



The Stiletto project: The GNU Health Federation and
Open Science in the context of international
epidemiological and biomedical research

Luis E. Falcón, MD, MSc
falcon@gnuhealth.org

About me



Academic & profession

- Physician
- Computer Scientist
- Genomics & Medical Genetics

Social Medicine

- Founder of GNU Solidario
- Author of GNU Health
- Animal Rights

falcon@gnuhealth.org

Mastodon:

[@meanmicio@todon.eu](https://meanmicio.todon.eu)

About GNU Solidario



Non-for-profit organization

- Works globally
- Focused on Social Medicine
- Fights for the right of human and nonhuman animals
- The organization behind GNU Health
- Promotes Libre Software and Open Science

Projects from GNU Solidario



Global**Exposome**





GlobalExposome

Compassionate Science, Sustainable Planet

Exposome

Exposome/ (ˈɛkspəʊsəm) /

“The cumulative measure of environmental influences and associated biological responses throughout the lifespan, including exposures from the environment, diet, behavior, and endogenous processes.”



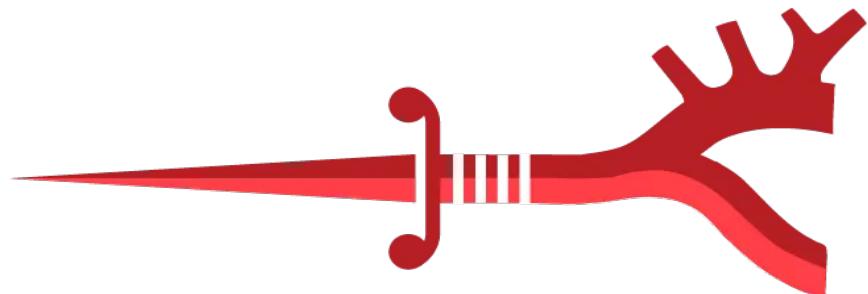
Building modern, empathetic societies for a sustainable planet



GlobalExposome
Compassionate Science, Sustainable Planet

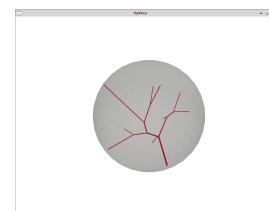


Stiletto Project components



STILETTO

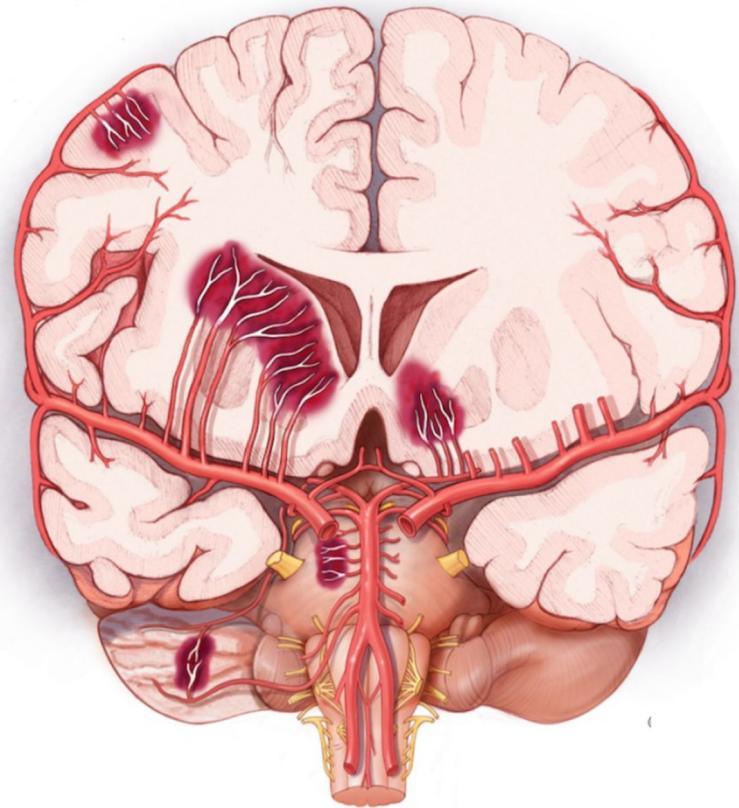
A computational model of the cerebral perforating arteries in health and disease



- Prospective, longitudinal, multicenter study
- Study of the role of the exposome in the etiology and progression of small vessel disease
- Relation among the exposome, genetics and pathology groups that made up cSVD
- Pave the way for future studies in polygenic factors in cSVD

- A computational model of the cerebral perforating arteries in health and disease
- Model and simulation of different scenarios of the perforating arteries and the Neurovascular Unit (NVU)

Intro to the cerebral microcirculation



Credit: Mayo clinic foundation for medical illustration and Research

- Small vessels (micrometers, most < 500 um)
- Brain parenchyma and subarachnoidal space
- Supply deep cerebral areas, including internal capsule, basal ganglia and thalamus.
- They play a critical role in motor, sensitive, cognitive and emotional functions.
- Their malfunctioning leads to Cerebral small vessel disease (cSVD)

Stroke and small vessel disease in numbers



12.2 Million new cases / year
(1 every 3 seconds)
Ischemic: 88% / Hemorrhagic: 12%
cSVD: approx 3 M



100 M live with stroke sequelae
1 of 4 persons will suffer a stroke
In 2035 incidence will increase 35%



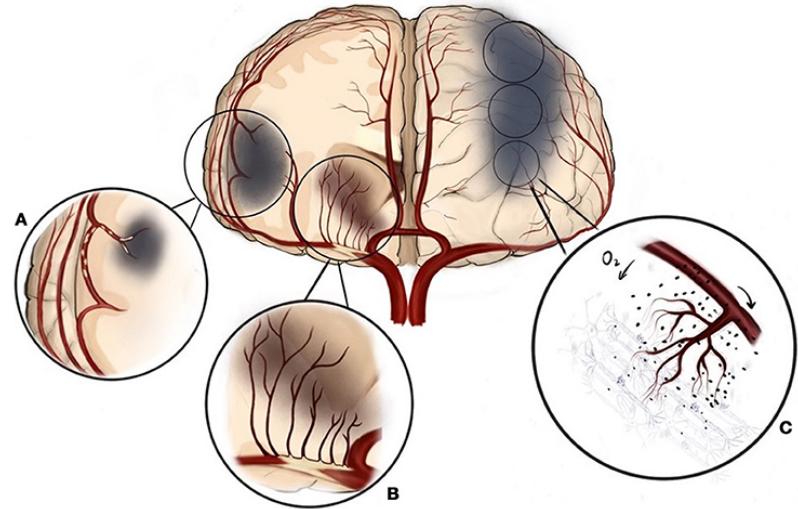
Second cause of death
Leading cause of permanent disability



