

# **VU Amsterdam Summer School 2020**

## **Nature and Nurture: Twin Research and Human Genetics**



**Course coordinator:  
Dr. Jenny van Dongen**

Teaching staff (in order of appearance)

**Professor Dorret Boomsma**  
di.boomsma@vu.nl

**Dr. René Pool**  
r.pool@vu.nl

**Professor Conor Dolan**  
c.v.dolan@vu.nl

**Dr. Michel Nivard**  
m.g.nivard@vu.nl

**Dr. Dennis van 't Ent**  
d.vant.ent@vu.nl

**Professor Meike Bartels**  
m.bartels@vu.nl

**Professor Gonneke Willemsen**  
a.h.m.willemsen@vu.nl

**Dr. Abdel Abdellaoui**  
a.abdellaoui@amc.uva.nl

**Dr. Lannie Ligthart**  
rsl.ligthart@vu.nl

**Dr. Veronika Odintsova**  
v.v.odintsova@vu.nl

**Dr. Jorien Treur**  
j.l.treur@amc.uva.nl

**Dr. Jenny van Dongen**  
j.van.dongen@vu.nl

**Dr. Rick Janssen**  
Ri.Jansen@ggzingeest.nl

**Dr. Elsje van Bergen**  
e.van.bergen@vu.nl

**Professor Michael Neale**  
michael.neale@vcuhealth.org

**Professor Eco de Geus**  
eco.de.geus@vu.nl



**General information**

Date: July 18 to August 1

ECTS credits: 3

**Contact information**

Dr. Jenny van Dongen (course coordinator)

email: [j.van.dongen@vu.nl](mailto:j.van.dongen@vu.nl)

VU Amsterdam Summer School:

e-mail: [amsterdamsummerschool@vu.nl](mailto:amsterdamsummerschool@vu.nl), telephone: +31 20 59 86429

**Course description**

Do twins hold the key to understanding complex human traits and diseases? Can they resolve the age-old debate between nature and nurture? What is determined by our DNA, what comes from our environment? Thanks to recent technological advances, we are closer than ever to explaining where our individual differences come from. Our ability to map human DNA at high resolution in large populations is now enabling us to link genetic variation to traits and disease at the molecular level.

This interdisciplinary course puts you at the forefront of these exciting and important developments. You focus on twins to explore the interplay of genes and environment in determining behaviour, lifestyle and health. Uniquely, you gain hands-on access to the world-renowned Netherlands Twin Register at VU Amsterdam – one of the largest longitudinal databases of its kind. Your tutors are scientists closely associated with this core asset, the people who collect the information and work with it on a daily basis to unravel the genetic etiology of a wide range of medical conditions and personal characteristics. They train you in working with twin data and information from genomics and epigenetics. You learn how to collect material on behaviour and health and how to use molecular data to better understand the path from genetics to medicine. Naturally, we also cover the theoretical and philosophical background to help you interpret genetic studies, understand effective methods and designs and increase your understanding of complex human traits.

## Learning objectives

At the end of this course the students:

- Understand and can interpret results from genetic studies of complex human behavioural traits.
- Understand the current state of human genetics research from a historical perspective and can contribute to discussions about gene-environment interaction.
- Can analyse genetically informative twin and family data.
- Understand the assessment and diagnosis of traits and phenotypes.
- Can work with multiple “-omics” data: genomics, epigenomics, transcriptomics and microbiomics.

## Social program – July 23

On Friday July 23, in addition to the general VU Amsterdam Summer School excursions, there will be a social program or excursion with the students from this summer school. More information will be announced later.

## Assignments

- Practical assignments: completed during the course
- Writing a research proposal
- Presenting an e-poster

## Grading

- Research proposal

The grades will be based on a final assignment - a written research proposal. During the e-poster presentation on Friday July 31 you will present your plan. **The research proposal should be handed in no later than August 14, 2020.** You can e-mail the proposal (or any other questions you may have) to [j.van.dongen@vu.nl](mailto:j.van.dongen@vu.nl). The final assignment is as follows:

- What **genetically informative** study would you conduct **within 2 years** if we gave you **1 million Euro's**? Write a **research proposal** about your idea.
- Use these two weeks to think about what is possible and what research questions you would like to answer.
- The research proposal should be **750-1000 words** long
- Feel free to discuss your ideas with your fellow students and teachers

Note: On Wednesday July 29 there will be a special session *Discussion research proposals & Tea* during which we can discuss your ideas.

- The research proposal (and the e-poster) should contain the following:

***..Introduction and Motivation:***

- Background information on the topic based on existing literature
- Research question(s)
- Relevance

***..Methodology:***

- Data collection (if necessary)
- Analyses

***..Knowledge utilization:***

- How will scientific research and/or society benefit from the study?

Present your research idea as an Electronic-Poster

- The E-poster should be **prepared** as a power point
- The E-poster should include no more than 3 slides

The written proposal will be evaluated based on the following criteria:

<b>Rubric category</b>	<5.5 Insufficient	5.5-7.25 Sufficient	7.25-8.5 Good	>8.5 Excellent
1. Relevance				
2. Methodology				
3. Knowledge utilization (feasibility)				
4. Effective academic writing				

