

# Helminth Genomics:

a team journey on worms and cancer from  
fundamentals towards applications

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Cholangiocarcinoma Research Institute  
Khon Kaen University Phenome Centre





# Brief CV

## Education

- 2012-2017 PhD in Biological Science at Sanger Institute, University of Cambridge, UK
- 2015 Biology of Parasitism Summer School, Marine Biological Laboratory, Woods Holes, Massachusetts, USA
- 2009-2012 BSc (Hons) Zoology, School of Biological Sciences, University of Bristol, UK

## Life in academia @ KKU (Khon Kaen University, Thailand)

- 2017-2020 Department of Biochemistry, Faculty of Medicine
- 2020-2023 Department of Biology, Faculty of Science
- 2023-now Department of Systems Biosciences and Computational Medicine, Faculty of Medicine



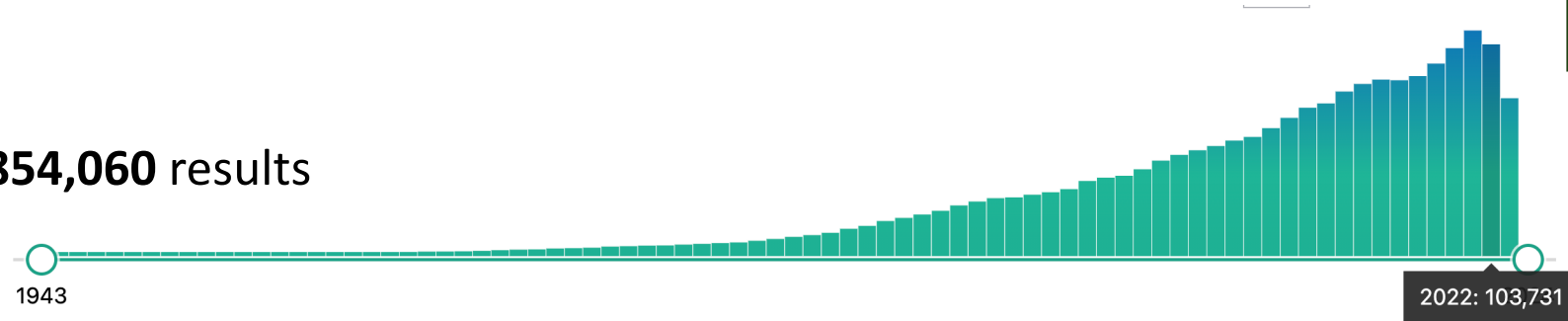
# Outline

- Building a career in helminth genomics in Thailand
- Local problems, global collaboration
- Capacity-building, bioinformatics training, formal education
- Challenges and future prospective