USD 452 billions global cost



cSVD
25% stroke cases
Causes the 45% dementia cases



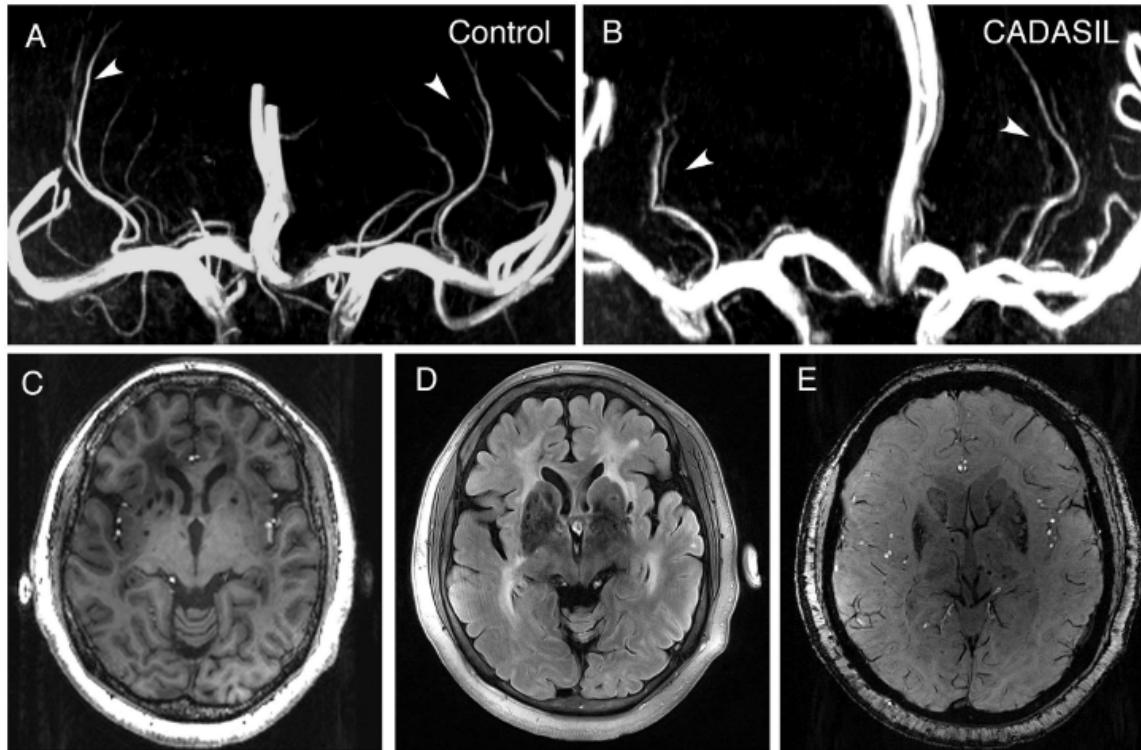
Front. Neurol., 21 August 2018
Sec. Endovascular and Interventional Neurology

Sources: World Stroke Organization (2022) / CDC / SAFE Europe

Cerebral small Vessel disease (cSVD) - Classification

CSVD types		
Type 1	Atherosclerosis ("sporadic")	Hypertension, diabetes, hyperlipidemia
Type 2	Cerebral Amyloid Angiopathy	
Type 3	Monogenic	CADASIL (notch3), CARASIL (HTRA1), MELAS, Fabry's disease,..
Type 4	Inflammatory / immuno-mediated	Wegner granulomatosis, Churg-Strauss, connective tissue vasculitis (Lupus, Sjögren, scleroderma, rheumatoid vasculitis..), microscopic polyangiitis, IgA vasculitis (Henoch-Schönlein purpura)
Type 5	Venous collagenosis	
Type 6	Others	Post-radiation angiopathy, non-amyloid microvasculature degeneration in Alzheimer disease

Radiological Markers in cSVD



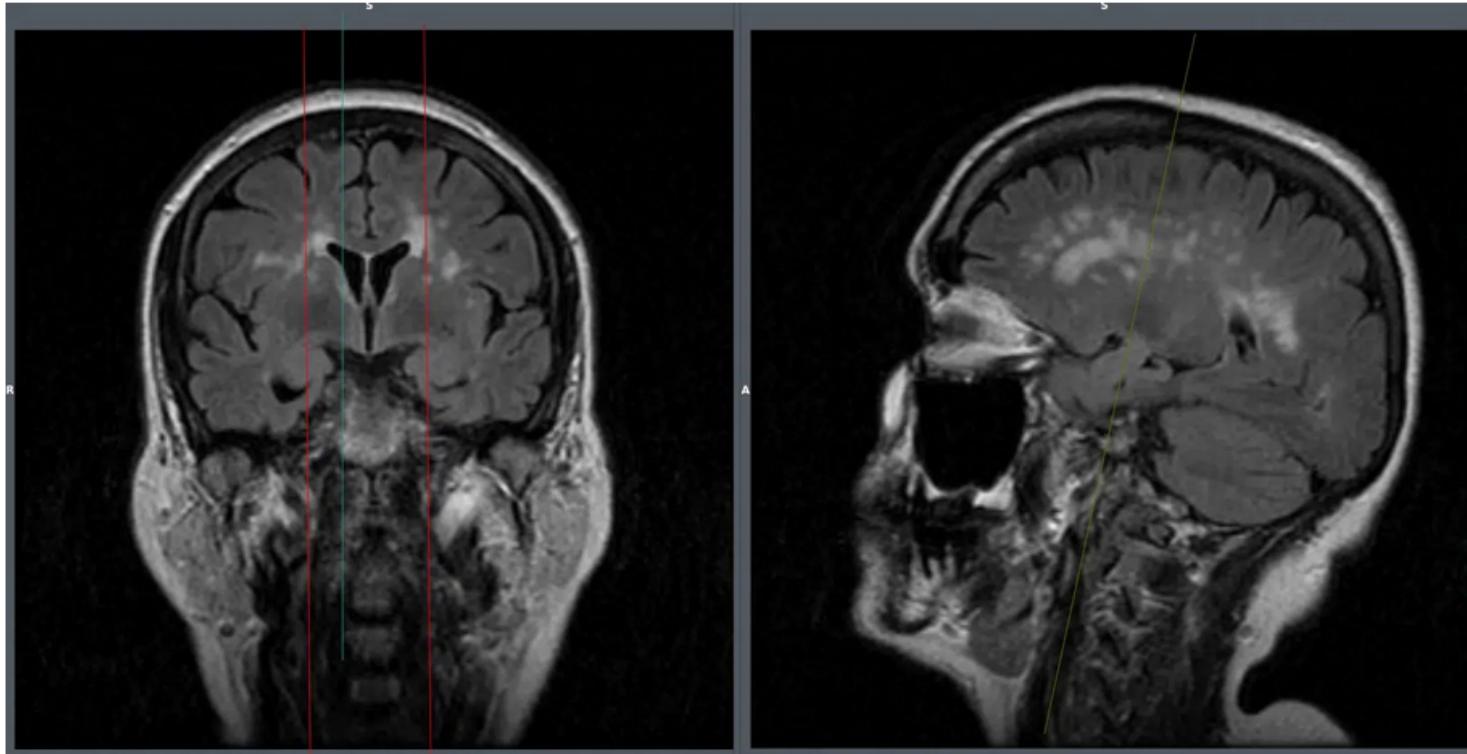
- Main markers
 - Leukoaraiosis / WMH
 - Microbleeds
 - Lacunar infarcts
 - Increased perivascular space (basal ganglia)
 - Cerebral atrophy (loss of volume)

