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Molekylær Plantebiologi
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Kort præsentation

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.

Kvalifikationer

Biological Sciences, PhD, University of East Anglia
Dimissionsdato: 16 jul. 2010

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

Ansættelse

Lektor - fremmelsesprogrammet

Molekylær Plantebiologi
Københavns Universitet
Frederiksberg C
31 dec. 2014 → nu

Adjunkt

Copenhagen Plant Science Center
Københavns Universitet
Frederiksberg C
1 jan. 2015 → 6 maj 2015

Publikationer

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

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

Cotranscriptional RNA processing and modification in plants

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

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

Gullotta, Giorgio, Korte, A. & Marquardt, Sebastian, 2023, I: Journal of Experimental Botany. 74, 7, s. 2338–2351 14 s.

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

Jin, Yu, Ivanov, M., Dittrich, A. N., Nelson, A. D. L. & Marquardt, Sebastian, 2023, I: EMBO Journal. 42, 11, 21 s., 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, I: Nature Communications. 13, 15 s., 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., Kasprovicz-Maluski, A., Smolinski, D. J., Mammarella, M. F., Ariel, F. D., Marquardt, Sebastian, Szweykowska-Kulinska, Z., Jarmolowski, A. & Manavella, P. A., 2022, I: Nature Plants. 8, 4, s. 402-418 17 s.

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, I: Cells. 10, 2, 22 s., 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, I: EMBO Journal. 40, 23, 16 s., 108903.

TranscriptomeReconstructoR: data-driven annotation of complex transcriptomes

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

Winter fields antisense RNAs to kick off flowering

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

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

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

DNA Processing in the Context of Noncoding Transcription

Gowthaman, U., Garcia Pichardo, Desire, Jin, Yu, Schwarz, Isabel Aimée & Marquardt, Sebastian, 2020, I: Trends in Biochemical Sciences. 45, 12, s. 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, I: Bio-protocol. 10, 20, 17 s., 3796.

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

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

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, I: EMBO Reports. 21, 4, 16 s., 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, I: Nature Communications. 11, 1, s. 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, I: PLOS Genetics. 15, 2, s. 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, I: eLife. 7, e31989.

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

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

Emerging properties and functional consequences of noncoding transcription

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

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, I: Cell. 157, 7, s. 1712-23 12 s.

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, I: Molecular Cell. 54, 1, s. 156-165 10 s.

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

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

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

Marquardt, Sebastian, Hazelbaker, D. Z. & Buratowski, S., maj 2011, I: Transcription. 2, 3, s. 145-154 10 s.

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

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

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

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

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, I: Proceedings of the National Academy of Sciences of the United States of America. 106, 21, s. 8772-7 6 s.

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

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

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

Weigl, C., Marquardt, Sebastian, Kuijt, S. J. H., Nowack, M. K., Jakoby, M. J., Hülskamp, M. & Schnittger, A., jun. 2005, I: Plant Cell. 17, 6, s. 1704-22 19 s.

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, I: Development (Cambridge, England). 131, 2, s. 389-400 12 s.

Aktiviteter

EMBO YIP lecture: Languages of the non-coding genome

Marquardt, Sebastian (Andet)
17 aug. 2023

EMBO Young Investigator Sectoral Meeting: Chromatin & Transcription

Marquardt, Sebastian (Deltager), Messerschmidt, Daniel Martin (Arrangør), Schulz, E. (Arrangør), Hamon, M. (Arrangør) & Cheung, A. (Arrangør)
4 jul. 2023 → 7 jul. 2023

