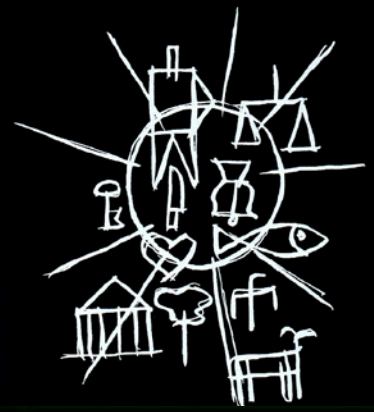
3rd European Conference on Whole Slide Imaging and Analysis

From Microscopy, Imaging to Clinical Research: A Latin American Perspective

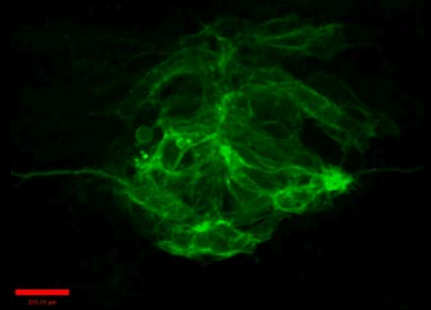


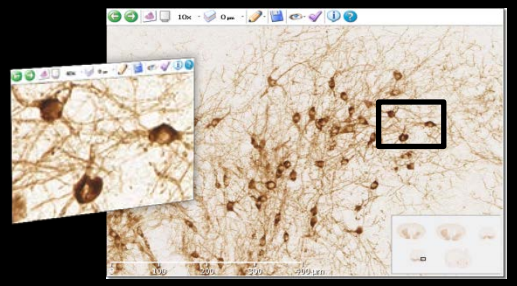
Joaquín Torres García

Steffen Härtel

www.scian.cl

Laboratory of Scientific Image Analysis (SCIAN-Lab)
Biomedical Neuroscience Institute (BNI)
Institute of Biomedical Sciences (ICBM)
Anatomy and Developmental Biology Program,
ICBM, Faculty of Medicine,
University of Chile





29th – 30th November 2013 | Hamamatsu TIGA Center
BioQuant, Heidelberg University

3rd European Conference on Whole Slide Imaging and Analysis

How to Survive in the Chilean Jungle

Steffen Härtel

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How to Survive in the ~~Chilean~~ Jungle Tissue

Steffen Härtel

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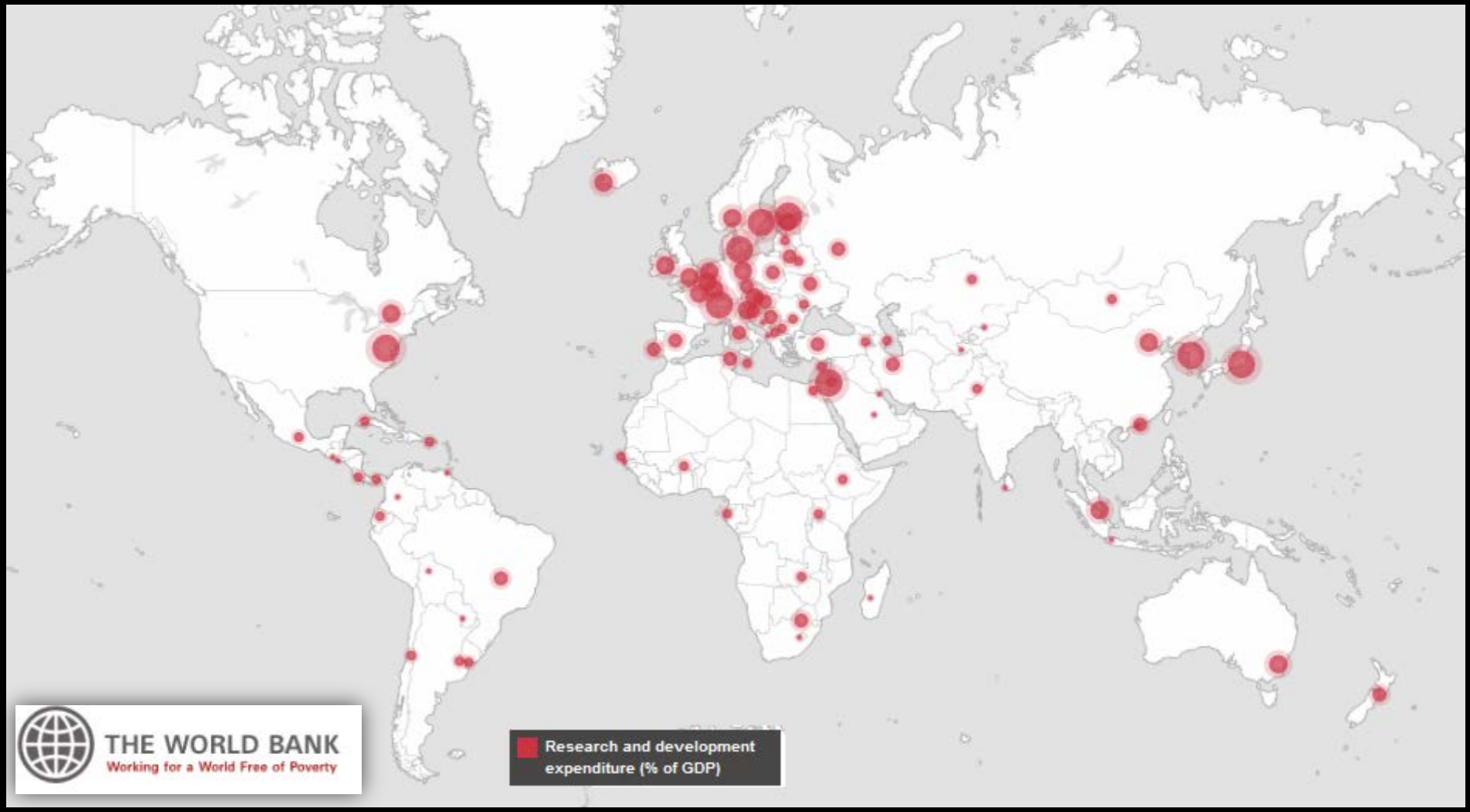
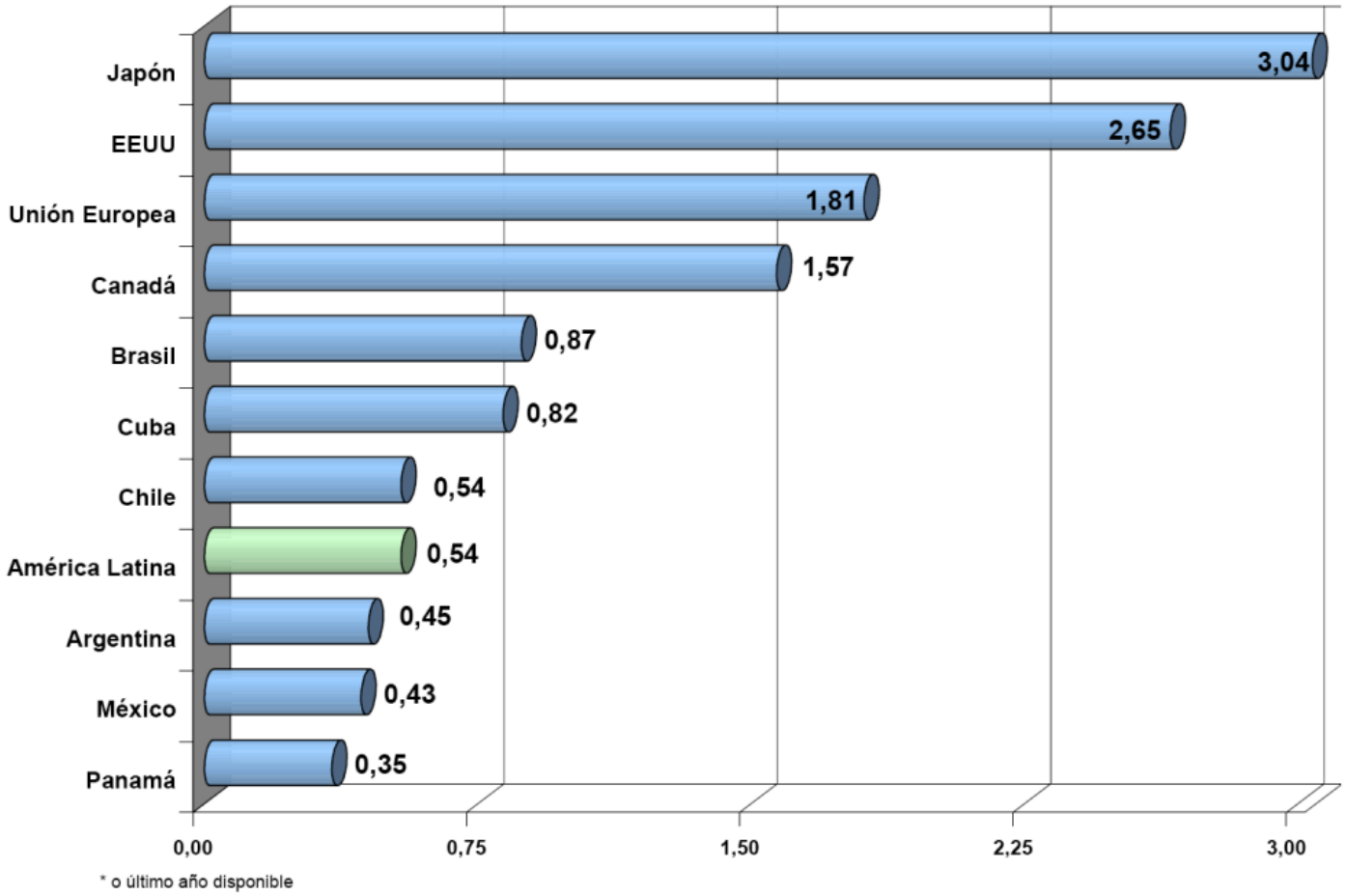
29th – 30th November 2013 | Hamamatsu TIGA Center
BioQuant, Heidelberg University