Fuente: Lenticulostriate Arteries and Basal Ganglia Changes in Cerebral Autosomal Dominant Arteriopathy With Subcortical Infarcts and Leukoencephalopathy, a High-Field MRI Study

Front. Neurol., 09 August 2019 (Sec. Applied Neuroimaging)

Volume 10 - 2019 | <https://doi.org/10.3389/fneur.2019.00870>

cSVD monogenic (CADASIL)



Magnetic Resonance showing multiple lesions in white cerebral white matter in a patient with CADASIL

© 2024 CC BY-SA Dr. Luis Falcón

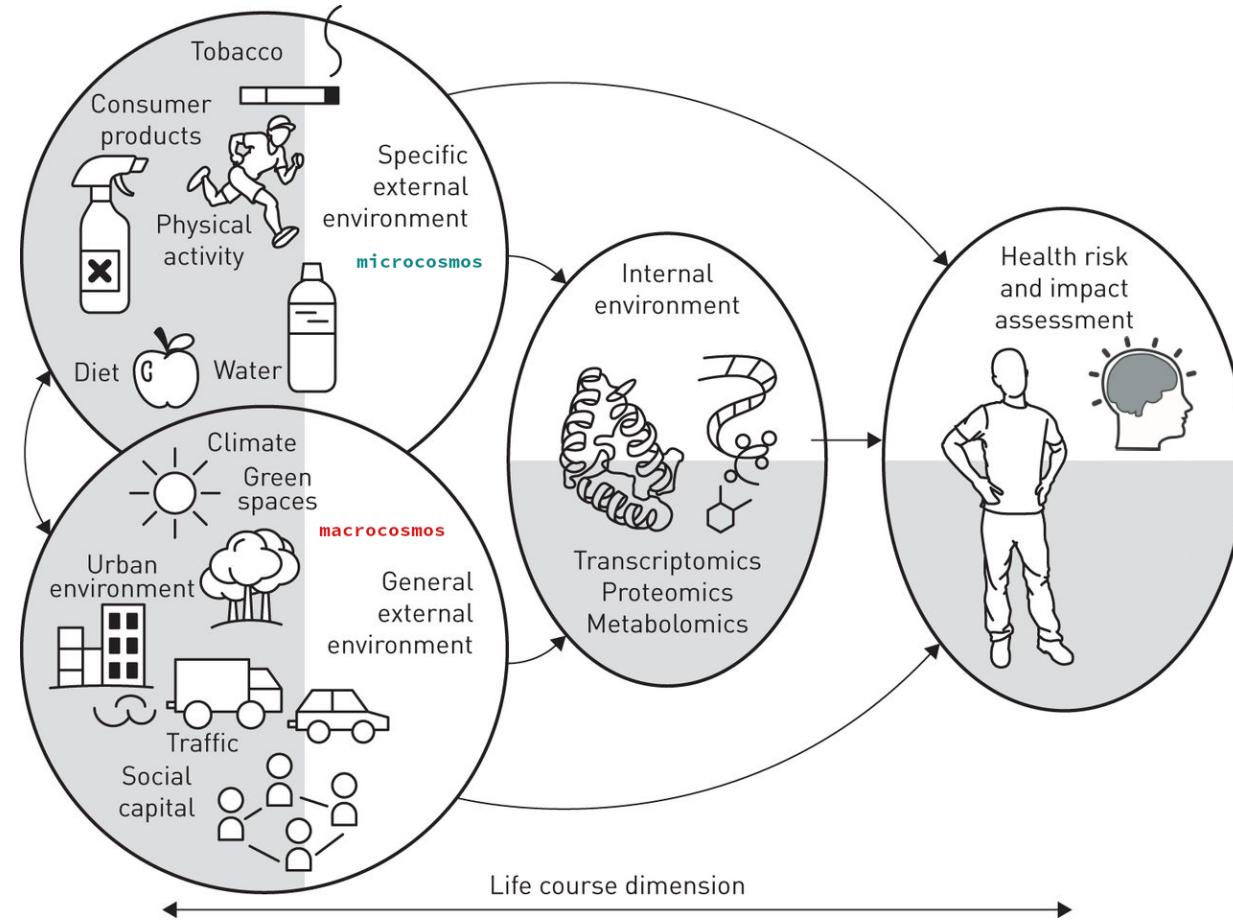
Sporadic cSVD



Magnetic Resonance from a elderly patient showing white matter hyperintensities and brain atrophy compatible with small vessel disease

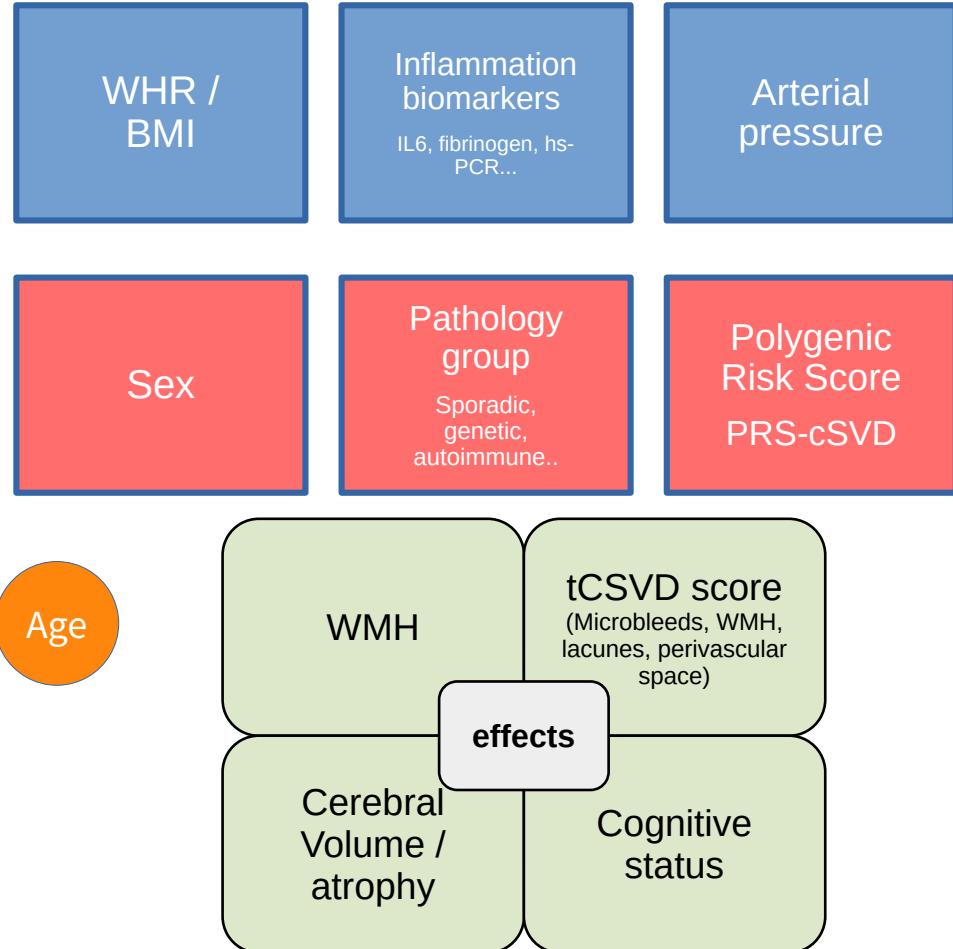
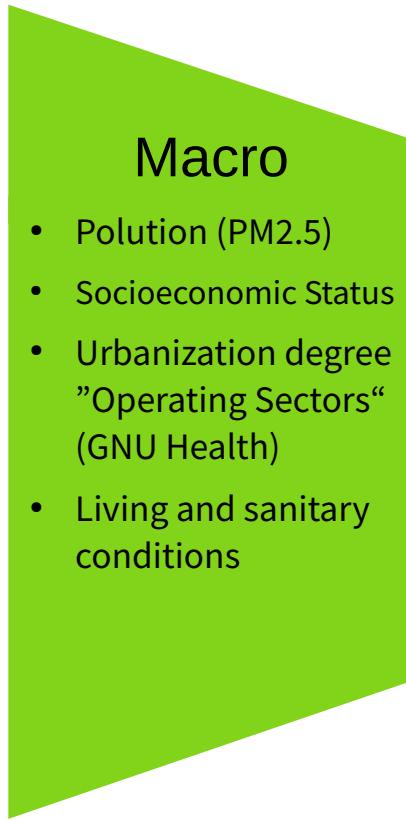
© 2024 CC BY-SA Dr. Luis Falcón

