apr 2023 → 30 Jun 2023

**EMBO YIP lecture: Languages of the non-coding genome**

Marquardt, Sebastian (Other)

6 Mar 2023

**BSc thesis supervision: Hilde Yuwan Børner Stax**

Marquardt, Sebastian (Participant)

1 Mar 2023 → 15 Jun 2023

**EMBO YIP lecture: Languages of the non-coding genome**

Marquardt, Sebastian (Other)

1 Mar 2023

**EMBO YIP lecture: Languages of the non-coding genome**

Marquardt, Sebastian (Other)

27 Feb 2023

**EMBO Young Investigator - Joint Lab Meeting on Singel Cell Transcriptomics**

Marquardt, Sebastian (Organizer)

16 Feb 2023 → 17 Feb 2023

**BSc thesis supervision - Jesper Sølvsten**

Marquardt, Sebastian (Participant)

15 Feb 2023 → 15 Jun 2023

**Beda Anttila**

Marquardt, Sebastian (Host)

15 Feb 2023 → 15 Jul 2023

**MSc supervision: Beda Anttila**

Marquardt, Sebastian (Participant)

15 Feb 2023 → 15 Jul 2023

**EMBO YIP lecture: Languages of the non-coding genome**

Marquardt, Sebastian (Other)

30 Jan 2023

**Languages of the non-coding genome**

Marquardt, Sebastian (Other)

8 Sep 2022

**MSc thesis supervision: Nicholas Bolsi**

Marquardt, Sebastian (Participant)

1 Sep 2022 → 15 Jun 2023

**Languages of the non-coding genome**

Marquardt, Sebastian (Other)

31 Aug 2022

**Censor BSc thesis, SDU**

Marquardt, Sebastian (Examiner)

1 Jul 2022

**Languages of the Non-coding Genome**

Marquardt, Sebastian (Other)

1 Jun 2022

**Languages of the Non-coding Genome**

Marquardt, Sebastian (Other)

5 May 2022

**Bert de Rybel**

Marquardt, Sebastian (Host)

25 Apr 2022

**Informed Breeding in the Genomics Era**

Marquardt, Sebastian (Other)

19 Apr 2022

**BSc thesis supervision**

Marquardt, Sebastian (Participant)

Feb 2022 → Jun 2022

**BSc thesis supervision**

Marquardt, Sebastian (Participant)  
Feb 2022 → Jun 2022

**BSc thesis supervision**

Marquardt, Sebastian (Participant)  
Feb 2022 → Jun 2022

**PhD thesis supervision**

Marquardt, Sebastian (Participant)  
Jan 2022 → Dec 2024

**Languages of the Non-coding Genome**

Marquardt, Sebastian (Other)  
7 Dec 2021

**Rules and roles of signaling through the non-coding genome**

Marquardt, Sebastian (Other)  
5 Nov 2021

**6th Annual Meeting on RNA**

Marquardt, Sebastian (Participant)  
4 Oct 2021

**Exploring the Functional role of the Non-coding Genome**

Marquardt, Sebastian (Other)  
20 Sep 2021

**Exploring the Functional role of the Non-coding Genome**

Marquardt, Sebastian (Other)  
17 Sep 2021

**BSc thesis supervision**

Marquardt, Sebastian (Participant) & La Bonté, A. (Award recipient)  
Sep 2021 → Jan 2022

