PARASIIDID – MEIE VAENLASED VÕI VANAD SÕBRAD?

Neglected Parasitic Diseases and Malaria:
Road Back from Molecular to Microscopy and AI

ESCMID ESGCP, Madriid 04.-08.03.2024

2025 Postgraduate course: Clinical Parasitology

2025 LUMC (Leiden)/E-UMC (Rotterdam)/Hogeschool Leiden
20.-31.01.2025

Anne Must

laborimeditsiini ja kliinilise mikrobioloogia
2. aasta arst-resident

livescience.com

Parasiithaiguste esinemine globaalselt, miljonites

Parasitic infection	Estimated number of infected subjects globally (millions)
Ascaris lumbricoides	1450
Trichuris trichiura	1050
Hookworms	1300
Strongyloides	30–100
Schistosoma spp.	207
Filaria	150
Malaria parasites	250
Leishmania	12
Trypanosomes	16–18
Entamoeba histolytica	50
Giardia	280

Data sources: Savioli and Albonico (2004); Steinman
Alleman (2006); Ottesen (2006); Boussinesq (2006);
and Lloyd (2002); World Health Organization (2008)

DOI:10.1016/j.ijpara.2010.05.003

DOI:10.4236/oje.2021.113016

WHO verifies Niger as the first country in the African Region to eliminate onchocerciasis

Français

30 January 2025 | News release | Geneva / Brazzaville / Niamey |Reading time: 2 min (553 words)

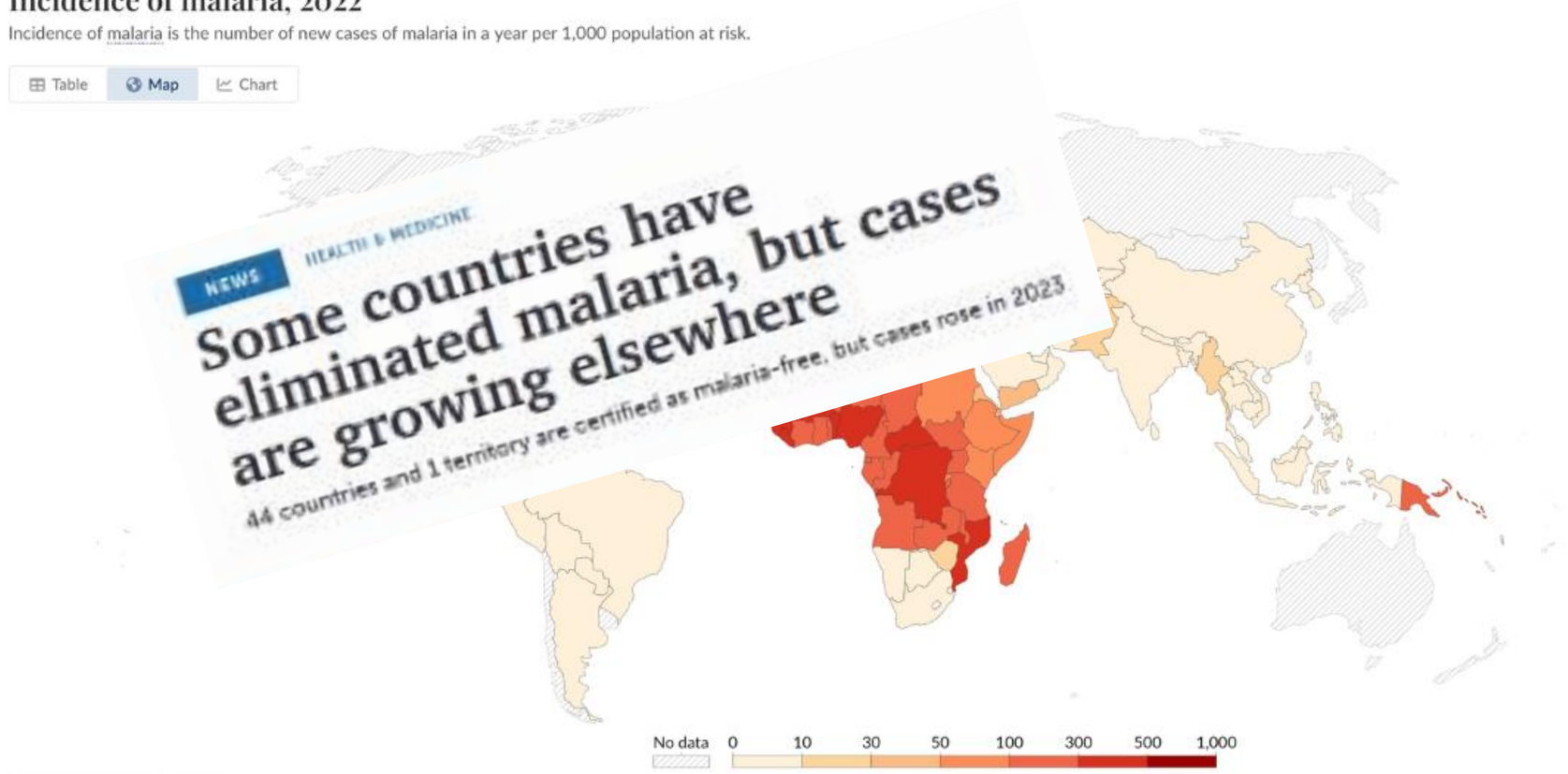
Guinea eliminates human African trypanosomiasis as a public health problem

Français

29 January 2025 | News release | Geneva / Brazzaville / Conakry |Reading time: 3 min (772 words)

Georgia certified malaria-free by WHO

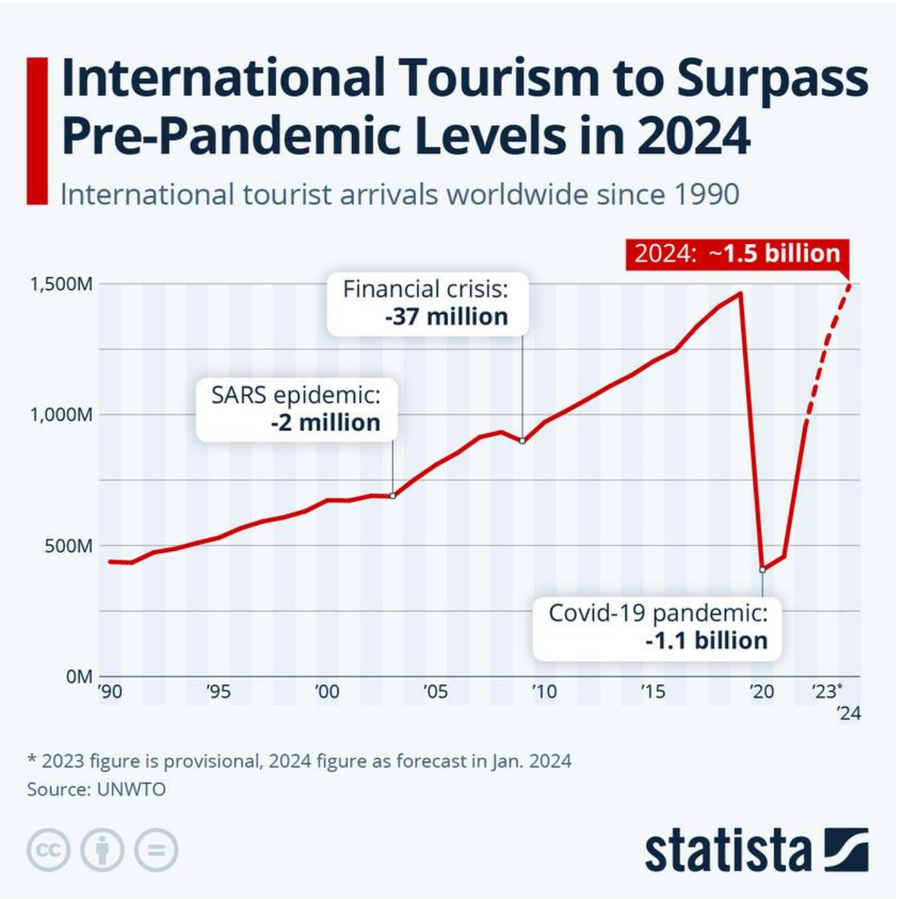
23 January 2025 | News release | Geneva / Copenhagen |Reading time: 2 min (587 words)



Egypt is certified malaria-free by WHO

20 October 2024 | News release | Geneva/Cairo |Reading time: 3 min (843 words)

Post-COVID pandeemia?



- **Kliimamuutused ja globaliseerumine**
  - vektorite levik
  - patogeenide levik
  - turism on ületanud pandeemia-eelse taseme
  - reisivad ka nakkustekitajad, sh parasiidid ja nende vektorid
- **Rändevoog ja pagulaskriisid**
- **Immuunkomprimeeritud** patsientide hulga suurenemine
- **Diagnostikameetodite areng**
- ***Neglected tropical diseases*:**
  - alarahastatud
  - vähe uuritud
  - olulised globaalse rahvatervise aspektist

Parasiidid, preventsioon ja diagnostika Eestis

- “Meil ei ole parasiite” vs epidemioloogiline vaikus?
  - *Toxoplasma gondii* seroprevalents >50%
  - *Echinococcus multilocularis* 30% rebastel
- Kliimamuutused
- Immigrandid, sõjapõgenikud
- Turistid
- Immuunkomprimeeritud patsiendid
- “Kliimapagulaste” diasporaa (nt Hispaania)
- Arstide ettevalmistus
- Reisimeditsiini kättesaadavus
- Laborite valmisolek

Lassen B, Janson M, Viltrop A, Neare K, Hütt P, Golovljova I, et al. (2016) **Serological Evidence of Exposure to Globally Relevant Zoonotic Parasites in the Estonian Population.** PLoS ONE 11 (10): e0164142.

The true *T. gondii* seroprevalence was 55.2% (95% CI 52.0–58.5) in the general population, 36.0% (95% CI 29.6–42.3) in children, 45.2% (95% CI 37.0–53.4) in veterinarians, 74.9% (95% CI 70.2–79.6) in animal caretakers, and 65.3% (95% CI 57.1–73.5) in hunters.

Table 5. *Toxoplasma gondii* ELISA results including those that tested positive (POS) and those that tested positive or yielded a grey zone result twice (POS+GREY) in the general population, children, veterinarians, animal caretakers, and hunters in Estonia.

	General population (n = 999)	Children (n = 248)	Veterinarians (n = 158)	Animal caretakers (n = 375)	Hunters (n = 144)
ELISA (POS)					
n positive	557	93	73	279	94
%	55.8	37.5 **	46.2	74.4 **	65.3
95% CI	52.7–58.8	31.6–43.7	38.5–54.0	69.8–78.6	57.2–72.7
ELISA (POS+GREY)					
n positive	564	94	73	281	94
%	56.0	37.9 **	46.2	74.7 **	65.3
95% CI	53.0–59.1	32.0–44.0	38.5–54.0	70.1–78.9	57.2–72.7

Comparison with the general population:

** $p \leq 0.001$

CI = confidence interval

doi:10.1371/journal.pone.0164142.t005

PERE.KODU

Teisneline Koolilaps Lasteaialaps Beebi Videoõps Alpa mäe

"Me kolisime Hispaaniasse elama!"