Exposome, macrocosmos, microcosmos & cSVD

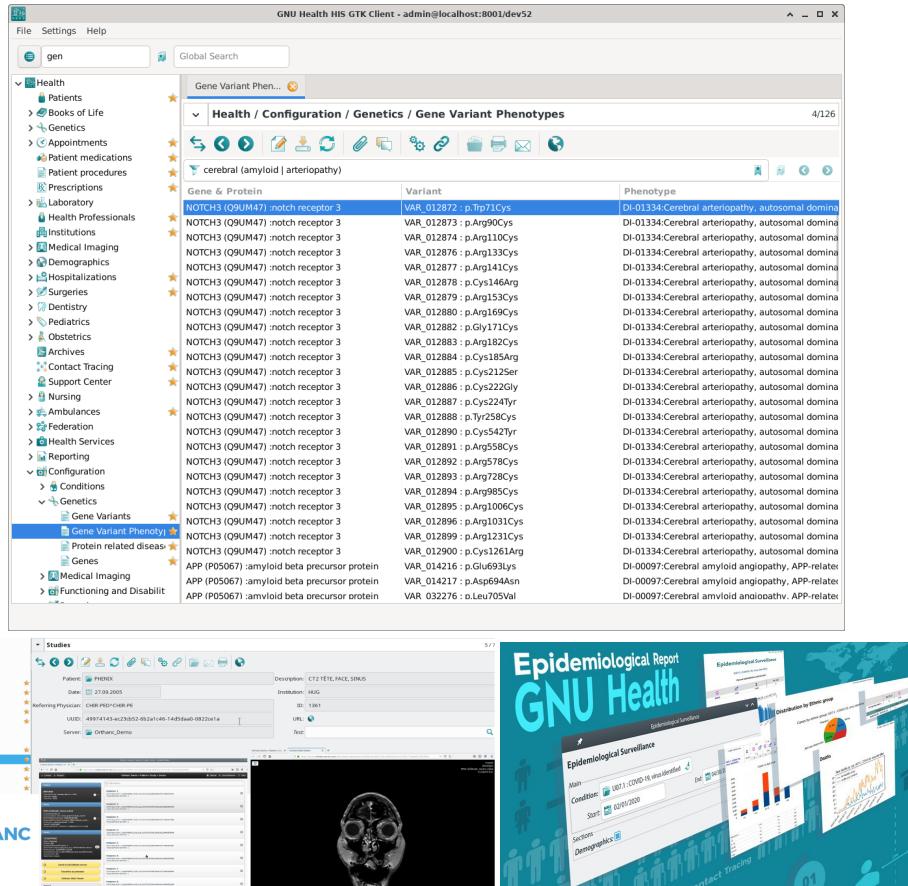


Adapted from
<https://publications.ersnet.org/content/errev/25/140/124>

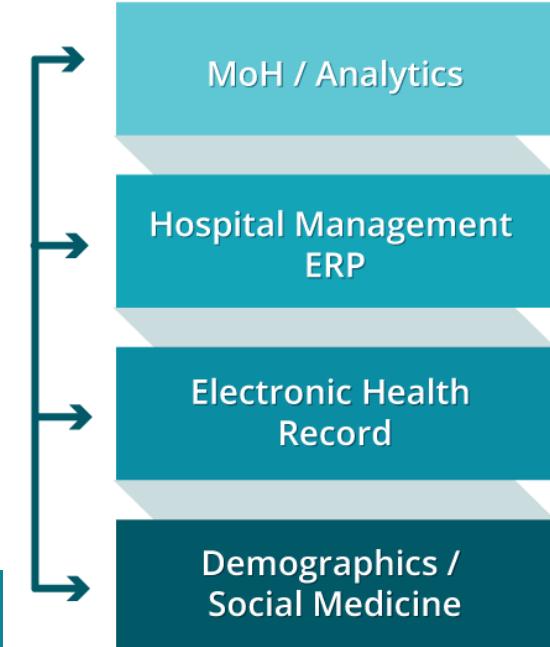
Some variables



Data collection: The GNU Health ecosystem



The image shows two screenshots of the GNU Health ecosystem. The top screenshot is the 'Gene Variant Phenotypes' page in the 'Health / Configuration / Genetics' section, displaying a table of variants and their phenotypes. The bottom screenshot is the 'Studies' page in the 'ORTHANC' module, showing a medical image of a head CT scan.