Research & Development as % of Gross Domestic Product GDP



R&D as % of gross domestic product GDP



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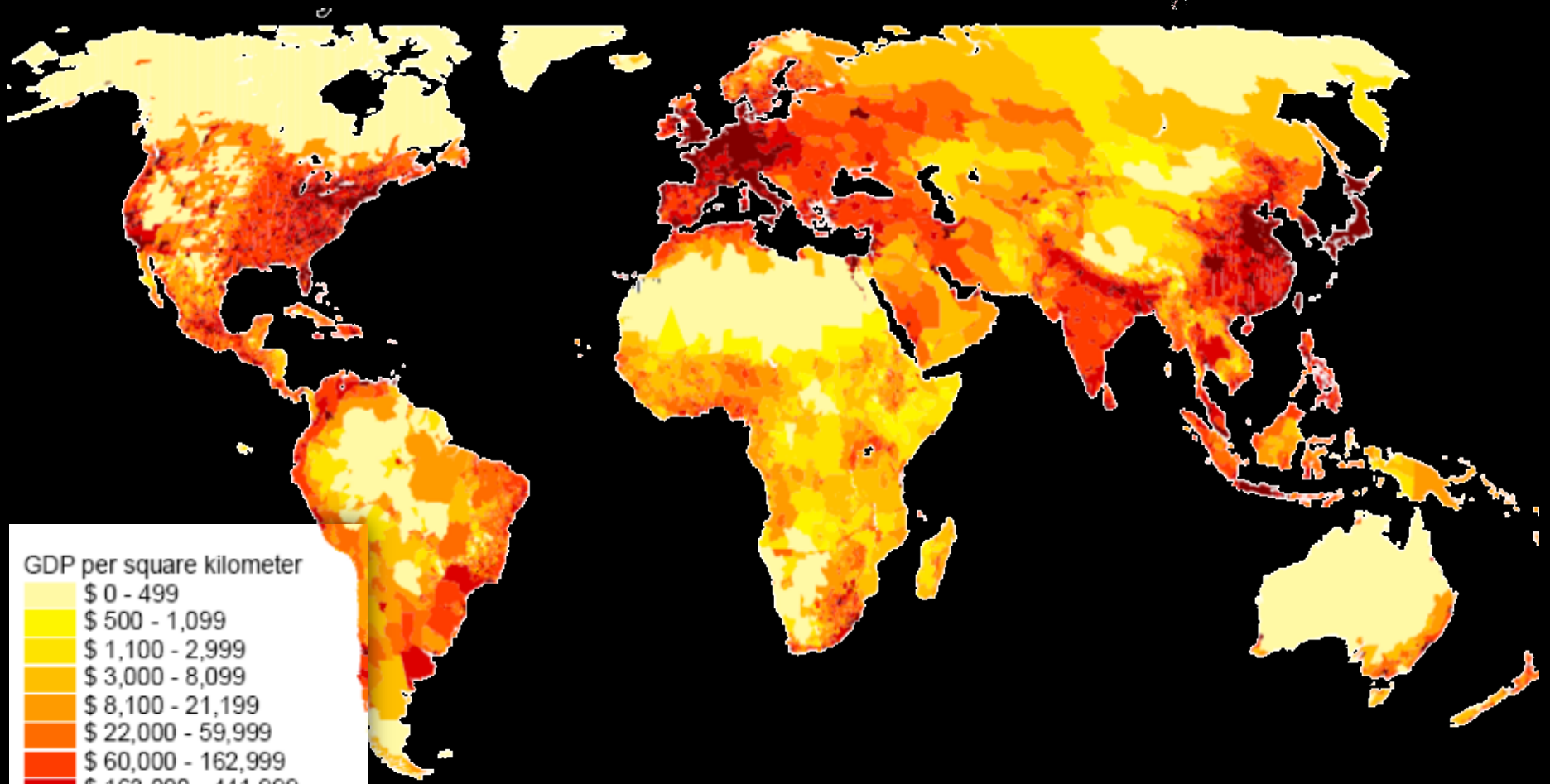
FACULTAD DE MEDICINA UNIVERSIDAD DE CHILE