Blogi 'See ei ole maineajutt'

Esimesel päeval käisime ringi kodukandis, sõime rannaäärses restoran/kohvikus, imetlesime vaadet ja nautisime ilma, 25 soojakraadi. Pärastlõunal läksime kastsime oma põhjamaa varbad ookeanivette!

Check for updates

OPEN ACCESS

EDITED BY
Emmanuel Serrano Ferron,
Autonomous University of Barcelona, Spain

REVIEWED BY
Eduardo Berriatua,
University of Murcia, Spain
Diana Gassó Garcia,
Universitat de Lleida, Spain

*CORRESPONDENCE
Alfonso Balmori-de la Puente
a.balmori@ibe.upf-csic.es
Rodrigo Morchón
rmorgar@usal.es

RECEIVED 12 March 2024
ACCEPTED 22 April 2024
PUBLISHED 02 May 2024

Analysis of the current risk of *Leishmania infantum* transmission for domestic dogs in Spain and Portugal and its future projection in climate change scenarios

Iván Rodríguez-Escolar[1], Alfonso Balmori-de la Puente[3]*, Manuel Collado-Cuadrado[1], Daniel Bravo-Barriga[2], Sarah Delacour-Estrella[3], Ricardo Enrique Hernández-Lambraño[4,5], José Ángel Sánchez Agudo[4,5] and Rodrigo Morchón[1,5]*

The Olive Press

HOME REGIONAL + OP DEUTSCH OTHER NEWS + PROPERTY + TRAVEL + NATIONAL SPORT ADVERTISE CONTACT +

6 MAY, 2024 @ 15:06 · ANDALUCIA·HEALTH·LEAD · 1 MIN READ

DISEASE WARNING IN SPAIN: MALARIA, DENGUE AND LEISHMANIASIS CASES ARE EXPECTED TO GROW DUE TO CLIMATE CHANGE, SAYS EXPERT – AFTER CAUSING MULTIPLE DEATHS IN 2023

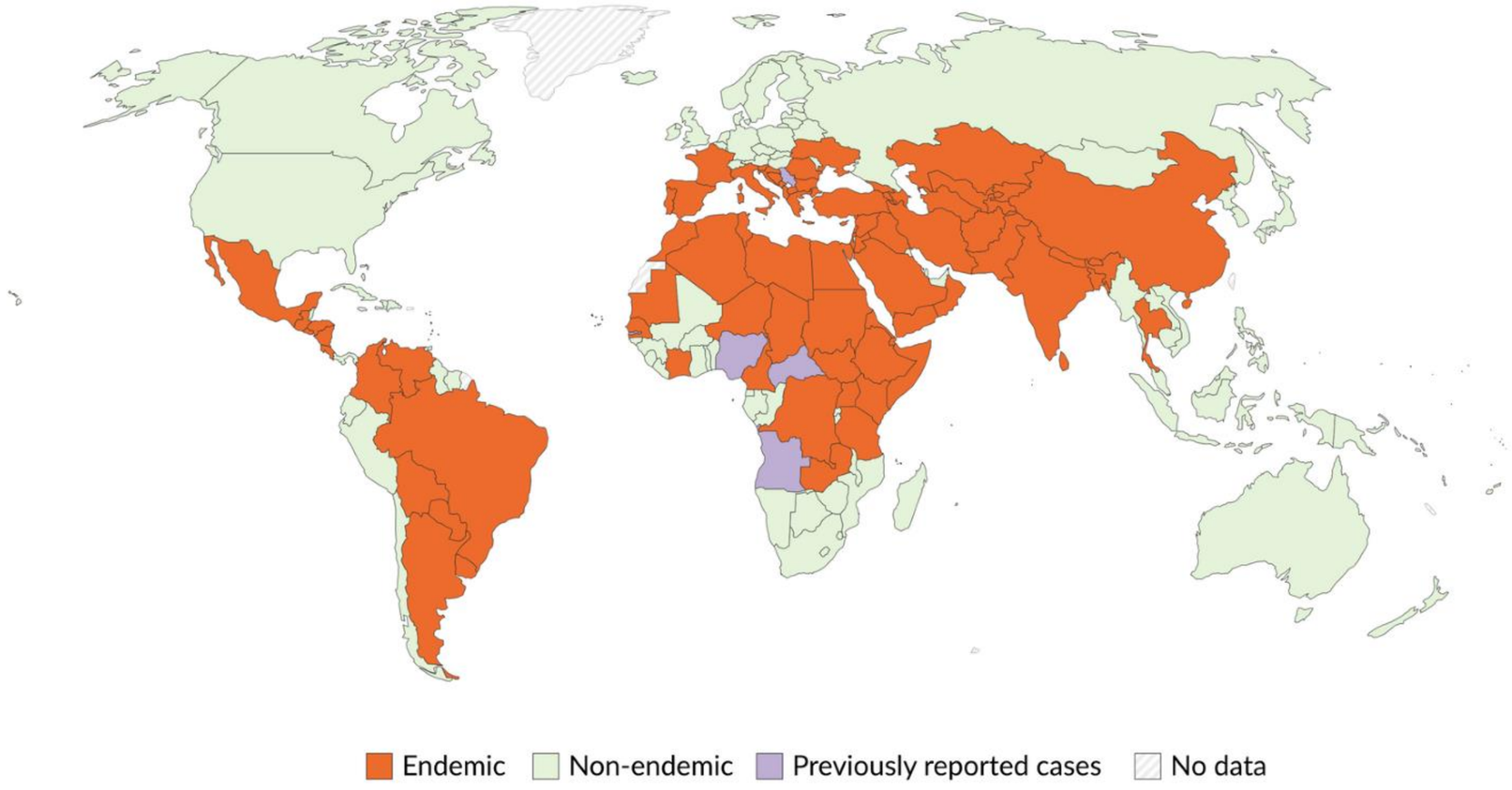
BY LAURENCE DOLLIMORE

TYPE Original Research
PUBLISHED 02 May 2024
DOI 10.3389/fvets.2024.1399772

Countries where visceral leishmaniasis is endemic, 2022

Our World in Data

Leishmaniasis[1] is a disease caused by parasites. In the visceral form, the parasites affect the liver, spleen, and bone marrow, causing symptoms such as fever, weight loss, anemia, and swelling of these organs.



Data source: World Health Organization - Global Health Observatory (2024) OurWorldinData.org/neglected-tropical-diseases | CC BY

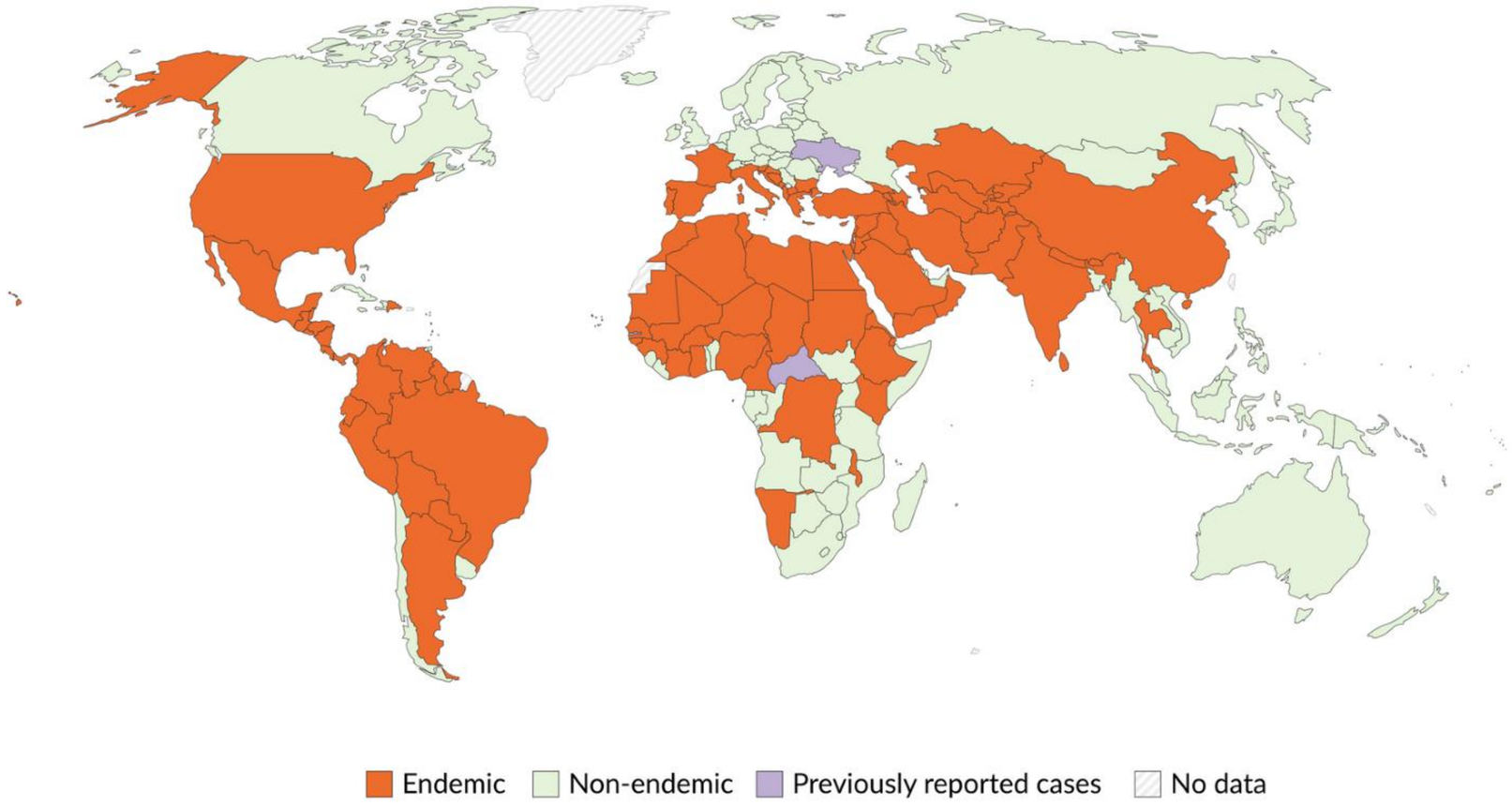
Note: A disease outbreak is endemic in a country if it is consistently present in the country. "Previously reported cases" means that at least one locally transmitted case has been reported, but the whole transmission cycle has not been demonstrated in the country.

1. Leishmaniasis: Leishmaniasis is a neglected tropical disease (NTD) caused by Leishmania parasites, and spread by sandflies. Over 90 sandfly species are known to transmit Leishmania parasites. There are three main forms of the disease: Cutaneous leishmaniasis: this most common form causes skin ulcers at the bite site, usually on exposed parts of the body like the face, arms, and legs. Mucocutaneous leishmaniasis: this form causes ulcers of the nose, mouth, and throat areas. Visceral leishmaniasis (also known as Kala-azar): this is the most severe form, and affects the liver, spleen, and bone marrow, causing symptoms such as fever, weight loss, anemia, and swelling of these organs.

Countries where cutaneous leishmaniasis is endemic, 2022

Our World in Data

Leishmaniasis[1] is a disease caused by parasites. In the cutaneous form, people develop skin ulcers.