Languages of the non-coding genome

Marquardt, Sebastian (Andet)
20 jun. 2023

EMBO YIP lecture: Languages of the non-coding genome

Marquardt, Sebastian (Andet)
16 jun. 2023

EMBO YIP lecture: Languages of the non-coding genome

Marquardt, Sebastian (Andet)
29 apr. 2023

BSc thesis supervision: Julie Overgaard Hansen

Marquardt, Sebastian (Deltager)
1 apr. 2023 → 15 jun. 2023

Lucia Gonzalo

Marquardt, Sebastian (Vært)
1 apr. 2023 → 30 jun. 2023

EMBO YIP lecture: Languages of the non-coding genome

Marquardt, Sebastian (Andet)
6 mar. 2023

BSc thesis supervision: Hilde Yuwan Børner Stax

Marquardt, Sebastian (Deltager)
1 mar. 2023 → 15 jun. 2023

EMBO YIP lecture: Languages of the non-coding genome

Marquardt, Sebastian (Andet)
1 mar. 2023

EMBO YIP lecture: Languages of the non-coding genome

Marquardt, Sebastian (Andet)
27 feb. 2023

EMBO Young Investigator - Joint Lab Meeting on Singel Cell Transcriptomics

Marquardt, Sebastian (Arrangør)

16 feb. 2023 → 17 feb. 2023

BSc thesis supervision - Jesper Sølvsten

Marquardt, Sebastian (Deltager)

15 feb. 2023 → 15 jun. 2023

Beda Anttila

Marquardt, Sebastian (Vært)

15 feb. 2023 → 15 jul. 2023

MSc supervision: Beda Anttila

Marquardt, Sebastian (Deltager)

15 feb. 2023 → 15 jul. 2023

EMBO YIP lecture: Languages of the non-coding genome

Marquardt, Sebastian (Andet)

30 jan. 2023

Languages of the non-coding genome

Marquardt, Sebastian (Andet)

8 sep. 2022

MSc thesis supervision: Nicholas Bolsi

Marquardt, Sebastian (Deltager)

1 sep. 2022 → 15 jun. 2023

Languages of the non-coding genome

Marquardt, Sebastian (Andet)

31 aug. 2022

Censor BSc thesis, SDU

Marquardt, Sebastian (Eksaminator)

1 jul. 2022

Languages of the Non-coding Genome

Marquardt, Sebastian (Andet)

1 jun. 2022

Languages of the Non-coding Genome

Marquardt, Sebastian (Andet)

5 maj 2022

Bert de Rybel

Marquardt, Sebastian (Vært)

25 apr. 2022

Informed Breeding in the Genomics Era

Marquardt, Sebastian (Andet)

19 apr. 2022

BSc thesis supervision

Marquardt, Sebastian (Deltager)

feb. 2022 → jun. 2022

BSc thesis supervision

Marquardt, Sebastian (Deltager)
feb. 2022 → jun. 2022

BSc thesis supervision

Marquardt, Sebastian (Deltager)
feb. 2022 → jun. 2022

PhD thesis supervision

Marquardt, Sebastian (Deltager)
jan. 2022 → dec. 2024

Languages of the Non-coding Genome

Marquardt, Sebastian (Andet)
7 dec. 2021

Rules and roles of signaling through the non-coding genome

Marquardt, Sebastian (Andet)
5 nov. 2021

6th Annual Meeting on RNA

Marquardt, Sebastian (Deltager)
4 okt. 2021

Exploring the Functional role of the Non-coding Genome

Marquardt, Sebastian (Andet)
20 sep. 2021

Exploring the Functional role of the Non-coding Genome

Marquardt, Sebastian (Andet)
17 sep. 2021

BSc thesis supervision

Marquardt, Sebastian (Deltager) & La Bonté, A. (Prismodtager)
sep. 2021 → jan. 2022