BIOMEDICAL NEUROSCIENCE INSTITUTE

Laboratory for SCIAN Scientific Image Analysis

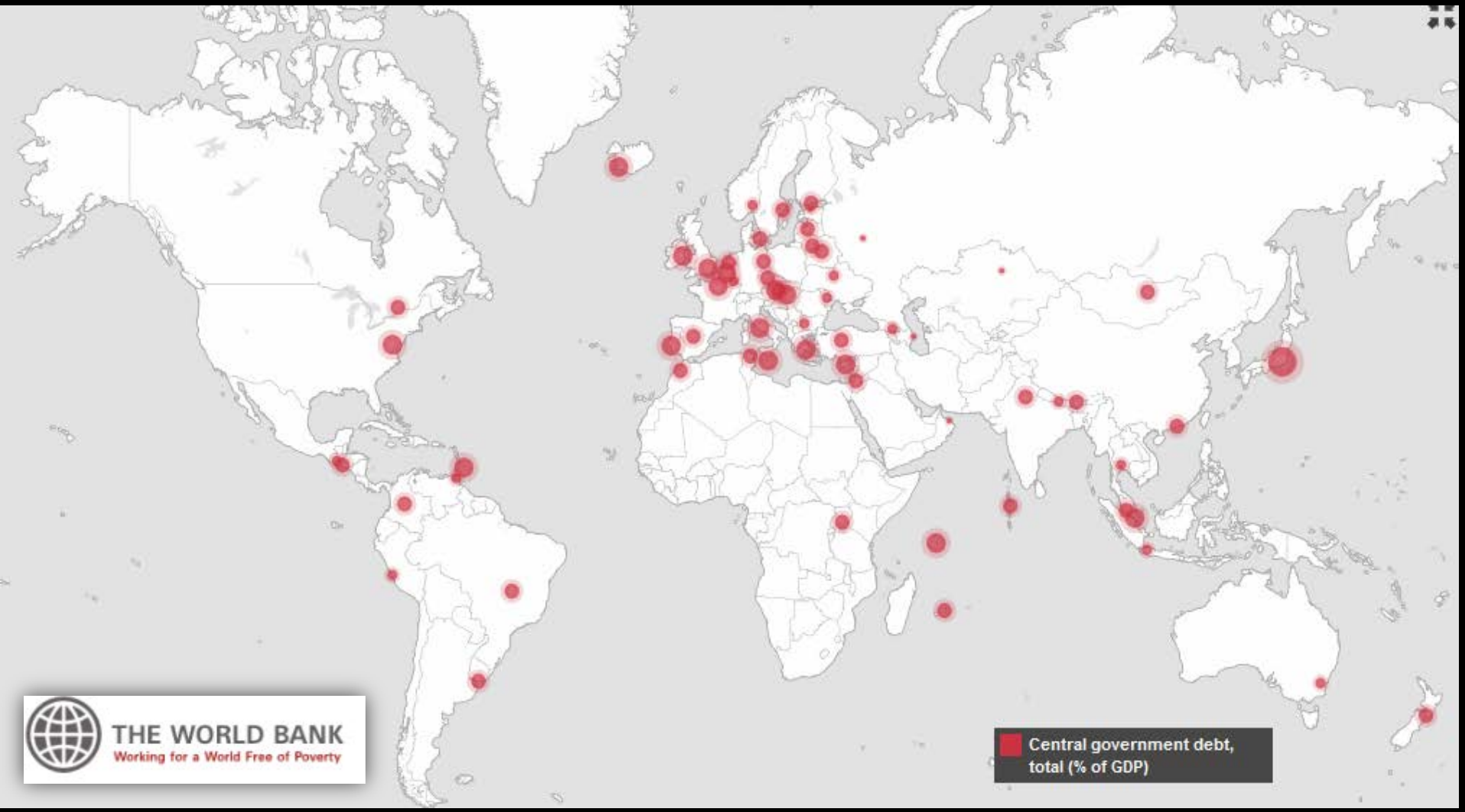
Gross Domestic Product GDP

GDP Density

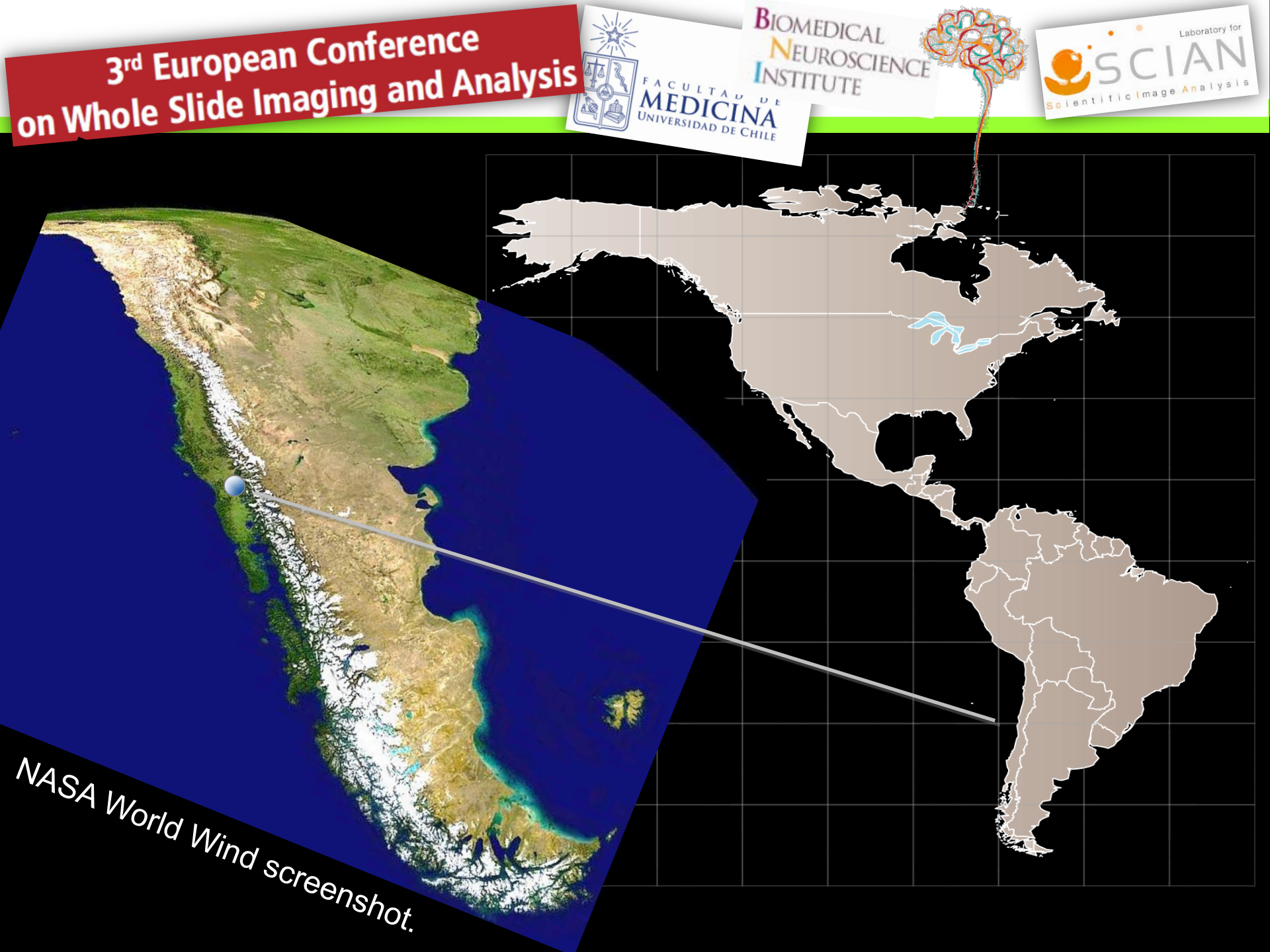


J Gallup, J Sachs and A Mellinger, 1999, *International Regional Science Review …*
"GDP density": multiplying GDP per capita by the number of people per square km.

Government Dept as % of Gross Domestic Product GDP



3rd European Conference on Whole Slide Imaging and Analysis



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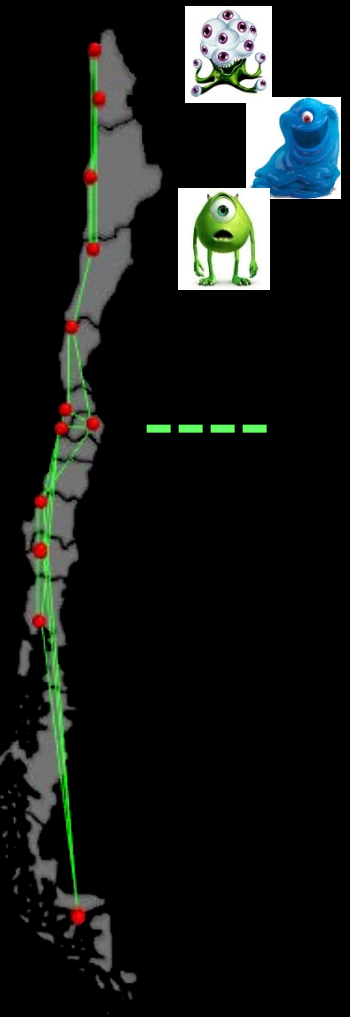
Very Large Telescope (VLT), 4 telescopes, 8m, 2600 m

Atacama Large Millimeter/submillimeter Array (ALMA), 66 antenna, 5000 m

E-ELT European Extremely Large Telescope, 39 m

NASA World Wind screenshot

3rd European Conference on Whole Slide Imaging and Analysis



Extraterrestrial Monster Science produces:
TeraB, PetaB, ExaB, ZettaB, YottaB

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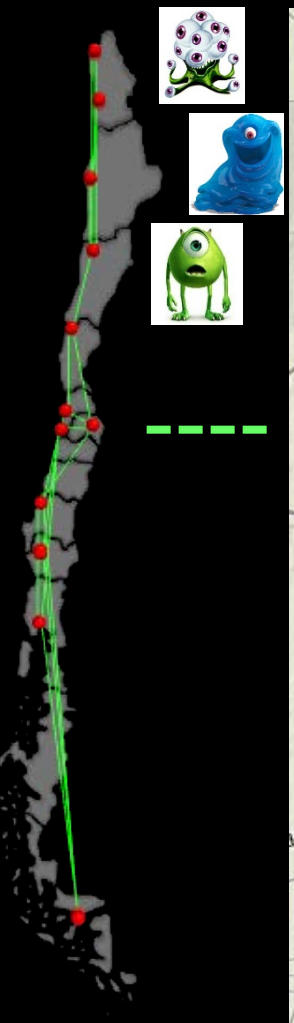
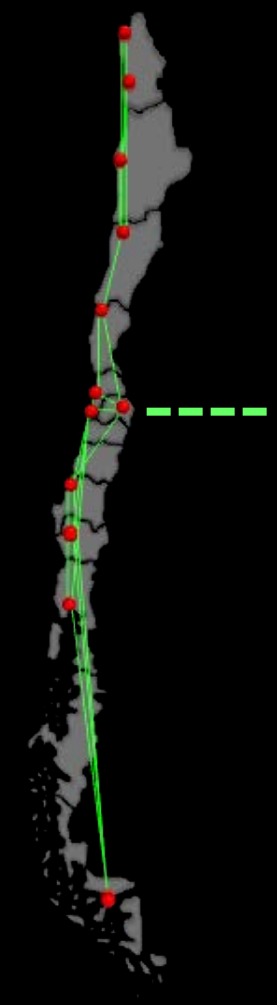


3rd European Conference on Whole Slide Imaging and Analysis



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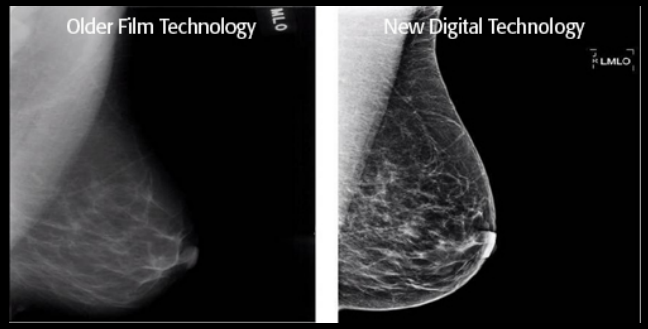
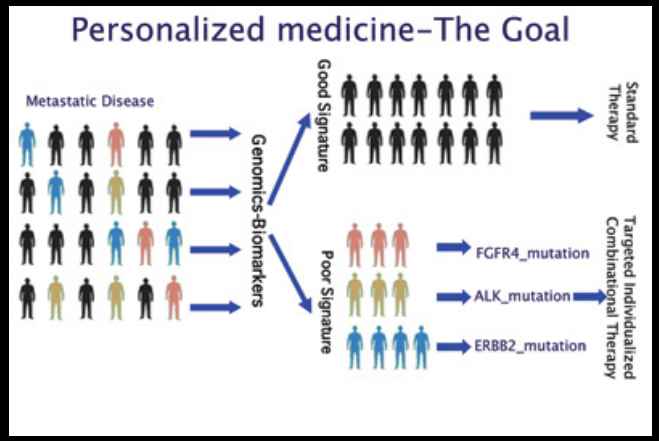
Data Quality and Quantity from
Biomedical Sciences to Clinical Research:

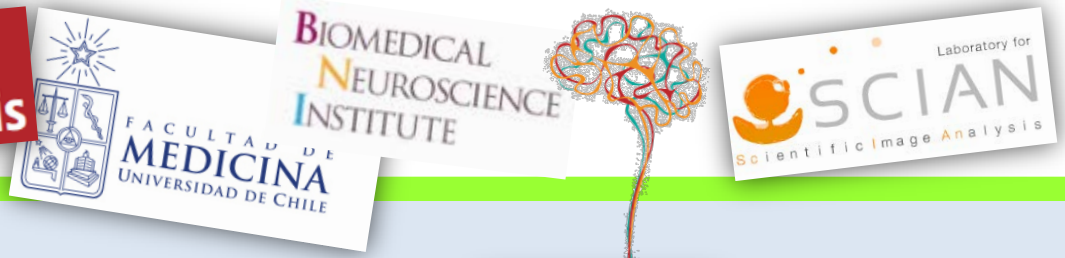
Dr Bettina Müller, Medical Oncologist – National Caner Institute, Executive Director - GOCCHI