Data source: World Health Organization - Global Health Observatory (2024) OurWorldinData.org/neglected-tropical-diseases | CC BY

Note: A disease outbreak is endemic in a country if it is consistently present in the country. "Previously reported cases" means that at least one locally transmitted case has been reported, but the whole transmission cycle has not been demonstrated in the country.

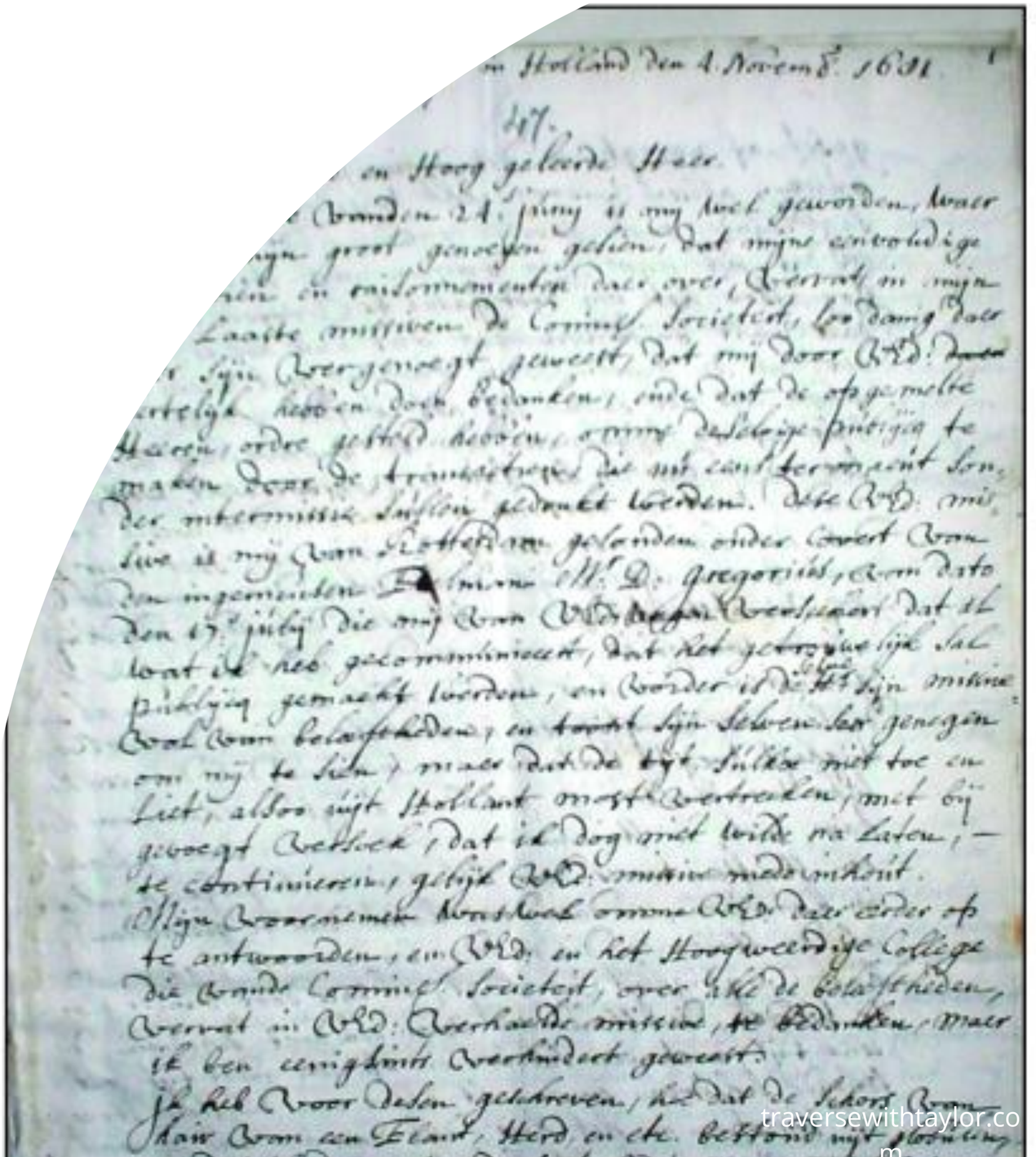
1. Leishmaniasis: Leishmaniasis is a neglected tropical disease (NTD) caused by Leishmania parasites, and spread by sandflies. Over 90 sandfly species are known to transmit Leishmania parasites. There are three main forms of the disease: Cutaneous leishmaniasis: this most common form causes skin ulcers at the bite site, usually on exposed parts of the body like the face, arms, and legs. Mucocutaneous leishmaniasis: this form causes ulcers of the nose, mouth, and throat areas. Visceral leishmaniasis (also known as Kala-azar): this is the most severe form, and affects the liver, spleen, and bone marrow, causing symptoms such as fever, weight loss, anemia, and swelling of these organs.

Kas Eesti on valmis?

- **Arstide teadlikkus ja ettevalmistus parasitoloogias:**
  - 5 loengut ja 8 praktikumi 1. kursusel Bioloogia aines
  - rõhk parasiitide taksonoomial, ehitusel, arengufaasidel, mitte aga kliinilisel kontekstil
- **Kõik erialad puutuvad kokku**:
  - lokalisatsioon pea kõigis elundites/kudedes
  - sümptomaatika sageli ebaspetsiifiline, kulg loid ja subkliiniline -> levitamine
  - diagnoos vahel aegkriitiline
- **Preventsioon**:
  - reisimeditsiin põhiõppe, peremeditsiini ega infektsioonhaiguste residentuuri programmis?
  - tasuline “mugavusteenus”
  - üksikud reisimeditsiini kabinetid
- **Koostöö veterinaar- ja keskkonnalaboritega?**
  - OneHealth ja zoonoosid

Kliiniline mikrobioloogia ja parasitoloogia Madalmaades

- endine koloniaalimpeerium = pikk kogemus troopiliste ja parasitaarhaiguste osas
- 8 ülikooli/tippkeskust, kus kliinilise mikrobioloogia residentuur
- olenevalt ülikooli/keskuse suurusest igal aastal 2-4 uut residenti
- konkurss residentuuri pääsemiseks on tihe (sageli eelduseks PhD)
- residentuur kestab 5 aastat
- 300 kliinilist parasitoloogi
- laborimeditsiini residentuuri ei ole
- tipptasemel teadustegevus
- Leideni ülikooli infektsioonhaiguste keskuse parasitoloogia uurimisgrupis 50-60 doktoranti ja järeldoktorit



Kursus Clinical Parasitology (Erasmus MC / LUMC)

- Kohustuslik ühiskursus kõigile Madalmaade CM residentidele
- Alates 2000.a igal aastal (tänavu 25. kursus)
- 20 osalejat
  - NL arst-residendid
  - NL bioanalüütikud (Medisch Laboratoriummedewerker), sh veterinaarlaboritest
  - välisosalejad: Rootsi, Norra, Rumeenia, Eesti
- Tunnustatud lektorid ja klinitsistid
- Esinduslik preparaadi- ja materjalikollektsioon
- Tihe programm: kodutööd, tunnikontrollid, juhuesitlused, vaheeksam, lõpueksam

Kursusel nähtud parasiidid

Ascaris lumbricoides	*Echinococcus granulosus*	*Opisthorchis*	*Balantidium coli*	*Toxoplasma gondii*
Trichuris trichiura	*Echinococcus multilocularis*	*Paragonimus spp.*	*Blastocystis hominis*	*Trichomonas vaginalis*
Necator americanus	*Diphyllobothrium spp.*	*Entamoeba histolytica*	*Cryptosporidium hominis*	*Pneumocystis*
Ancylostoma duodenale	*Hymenolepis nana*	*Entamoeba dispar*	*Cryptosporidium parvum*	*Pediculus humanus capitis*
Ancylostoma caninum	*Hymenolepis diminuta*	*Entamoeba coli*	*Cyclospora cayetanensis*	*Pediculus humanus corporis*
Ancylostoma brasiliense	*Dipylidium caninum*	*Entamoeba hartmanni*	*Cystoisospora belli*	
Strongyloides stercoralis	*Schistosoma mansoni*	*Entamoeba polecki*	*Plasmodium falciparum*	*Phthirus pubis*
Enterobius vermicularis	*Schistosoma haematobium*	*Entamoeba moskovskii*	*Plasmodium vivax*	*Tunga penetrans*
Trichinella	*Schistosoma japonicum*	*Endolimax nana*	*Plasmodium ovale*	*Pulex*
Toxocara cati	*Schistosoma intercalatum*	*Iodamoeba bütschlii*	*Plasmodium malariae*	*Cimex lectularius*
Toxocara canis	*Schistosoma matthei*	*Acanthamoeba spp.*	*Plasmodium knowlesi*	*Cordylobia anthropophaga*
Anisakis	*Schistosoma mekongi*	*Balamuthia mandrillaris*	*Babesia*	*Dermatobia hominis*
Pseudoterranova	*Fasciola hepatica*	*Naegleria fowleri*	*Leishmania spp.*	*Sarcoptes scabiei*
Taenia saginata	*Fasciola gigantica*	*Giardia lamblia*	*Trypanosoma brucei spp.*	
Taenia solium	*Clonorchis sinensis*	*Dientamoeba fragilis*	*Trypanosoma cruzi*	

Kursuse rõhuasetused

Oma silm on kuningas

- morfoloogiline ekspertiis on kaduv kunst
- seroloogia, Ag testid ja molekulaarsed meetodid on kenad, ent mikroskoopia on ainus otsene meetod
- mikroskoopia on referentsi kuldstandard
- mikroskoopia on kvantitatiivne meetod
- AI ei saa praegu veel tuvastamisega hakkama, vajab kinnitamist inimese poolt
- Miinused: mikroskoopia on aeglane ja kallis, eeldab väljaõpet ja kogemust, operaatorsõltuv

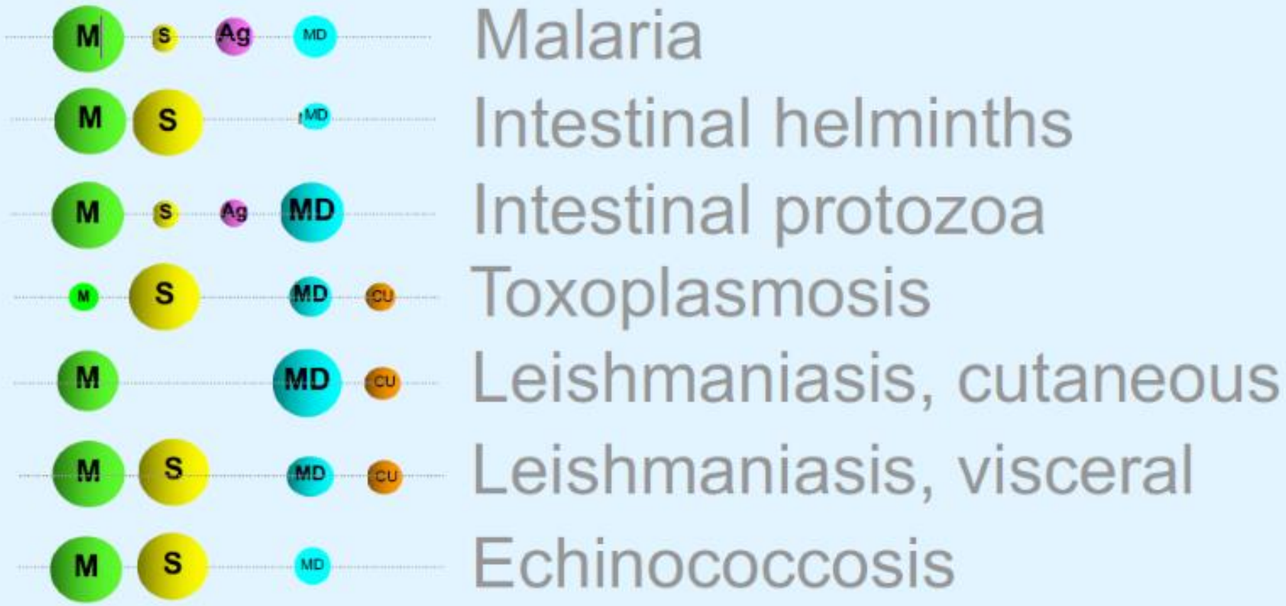
Kaasnevad toimetused

- proovi kogumine
- preparaadi valmistamine
  - natiivpreparaat
  - kontsentreerimine, fikseerimine
    - Ridley (formaliineeter)
    - glütseriinsedimentatsioon
    - vastsete eraldamine (Baermann, *Strongyloides*)
    - kultiveerimine (*Strongyloides*e kultuur)
    - munade kvantiteerimine (Kato)
  - värvingud (ZN, Uvitex, jood etc)

NEGLECTED INFECTIOUS DISEASES: A ROAD BACK?