BSc thesis supervision

Marquardt, Sebastian (Deltager)
sep. 2021 → jan. 2022

MSc thesis supervision

Marquardt, Sebastian (Deltager)
sep. 2021 → aug. 2022

International Conference on Arabidopsis Research, ICAR 2021

Marquardt, Sebastian (Deltager)
24 jun. 2021

PhD thesis supervision

Marquardt, Sebastian (Deltager)
apr. 2021 → mar. 2024

BSc thesis supervision

Marquardt, Sebastian (Deltager)
feb. 2021 → jun. 2021

BSc thesis supervision

Marquardt, Sebastian (Deltager)
feb. 2021 → jun. 2021

Genomic Punctuation

Marquardt, Sebastian (Andet)
27 nov. 2020

Chairman PhD assesemnt committe

Marquardt, Sebastian (Eksaminator)
4 nov. 2020

Epigenetics of Genomic Punctuation

Marquardt, Sebastian (Andet)
20 aug. 2020

Grzegorz Brzyżek

Marquardt, Sebastian (Vært)
11 aug. 2020 → 10 nov. 2020

MSc thesis censor

Marquardt, Sebastian (Eksaminator)
26 jun. 2020

External opponent, PhD defense at Aarhus University

Marquardt, Sebastian (Eksaminator)
20 maj 2020

Copenhagen Plant Science Center (Organisation)

Marquardt, Sebastian (Medlem)
2020

Franziska Turck

Marquardt, Sebastian (Vært)
5 dec. 2019

Szymon Swiezewski

Marquardt, Sebastian (Vært)
5 dec. 2019

EMBO Young Investigator Programme

Marquardt, Sebastian (Andet)
31 okt. 2019

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

Marquardt, Sebastian (Deltager)
7 okt. 2019

BSc thesis supervision

Marquardt, Sebastian (Deltager)
sep. 2019 → mar. 2020

BSc thesis supervision

Marquardt, Sebastian (Deltager)
sep. 2019 → jan. 2020

MSc thesis supervision

Marquardt, Sebastian (Deltager)
sep. 2019 → sep. 2020

MSc thesis supervision

Marquardt, Sebastian (Deltager)
sep. 2019 → sep. 2020

MSc thesis supervision

Marquardt, Sebastian (Deltager)
sep. 2019 → nov. 2020

Censor BSc thesis Aarhus University

Marquardt, Sebastian (Eksaminator)
19 jun. 2019

Interplay Between Co-Transcriptional Chromatin States and Transcript Isoform Diversity

Marquardt, Sebastian (Andet)
14 jun. 2019

MSc thesis supervision

Marquardt, Sebastian (Deltager)
jun. 2019 → dec. 2019

MSc thesis supervision

Marquardt, Sebastian (Deltager)
apr. 2019 → mar. 2020

MSc thesis censor, SDU

Marquardt, Sebastian (Eksaminator)
21 mar. 2019

BSc thesis supervision

Marquardt, Sebastian (Deltager)
feb. 2019 → jun. 2019

Molekylær Plantebiologi (Organisation)

Marquardt, Sebastian (Medlem)
2019

EMBO Young Investigator Interview

Marquardt, Sebastian (Andet)
30 okt. 2018

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

Marquardt, Sebastian (Deltager)
9 okt. 2018

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

Marquardt, Sebastian (Andet)

6 okt. 2018

Rules and Roles of Non-coding Transcription

Marquardt, Sebastian (Andet)

5 okt. 2018

MSc thesis supervision

Marquardt, Sebastian (Deltager)

okt. 2018 → feb. 2019

Rules and Roles of Non-coding Transcription

Marquardt, Sebastian (Andet)

31 jul. 2018

Gene Repression by the Act of Transcription

Marquardt, Sebastian (Andet)

19 jun. 2018

Rules and Roles of non-coding Transcription

Marquardt, Sebastian (Andet)

13 jun. 2018

Rules and Roles of non-coding Transcription

Marquardt, Sebastian (Andet)

24 maj 2018

PhD thesis supervision

Marquardt, Sebastian (Deltager)

mar. 2018 → sep. 2021

Rules and Roles of non-coding Transcription

Marquardt, Sebastian (Andet)

27 feb. 2018

Gene Repression Through the Act of Transcription

Marquardt, Sebastian (Andet)

22 feb. 2018

BSc thesis supervision

Marquardt, Sebastian (Deltager)

feb. 2018 → jul. 2018

BSc thesis supervision

Marquardt, Sebastian (Deltager)

feb. 2018 → jun. 2018

BSc thesis supervision

Marquardt, Sebastian (Deltager)

jan. 2018 → jun. 2018

Gene Regulation By the Act of Upstream RNA Polymerase II Transcription

Marquardt, Sebastian (Andet)

