



# CV

## PROF. DR. NIELS VERHULST

### GROUP LEADER VECTOR ECOLOGY

#### KONTAKT

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Nationality Dutch

#### PUBLICATIONS (JAN 2022)

- ▶ Total: 47
- ▶ First author: 22
- ▶ Last author: 8
- ▶ Citations: 2371
- ▶ H-index: 25
- ▶ I10-index 32
- ▶ Publication list:

<https://scholar.google.nl/citations?user=moeyGfAAAAAJ&hl=en>

#### Short Profile

Leader of the vector ecology group within the Institute for Parasitology at the University of Zürich and part of the National Centre for Vector Entomology. As a chemical ecologist I study the behaviour of vectors of different pathogens, with the aim to develop new vector control tools. Understanding the thermal preference of vectors will help to develop better disease risk models. The thermal preference of mosquitoes and biting midges is studied with video tracking and (semi)-field setups. Host preference is another important determinant of pathogen transmission. Skin bacterial odours influence host finding of mosquitoes and biting midges. Goal is to develop skin bacterial products that could reduce biting and thereby pathogen transmission.

#### Professional experience

2017 - Present

**Group leader vector ecology**

**Institute for Parasitology, University of Zürich, Switzerland**

- Leading a group of 6 scientists (1 PostDoc, 3 Doctoral students, 1 Junior researcher, 1 Technician)
- Teaching several courses at BsC, MsC and PhD level for biology and veterinary students

Current main projects:

- Spatial repellents to reduce pathogen transmission to animals by biting midges, FAN Stiftung
- Skin microbials against biting midges, Gebert Rüt Stiftung
- Thermal preferences of mosquitoes & biting midges, SNF grant
- BioCamo: Microbiome-based human signature management for disease vector control, DARPA

Other projects:

- Co-supervisor a PhD student in the Netherlands working on a grant I obtained in 2017: The smell of success: Detection of nutritious blood meals by mosquitoes
- Xenodiagnostics for disease detection in animals

2014 - 2017

**PostDoc**

**Laboratory of Entomology, Wageningen University, NL**

*Project: Mosquitoes as bridge vectors of infectious pathogens between apes and humans*

- Personal NWO-Veni grant (equivalent to Swiss Ambizione)
- Volatile and microbiome analysis of apes and humans
- Sampling mosquitoes in Cameroon and The Republic of Congo near wild primates

2010 - 2014

**PostDoc**

**Laboratory of Entomology, Wageningen University, NL**

*Project: Skin microbiota as determinant of host specificity in mosquitoes*

- Host preference of different mosquito species
- Role of bacterial volatiles in mosquito host-seeking
- Supervision of PhD candidate, Annette Busula, ICIPE, Kenya

2006 - 2010

**PhD student**

**Laboratory of Entomology, Wageningen University, NL**

*Project: Behavioral response of Anopheles gambiae to human odors and the role of skin microbiota*

2005 **Researcher, Tropenzorg B.V., NL**

2004 **Reviewer phytosanitary law, NVWA, NL**

## LANGUAGES

- ▶ Dutch Native speaker
- ▶ English Fluent
- ▶ German Good
- ▶ Spanish Basic

## SOFTWARE (SELECTION)

- ▶ Slack
- ▶ R-programming
- ▶ Xcalibur (GC-MS analysis)
- ▶ SIMCA-P
- ▶ Ethovision (Video tracking)

## INTERESTS

- ▶ Skiing
- ▶ Hiking
- ▶ Travel
- ▶ Nature

2003 [Field researcher](#)

*Instituut voor Rationele Suikerproductie (IRS), Bergen op Zoom, NL*

2003 [Researcher](#), *Laboratory of Entomology, Wageningen University, NL*

## Project grants

- 2022 FAN Stifting, 1 year: Spatial repellents against biting midges
- 2020 Gebert Rûf Stiftung, 3-year: Skin microbials against biting midges
- 2020 SNF, 3.5-year: Thermal preferences of mosquitoes and biting midges
- 2020 DARPA, 2x1.5-year BioCamo: Microbiome-based human signature management for disease vector control
- 2019 UZH Investitionskredit for Noldus camera tracking system
- 2017 NWO-ALW, 4-year PhD project: The smell of success: Detection of nutritious blood meals by mosquitoes
- 2013 NWO-Veni, (equivalent to Swiss Ambizione) 3.5-year: Mosquitoes as bridge vectors of infectious pathogens between apes and humans
- 2010 NWO-ALW, 3-year: Skin microbiota as determinant of host specificity in mosquitoes