Different parasitic infections different diagnostic methods,

Examples:



Microscopy — Micro

Antigen detection — Ag

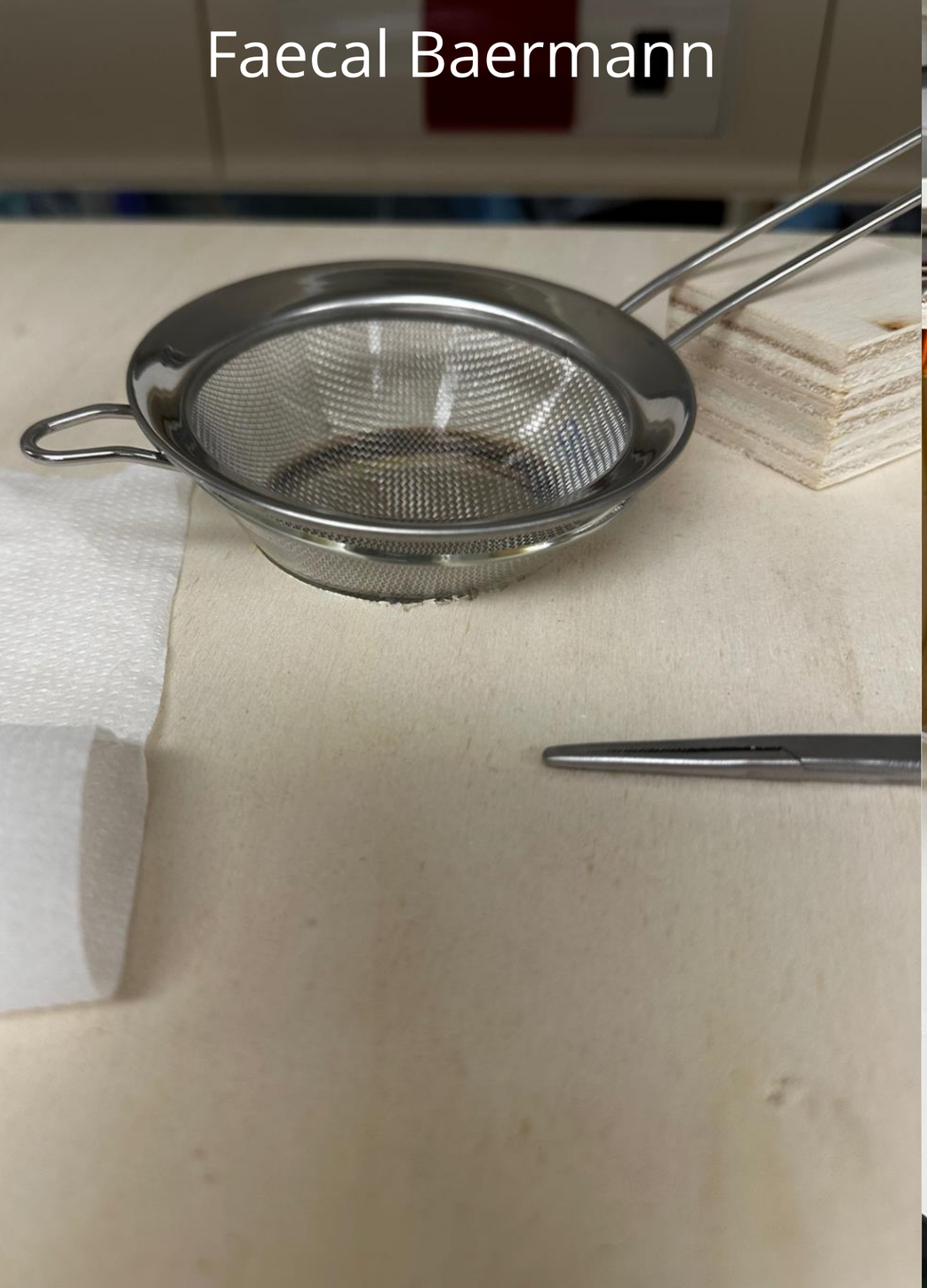
Serology — Sero

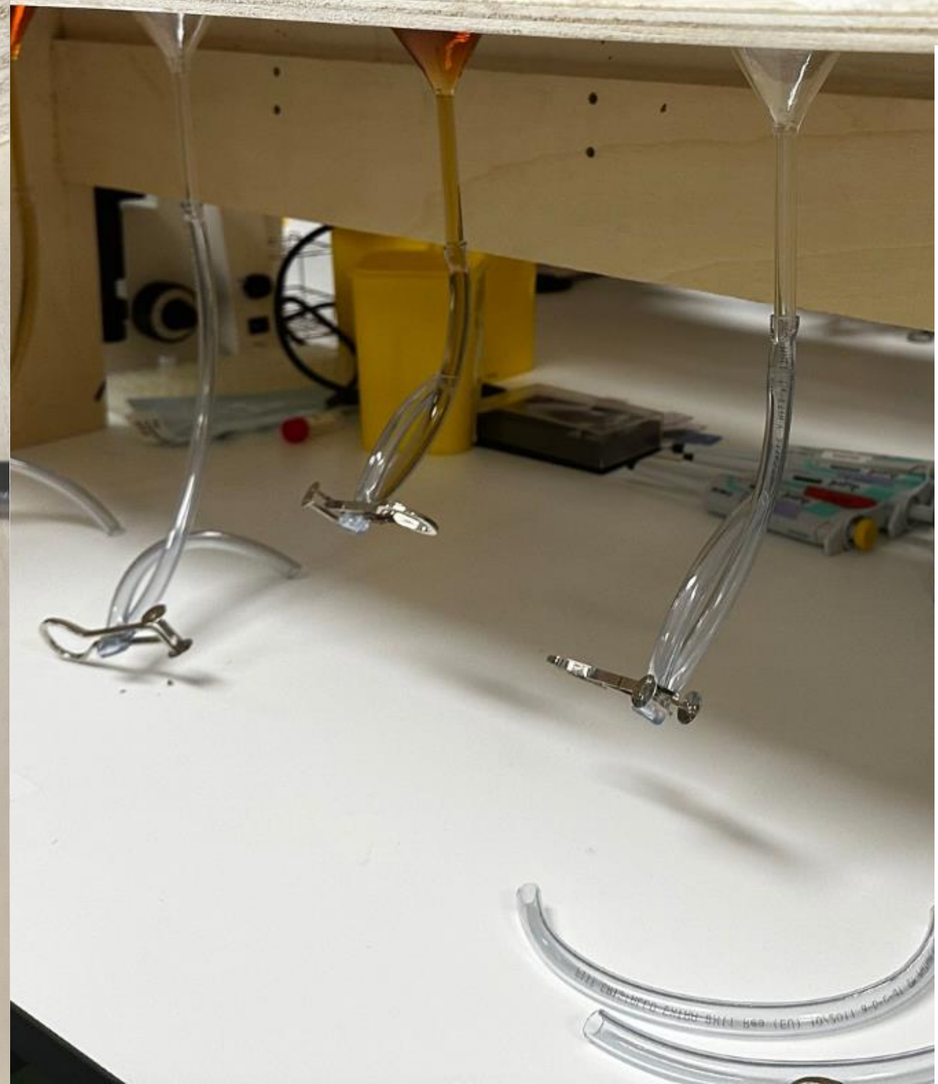
Mol diagnosis — PCR

Culture — Cult

Dr Tom v Gool, AmsterdamUMC

Faecal Baermann





Malaaria

- Hallasääski 430 liiki
  - 40-50 *Plasmodiumi* vektorid
  - ka Eesti hallasääsed võimelised malaariat kandma
- Malaariaprofülaktika
  - reisijate teadlikkus madal
  - probleemid ordineerimisega, teenuse kättesaadavusega
- Mujal Euroopas suurem osa juhtumeist jaanuaris
  - Aafrika ekspatid käivad kodumaal jõule tähistamas
- Odüsseuse malaaria
  - 2018-2022 Euroopas kirjeldatud 145 juhtu: 105 lennujaamamalaaria, 32 pagasimalaaria, 8 juhtu segatüüpi (Eurosurveillance, 2024)
  - Prantsusmaal 52, Belgias 19, Saksamaal 9 (suuremad transiitlennujaamad)
  - diagnoos hilineb keskmiselt nädala võrra

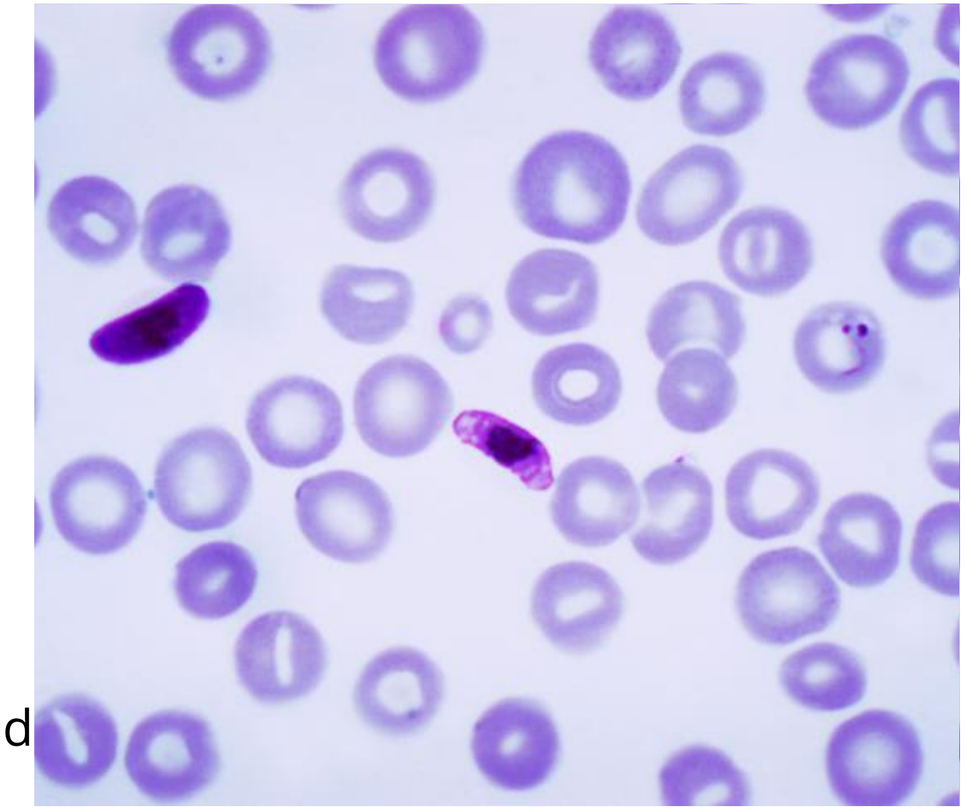
Malaaria diagnostilised väljakutsed: mikroskoopia