**BSc thesis supervision**

Marquardt, Sebastian (Participant)  
Sep 2021 → Jan 2022

**MSc thesis supervision**

Marquardt, Sebastian (Participant)  
Sep 2021 → Aug 2022

**International Conference on Arabidopsis Research, ICAR 2021**

Marquardt, Sebastian (Participant)  
24 Jun 2021

**PhD thesis supervision**

Marquardt, Sebastian (Participant)  
Apr 2021 → Mar 2024

**BSc thesis supervision**

Marquardt, Sebastian (Participant)  
Feb 2021 → Jun 2021

**BSc thesis supervision**

Marquardt, Sebastian (Participant)  
Feb 2021 → Jun 2021

**Genomic Punctuation**

Marquardt, Sebastian (Other)  
27 Nov 2020

**Chairman PhD assesemnt committe**

Marquardt, Sebastian (Examiner)  
4 Nov 2020

**Epigenetics of Genomic Punctuation**

Marquardt, Sebastian (Other)  
20 Aug 2020

**Grzegorz Brzyżek**

Marquardt, Sebastian (Host)  
11 Aug 2020 → 10 Nov 2020

**MSc thesis censor**

Marquardt, Sebastian (Examiner)  
26 Jun 2020

**External opponent, PhD defense at Aarhus University**

Marquardt, Sebastian (Examiner)  
20 May 2020

**Copenhagen Plant Science Center (Organisational unit)**

Marquardt, Sebastian (Member)  
2020

**Franziska Turck**

Marquardt, Sebastian (Host)  
5 Dec 2019

**Szymon Swiezewski**

Marquardt, Sebastian (Host)  
5 Dec 2019

**EMBO Young Investigator Programme**

Marquardt, Sebastian (Other)  
31 Oct 2019

**5th Annual Meeting on RNA: from basic research to industrial applications**

Marquardt, Sebastian (Participant)  
7 Oct 2019

**BSc thesis supervision**

Marquardt, Sebastian (Participant)  
Sep 2019 → Mar 2020

**BSc thesis supervision**

Marquardt, Sebastian (Participant)  
Sep 2019 → Jan 2020

**MSc thesis supervision**

Marquardt, Sebastian (Participant)  
Sep 2019 → Sep 2020

**MSc thesis supervision**

Marquardt, Sebastian (Participant)  
Sep 2019 → Sep 2020

**MSc thesis supervision**

Marquardt, Sebastian (Participant)  
Sep 2019 → Nov 2020

**Censor BSc thesis Aarhus University**

Marquardt, Sebastian (Examiner)  
19 Jun 2019

**Interplay Between Co-Transcriptional Chromatin States and Transcript Isoform Diversity**

Marquardt, Sebastian (Other)  
14 Jun 2019

**MSc thesis supervision**

Marquardt, Sebastian (Participant)  
Jun 2019 → Dec 2019

**MSc thesis supervision**

Marquardt, Sebastian (Participant)  
Apr 2019 → Mar 2020

**MSc thesis censor, SDU**

Marquardt, Sebastian (Examiner)  
21 Mar 2019

**BSc thesis supervision**

Marquardt, Sebastian (Participant)  
Feb 2019 → Jun 2019

**Section for Molecular Plant Biology (Organisational unit)**

Marquardt, Sebastian (Member)  
2019

**EMBO Young Investigator Interview**

Marquardt, Sebastian (Other)  
30 Oct 2018

**4th Annual Meeting on RNA - From basic research to industrial applications**

Marquardt, Sebastian (Participant)  
9 Oct 2018



**My Journey from JIC/TSL Rotation Student to the University of Copenhagen**

Marquardt, Sebastian (Other)

6 Oct 2018

**Rules and Roles of Non-coding Transcription**

Marquardt, Sebastian (Other)

5 Oct 2018

**MSc thesis supervision**

Marquardt, Sebastian (Participant)

Oct 2018 → Feb 2019

**Rules and Roles of Non-coding Transcription**

Marquardt, Sebastian (Other)

31 Jul 2018

**Gene Repression by the Act of Transcription**

Marquardt, Sebastian (Other)

19 Jun 2018

**Rules and Roles of non-coding Transcription**

Marquardt, Sebastian (Other)

13 Jun 2018

**Rules and Roles of non-coding Transcription**

Marquardt, Sebastian (Other)

24 May 2018

**PhD thesis supervision**

Marquardt, Sebastian (Participant)

Mar 2018 → Sep 2021

**Rules and Roles of non-coding Transcription**

Marquardt, Sebastian (Other)

27 Feb 2018

**Gene Repression Through the Act of Transcription**

Marquardt, Sebastian (Other)

22 Feb 2018

**BSc thesis supervision**

Marquardt, Sebastian (Participant)

Feb 2018 → Jul 2018

**BSc thesis supervision**

Marquardt, Sebastian (Participant)

Feb 2018 → Jun 2018

**BSc thesis supervision**

Marquardt, Sebastian (Participant)

Jan 2018 → Jun 2018

**Gene Regulation By the Act of Upstream RNA Polymerase II Transcription**

Marquardt, Sebastian (Other)

