

# Quantitative Developmental Biology, J.S. van Zon (2017-2022)

## Biography



Jeroen van Zon was born on March 30, 1977 in Haarlem, the Netherlands. He did a PhD in theoretical physics at the Vrije Universiteit Amsterdam, under supervision of Prof. Fred MacKintosh. He did a postdoc in mathematical biology at Imperial College with Prof. Martin Howard, from 2006-2008, and a subsequent postdoc in experimental quantitative biology at MIT with Prof. Alexander van Oudenaarden, from 2008-2012. In 2012, he started at AMOLF as tenure track group leader of the 'Quantitative Developmental Biology' group, and received tenure in 2017. He received an ERC Starting Grant in 2013 and an NWO VIDI grant in 2014.

Jeroen is fascinated by the ability of living cells to make decisions, measure time and self-organize into intricate patterns during embryonic development. The central question driving his research is how, during animal development, robust patterns emerge in space and time, despite strong variability on the molecular and cellular level. His approach is to study simple experimental model systems for development – the nematode worm *C. elegans* as well as mammalian organoids – by custom microscopy, quantitative data analysis and predictive mathematical modeling, using concepts from nonlinear dynamics and statistical physics. Key topics include cell fate maintenance by bistable genetic networks, stem cell dynamics and differentiation dynamics and control of developmental timing.

## Group output

### Peer reviewed Publications 2017-2022

#### 2017

1. G. Huelsz-Prince and J.S. van Zon, *Canalization of C. elegans vulva induction against anatomical variability*, Cell Syst, 4(2): 219-230 (2017).
2. D. Katsanos, S.L. Koneru, L. Mestek Boukhibar, N. Gritti, R. Ghose, P.J. Appleford, M. Doitsidou, A. Woollard, J.S. van Zon, R.J. Poole, M. Barkoulas, *Stochastic loss and gain of symmetric divisions in the C. elegans epidermis perturbs robustness of stem cell number*, PLoS Biol. 15(11): e2002429 (2017)

#### 2018

1. M. Doitsidou, G. Minevich, J. R. Kroll, G. Soete, S. Gowtham, H. C. Korswagen, J. S. van Zon, and O. Hobert, *A Caenorhabditis elegans Zinc Finger Transcription Factor, ztf-6, Required for the Specification of a Dopamine Neuron-Producing Lineage Maria*", *G3: Genes, Genomes, Genet.*, vol. 8, 1, 17–26, (2018). **Gold OA**

#### 2019

1. L. Hartl, G. Huelsz-Prince, J.S. van Zon and S.J. Tans, *Apical constriction is necessary for crypt formation in small intestinal organoids*, Dev. Biol. **450** (2), 76-81, (2019). **Hybrid OA**
2. G. Huelsz-Prince, A.L. DeVries, H.J. Bakker, J.S. van Zon and K. Meister, *Effect of Antifreeze Glycoproteins on Organoid Survival during and after Hypothermic Storage*, Biomolecules **9** (3), 110, (2019). **Gold OA**

3. N. Sachs, A. Papaspyropoulos, D.D. Zomer-van Ommen, I. Heo, L. Böttinger, D. Klay, F. Weeber, G. Huelsz-Prince, N. Iakobachvili, G.D. Amatngalim, J. de Ligt, A. van Hoeck, N. Proost, M.C. Viveen, A. Lyubimova, L. Teeven, S. Derakhshan, J. Korving, H. Begthel, J.F. Dekkers, K. Kumawat, E. Ramos, M.F.M. van Oosterhout, G.J. Offerhaus, D.J. Wiener, E.P. Olimpio, K.K. Dijkstra, E.F. Smit, M. van der Linden, S. Jaksani, M. van de Ven, J. Jonkers, A.C. Rios, E.E. Voest, C.H.M. van Moorsel, C.K. van der Ent, E. Cuppen, A. Oudenaarden, F.E. Coenjaerts, L. Meyaard, L.J. Bont, P.J. Peters, S.J. Tans, J.S. van Zon, S.F. Boj, R.G. Vries, J.M. Beekman and H. Clevers, *Long-term expanding human airway organoids for disease modeling*, EMBO J. **38** (4), e100300:1-20 (2019). **Hybrid OA**

## 2020

1. R.N.U. Kok, L. Hebert, G. Huelsz-Prince, Y.J. Goos, X. Zheng, K. Bozek, G.J. Stephens, S.J. Tans and J.S. van Zon, *OrganoidTracker: : Efficient cell tracking using machine learning and manual error correction*, PLoS One **15**, (10), e0240802: 1-18 (2020), **Gold OA**.
2. B. Artegiani, D. Hendriks, J. Beumer, R.N.U. Kok, X. Zheng, I. Joore, S. Chuva de Sousa Lopes, J.S. van Zon, S.J. Tans and H. Clevers, *Fast and efficient generation of knock-in human organoids using homology-independent CRISPR–Cas9 precision genome editing*, Nature Cell Biol. **22**, (3), 321-331 (2020), **Green OA**.
3. J.R. Kroll, J. Tsiaxiras and J.S. van Zon, *Variability in the timing of a  $\beta$ -catenin pulse biases a stochastic cell fate decision in *C. elegans**, Dev. Biol. **461**, (2), 110-123 (2020), **Hybrid OA**.