Esmane uuring kiirtest või vereäige ja paksu tilga preparaadi mikroskoopia

- kiirtest tuleb alati kinnitada mikroskoopiaga
- lisavõimalused: LAMP, voolutsütomeetria

Töömahukas, kogemust nõudev:

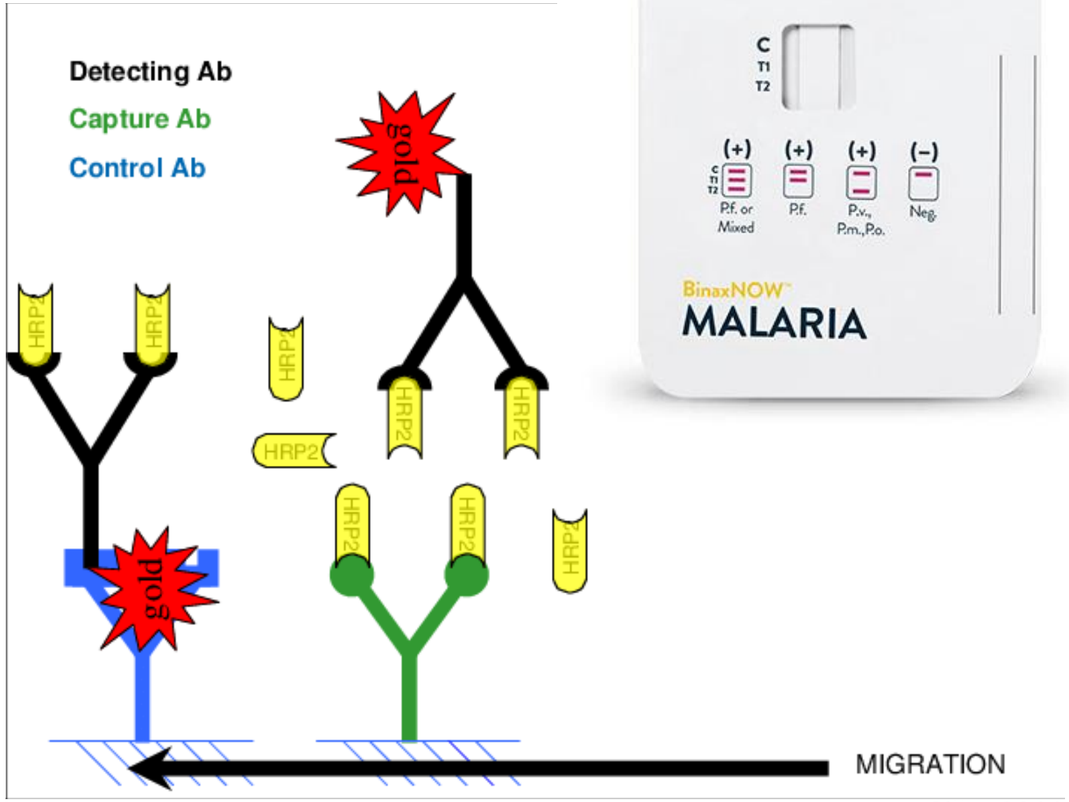
- negatiivse tulemuse kinnitamiseks tuleb 1000x suurendusega hinnata vähemalt 100 vaatevälja
- parasiidi leidmisel tuleb hinnata lisaks 100 vaatevälja, et välistada segainfektsioon
- P *vivax/ovale/malariae* parasiteemia max 2%, sest haaratud vaid noored/vanad RBC



At present, molecular diagnostic tools based on nucleic-acid amplification techniques (e.g. loop-mediated isothermal amplification or polymerase chain reaction [PCR]) do not have a role in the clinical management of malaria. (WHO Guideline 2024)

Malaaria diagnostilised väljakutsed: valenegatiivne kiirtest

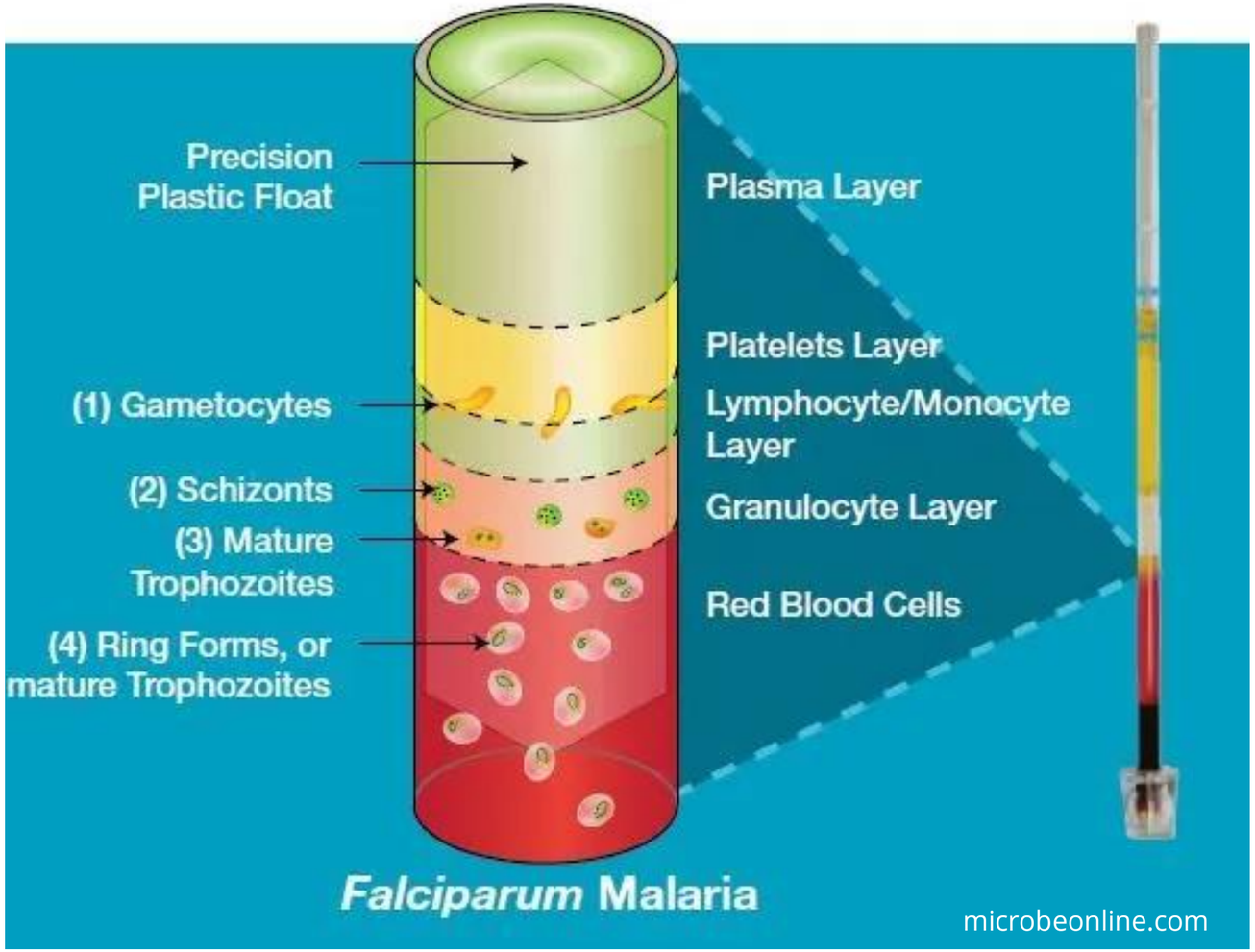
- *prozone effect* tekib kõrge parasiteemia korral (>5%)
- kasutatavad antigeenid:
  - P.f.: HRP-2
  - non-f.: aldolaas
- Probleem, kui:
  - P.f. HRP-2 deletsioon / defitsiit
  - kõrge parasiteemia - Ag küllastab mõlemad Ab üle -> valeneg tulemus
  - aldolaasi puhul ei ole *prozone* efekti kirjeldatud
- Järeldus: kiirtest tuleb alati mikroskoopiaga kinnitada



Gillet 2011

Malaaria diagnostilised väljakutsed: *quantitative buffy coat* test

- veri kogutakse EDTA, hepariini, K-oksalaadi ja akridiinoranžiga kaetud BD kapillaari
- kapillaari sisestatakse ujuk
- fuugimisel (12 g x 5 min) lahutuvad plasma, erütrotsüüdid ja *buffy coat;* ujuk paikneb erütrotsüütide massi kohal
- *buffy coat*is kihistuvad trombotsüüdid, lümfotsüüdid, monotsüüdid, granulotsüüdid
- fluorestsentsmikroskoobi all helendavad DNA ja RNA sisaldavad rakud, sh parasiidid
- Parasiite eristatakse morfoloogia, värvumise ja kihtides paiknemise järgi
- Efektiivne ka väga madala parasiteemia korral (<10 parasiidi mikroliitris veres)
- lisaks *Plasmodium*ile veel *Babesia, Trypanosoma*, *Leishmania*, *Filaria*
- kiire, kõrge tundlikkus, lihtne teostada, lihtne interpreteerida



Malaaria diagnostilised väljakutsed: voolutsütomeetria

Sysmex XN-31:

- kiire uuring (vastus 1 min jooksul)
- lihtne teostada
- kõrge NPV
- annab parasiteemia % analoogselt mikroskoopiale
- eristab P *falciparum*it *non-falciparum*ist
- tuvastab ka Babesia ja Trypanosoma (ilmuvad samale *scattergramile*)
- 100% tundlikkus and 98.39% spetsiifilisus (võrreldes mikroskoopiaga)

Miinused:

- kallis
- moodul valideeritud ainult malaaria diagnostikaks
- hetkel Euroopas vaid üks masin NL ja teine FR

Parasiiditeadus Leidenis

The NEW ENGLAND JOURNAL of MEDICINE

SPECIALTIES TOPICS MULTIMEDIA CURRENT ISSUE LEARNING/CME AUTHOR CENTER PUBLICATIONS

ORIGINAL ARTICLE

Safety and Efficacy of Immunization with a Late-Liver-Stage Attenuated Malaria Parasite

Authors: Olivia A.C. Lamers, M.D., Blandine M.D. Franke-Fayard, Ph.D., Jan Pieter R. Koopman, M.D., Geert V.T. Roozen, M.D., Jacqueline J. Janse, M.Sc., Severine C. Chevalley-Maurel, M.Sc., Fiona J.A. Geurten, B.Sc., +14, and Meta Roestenberg, M.D., Ph.D. Author Info & Affiliations

Published November 20, 2024 | N Engl J Med 2024;391:1913-1923 | DOI: 10.1056/NEJMoa2313892

VOL. 391 NO. 20 | Copyright © 2024

wormvacs 2.0

A World Without Asthma

freeBILy
Schistosomiasis RDT implementation

CONTROLLED HUMAN INFECTIONS CENTRE

Shigella-vaccin

Shigella is een bacterie die ernstige diarree kan veroorzaken. Op plekken met weinig toegang tot schoon drinkwater, komen er epidemieën van Shigella-infecties voor. Voor dit onderzoek zoeken wij gezonde mensen van 18 t/m 50 jaar oud.