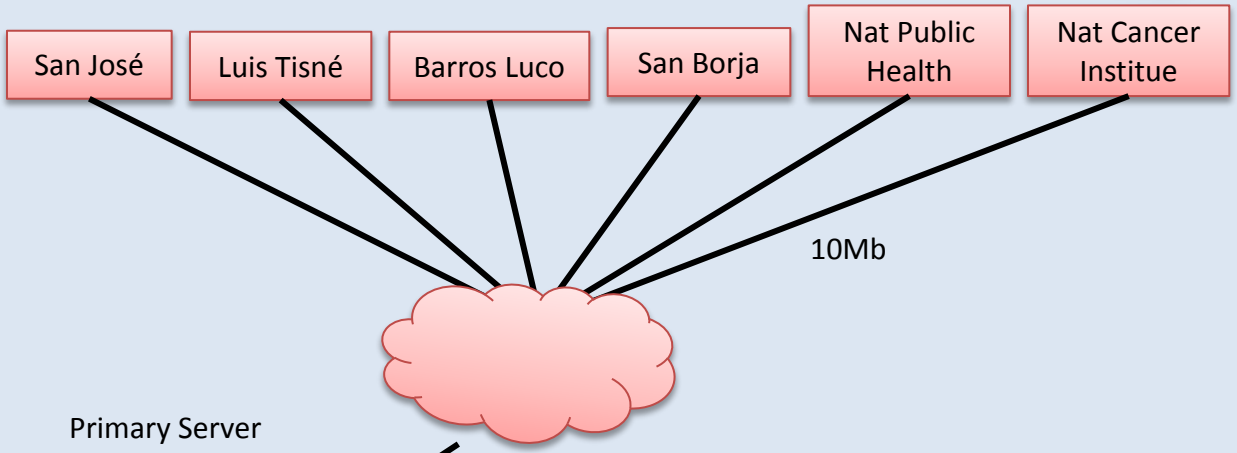
- Tools for prevention
  risk factors
- Tools for early detection
  applicable - acceptable – efficient
- Personalized Treatments
  predictive and prognostic tools

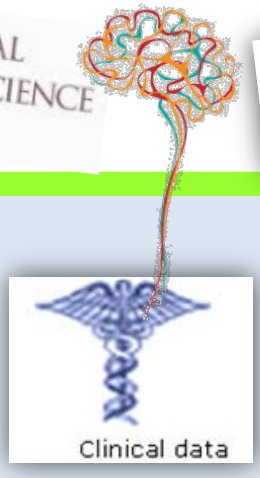




3rd European Conference on Whole Slide Imaging and Analysis







Primary Server (F-Med, University Hospital)

100Mb

BACKUP Server s & HPC)

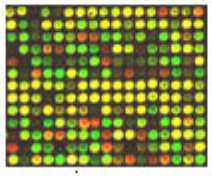
10 Gb

OpenClinica / BSI server **in Chile**

- Conectivity
- Speed
- Security

… Clinical Studies

Disparate Data Sources

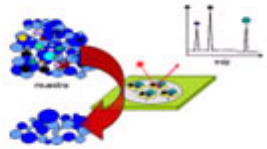

Expression array data


SNPArray data


Clinical data


Pathology


Radiology


Proteomics data

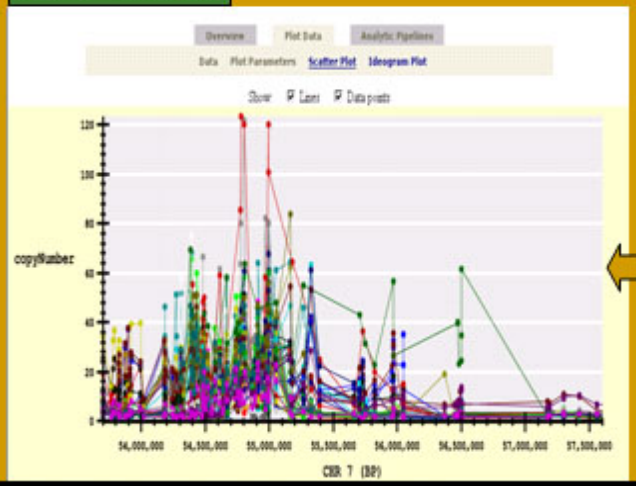
Datawarehouse

Query Engine

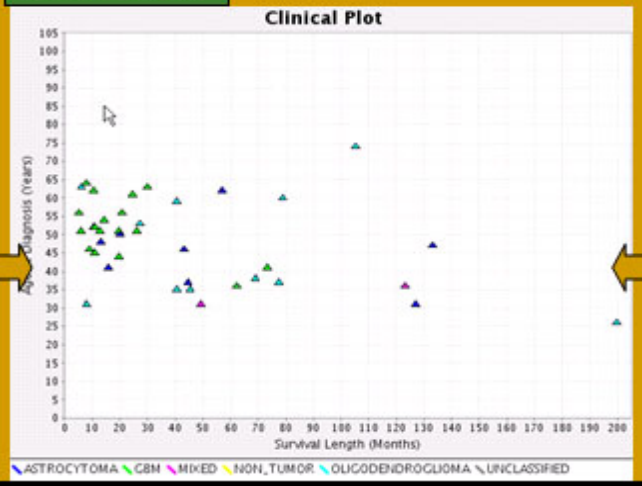
Comparison Tools	Visualization Tools	Developer Tools	Intuitive User Interface
-Access and Integrate clinical and genomic data -Integrate copy number data with Gene expression data -Compare molecular signatures from different disease groups	-Copy number frequency charts -Ideograms -PCA graph -Kaplan-Meier survival charts -user-friendly reports	-Service APIs to access Clinical genomic objects and Biomarker Findings -Analysis APIs -DDL and data load scripts -Java Docs	-Navigation based on user selection -Context-sensitive help throughout the application -Minimal training required to use the system

User Interface

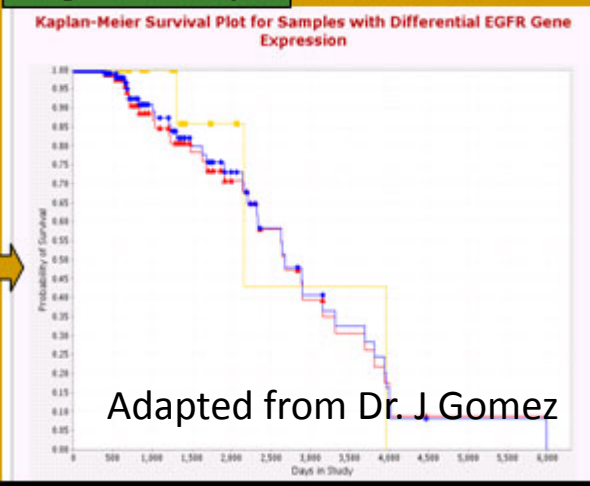
Genomic Data



Clinical Data



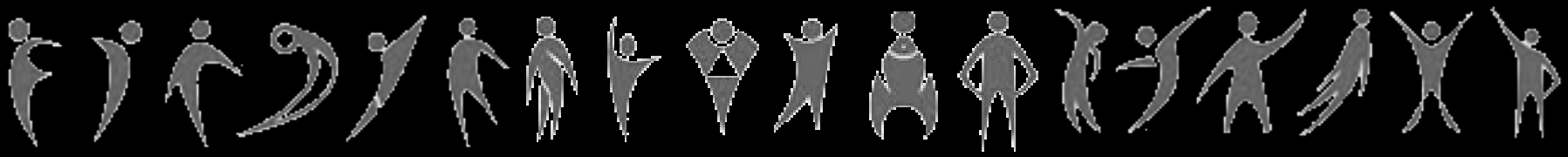
Integrative Analysis



Adapted from Dr. J Gomez

3rd European Conference on Whole Slide Imaging and Analysis

Basic Science	R&D	Human Capital Formation Medical Informatics	Basic Science
FONDECYT CONICYT	FONDEF CONICYT	DAAD / DFG	ICM



SCIAN-Lab Members		
PI	●	Biophysics
PostDocs	●●●●	Biology / Computer Sc / Electric Engineer
PhD - students	●●●●	Computer Sc / Electric Engineer / Biology
Master - students	●●	Medical Technology / Electric Engineer
Undergraduate	●	Computer Sc
Research – Assistants	●●●●●	Medicine / Computer Sc / Electrical Engineer / Biology
Technicians	●●●	Biotechnology / Labtechnician / Administration

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Laboratory for SCIAN Scientific Image Analysis

MICROSCOPIA VIRTUAL

UNIVERSITÄT HEIDELBERG
HEIDELBERG CENTER LATEINAMERIKA
Universidad de Chile

BIOMEDICAL NEUROSCIENCE INSTITUTE

Basic Science	R&D	Human Capital Formation Medical Informatics	Basic Science
FONDECYT CONICYT	FONDEF CONICYT	DAAD / DFG	ICM

GOCCHI
Grupo Oncológico Cooperativo Chileno de Investigación
Chilean Cooperative Group For Oncologic Research

United States-Latin America Cancer Research Network, US-LA CRN

2013-2014: U-Redes BioMed-HPC: Network for High Performance Computing

2013-2014: Initiative for Big-Data-Management, Processing, and Distribution for Science and Education in R&D