- Demographic information
- Social Medicine
- Lifestyle
- Domiciliary Units / urbanism degree
- Clinical history / variables of interest
- Medical Imaging / Radiology
- Laboratory / biochemistry
- Genetics (phenotypes, natural variants, family history)
- ICD-11
- Data anonymization
- Reporting

GNU Health Information System

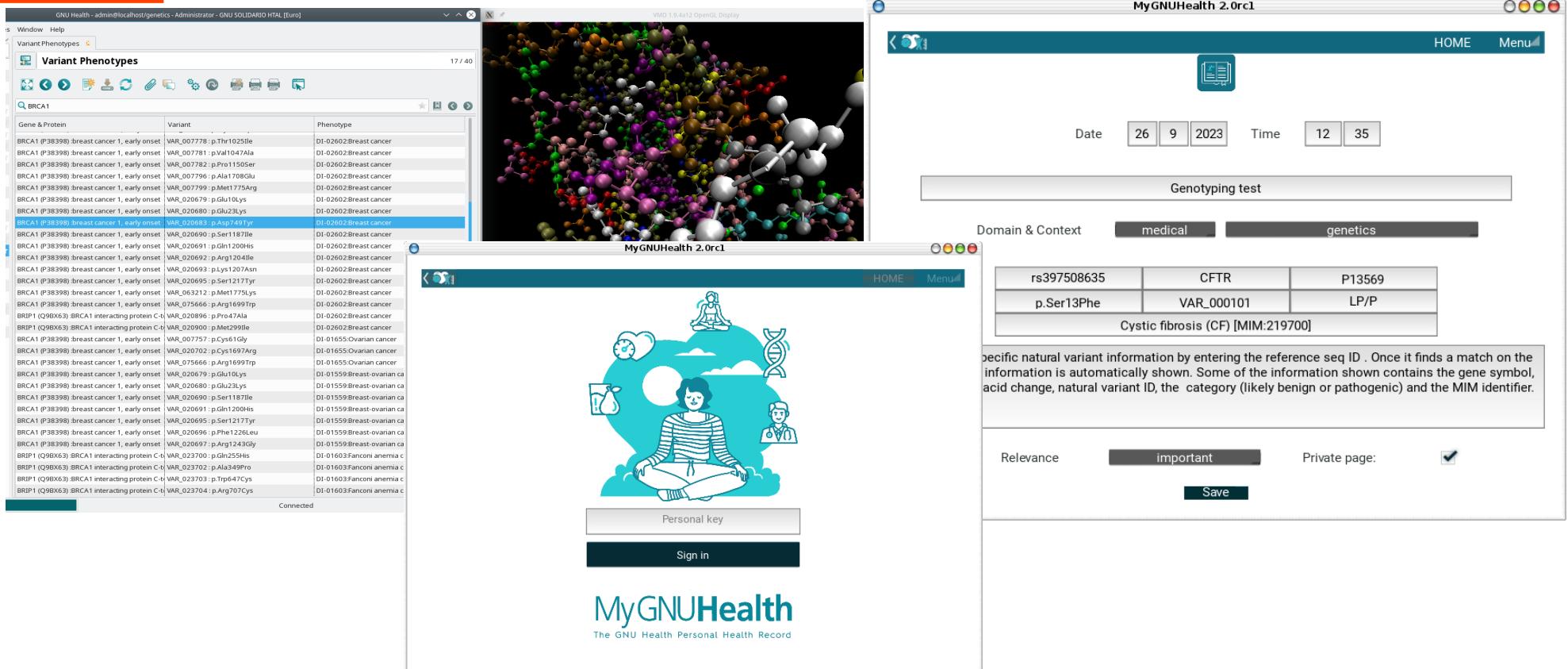


Collecting and aggregating data from participating entities: Federated Health Network & Information System



Collecting and updating information from MyGNUHealth PHR

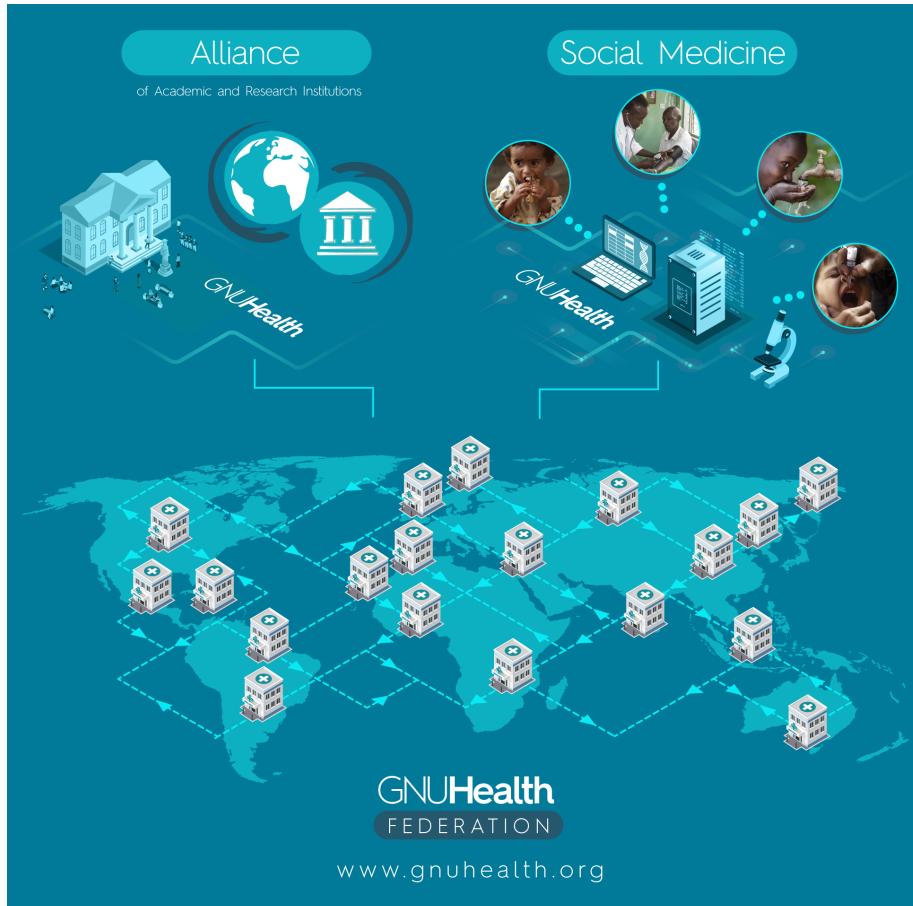
Research



The image shows the MyGNUHealth 2.0rc1 interface, a web-based Personal Health Record (PHR) system. The interface is divided into several sections:

- Left Panel (Variant Phenotypes):** A table listing variants for the BRCA1 gene. The first row is highlighted in blue, showing a variant: VAR_007778: p.Thr1025Ile. The table includes columns for Gene & Protein, Variant, and Phenotype.
- Middle Panel (3D Molecular Structure):** A 3D ball-and-stick model of a complex molecular structure, likely a protein-ligand complex, with atoms represented by spheres of different colors.
- Right Panel (Genotyping test):** A form titled "Genotyping test" with fields for Date (26/9/2023) and Time (12:35). It includes tabs for "Domain & Context" (set to "medical"), "medical", and "genetics". A table shows a match for rs397508635 (CFTR, P13569, p.Ser13Phe, VAR_000101, LP/P, Cystic fibrosis (CF) [MIM:219700]).
- Bottom Panel (Personal key):** A sign-in form with fields for "Personal key" and "Sign in".

Work with the GNU Health installed base



The Stiletto project: The GNU Health Federation and Open Science in the context of international epidemiological and biomedical research

Luis Falcón

Work with the GNU Health installed base



HEADQUARTERS



HEALTH INSTITUTIONS



ACADEMIC INSTITUTIONS



REGIONAL OFFICES



ANIMAL RIGHTS



HUMANITARIAN MISSIONS

... and Academic institutions / the GNU Health Alliance

HST.936: Global Health
Informatics to Improve
Quality of Care

The 2015 Iteration of our course will focus on Public Health
Emergencies and Humanitarian Crises.