## Education

- 2020 Course: Teaching Skills - Systematic Development of Teaching Competence. I acquired the "Teaching Skills" attestation
- 2006-2010 PhD-student at the Laboratory of Entomology, Wageningen University, NL.
- 1997-2003 Plant Breeding and Crop Protection, specialization Ecological Crop Protection, Wageningen University, NL
- 1991-1997 Secondary education, VWO, Haarlemmermeerlyceum, NL

## Teaching

- 2021-now Parasitology II
- 2018,2021 Lecturer in the doctoral course "Very Important Parasites"
- 2018-now Bio 298: Arthropods (insects and ticks) of (veterinary)medical importance
- 2018-now Bio 299: Veterinary and wild animal parasitology
- 2018-now Practical afternoon Pathobiology course
- 2018 Guest lecture on host preference for the PhD insect chemical ecology course, Alnarp Sweden
- 2013-2017 Analysis and Prevention of Tropical Health Risks
- 2010-2017 Frontiers in Medical and Veterinary Biology
- 2013 Guest speaker, Leids Universitair Medisch Centrum, Entomological aspects of malaria

## Invited talks

- 2022 MSD Leadership council meeting
- 2021 Microbiome connect. Amsterdam, The Netherlands
- 2021 Interdisciplinary colloquium on body odours
- 2019 Le Studium Conference. Tours, France
- 2019 Swiss Vector Entomology Group (SVEG), Neuchatel, Switzerland, Keynote speaker
- 2017 Trade mission with Dutch minister of agriculture, UC Davis, USA
- 2017 Amsterdam Kindersymposium, Amsterdam
- 2016 European Society of Vector Ecology (ESOVE), Lisbon, Portugal
- 2015 International Society of Chemical Ecology (ISCE), Stockholm, Sweden
- 2014 Latin American Society of Chemical Ecology (ALAEQ), Bogota, Colombia. Keynote speaker
- 2012 International Society of Chemical Ecology (ISCE), Vilnius, Lithuania

## Scientific memberships

- International Society of Chemical Ecology (ISCE)
- Society of Vector Entomology (SOVE)
- Swiss Society of Tropical Medicine and Parasitology (SSTMP)