FONDEFS, U-Chile, BNI, F-Med, ICBM, REUNA, …

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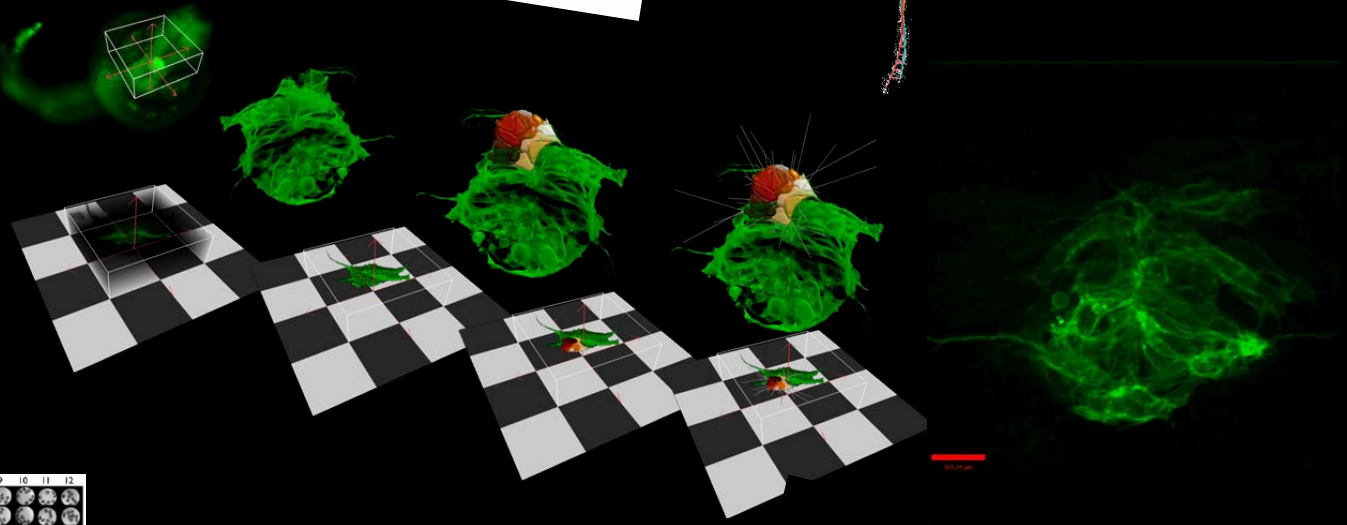
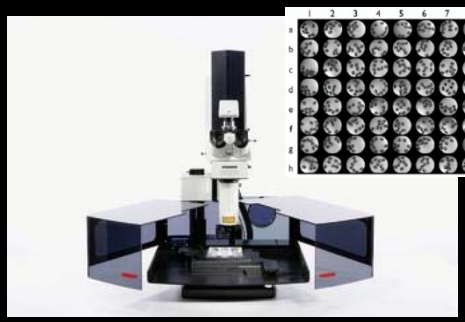
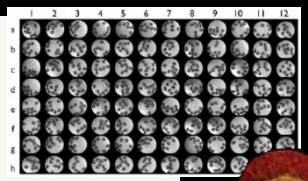
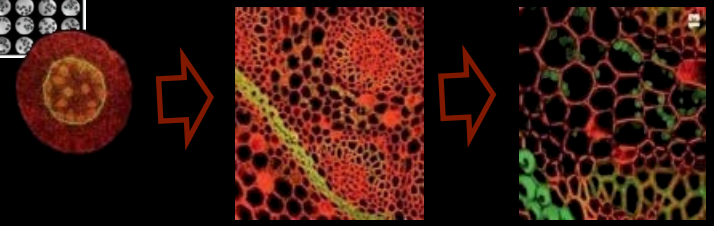
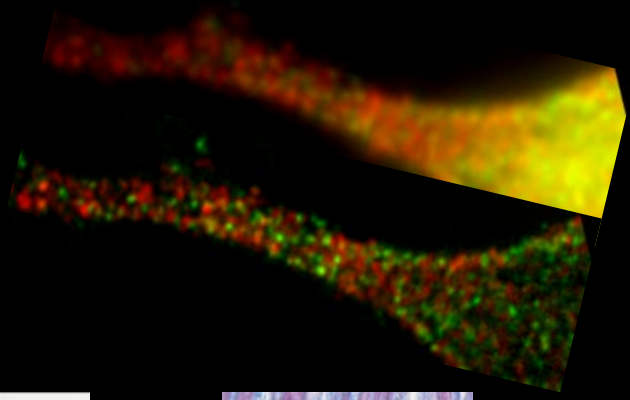
Perkin Elmer Spinning Disk