Classes begin: February 6, 2015
Fridays 9am - 11am ET (GMT -5)
Room: 09-057



GNUHealth
ALLIANCE
OF ACADEMIC AND RESEARCH INSTITUTIONS

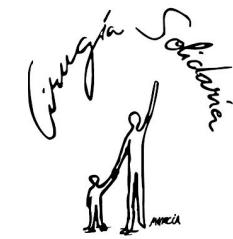


Leibniz
Universität
Hannover



... and medical & surgical partners

Collaboration



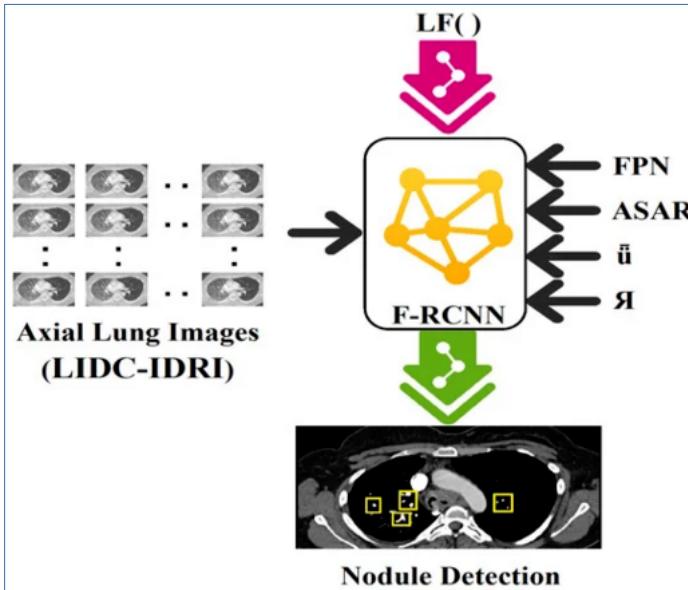
Genomics and Medical Genetics

Collaboration

Open Science: Using GNU Health in the context of a BRCA1 gene mutation and the structural representation of its protein BRCA1-M1775R ("PDB source: 1N5O *Structural consequences of a cancer-causing BRCA1-BRCT missense mutation*") with PyMOL.

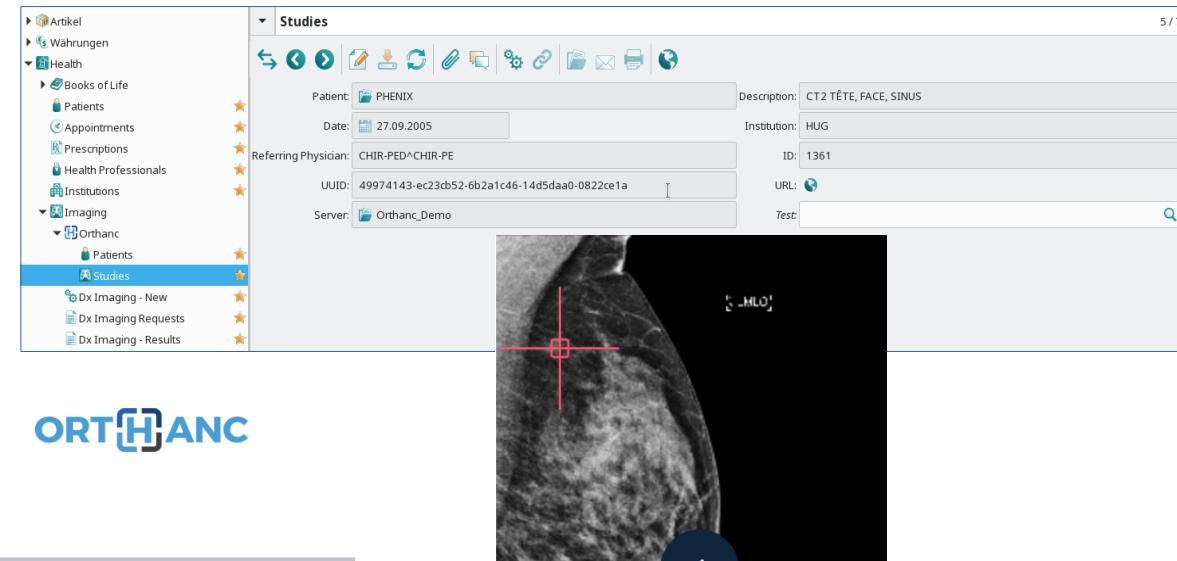
Medical Imaging & Orthanc

Collaboration



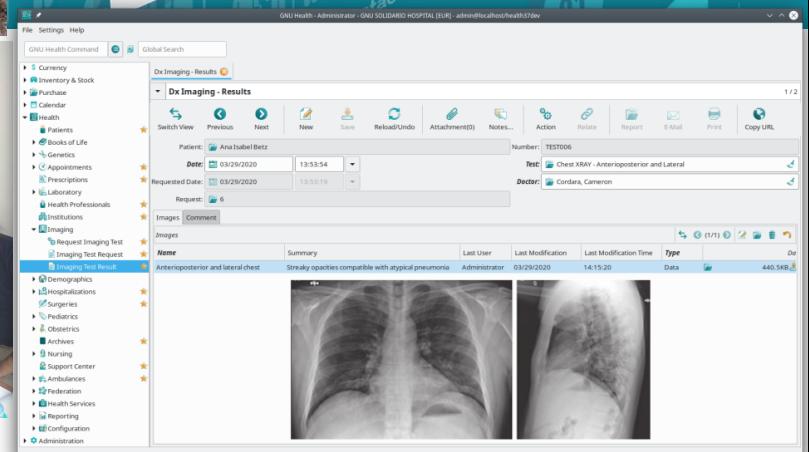
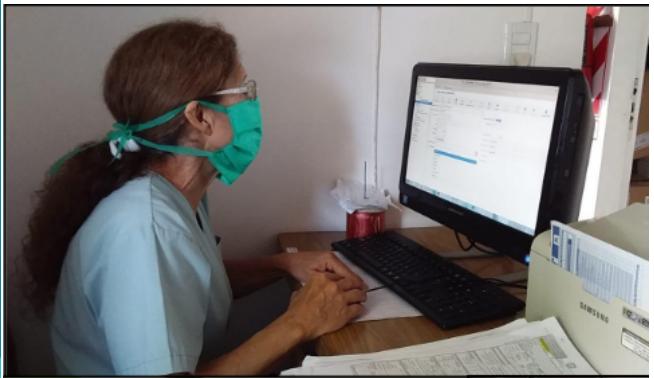
GNU Health used in "Early Detection of Lung Nodules Using a Revolutionized Deep Learning Model"

Some examples of use cases of GNU Health and Orthanc for the early detection of **breast** and **lung** cancer



GNU Health in pandemic context

Collaboration



Mental Health and its socioeconomic determinants

Collaboration



Learn from previous research projects related to Social Medicine

IN SITU
EL CÁNCER COMO INJUSTICIA SOCIAL

NATALIA LUXARDO - FERNANDO SASSETTI
editores

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editores

IN SITU

EL CÁNCER COMO INJUSTICIA SOCIAL

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MARIANA SCHMIDT CHRISTINE HOLMBERG Y MÁS...