20 nov. 2017

3rd Annual Meeting on RNA, 2017

Marquardt, Sebastian (Deltager)
10 okt. 2017

Gene Regulation Through the Act of Upstream Transcription in Arabidopsis

Marquardt, Sebastian (Andet)
10 okt. 2017

Gene Regulation Through the Act of Upstream Transcription in Arabidopsis

Marquardt, Sebastian (Andet)
10 okt. 2017

Rules and Roles of Non-coding Transcription

Marquardt, Sebastian (Andet)
10 okt. 2017

PhD thesis supervision

Marquardt, Sebastian (Deltager)
okt. 2017 → mar. 2021

PhD thesis supervision

Marquardt, Sebastian (Deltager)
okt. 2017 → apr. 2021

Gene Regulation Through the Act of Upstream Transcription in Arabidopsis

Marquardt, Sebastian (Andet)
28 sep. 2017

Gene Regulation Through the Act of Upstream Transcription in Arabidopsis

Marquardt, Sebastian (Andet)
22 sep. 2017

Stalling DNA processing

Marquardt, Sebastian (Deltager)
16 jun. 2017

Stalling DNA processing

Marquardt, Sebastian (Deltager)
16 jun. 2017

Rules and Roles of Non-coding Transcription

Marquardt, Sebastian (Andet)
9 maj 2017

BSc thesis supervision

Marquardt, Sebastian (Deltager)
feb. 2017 → jun. 2017

BSc thesis supervision

Marquardt, Sebastian (Deltager)
feb. 2017 → jun. 2017

MSc thesis supervision

Marquardt, Sebastian (Deltager)
jan. 2017 → jul. 2017

MSc thesis supervision

Marquardt, Sebastian (Deltager)
jan. 2017 → jul. 2017

MSc thesis supervision

Marquardt, Sebastian (Deltager)
jan. 2017 → maj 2017

Caroline Dean

Marquardt, Sebastian (Vært)
18 okt. 2016

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

Marquardt, Sebastian (Deltager)
11 okt. 2016

MSc thesis supervision

Marquardt, Sebastian (Deltager)
sep. 2016 → sep. 2017

MSc thesis supervision

Marquardt, Sebastian (Deltager)
sep. 2016 → sep. 2017

Rules and roles of non-coding transcription

Marquardt, Sebastian (Andet)
23 aug. 2016

Andreas Mayer

Marquardt, Sebastian (Vært)
7 jul. 2016

Rules and Roles of Long Non-Coding Transcription

Marquardt, Sebastian (Andet)
4 feb. 2016

PhD thesis supervision

Marquardt, Sebastian (Deltager)
jan. 2016 → nov. 2019

Rules and Roles of Long Non-Coding Transcription

Marquardt, Sebastian (Andet)
10 dec. 2015

Danish National Workshop on non-coding RNA - 2015

Marquardt, Sebastian (Deltager)
7 okt. 2015

Rules and Roles of Long Non-Coding Transcription

Marquardt, Sebastian (Andet)
21 sep. 2015

Rules and Roles of Long Non-Coding Transcription

Marquardt, Sebastian (Andet)
28 maj 2015

MSc thesis supervision

Marquardt, Sebastian (Deltager)
mar. 2015 → jul. 2015

Roles and Rules for Long Non-Coding Transcription

Marquardt, Sebastian (Andet)
2 feb. 2015

Danish RNA Society

Marquardt, Sebastian (Deltager)
2015 → 2017

Danish RNA society (Ekstern organisation)

Marquardt, Sebastian (Medlem)
2015 → 2018

Priser**EMBO Young Investigator Program**

Marquardt, Sebastian (Modtager), 1 jan. 2020

European Research Council Starting Grant 2017

Marquardt, Sebastian (Modtager), 2017

Hallas-Møller Investigator Award

Marquardt, Sebastian (Modtager), 2015

Novo Nordisk Ascending Investigator

Marquardt, Sebastian (Modtager), 2021