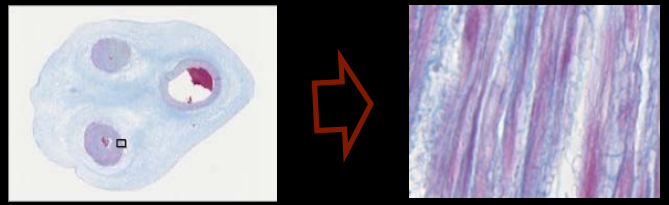




Leica TCS LSI: Super Zoom Confocal + SOFI

TB of Data per Experiment

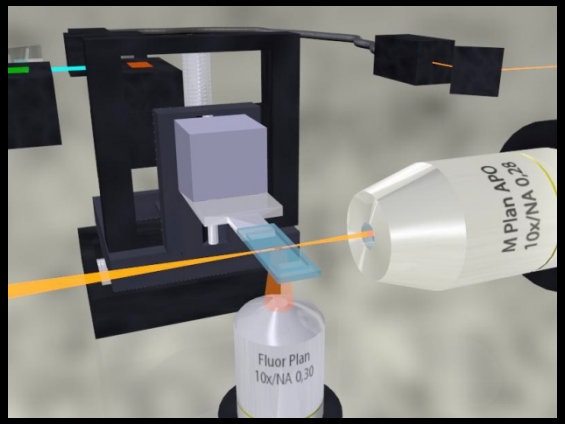
NanoZoomer: Tissue Imaging

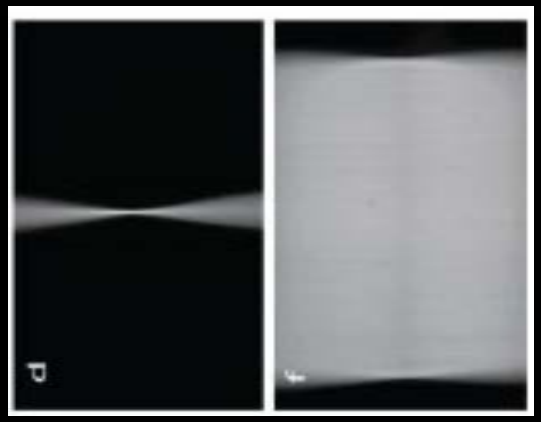


3rd European Conference on Whole Slide Imaging and Analysis

Pulgar, Concha, Keller 2012 unpublished

H2B-mCherry | crestin::GFP | merge | 00:00:00





Keller et al, Science 322, 2008

Tens of TB of Data

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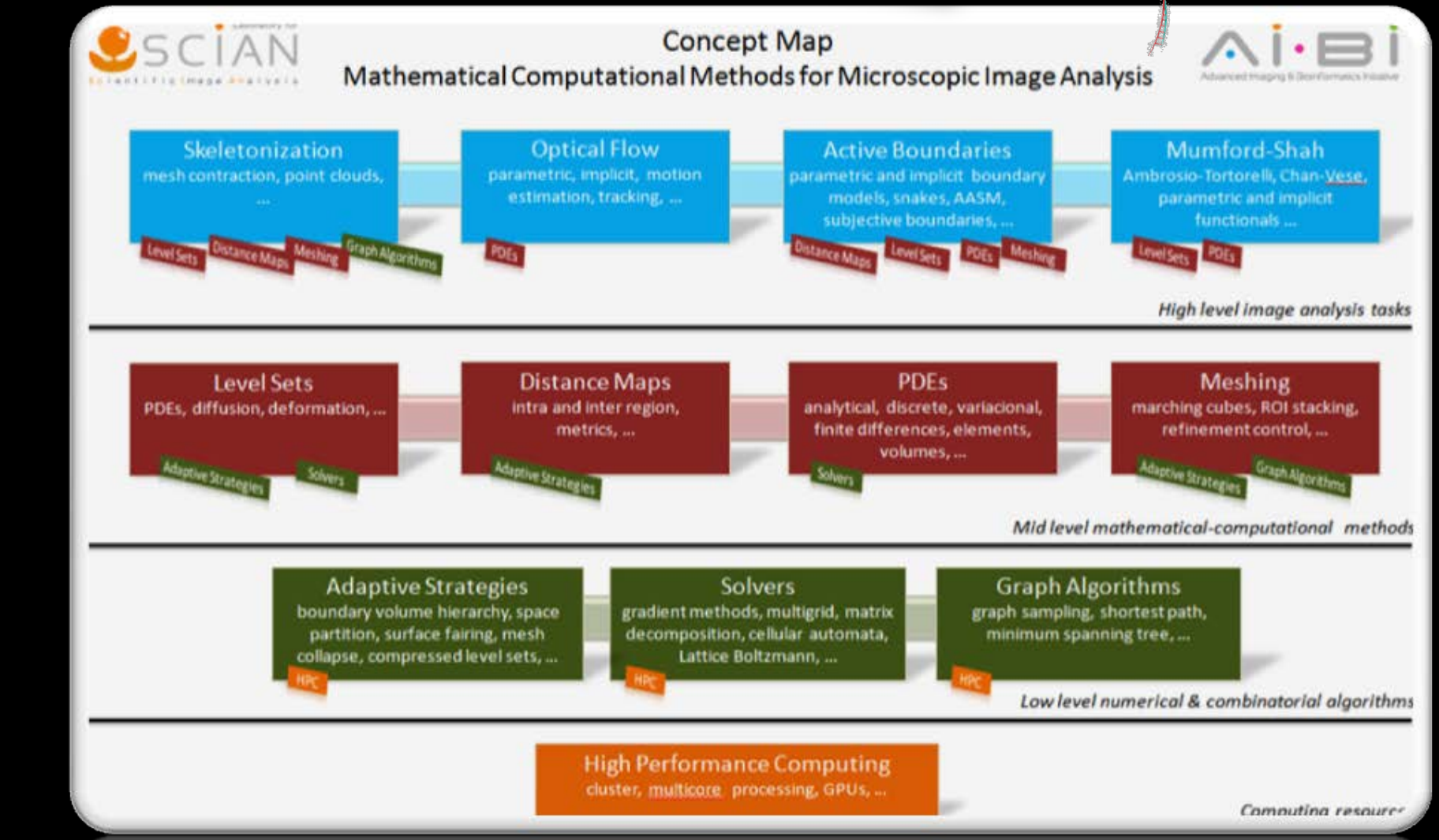
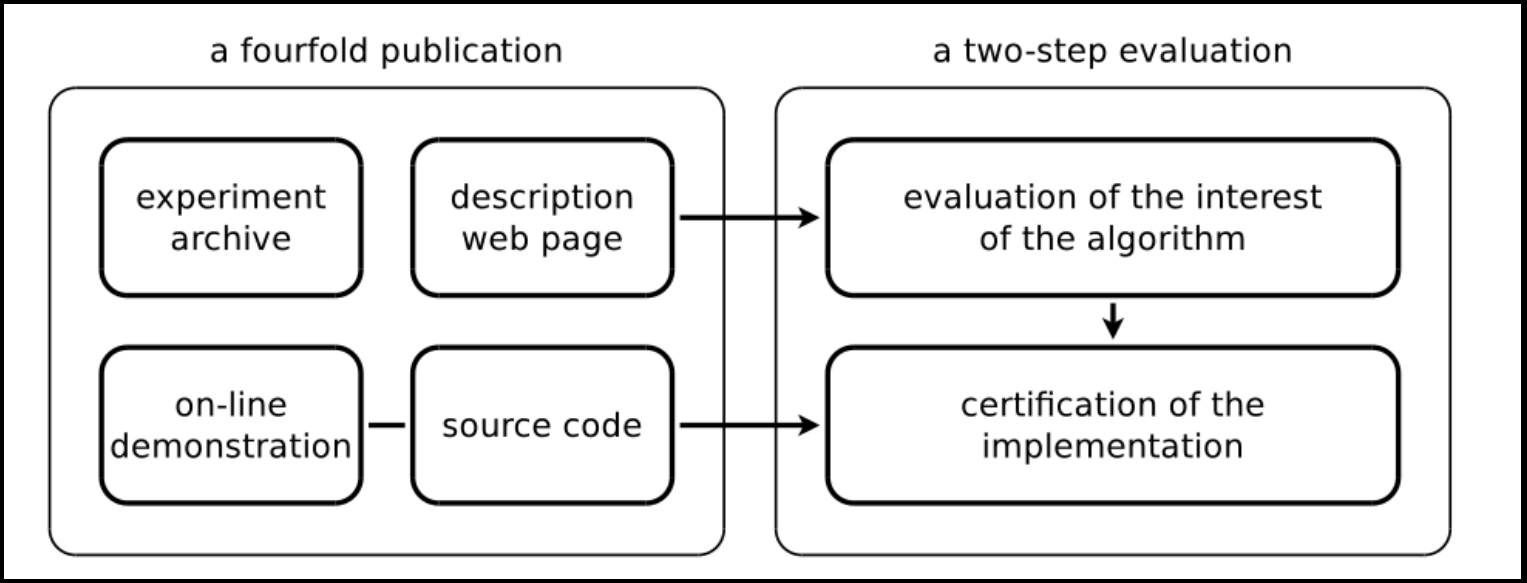


IPOL publishes image processing algorithms as precise and comprehensive as possible.



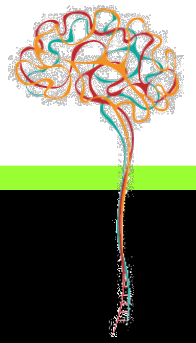
The publication of each algorithm includes:

- detailed description, bibliography, commented examples and a failure case analysis
- on line demo site for testing of user data
- downloadable program in C or C++
- discussion forum on the algorithm

Laboratory for SCIAN Scientific Image Analysis

... Image Processing Online: iPol @ www.ipol.im

BIOMEDICAL NEUROSCIENCE INSTITUTE



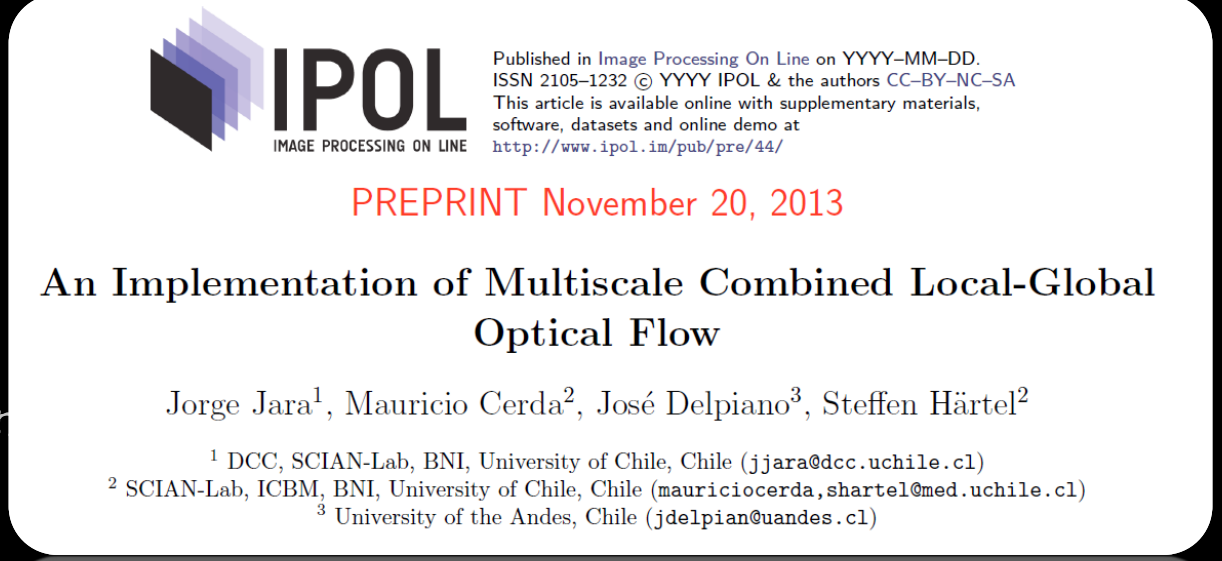
iPol - Latin America (iPol - LA):
financed by CLARA/REUNA from June 2011 – July 2012

Organisation and Coordination:
Juan Cardelino / Haldo Spontón UdelaR (Uy)

Participation:
UBA (Arg) U-Chile (Ch)

Mission:
Diffusion of iPol philosophy ar

Editorial Board:
JM Morel G Sapiro S Osher B Jähne G Randall ...



IPOL IMAGE PROCESSING ON LINE

Published in Image Processing On Line on YYYY–MM–DD.
ISSN 2105–1232 © YYYY IPOL & the authors CC–BY–NC–SA
This article is available online with supplementary materials,
software, datasets and online demo at
http://www.ipol.im/pub/pre/44/

PREPRINT November 20, 2013

An Implementation of Multiscale Combined Local-Global Optical Flow

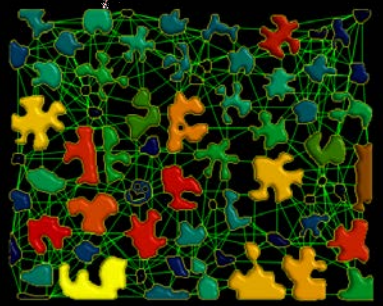
Jorge Jara[1], Mauricio Cerda[2], José Delpiano[3], Steffen Härtel[2]

[1] DCC, SCIAN-Lab, BNI, University of Chile, Chile (jjara@dcc.uchile.cl)
[2] SCIAN-Lab, ICBM, BNI, University of Chile, Chile (mauriciocerda,shartel@med.uchile.cl)
[3] University of the Andes, Chile (jdelpian@uandes.cl)

3rd European Conference on Whole Slide Imaging and Analysis

Partial differential equations

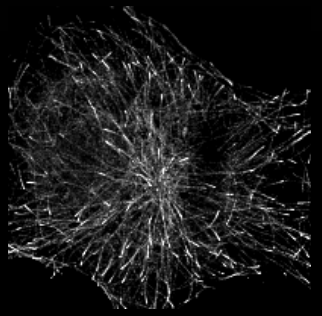
2D / 3D · Morpho-topology
2013 Development
2012 European Biophysics Journal
2011 J Microbiol Methods
2010 J of Struct Biol
2010 Development
2010 Biological research
2010 BBA
...



IPOL

Image Processing On Line

Motion estimation and tracking
2014 Current Molecular Medicine
2013 IPOL
2013 IEEE Transactions on Pattern Analysis ...
2013 Biological Cybernetics
2013 Reproduction, Fertility and Development
2012 Machine Vision and Applications
2012 PLosOne
2011 Revista Médica de Chile
...

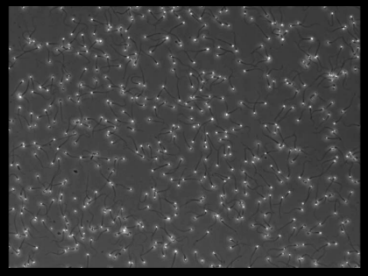


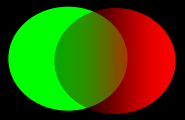
Cross correlation functions

ImageJ
Image Processing and Analysis in Java

Laboratory for SCIAN Scientific Image Analysis

Colocalization
2012 PLosOne
2011 JBC
2011 Arthritis & Rheumatism
2011 Biol Research
2011 Antioxid Redox Signal
2010 Journal of Microscopy
...