PREFACIO: JAIME BREILH PRÓLOGO: CLAUDIO MARTYNIUK

Editorial Biblos

NATALIA LUXARDO es investigadora del Conicet en el Área Salud y Población del Instituto Gino Germani. Profesora en la carrera de Trabajo Social de la Universidad de Buenos Aires. Se dedica al desarrollo de investigaciones transdisciplinarias y colaborativas en los territorios, desde escalas de la indagación micro y centrada en poblaciones estigmatizadas y en contextos de vulnerabilidad y exclusión. Su línea de trabajo desde las últimas décadas versa sobre diferentes dimensiones relativas a las inequidades sociales, especialmente en salud.

FERNANDO SASSETTI es bioingeniero (Universidad Nacional de Entre Ríos). Magíster en Gestión de Sistemas y Servicios de Salud (Universidad Nacional de Rosario) y doctor en Ingeniería (Universidad Nacional del Litoral). Es docente adjunto de Organización de los Sistemas de Salud de la carrera de Bioingeniería en la Facultad de Ingeniería (UNER). Participa como investigador en diversos proyectos liderados por Natalia Luxardo vinculados con el abordaje del cáncer en Argentina.



Dra. Natalia Luxardo
Univ Buenos Aires
CONICET



Dr. Fernando Sassetti
Univ Entre Ríos
Cátedra Salud Pública

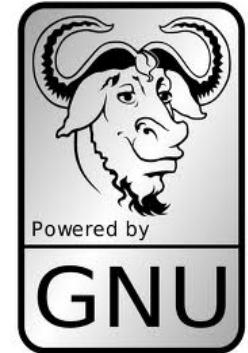


GNU Health was used to collect and process the demographic, clinical, epidemiological and socio-sanitary information from the participating centers

100% Free Software and Open Science



Digital
Public
Goods
Alliance



python



statsmodels



GnuPG



PyVista



Codeberg



matplotlib



ORTHANC



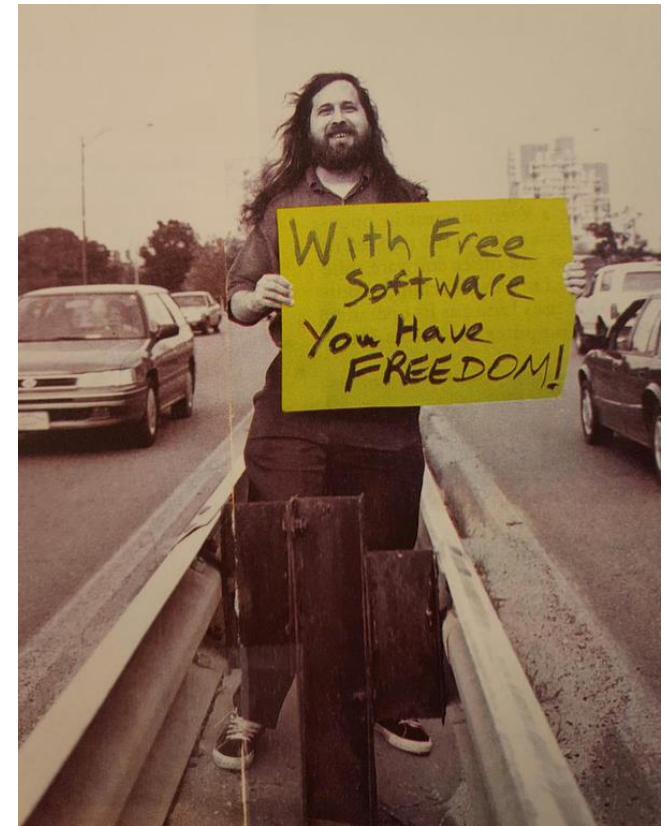
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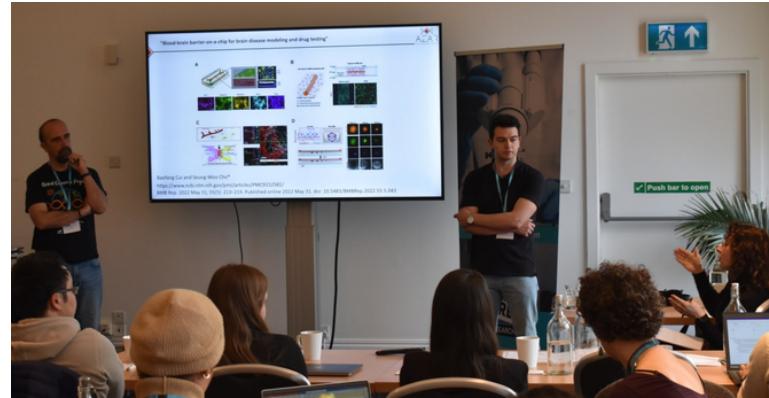
We are Free/Libre Software, not “open source”

- Free/Libre software is a philosophy and movement (free culture & science)
- It's about collaboration, solidarity, equity and privacy
- Big tech companies have taken over part of the movement, making “open source” their business.
- The term “Free Software” respects RMS (father of the movement) will and the organizations behind the movement.



Human-relevant, cruelty free research

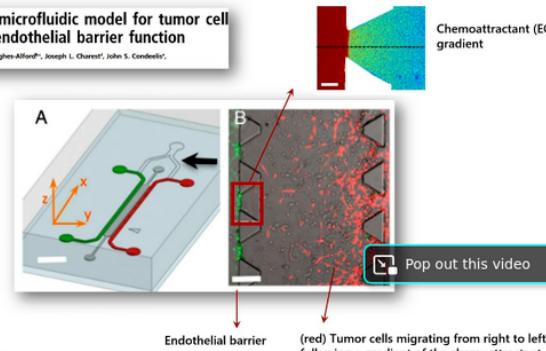
Organ-on-a-chip



Three-dimensional microfluidic model for tumor cell intravasation and endothelial barrier function

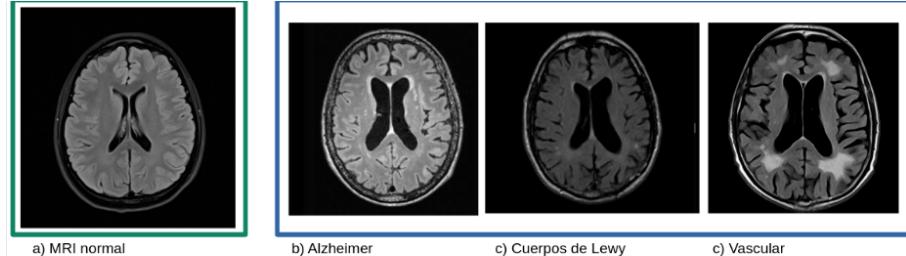
Inessa K. Zervantakis*, Shannon K. Hughes-Alford*, Joseph L. Charest*, John S. Condeelis*,