Reeds voldoende deelnemers

Meer informatie

CONTROLLED HUMAN INFECTIONS CENTRE

Malariavaccin: CoGA-Re studie

Eerder onderzoek in het LUMC heeft aangetoond dat toedienen van GA2 met muggenbeten veilig is. In de CoGA-Re studie willen we onderzoeken hoelang deze bescherming duurt.

Deelnemers gezocht

Meer informatie

CONTROLLED HUMAN INFECTIONS CENTRE

CloDiCo Fase 3

Infectie met de darmbacterie Clostridioides difficile is de meest voorkomende oorzaak van diarree in het ziekenhuis.

Met de huidige (antibiotica) behandelingen komt de bacterie nog vaak terug. Er zijn dus nieuwe behandelingen nodig.

Reeds voldoende deelnemers

Meer informatie

CONTROLLED HUMAN INFECTIONS CENTRE

Schistosomiasis

De afdeling Parasitologie van het LUMC doet onderzoek met gezonde vrijwilligers (18-45 jaar) naar schistosomiasis.

Reeds voldoende deelnemers

Meer informatie

Late-Liver-Stage Attenuated Malaria Vaccine

A PLAIN LANGUAGE SUMMARY

Based on the NEJM publication: Safety and Efficacy of Immunization with a Late-Liver-Stage Attenuated Malaria Parasite by O.A.C. Lamers et al. (published November 21, 2024)

In this trial, researchers assessed the use of mosquito bites for immunization with GA2 — a *mei2* single knockout *Plasmodium falciparum* NF54 parasite (sporozoite form) with extended development into the liver stage — in healthy adults who had not had malaria.

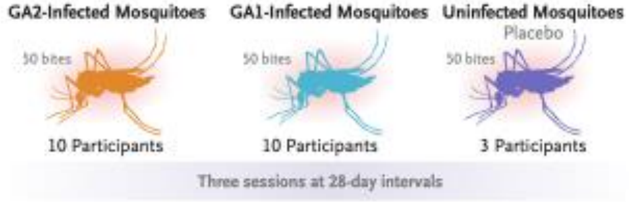
Progress in the **eradication of malaria** has slowed, and there is a need for new tools.

WHY WAS THE TRIAL DONE?

The malaria vaccines currently approved by the World Health Organization are subunit vaccines that result in protection that is modest and short-lived. Alternative vaccination strategies based on whole, genetically attenuated plasmodium parasites might improve protection. GA1, a genetically attenuated plasmodium parasite with short intrahepatic development, resulted in low protective efficacy in a previous trial. Whether late-arresting GA2 can induce better protection than GA1 is unclear.

HOW WAS THE TRIAL CONDUCTED?

After an open-label dose-escalation stage (stage A), adults who had not had malaria were randomly assigned to receive 50 bites from GA2-infected mosquitoes, 50 bites from GA1-infected mosquitoes, or 50 bites from uninfected mosquitoes (placebo), in three immunization sessions at 28-day intervals (stage B). Three weeks after the last immunization, participants underwent controlled human malaria infection with 5 bites from mosquitoes infected with unattenuated *P. falciparum* strain 3D7. The primary end point was the number and severity of adverse events and blood-stage parasitemia indicating breakthrough infection after GA2 mosquito-bite immunization.



PARTICIPANTS

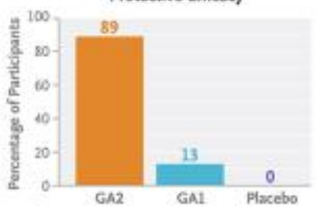
WHO	43 adults: 20 in stage A and 23 in stage B
	Age: 19–35 years; median, 23 years
	Women: 51%; Men: 49%
CLINICAL STATUS	Had not had malaria
	In good health, as assessed by medical history, physical examination, and general laboratory evaluation

TRIAL DESIGN

- MULTISTAGE
- DOSE-ESCALATED (STAGE A)
- DOUBLE-BLIND (STAGE B)
- RANDOMIZED
- PLACEBO-CONTROLLED (STAGE B)
- LOCATION: THE NETHERLANDS

RESULTS

Protective efficacy after controlled human malaria infection was greater in the GA2 group than in the GA1 and placebo groups.



Adverse events were similar in the three groups. No serious adverse events occurred. In addition, there were no breakthrough infections after immunization with GA2.

P. FALCIPARUM STRAIN

P. falciparum strain 3D7, used in the trial for controlled human malaria infection, is an unattenuated clone of the parental parasite strain *P. falciparum* NF54, which was used to generate the attenuated strains GA2 and GA1.

LIMITATIONS AND REMAINING QUESTIONS

- Conclusions from this trial are limited by the small sample size and the large number of immunologic analyses. More trials with greater numbers of participants are required to better understand the safety profile of GA2.
- The immunogenicity of GA2 needs to be assessed for durability and against heterologous *P. falciparum* strains in regions where malaria is endemic.

CONCLUSIONS

The findings of this small trial suggest that a late-arresting parasite (GA2) offers higher protective efficacy against *P. falciparum* controlled human malaria infection than an early-arresting parasite (GA1), without known safety concerns.

LINKS: FULL ARTICLE | NEJM QUICK TAKE

FURTHER INFORMATION

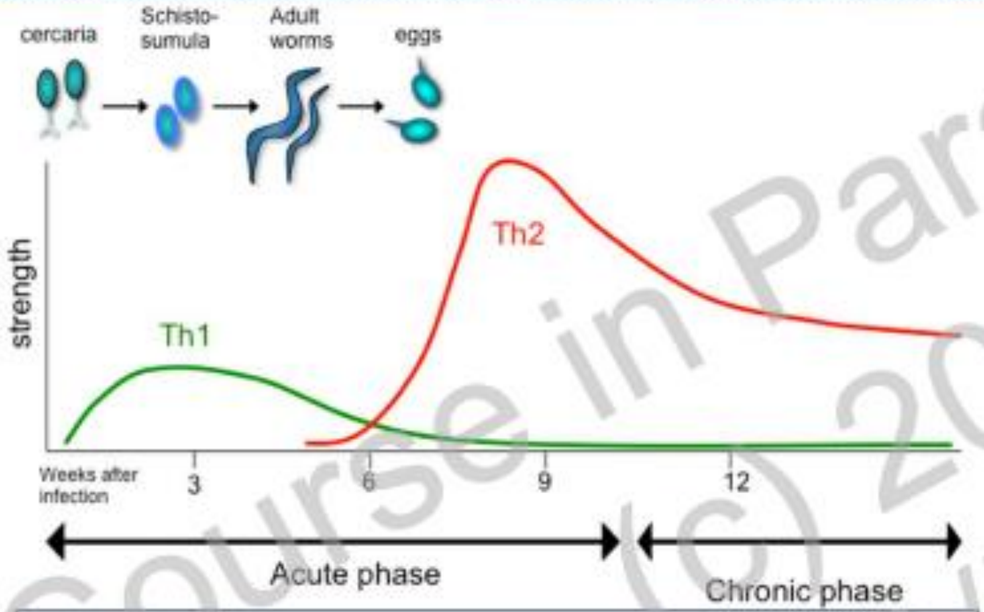
Trial registration: ClinicalTrials.gov number, NCT04577066

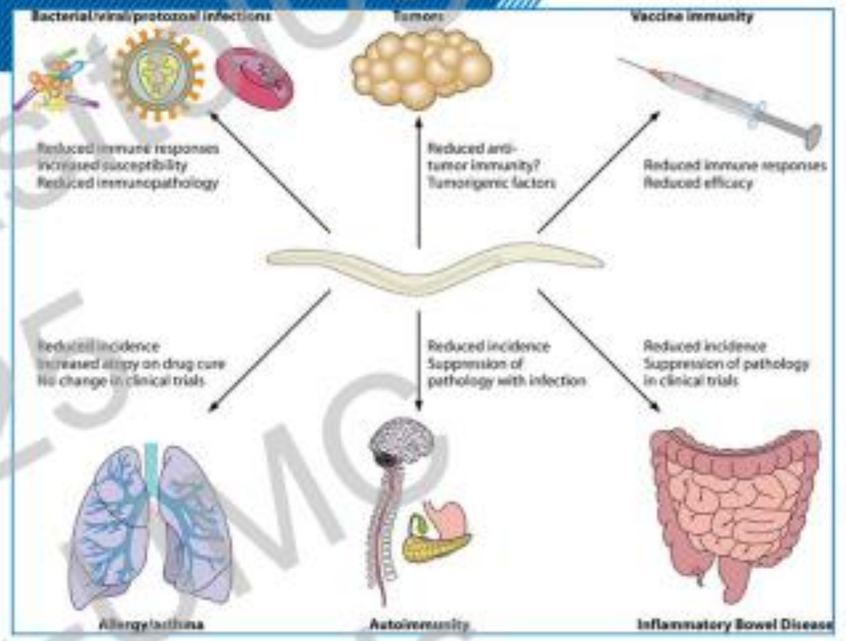
Trial funding: Bontius Foundation

Full citation: Lamers OAC, Franke-Fayard BMD, Koopman JPR, et al. Safety and efficacy of immunization with a late-liver-stage attenuated malaria parasite. N Engl J Med 2024;391:1913-23. DOI: 10.1056/NEJMoa2313892

Parasiidid on küll pahad, aga...

.... but also are major drivers of Th2 responses and regulatory networks, and chronic infections.