## 2021

1. J.J.H. Traets, S.N. van der Burght, S. Rademakers, G. Jansen and J.S. van Zon, *Mechanism of life-long maintenance of neuron identity despite molecular fluctuations*, eLife **10**, e66955: 1-28 (2021) Gold OA
2. M.A. Betjes, X. Zheng, R.N.U. Kok, J.S. van Zon and S.J. Tans, *Cell Tracking for Organoids: Lessons From Developmental Biology*, Front. Cell Dev. Biol. **9**, 675013: 1-7 (2021) Gold OA
3. S.L. Koneru, F.X. Quah, R. Ghose, M. Hintze, N. Gritti, J.S. van Zon and M. Barkoulas, *A role for the fusogen *eff-1* in epidermal stem cell number robustness in *Caenorhabditis elegans**, Sci. Rep. **11**, (1), 9787: 1-13 (2021) Gold OA

## 2022

1. G. Huelsz-Prince, R.N.U. Kok, Y.J. Goos, L. Bruens, X. Zheng, S. Ellenbroek, J. Van Rheenen, S.J. Tans and J.S. van Zon, *Mother cells control daughter cell proliferation in intestinal organoids to minimize proliferation fluctuations*, eLife **11**, e80682: 1-21 (2022) Gold OA
2. G.-W. He, L. Lin, J. DeMartino, X. Zheng, N. Staliarova, T. Dayton, H. Begthel, W.J. van de Wetering, E. Bodewes, J.S. van Zon, S.J. Tans, C. Lopez-Iglesias, P.J. Peters, W. Wu, D. Kotlarz, C. Klein, T. Margaritis, F. Holstege and H. Clevers, *Optimized human intestinal organoid model reveals interleukin-22-dependency of paneth cell formation*, Cell Stem Cell **29**, (9), 1333-1345.e6 (2022) Hybrid OA
3. O. Filina, B. Demirbas, R. Haagmans and J.S. van Zon, Reply to Zhang et al.: *The critical temperature dependence of developmental rates is in search of a mechanism*, PNAS **119**, (26), e2206338119: 1-1 (2022) Hybrid OA
4. O. Filina, B. Demirbas, R. Haagmans and J.S. van Zon, *Temporal scaling in *C. elegans* larval development*, PNAS **119**, (11) (2022) Hybrid OA

Contributions to scientific books (chapters or entire book) 2017-2022

N/A

## PhD theses 2017-2022

### 2017

1. N. Gritti, *Time-lapse microscopy study of noise in development*, Delft University of Technology, 13-04-2017

### 2019

1. G. Huelsz-Prince, *Snooping on cells in worms and mini-organs*, Delft University of Technology, October 14, 2019. **OA**

### 2021

1. O. Filina, *Temporal dynamics in C. Elegans Development and stress response*, Delft University of Technology, 2021-03-31 **OA**
2. J.J.H. Traets, *Developmental timing and cell fate maintenance in Caenorhabditis elegans*, VU University Amsterdam, 2021-02-10 **OA**

## Masters and Bachelors theses 2017-2022

### 2018

1. MSc thesis; Rutger Kok (2018) Automatic cell tracking in growing intestinal organoids. Universiteit Utrecht.
2. MSc thesis; Muriel Heldring (2018) Stress-induced DAF-16 nuclear localization dynamics in C. elegans depend on stress type and intensity. Vrije Universiteit.
3. MSc thesis; Rik Haagmans (2018) Period homolog lin-42 regulates rate of development, but not relative developmental timing, and is required for coupling of growth to development. Universiteit Utrecht.

### 2019

1. Dimphy van Boerdonk, Expression variability in C.elegans and epigenetic transgenerational inheritance of pharynx muscle and neuron related genes, Wageningen Universiteit. (master thesis)
2. Simon Isphording, Using vertex models to study Paneth cell localization, Vrije Universiteit/ Universiteit van Amsterdam, jointly supervised with P.R. ten Wolde.
3. Widya Puspitaloka, Asymmetric Cell Fate: A Novel Computational Analysis to Examine Cell Homeostasis in Growing Intestinal Organoids, University College Amsterdam, jointly supervised with S.J. Tans (bachelor thesis).

### 2020

1. Madelon Geurts, Modelling the synchronization of DAF-16 oscillations under starvation in multiple cells, Universiteit van Amsterdam & Vrije Universiteit Amsterdam (batchelor thesis).

### 2021

1. Anastasia Spinou, "Modelling the pulse synchronization of DAF-16 in Caenorhabditis elegans cells", master's thesis, Wageningen University, 08/2021.

## Invited lectures at international conferences and meetings

### 2017

1. J.S. van Zon, *Multiple noise sources drive the stochastic AC/VU decision during C. elegans development*, 21<sup>th</sup> International C. elegans meeting, Los Angeles, USA, June 21-25, 2017 (selected talk)
2. J.S. van Zon, *Robustness and variability in C. elegans development*, Cambridge Area Worm Meeting, Cambridge, UK, April 26, 2017

## **2019**

1. J.S. van Zon, How to maintain cell fate despite intrinsic variability on the molecular level, 22th International C. elegans meeting, Los Angeles, USA, June 20-24, 2019 (selected talk)

## **2020**

1. J.S. van Zon, *How to maintain cell fate despite intrinsic variability on the molecular level*, Institute of Molecular Pathology (IMP), Vienna, February 20, 2020

## **2022**

1. J.S. van Zon, *All cells, all the time -tracking the biophysics of development using organoids*, Workshop 'The Future of the Physics of Life', Amsterdam, June 16-17, 2021

## Academic Teaching 2017-2022

### **2019**

1. J.S. van Zon, Rolling dice for development: the role of randomness in developing C. elegans worms, Masterclass for master students, Universiteit Utrecht, April 4, 2019.

### **2021**

1. J.S. van Zon, lecture block on 'Noise in development' for the course 'Physics of Biological Systems: mathematical modelling' at the TU Delft, including assignments and exam questions (2021).

### **2022**

1. J.S. van Zon, lecture block on 'Noise in development' for the course 'Mukltiscale mathematical modelling' at Leiden University (2022).

## Selected awards & recognitions 2017-2022

N/A

## Valorization 2017-2022

N/A