- Lucas-Barbosa, D., DeGennaro, M., Mathis, A. & Verhulst, N. O. (2022) Skin bacterial volatiles: propelling the future of vector control. *Trends in parasitology*, **38**, 15-22.
- Štefanić, S., Grimm, F., Mathis, A., Winiger, R. & Verhulst, N. O. (2022) Xenosurveillance proof-of-principle: Detection of *Toxoplasma gondii* and SARS-CoV-2 antibodies in mosquito blood meals by (pan)-specific ELISAs. *Current Research in Parasitology & Vector-Borne Diseases*, **2**, 100076.
- Verhulst, N. O. & Diez-Fernández, A. (2022) Effect of host preferences of mosquitoes on disease transmission between wildlife and humans. In *Ecology and Control of Vector-borne Diseases*, pp. 194-200. Wageningen Academic Publishers.
- Verhulst, N. O. (2022) The search for sex pheromones in malaria mosquitoes. *Peer Community in Ecology*, 100091.
- Ziegler, R., Blanckenhorn, W. U., Mathis, A. & Verhulst, N. O. (2022) Video analysis of the locomotory behaviour of *Aedes aegypti* and *Ae. japonicus* mosquitoes under different temperature regimes in a laboratory setting. *Journal of Thermal Biology*, **105**, 103205.
- Paslaru, A. I., Verhulst, N. O., Maurer, L. M., Brendle, A., Pauli, N., Vögltin, A., et al. (2021) Potential mechanical transmission of Lumpy skin disease virus (LSDV) by the stable fly (*Stomoxys calcitrans*) through regurgitation and defecation. *Current Research in Insect Science*, **1**, 100007.
- Bakker, J. W., Loy, D. E., Takken, W., Hahn, B. H. & Verhulst, N. O. (2020) Attraction of mosquitoes to primate odours and implications for zoonotic *Plasmodium* transmission. *Medical and Veterinary Entomology*, **34**, 17-26.
- Verhulst, N. O., Cavegn, J. C. & Mathis, A. (2020) Spatial repellency and vapour toxicity of transfluthrin against the biting midges *Culicoides nubeculosus* and *C. sonorensis* (Ceratopogonidae). *Current Research in Insect Science*, 100002.
- Verhulst, N. O., Brendle, A., Blanckenhorn, W. U. & Mathis, A. (2020) Thermal preferences of subtropical *Aedes aegypti* and temperate *Ae. japonicus* mosquitoes. *Journal of Thermal Biology*, **91**, 102637.
- Visser, T. M., de Cock, M. P., Hiwat, H., Wongsokarijo, M., Verhulst, N. O. & Koenraadt, C. J. M. (2020) Optimisation and field validation of odour-baited traps for surveillance of *Aedes aegypti* adults in Paramaribo, Suriname. *Parasites & Vectors*, **13**, 121.
- Koenraadt, C. J. M., Möhlmann, T. W. R., Verhulst, N. O., Spitzen, J. & Vogels, C. B. F. (2019) Effect of overwintering on survival and vector competence of the West Nile virus vector *Culex pipiens*. *Parasites & Vectors*, **12**, 147.
- Robinson, A., Busula, A. O., Voets, M. A., Beshir, K. B., Caulfield, J. C., Powers, S. J., et al. (2018) *Plasmodium* associated changes in human odor attract mosquitoes. *Proceedings of the National Academy of Sciences*, **115**, E4209-E4218.
- Verhulst, N. O., Spitzen, J. & Boulanger, N. (2018) Impact of skin microbiome on attractiveness to arthropod vectors and pathogen transmission. In *Skin and Arthropods* (ed. by N. Boulanger), pp. 55-82. Academic Press, London.
- Verhulst, N. O., Umanets, A., Weldegergis, B. T., Maas, J. P. A., Visser, T. M., Dicke, M., et al. (2018) Do apes smell like humans? The role of skin bacteria and volatiles of primates in mosquito host selection. *Journal of Experimental Biology*, **221**, jeb.185959.
- Busula, A. O., Bousema, T., Mweresa, C. K., Masiga, D., Logan, J. G., Sauerwein, R. W., et al. (2017) Gametocytemia and attractiveness of *Plasmodium falciparum*-infected Kenyan children to *Anopheles gambiae* mosquitoes. *The Journal of Infectious Diseases*, **216**, 291-295.
- Busula, A. O., Verhulst, N. O., Bousema, T., Takken, W. & de Boer, J. G. (2017) Mechanisms of *Plasmodium*-enhanced attraction of mosquito vectors. *Trends in Parasitology*, **33**, 961-973.
- Busula, A. O., Takken, W., De Boer, J. G., Mukabana, W. R. & Verhulst, N. O. (2017) Variation in host preferences of malaria mosquitoes is mediated by skin bacterial volatiles. *Medical and Veterinary Entomology*, **31**, 320-326.
- Junker, R. R., Kuppler, J., Amo, L., Blande, J. D., Borges, R. M., van Dam, N. M., et al. (2017) Covariation and phenotypic integration in chemical communication displays: biosynthetic constraints and eco-evolutionary implications. *New Phytologist*, **220.3**, 739-749.
- Takken, W. & Verhulst, N. (2017) Chemical signaling in mosquito-host interactions: the role of human skin microbiota. *Current Opinion in Insect Science*, **20**, 68-74.
- Takken, W., van Vliet, A. J. H., Verhulst, N. O., Jacobs, F. H. H., Gassner, F., Hartemink, N., et al. (2016) Acarological risk of *Borrelia burgdorferi* sensu lato infections across space and time in The Netherlands. *Vector-Borne and Zoonotic Diseases*, **17**, 99-107.
- Verhulst, N. O., Weldegergis, B. T., Menger, D. & Takken, W. (2016) Attractiveness of volatiles from different body parts to the malaria mosquito *Anopheles coluzzii* is affected by deodorant compounds. *Scientific Reports*, **6**, 27141.
- Busula, A., Takken, W., Loy, D., Hahn, B., Mukabana, W. & Verhulst, N. O. (2015) Mosquito host preferences affect their response to synthetic and natural odour blends. *Malaria Journal*, **14**, 133.
- Mweresa, C. K., Otieno, B., Omusula, P., Weldegergis, B. T., Verhulst, N. O., Dicke, M., et al. (2015) Understanding the long-lasting attraction of malaria mosquitoes to odor baits. *PLoS ONE*, **10**, e0121533.
- van Loon, J. J. A., Smallegange, R. C., Bukovinszkiné-Kiss, G., Jacobs, F., De Rijk, M., Mukabana, W. R., et al. (2015) Mosquito attraction: crucial role of carbon dioxide in formulation of a five-component blend of human-derived volatiles. *Journal of Chemical Ecology*, **41**, 567-573.