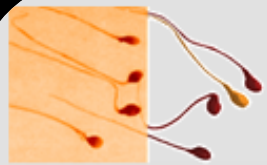
Center for Internet Assisted Sperm Analysis

CEDAI
Centro de Espermiogramas Digitales Asistidos por Internet

CEDAI cuantifies:

i. concentration,
ii. motility,
iii. vitality,
iv. DNA fragmentacion,
v. morphology.

with mathematical algoritms calibrated and standardized by national experts.



Gold Standards, M2M, and Expert Driven Calibrations

20 Muestras

20 Muestras

Manual|Gold Standard Expertos

Digital CED·AI

Digital Supervisado CASA

Luis Sarabia (U-Chile)
Marcia Madariaga (IDIMI)
Adolfo Acosta (Clínica Las Condes)

Espermiogramas Digitales Asistidos por Internet (CEDAI, F-Med, U-Chile)

SCA
INFOBIC
(U-Buenos Aires)

Motilidad (OMS 2010)
Grupos: A Progresivo
B No progresivo
C Inmóvil

Concentración
millones/ml

Celulas redondas
millones/ml

Vitalidad
%

Fragmentación ADN
%

Assisted
is

CED·AI
Centro de Espermiogramas Digitales Asistidos por Internet

Análisis Biomédico a Distancia
CED·AI SpA
CENTRO DE ESPERMIOGRAMAS DIGITALES ASISTIDOS POR INTERNET

Usuario
Password
Acceder

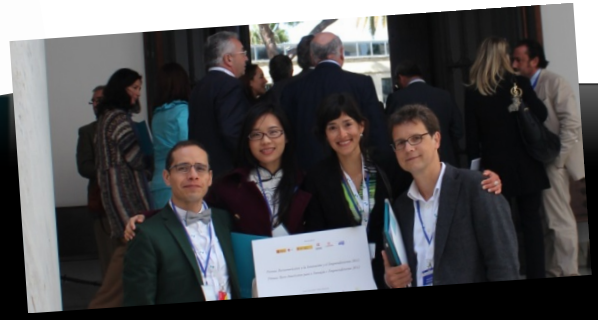
ACERCA | SERVICIOS | EQUIPO | EVENTOS | CONTACTO

Este proyecto permite el acce
tecnología y diagnóstico d
costos operativos, optimizar
respuesta, estandarizando la cal
y finalmente permitiendo selecc
óptima para el tratamiento

CÁDIZ SERÁ EN EL 2012
SEDE DE LA CUMBRE IBEROAMERICANA
DE JEFES DE ESTADO Y DE GOBIERNO

un éxito de todos los gaditanos
Cádiz 2012

Premios Iberoamericanos a la Innovación y el Emprendimiento 2012



Científicos chilenos desarrollan Centro de Espermiogramas Digitales

A través de modernos programas computacionales y desde Internet, se puede medir con mayor precisión la movilidad, concentración y vitalidad de espermatozoides en pacientes que consultan por infertilidad. El proyecto, liderado por el biofísico y académico de la Facultad de Medicina, profesor Steffen Hartel, está siendo testeado en el Instituto de Investigaciones Materno Infantil, Idimi, y en Clínica Las Condes. [Ver más]

Premios Iberoamericanos a la Innovación y el Emprendimiento 2012

La Secretaría General Iberoamericana tiene la satisfacción de anunciar que el Jurado de los Premios Iberoamericanos a la Innovación y el Emprendimiento, en su reunión del día 30 de Julio de 2012... [Ver Mas]

Premio Visión Emprendedora 100K Santander Universidades

La organización del certamen, en cuyo diseño y bases colaboraron distintas casas de estudios superiores, está a cargo de Universia, en su calidad de Red de Universidades Chilenas, con el apoyo... [Ver Mas]

Adjudicación Primer Concurso Programa Valorización de la Investigación en la Universidad

A través de su Programa Fondef, CONICYT adjudicará 54 propuestas seleccionadas del Primer Concurso de Valorización de Investigación en la Universidad, cuyo objetivo es promover la creación... [Ver más]

UNIVERSIDAD DE CHILE | Xperts | SCIAN | Fondef | idimi | UMR

CNN CHILE

Proyecto D11I1096

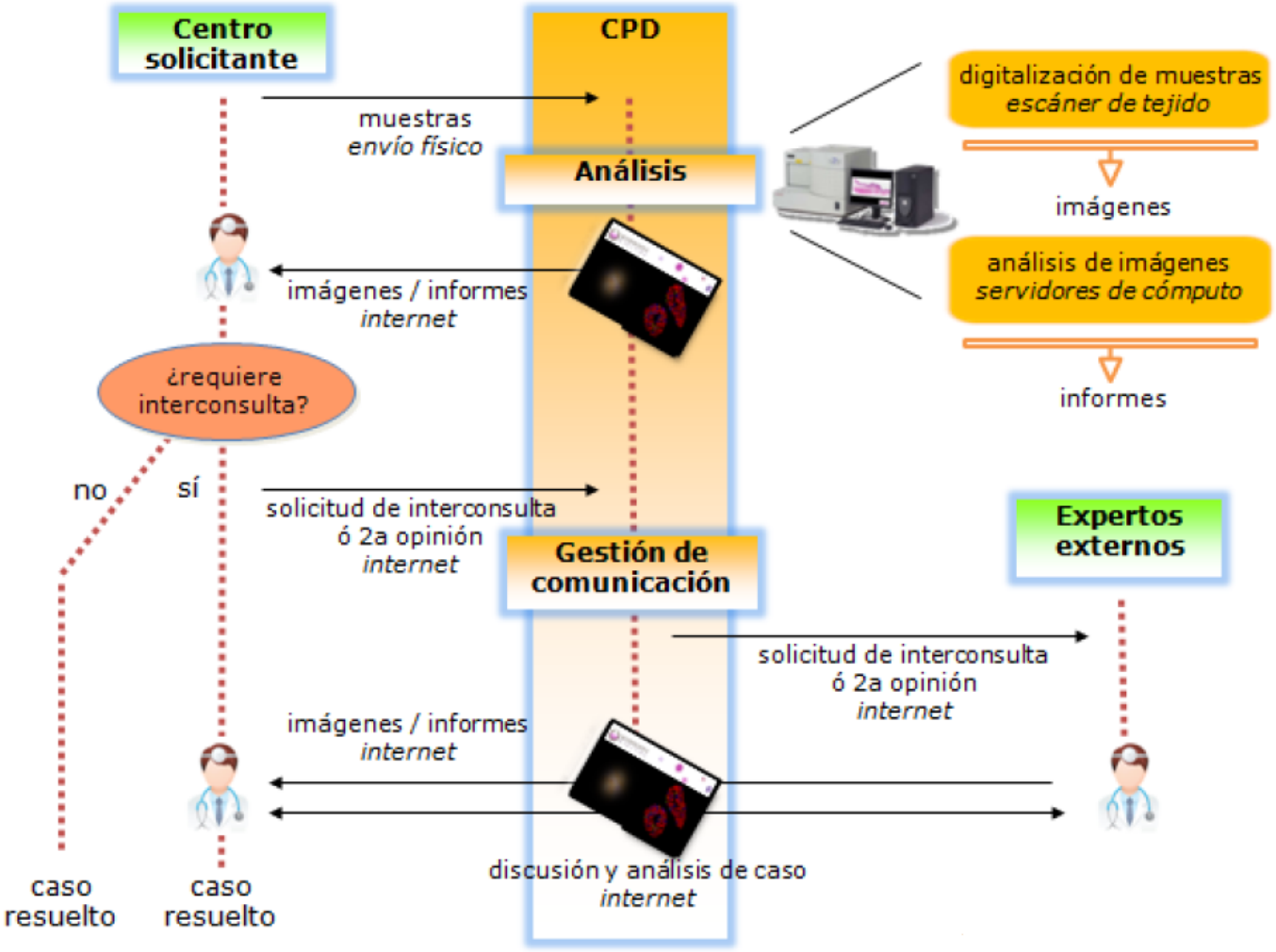
I+D precompetitivo

MICROSCOPIA VIRTUAL

CENTRO DE PATOLOGÍA DIGITAL ASISTIDA POR INTERNET

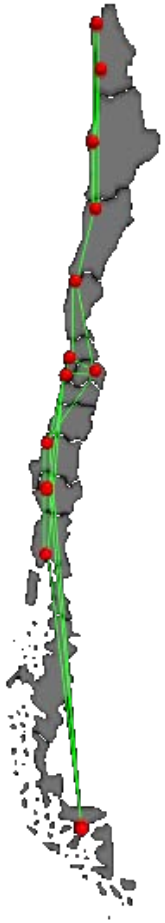
XIX Concurso de Proyectos FONDEF de I+D 2011

CPD
Center of Digital Pathology

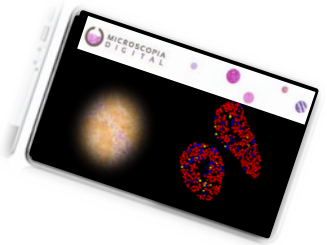


MICROSCOPIA VIRTUAL

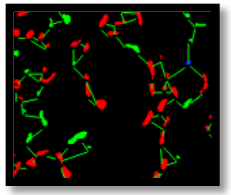
Methodology I&D



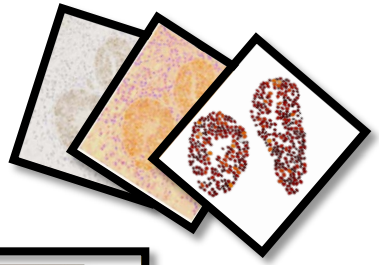
I&D **platform for tele-interconsulting**.
Development of a Software Platform.