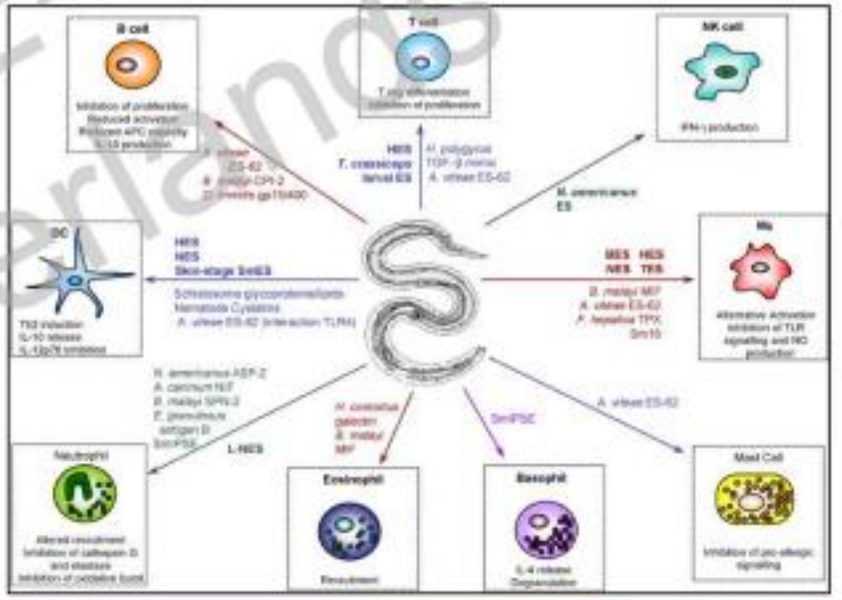




Long term survival of the parasite
Immunomodulatory/regulatory effects on the host

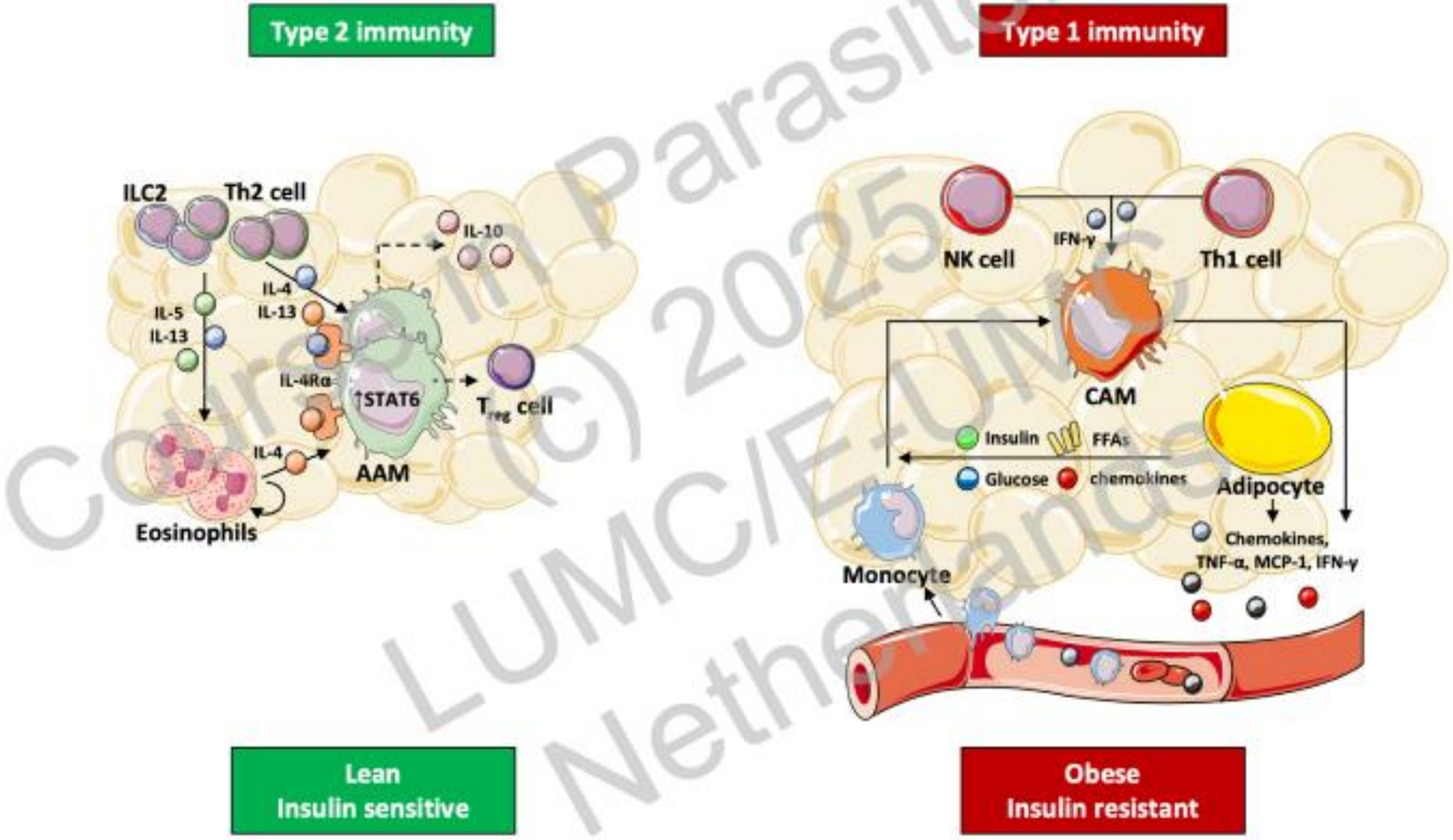
Schistosomes, as strong inducers of type 2 immunity embedded in a rich network of regulatory processes, possess strong abilities to shift inflammatory and allergic diseases in infected hosts, for example by generating feedback loops that impair T cell responses to heterologous antigens. This may lead to altering responses to vaccination as well as manifestations of immune disorders including allergy.

Parasitic infections not only make people sick, but can also make the immune system more resilient to inflammatory diseases such as allergies or type 2 diabetes.



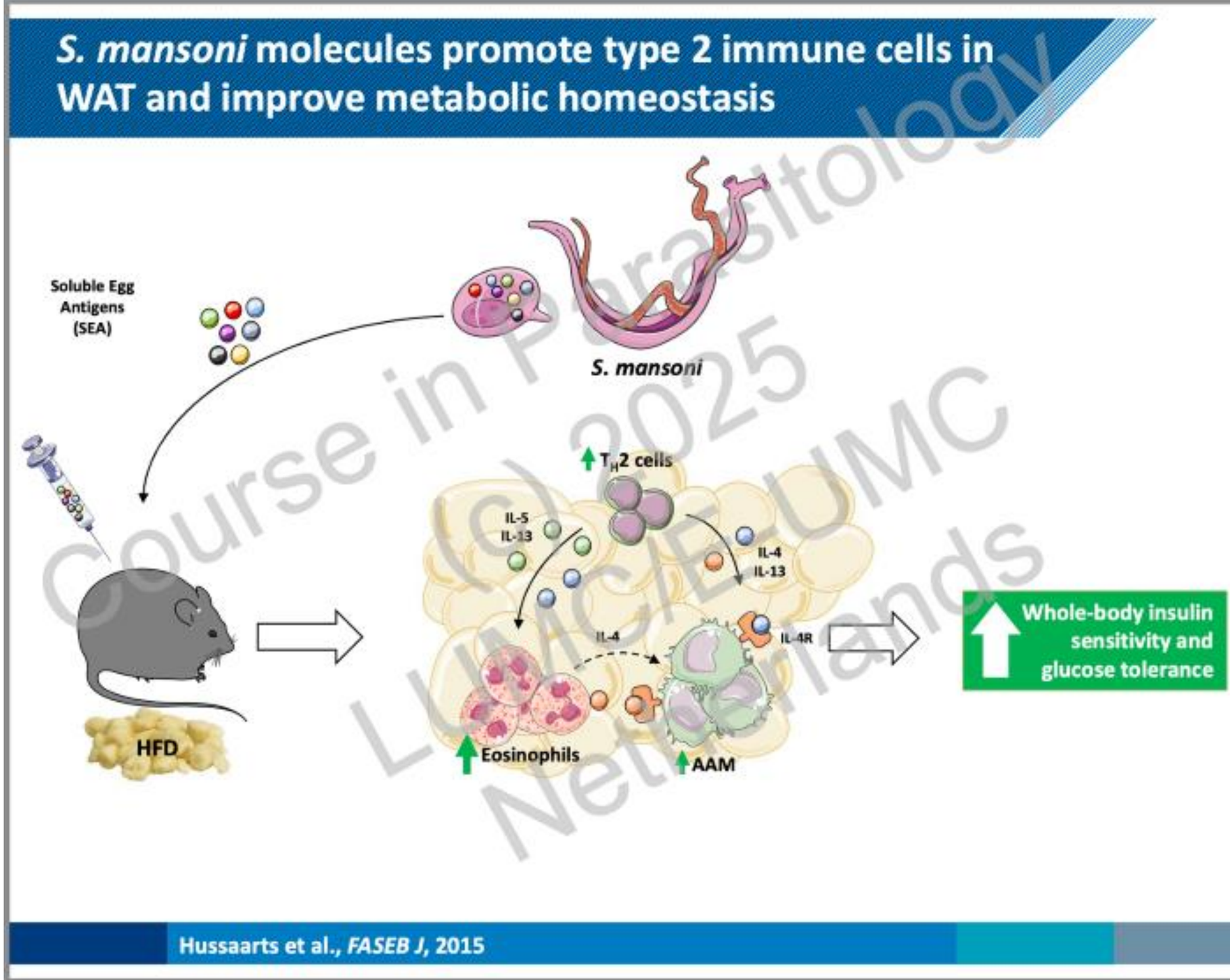
Prof Ron Hokke,
[Leiden University Center for Infectious Diseases (LUCID)]
juht

Adipose tissue immune cells and metabolic homeostasis



Adapted from Lackey & Olefsky, *Nat. Rev. Endo.*, 2016

Prof Ron Hokke,
Leiden University Center for Infectious Diseases (LUCID)
juht



Prof Ron Hokke,
[Leiden University Center for Infectious Diseases (LUCID)](#)
juht

Clinical trials registered - with helminths or helminth eggs

Trial identifier	Sponsor	Phase	Status	Condition	Intervention
EUCTR2007-006099-12-DK	Statens Serum Institut, Denmark	2	completed	Allergic rhinitis	TSO
NCT01070498	Beth Israel,Boston, US	1	completed	Food allergy	TSO
NCT01279577 / EUCTR2006-000720-13-DE	Dr. Falk Pharma, Frankfurt, Germany	2	recruiting	Crohn's disease	TSO
ACTRN12608000241336	Asphelia Pharaceuticals	1	not yet recruiting	Crohn's disease	TSO
NCT01434693	Coronado Biosciences, US	1	ongoing	Crohn's disease	TSO
NCT01576471	Coronado Biosciences, US	2	recruiting	Crohn's disease	TSO
NCT01433471	NYU, New York, US	2	recruiting	Ulcerative colitis	TSO
NCT01413243 / EUCTR2009-015319-41-DE	Charite, Berlin, Germany	2	recruiting	MS	TSO
NCT00645749	University of Wisconsin, Madison, US	2	recruiting	MS	TSO
NCT01006941	Rigshospitalet, Copenhagen, Denmark	2	completed	MS	TSO
NCT01836939	Mount Sinai School of Medicine	2	recruiting	Psoriasis	TSO
NCT01040221	Montefiore, New York, US	1	recruiting	Autism	TSO
NCT01734941	Hadassah Medical Organization, Jerusalem, Israel	2	not yet recruiting	Autism	TSO
NCT00232518	University of Nottingham, UK	1	completed	Allergic rhinoconjunctivitis	hookworm larvae
NCT00469989	University of Nottingham, UK	1	completed	Asthma	hookworm larvae
NCT00671138	Brisbane, Australia	2	unknown	Celiac Disease	hookworm larvae
NCT01661933	Brisbane, Australia	1&2	recruiting*	Celiac Disease	hookworm larvae
NCT01470521 / EUCTR2008-005008-24-GB	University of Nottingham, UK	2	recruiting	MS	hookworm larvae