20 Nov 2017

**3rd Annual Meeting on RNA, 2017**

Marquardt, Sebastian (Participant)  
10 Oct 2017

**Gene Regulation Through the Act of Upstream Transcription in Arabidopsis**

Marquardt, Sebastian (Other)  
10 Oct 2017

**Gene Regulation Through the Act of Upstream Transcription in Arabidopsis**

Marquardt, Sebastian (Other)  
10 Oct 2017

**Rules and Roles of Non-coding Transcription**

Marquardt, Sebastian (Other)  
10 Oct 2017

**PhD thesis supervision**

Marquardt, Sebastian (Participant)  
Oct 2017 → Mar 2021

**PhD thesis supervision**

Marquardt, Sebastian (Participant)  
Oct 2017 → Apr 2021

**Gene Regulation Through the Act of Upstream Transcription in Arabidopsis**

Marquardt, Sebastian (Other)  
28 Sep 2017

**Gene Regulation Through the Act of Upstream Transcription in Arabidopsis**

Marquardt, Sebastian (Other)  
22 Sep 2017

**Stalling DNA processing**

Marquardt, Sebastian (Participant)  
16 Jun 2017

**Stalling DNA processing**

Marquardt, Sebastian (Participant)  
16 Jun 2017

**Rules and Roles of Non-coding Transcription**

Marquardt, Sebastian (Other)  
9 May 2017

**BSc thesis supervision**

Marquardt, Sebastian (Participant)  
Feb 2017 → Jun 2017

**BSc thesis supervision**

Marquardt, Sebastian (Participant)  
Feb 2017 → Jun 2017

**MSc thesis supervision**

Marquardt, Sebastian (Participant)  
Jan 2017 → Jul 2017

**MSc thesis supervision**

Marquardt, Sebastian (Participant)  
Jan 2017 → Jul 2017

**MSc thesis supervision**

Marquardt, Sebastian (Participant)  
Jan 2017 → May 2017

**Caroline Dean**

Marquardt, Sebastian (Host)  
18 Oct 2016

**2nd Annual Meeting on RNA: from basic research to industrial applications - October 11 2016**

Marquardt, Sebastian (Participant)  
11 Oct 2016

**MSc thesis supervision**

Marquardt, Sebastian (Participant)  
Sep 2016 → Sep 2017

**MSc thesis supervision**

Marquardt, Sebastian (Participant)  
Sep 2016 → Sep 2017

**Rules and roles of non-coding transcription**

Marquardt, Sebastian (Other)  
23 Aug 2016

**Andreas Mayer**

Marquardt, Sebastian (Host)  
7 Jul 2016

**Rules and Roles of Long Non-Coding Transcription**

Marquardt, Sebastian (Other)  
4 Feb 2016

**PhD thesis supervision**

Marquardt, Sebastian (Participant)  
Jan 2016 → Nov 2019

**Rules and Roles of Long Non-Coding Transcription**

Marquardt, Sebastian (Other)  
10 Dec 2015

**Danish National Workshop on non-coding RNA - 2015**

Marquardt, Sebastian (Participant)  
7 Oct 2015

**Rules and Roles of Long Non-Coding Transcription**

Marquardt, Sebastian (Other)  
21 Sep 2015

**Rules and Roles of Long Non-Coding Transcription**

Marquardt, Sebastian (Other)  
28 May 2015

**MSc thesis supervision**

Marquardt, Sebastian (Participant)  
Mar 2015 → Jul 2015

**Roles and Rules for Long Non-Coding Transcription**

Marquardt, Sebastian (Other)  
2 Feb 2015

**Danish RNA Society**

Marquardt, Sebastian (Participant)  
2015 → 2017

**Danish RNA society (External organisation)**

Marquardt, Sebastian (Member)  
2015 → 2018

**Prizes****EMBO Young Investigator Program**

Marquardt, Sebastian (Recipient), 1 Jan 2020

**European Research Council Starting Grant 2017**

Marquardt, Sebastian (Recipient), 2017

**Hallas-Møller Investigator Award**

Marquardt, Sebastian (Recipient), 2015

**Novo Nordisk Ascending Investigator**

Marquardt, Sebastian (Recipient), 2021