Frank G. Gertler*, and Roger D. Kamm*



[Link to paper](#)

Zervantakis, I. K., Hughes-Alford, S. K., Charest, J. L., Condeelis, J. S., Gertler, F. B., & Kamm, R. D. (2012). Three-dimensional microfluidic model for tumor cell intravasation and endothelial



GNU Health Command

File Settings Help

Health / Configuration / Genetics / Gene Variant Phenotypes

notch3

Gene & Protein Variant Phenotype

NOTCH3 (09K447) - Notch homolog 3 (Dbn VAR_012871; p.Cys497Yr) Di-01334:Cerebral arteriopathy, autosomal dominant, with subcortical infarcts and leukoencephalopathy, 1

NOTCH3 (09K447) - Notch homolog 3 (Dbn VAR_012872; p.Tyr71Cys) Di-01334:Cerebral arteriopathy, autosomal dominant, with subcortical infarcts and leukoencephalopathy, 1

NOTCH3 (09K447) - Notch homolog 3 (Dbn VAR_012873; p.Arg90Cys) Di-01334:Cerebral arteriopathy, autosomal dominant, with subcortical infarcts and leukoencephalopathy, 1

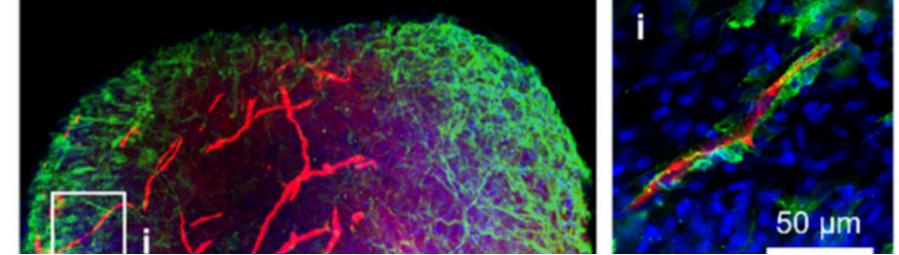
NOTCH3 (09K447) - Notch homolog 3 (Dbn VAR_012874; p.Thr130Cys) Di-01334:Cerebral arteriopathy, autosomal dominant, with subcortical infarcts and leukoencephalopathy, 1

NOTCH3 (09K447) - Notch homolog 3 (Dbn VAR_012876; p.Arg131Cys) Di-01334:Cerebral arteriopathy, autosomal dominant, with subcortical infarcts and leukoencephalopathy, 1

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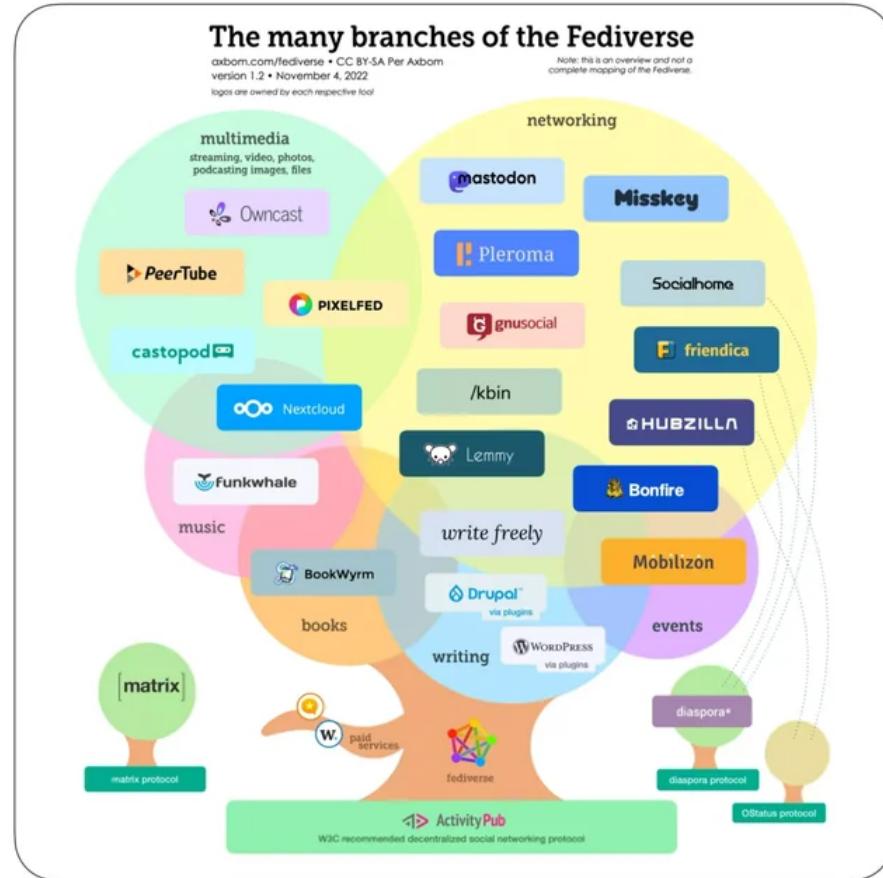
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NOTCH3 (09K447) - Notch homolog 3 (Dbn VAR_012879; p.Arg153Cys) Di-01334:Cerebral arteriopathy, autosomal dominant, with subcortical infarcts and leukoencephalopathy, 1



Meet and Join us at the Fediverse

Collaboration



GNU Health

<https://mastodon.social/@gnuhealth>

GNU Solidario

<https://mastodon.social/@gnusolidario>

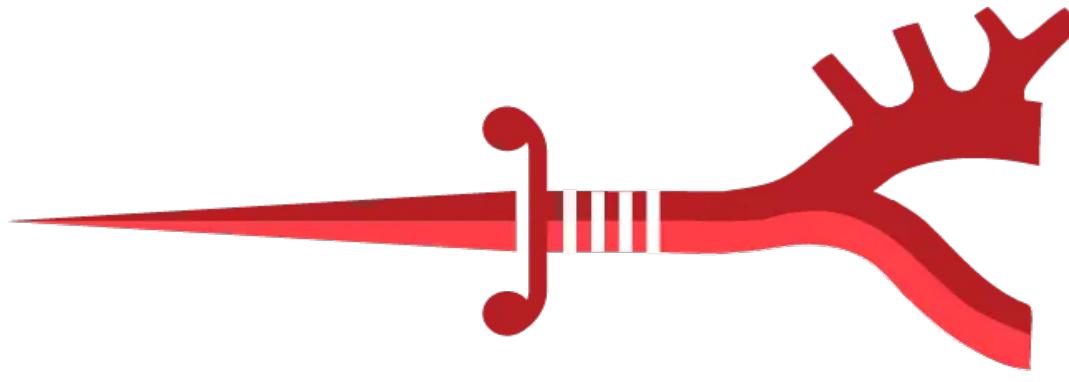
Respect: “First, do no harm”

Respect
Mother nature, animals
(human and non-human)

Primum non nocere



Thank you!



STILETTO

stiletto@globalexposome.org

falcon@gnuhealth.org