Joel Weinstock

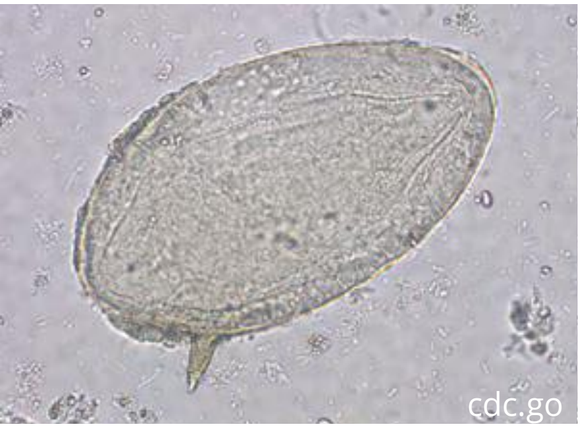
Patients recieved 2500 mature eggs every two weeks during 12 weeks

Whipworm (*Trichuris spp*)

Prof Ron Hokke,
[Leiden University Center for Infectious Diseases (LUCID)](#)
juht

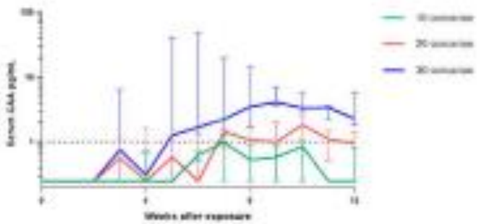
TSO® is Tanawisa's convenient **probiotic supplement**, approved by the Thai FDA and permitted for export since October 2006. By encouraging effective immune regulation, this completely natural product controls inflammation halts autoimmunity, and prevents allergies without any of the long-term adverse side effects often associated with pharmaceutical treatments.

Mansoni vereimiuss
(Schistosoma mansoni)

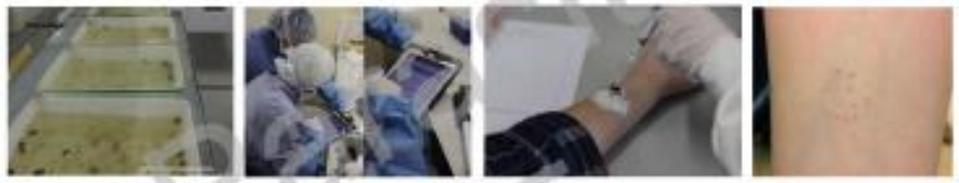


S mansoni muna

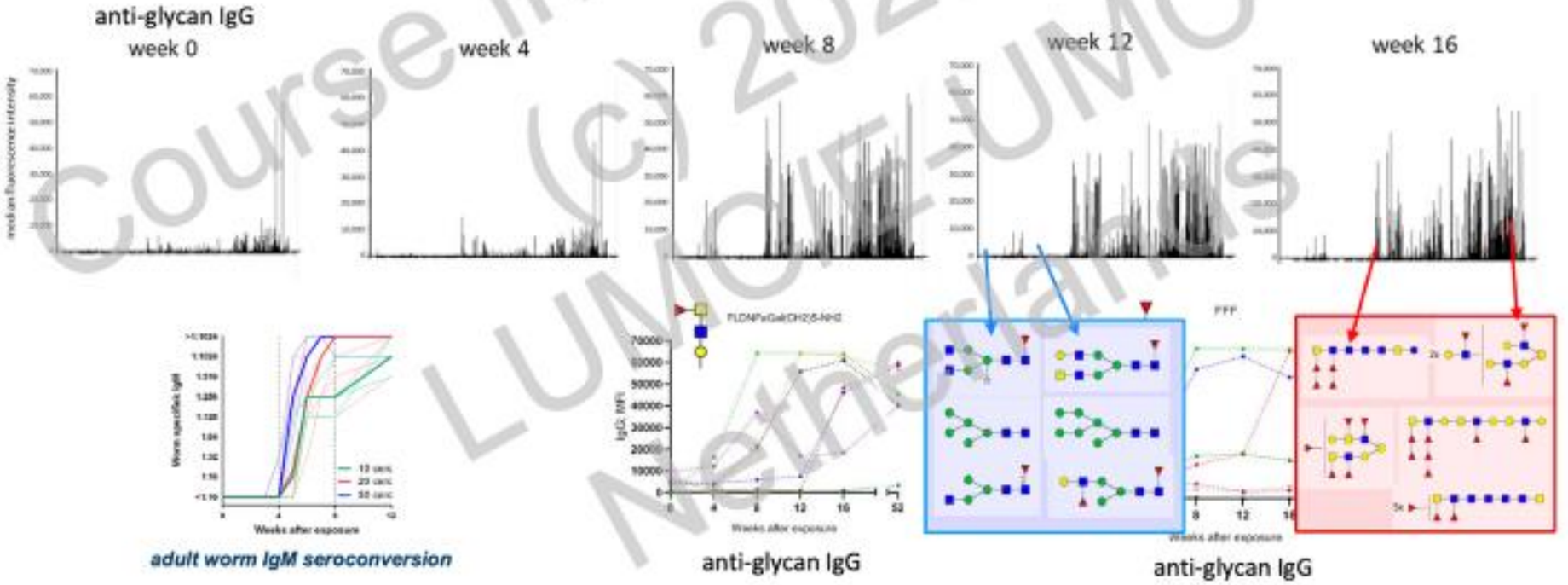
Anti-glycan antibodies during controlled *S. mansoni* (male worm only) infection: antigenicity of fucosylated glycans



. Serum UCP-LF CAA. A-C Weekly serum CAA levels for individual volunteers in pg/ml



Meta Roestenberg and team



Langenberg et al Nat Med. 2020; v Diepen et al, unpublished

Prof Ron Hokke,
Leiden University Center for Infectious Diseases (LUCID) juht

Garcia “Practical Guide To Diagnostic Parasitology”

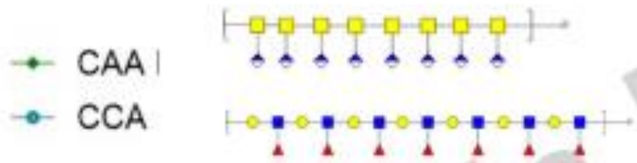
Epidemiology	*S. mansoni*: western and central Africa, Egypt, Madagascar, Arabian Peninsula, Brazil, Suriname, Venezuela, West Indies
	S. japonicum: Far East, China, Indonesia, Japan, Philippines
	S. haematobium: Africa, Asia Minor, Cyprus, islands off Africa's east coast, southern Portugal; focus in India
	S. mekongi: Mekong River basin in Kampuchea, Laos, and Thailand

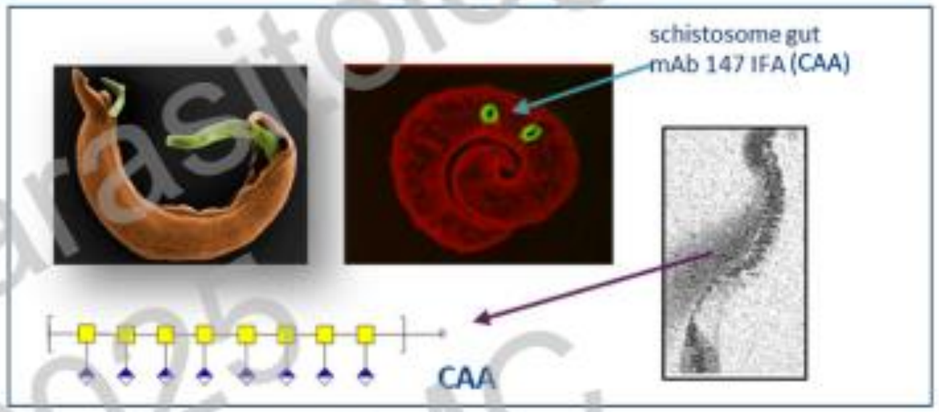
freeBILy

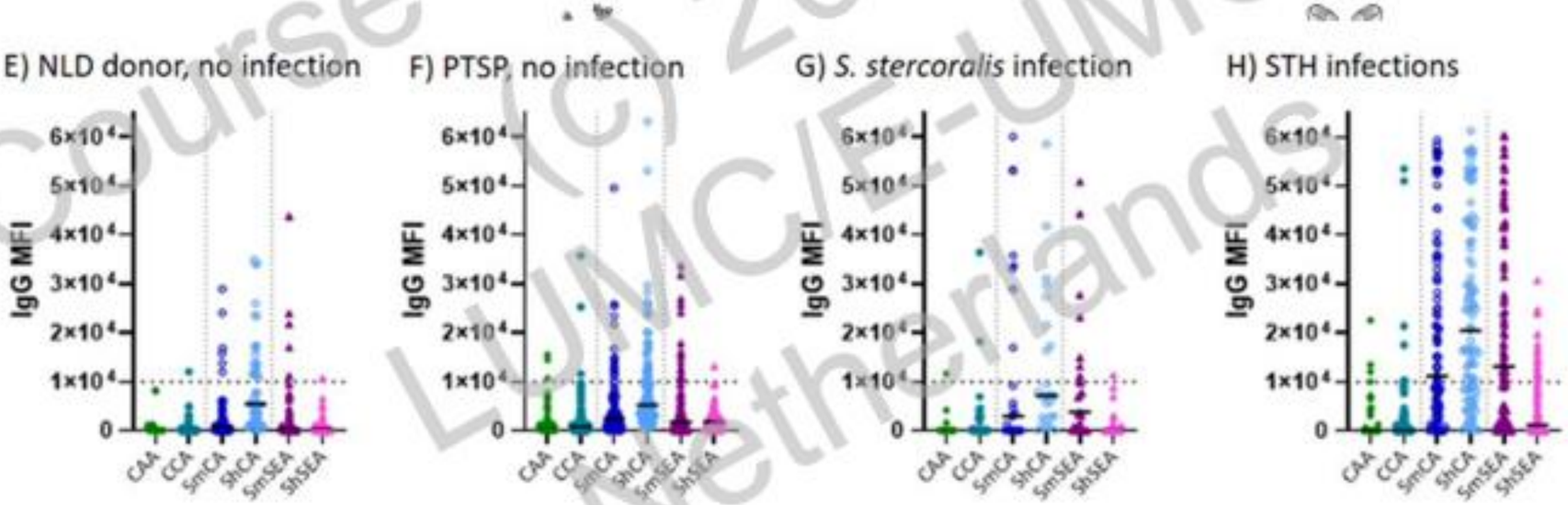
Schistosomiasis RDT implementation

High specificity and sensitivity of anti-CAA antibodies as marker of primary infection in Dutch volunteers infected with male *S. mansoni* cercaria

Native CAA and CCA, each consisting of long repetitive carbohydrate chains of know structure, were among the targets in the array screenings







Prof Ron Hokke,
[Leiden University Center for Infectious Diseases (LUCID)](#) juht

Kildemoes *et al*, J Clin Microbiol. 2025

Parasiididiagnostika tulevik?

Road Map to 2030

What was NOT going to be replaced is the Expert Parasitologists

Dx is Patient and Parasite-Based rather than Test-based

Madriidi kursus
Prof Ayman El-Badry (Kairo Ülikool, Egiptus)