- Verhulst, N. O., Bakker, J. W. & Hiscox, A. (2015) Modification of the suna trap for improved survival and quality of mosquitoes in support of epidemiological studies. *Journal of the American Mosquito Control Association*, **31**, 223-232.
- Verhulst, N. O. & Takken, W. (2015) Skin microbiota and attractiveness to mosquitoes. In *Encyclopedia of Metagenomics* (ed. by N. E. Karen), pp. 591-595. Springer.
- Pombi, M., Jacobs, F., Verhulst, N. O., Caputo, B., della Torre, A. & Takken, W. (2014) Field evaluation of a novel synthetic odour blend and of the synergistic role of carbon dioxide for sampling host-seeking *Aedes albopictus* adults in Rome, Italy. *Parasites & Vectors*, **7**, 580.
- Takken, W. & Verhulst, N. O. (2013) Host preferences of blood-feeding mosquitoes. *Annual Review of Entomology*, **58**, 433-453.
- Verhulst, N. O., Beijleveld, H., Qiu, Y. T., Maliepaard, C., Verduyn, W., Haasnoot, G. W., et al. (2013) Relation between HLA genes, human skin volatiles and attractiveness of humans to malaria mosquitoes. *Infection, Genetics and Evolution*, **18**, 87-93.
- Verhulst, N. O., Loonen, J. A. C. M. & Takken, W. (2013) Advances in methods for colour marking of mosquitoes. *Parasites & Vectors*, **6**, 200.
- Verhulst, N. O., Smallegange, R. C. & Takken, W. (2012) Mosquitoes as potential bridge vectors of malaria parasites from non-human primates to humans. *Frontiers in Physiology*, **3**, 197.
- Gassner, F., van Vliet, A. J. H., Burgers, S. L. G. E., Jacobs, F., Verbaarschot, P., Hovius, E. K. E., et al. (2011) Geographic and temporal variations in population dynamics of *Ixodes ricinus* and associated *Borrelia* infections in the Netherlands. *Vector-Borne and Zoonotic Diseases*, **11**, 523-532.
- Smallegange, R. C., Verhulst, N. O. & Takken, W. (2011) Sweaty skin: an invitation to bite? *Trends in Parasitology*, **27**, 143-148.
- Verhulst, N. O., Mukabana, W. R., Takken, W. & Smallegange, R. C. (2011) Human skin microbiota and their volatiles as odour baits for the malaria mosquito *Anopheles gambiae* s.s. *Entomologia Experimentalis et Applicata*, **139**, 170-179.
- Verhulst, N. O., Mbadi, P., Kiss, G., Mukabana, W., van Loon, J. J. A., Takken, W., et al. (2011) Improvement of a synthetic lure for *Anopheles gambiae* using compounds produced by human skin microbiota. *Malaria Journal*, **10**, 28.
- Verhulst, N. O., Qiu, Y. T., Beijleveld, H., Maliepaard, C., Knights, D., Schulz, S., et al. (2011) Composition of human skin microbiota affects attractiveness to malaria mosquitoes. *PLoS One*, **6**, e28991.
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- Verhulst, N. O. (2010) The role of skin microbiota in the attractiveness of humans to the malaria mosquito *Anopheles gambiae* Giles. Wageningen University, Wageningen.
- Verhulst, N. O., Takken, W., Dicke, M., Schraa, G. & Smallegange, R. C. (2010) Chemical ecology of interactions between human skin microbiota and mosquitoes. *FEMS Microbiology Ecology*, **74**, 1-9.
- Verhulst, N. O., Beijleveld, H., Smallegange, R. C., Takken, W., Knols, B. G. J., Qiu, Y. T., et al. (2009) Behaviour modifying compounds for malaria mosquitoes. In *World Intellectual Property Organisation* (ed. by W. University), the Netherlands.
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- Takken, W., Verhulst, N., Scholte, E. J., Jacobs, F., Jongema, Y. & van Lammeren, R. (2008) The phenology and population dynamics of *Culicoides* spp. in different ecosystems in The Netherlands. *Preventive Veterinary Medicine*, **87**, 41-54.
- Verhulst, N. O., Takken, W. & Smallegange, R. C. (2008) Structural design affects entry response of mosquitoes in olfactometers. *Proceedings of the Netherlands Entomological Society meeting*, **19**, 129-136.
- Takken, W., Verhulst, N. O., Scholte, E. J., Jacobs, F. H. H., Jongema, Y., Lammeren, R. J. A. v., et al. (2007) Distribution and dynamics of arthropod vectors of zoonotic disease in the Netherlands in relation to risk of disease transmission, pp. 59. Wageningen University.
- Takken, W., Rooij, E. M. A. v., Verhulst, N. O., Jacobs, F., Huijben, S., Beeuwkes, J., et al. (2007) Bluetongue: an emerging vector-borne disease outbreak in North-western Europe. In *Emerging Pests and Vector-borne Diseases in Europe* (ed. by W. Takken & B. Knols), pp. 113-121. Wageningen Academic Publishers, Wageningen.
- Verhulst, N. O., Curtis, C. F. & Hill, N. (2007) Personal protection against European disease vectors. In *Emerging Pests and Vector-borne Diseases in Europe* (ed. by W. Takken & B. Knols), pp. 355-368. Wageningen Academic Publishers, Wageningen.