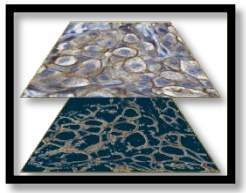
Quantification of lymphosites in focal regions (**oral pathology**).
I&D, clinical validation of image processing algorithms (HE).



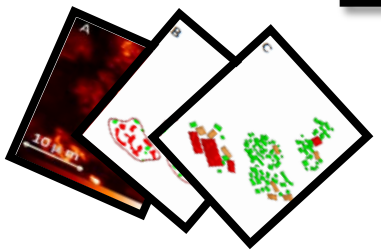
Quantification of estrogen **receptor in human mammalian tissue**.
I&D, clinical validation of image processing algorithms (IHQ).



Quantification of **Cerb2 (IHQ) in human mammalian tissue**.
I&D, clinical validation of image processing algorithms (IHQ).

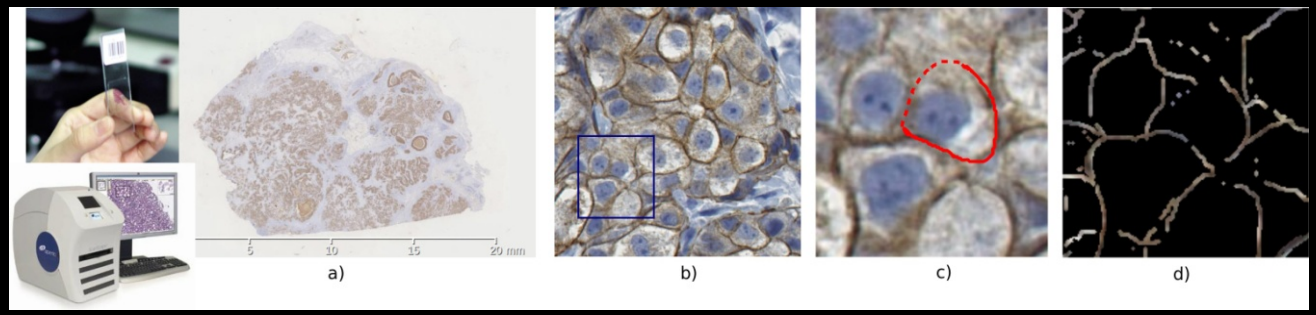


Quantification of **granules in kidney tissue**.
I&D, clinical validation of image processing algorithms (IF).

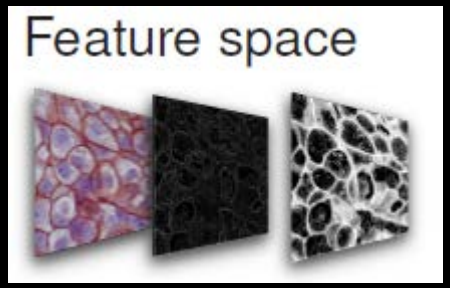


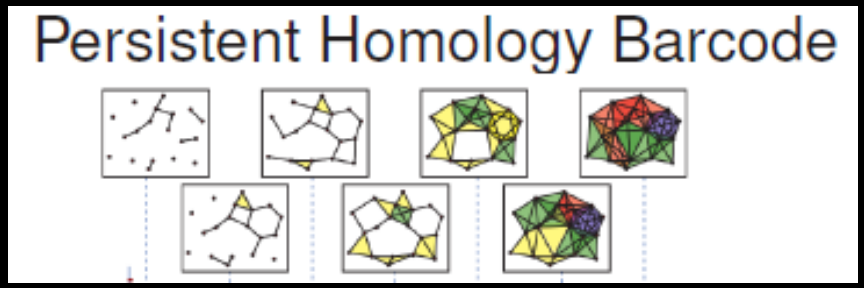
3rd European Conference on Whole Slide Imaging and Analysis

Raquel Pezoa (cand PhD): A segmentation method for images with subjective contours in the field of digital pathology



Poster Rodrigo Rojas (cand PhD): Topological Invariants for Segmentation of Nuclei and Membranes in Breast Cancer Analysis





3rd European Conference on Whole Slide Imaging and Analysis

Poster Dra Eugenia Diaz: Virtual Microscopy for Professional Development and University Education in Chile

Professional Development for High School Teachers

'Nervous Tissue: Interactive Practical Activity'

Summer School for High School Students

‘Basic Tissues of the Organism'

First Year Medical School Students

'Interactive Histology'

Kothari S, et al. J Am Med Inform Assoc 2013;20:1099–1108

Review

Table 3 Summary of key methods in each component of a WSI-based clinical decision support system

Section	Subsection	Key methods
Quality control	Image artifacts	Tissue folds,[13–15] blurred regions,[16] and chromatic aberration[17]
	Batch effects	Color normalization,[18–20] batch-invariant color space,[21–23] and scale normalization[24]
Image description	Pixel-level features	Color,[38] gray-level intensity profiles,[30] Haralick features,[23 30 35 36] wavelet and multiwavelet submatrices,[30 36 37] Gabor filter responses,[23 30 36] and Fractals[30 36]
	Object-level features	Shape[47 48] and graph-based topology[52–56]
	Semantic-level features	Bag-of-features[60] and spatial hidden Markov model[61]
Prediction modeling	ROI selection and tile-based WSI representation	ROI selection: supervised[13 63–65] and unsupervised[66 67]; tile combination: feature[49] and prediction[22]; multiscale analysis[22 23 67 70]
	Informative feature selection and reduction	Feature selection: filter,[30 51 53 57] sequential search (wrapper),[22 36 91] and random forest (embedded)[65]; Feature reduction: PCA,[32 39 91] graph embedding,[54] ISOMAP,[80] and MDS[92]
	Classification	Multiple classifiers,[22 29 36 39 80] boosting,[23 80 93] ensemble methods,[22] and active learning[3 94–96]
Visualization and exploratory analysis	Unsupervised clustering and high-dimensional feature patterns	Hierarchal clustering,[49 68 72–74] Self-organizing maps,[75 76] k-means,[58 79 80] and expectation maximization[22]
	Virtual microscope and spatial patterns	Image compression,[83 84] Google map interface,[82 85 86] highlight ROI,[56 64 65 67 70 87] annotation,[61 62] and spatial variation of features[13 71]

MDS, ; PCA, ; ROI, region of interest; WSI, whole-slide image.

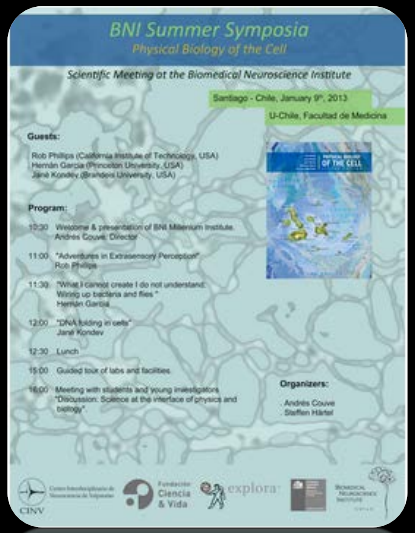
- Human and Data Network ? Ok !
- Instrument ? Ok !
- Which software … standards/quality?
  Black box ←→ development ?
- What convinces the pathologist
  and the developer ?
- How to integrate into the workflows ?

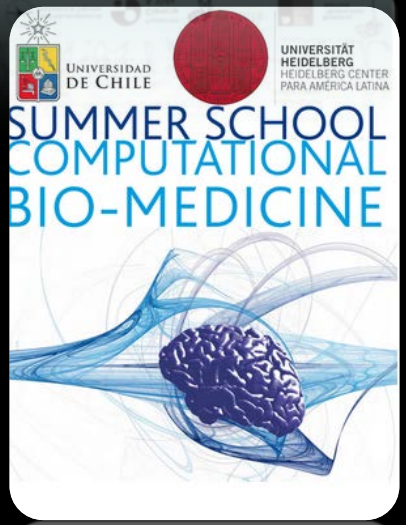
Laboratory for SCIAN Scientific Image Analysis

2013 ← Symposium & Curses → 2014

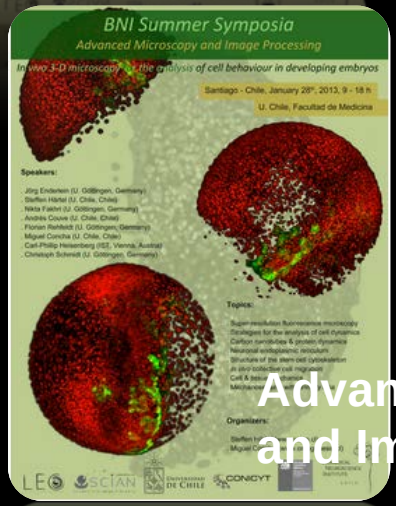
BIOMEDICAL NEUROSCIENCE INSTITUTE

Physical Biology of the Cell





Optics, Forces & Development



SYMPOSIUM cellmorphodynamics.cl

QuanTissue:

Advanced Microscopy and Image Processing

Computational Bio-Medicine

3rd European Conference on Whole Slide Imaging and Analysis

Thank you very much

Muchas Gracias

Vielen Dank

どうもありがとうございました