**Provisional reading list**

Date	Literature
Monday 20-07	Establishing a Twin Register: An Invaluable Resource for (Behavior) Genetic, Epidemiological, Biomarker, and 'Omics' Studies - Odintsova VV et al World of Twins - Nancy Segal The Future of Twin Studies - Nicholas Martin
Tuesday 21-07	Lecture Notes (1) – Conor Dolan Intro to R: <a href="https://www.youtube.com/playlist?list=PLOU2XLYxmsIK9qQfztXeybpHvru-TrqAP">https://www.youtube.com/playlist?list=PLOU2XLYxmsIK9qQfztXeybpHvru-TrqAP</a> - Google Developers – Youtube
Thursday 23-07	Lecture Notes (2) – Conor Dolan
Friday 24-07	Genetics and intelligence differences – Robert Plomin & Ian Deary – Molecular Psychiatry (2015)
Monday 27-07	A Tutorial on Statistical Methods for Population Association Studies – David Balding – Nature Reviews Genetics (2006) 10 Years of GWAS Discovery: Biology, Function, and Translation – Peter Visscher et al – American Journal of Human Genetics (2017) Dissecting the Genetics of Complex Traits Using Summary Association Statistics – Bogdan Pasanuic & Alkes Price – Nature Reviews Genetics (2016)
Wednesday 29-07	Mendelian randomization: genetic anchors for causal inference in epidemiological studies – George Davey Smith & Gibran Hermani – Human Molecular Genetics (2014)
Thursday 30-07	An epigenomics approach to individual differences and its translation to neuropsychiatric conditions – J David Sweatt & Carol A. Tamminga – Translational Research (2016)
Friday 31-07	Genetics in Population Health Science: Strategies and Opportunities Belsky DW, Moffitt TE, Caspi A. – Genetics in population health science: strategies and opportunities. (2013)



Week 1 – Classical Twin Studies

Day	Time	Topic	Lecturers	Location
Monday 20-07	9.00 – 10.00	Campus tour		
	10.00-11.30	Introduction to Twin Research	Professor Dorret Boomsma	
	11.30-12.30	Lunch Break		
	12.30-13.30	Introduction to Human Genetics	Dr. René Pool	
	13.30-13.45	Break		
	13.45-14.45	<i>Practical:</i> Introduction to TR&HG	Professor Dorret Boomsma	
	14.45-15.00	Break		
	15.00-	Pub quiz		
Tuesday 21-07	10.00-11.00	Twin Methods & Statistics – Lecture 1/2	Professor Conor Dolan	
	11.00-11.30	Break		
	11.30-12.30	Statistics in R – Lecture 1/2	Dr. Michel Nivard	
	12.30-13.30	Lunch Break		
	13.30-16.00	<i>Practical:</i> Twin Methods & Statistics in R	Professor Conor Dolan & Dr Michel Nivard	
Wednesday 22-07	09.00-10.00	Brain imaging	Dr. Dennis van 't Ent	
	10:00-12.00	Lab visit	TBA	
	12.00-13.00	Lunch Break		
	13.00-?	VU Summer School Excursion		
Thursday 23-07	10.00-11.00	Twin Methods & Statistics – Lecture 2/2	Professor Conor Dolan	
	11.00-11.15	Break		
	11.15-12.15	Statistics in R – Lecture 2/2	Dr. Michel Nivard	
	12.15-13.30	Lunch Break		
	13.30-16.00	<i>Practical:</i> Twin Methods & Statistics in R	Professor Conor Dolan & Dr. Michel Nivard	
Friday 24-07	09.00-09.45	Cognition	Professor Conor Dolan	



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Heritable phenotypes & excursion	09.45-10.00	Break		
	10.00-10.45	Well-being		Professor Meike Bartels
	10.45:11.00	Break		
	11.00-11.45	Stress and physiological activity		Professor Gonneke Willemsen
	12.00-16.30	Lunch + Excursion		Dr. Jenny van Dongen & PhD student & Research master student
Saturday 25-07		VU Summer School Excursion		

Week 2 – Molecular Genetics

Day	Time	Topic	Lecturers	Location	
Monday 27-07	10.00-11.30	Introduction to the Genomics Era	Dr. Abdel Abdellaoui		
	11.30-12.30	Lunch Break			
	Introduction to the Genomics Era	12.30-13.30	Introduction to GWAS	Dr. Lannie Ligthart	
		13.30-14.00	Break		
		14.00-15.30	Linux beginner's workshop	Dr. René Pool	
Tuesday 28-07	10.00-11.30	<i>Practical: GWAS</i>	Dr. Lannie Ligthart + PhD student		
	11.30-11.45	Break			
	GWAS	11.45-12.30	TBA	TBA	
		12.30-13.30	Lunch Break		
		13.30-16.00	Movie (GATTACA) + discussion	Dr. Veronika Odintsova	
Wednesday 29-07	10.00-11:00	Mendelian Randomization	Dr. Jorien Treur		
	Mendelian Randomization & discussion of research proposals	11.00-12.00	Discussion of research proposals with lecturers with coffee and tea	Lecturers	
		12.00-13.00	Lunch Break		
	13.00-	VU Summer School Excursion			
Thursday 30-07	10.00-12.30	Epigenetics (Lecture + <i>Practical</i> )	Dr. Jenny van Dongen		
	12.30-13.30	Lunch Break			
	Epigenetics, gene expression and working in academia	13.30-14.30	Gene expression	Dr. Rick Jansen	
		14.30-15.00	Break		
		15.00-16.30	Working as a behavior geneticist in academia	Dr. Elsje van Bergen & PhD student & Research master student	
Friday 31-07	10.00-11.00	Strengthening causal inference via genetically informative samples	Professor Michael Neale		
	Clinical Applications and student presentations	11.00-11.15	Break		



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	11.15-12.15	Clinical Applications in Human Genetics	Professor Eco de Geus	
	12.30-14.45	Lunch + E-poster presentations by participants + Meet & Greet NTR Researchers	All lecturers and NTR researchers	
	15.00-?	Goodbye Drinks		The Basket