# of publications  
in 2022

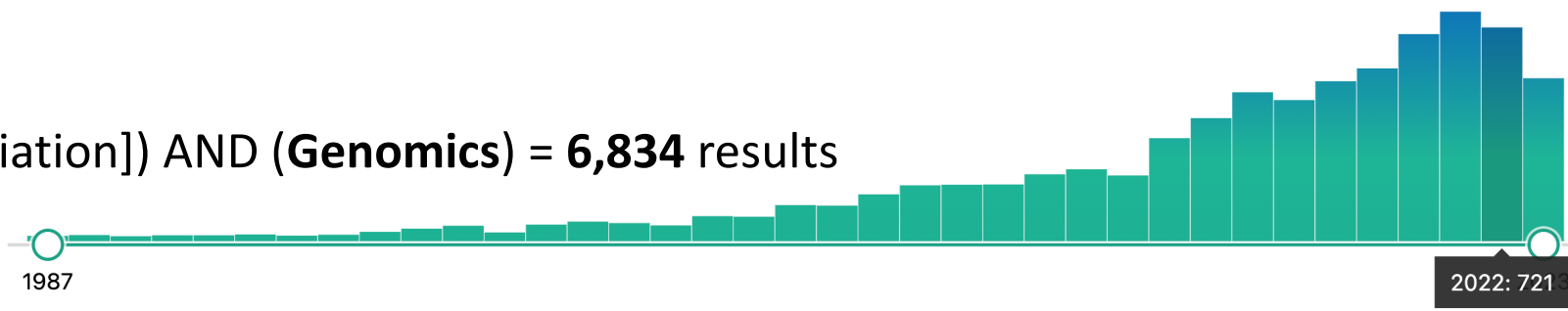
Genomics = 1,854,060 results



All

103,731

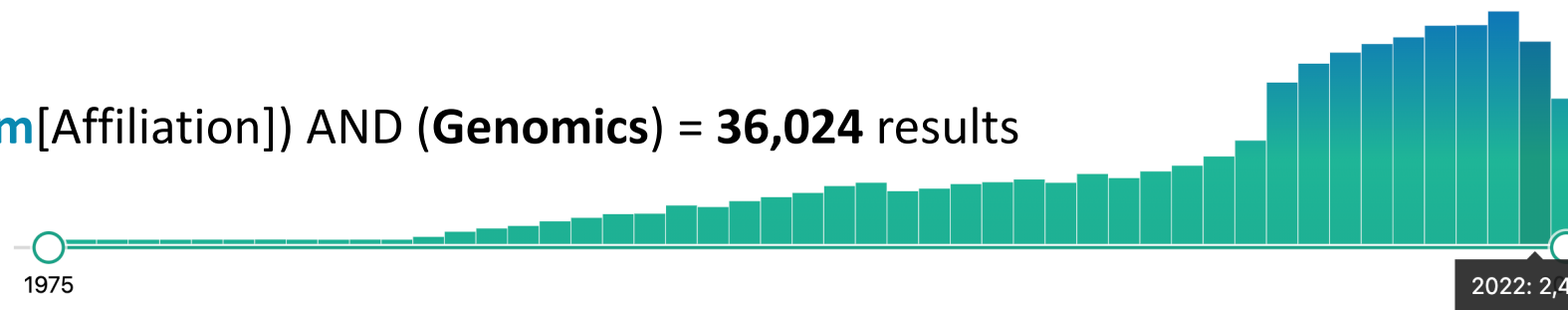
(Thailand[Affiliation]) AND (Genomics) = 6,834 results



Thailand

721

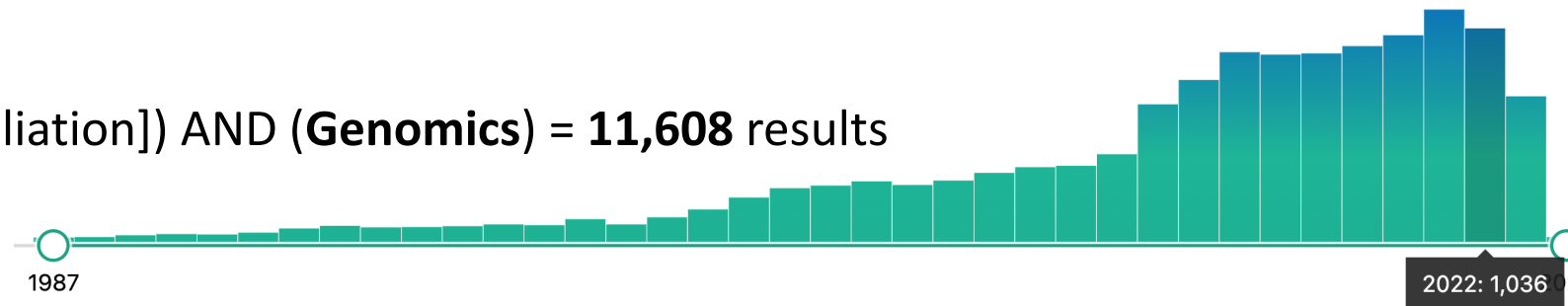
(United Kingdom[Affiliation]) AND (Genomics) = 36,024 results



UK

2,467

(Singapore[Affiliation]) AND (Genomics) = 11,608 results



Singapore

1,036





# A career in helminth genomics in Thailand

## Starting off

Now a lecturer = many new responsibilities

No lab space for molecular work

No graduate students

Exploring research questions

## Building collaboration

Asking for what needed

# A career in helminth genomics in Thailand

Starting off	Moving on
Now a lecturer = many new responsibilities	Getting starting grant – bioinformatic-focused
No lab space for molecular work	Shared lab space / help train grad students
No graduate students	All sequencing materials need to be shipped out for sequencing elsewhere
Exploring research questions	
Building collaboration	Reconstruct work management system
Asking for what needed	Keep calm

# A career in helminth genomics in Thailand

Starting off	Moving on	~ 4 years in
Now a lecturer = many new responsibilities	Getting starting grant – bioinformatic-focused	Writing, writing, writing
No lab space for molecular work	Shared lab space / help train grad students	Formally supervise grad students
No graduate students	All sequencing materials need to be shipped out for sequencing elsewhere	Part of a research team/institute
Exploring research questions		2 NGS projects on Ov liver fluke
Building collaboration	Reconstruct work management system	Shifting mindset from <i>do it all myself</i> to <i>supervising and mentoring</i>
Asking for what needed	Keep calm	

# A career in helminth genomics in Thailand

Starting off	Moving on	~ 4 years in	Now
<p>Now a lecturer = many new responsibilities</p> <p>No lab space for molecular work</p> <p>No graduate students</p> <p>Exploring research questions</p>	<p>Getting starting grant – bioinformatic-focused</p> <p>Shared lab space / help train grad students</p> <p>All sequencing materials need to be shipped out for sequencing elsewhere</p>	<p>Writing, writing, writing</p> <p>Formally supervise grad students</p> <p>Part of a research team/institute</p> <p>2 NGS projects on Ov liver fluke</p>	<p>Catching up</p> <p>Local sequencing capacity! (Illumina and Nanopore) = making lab space for genomics</p> <p>Computing infrastructure</p> <p>More sequencing projects</p>
<p>Building collaboration</p> <p>Asking for what needed</p>	<p>Reconstruct work management system</p> <p>Keep calm</p>	<p>Shifting mindset from <i>do it all myself</i> to <i>supervising and mentoring</i></p>	<p>Growing a team</p> <p>Survive the tenure track</p>



# Liver fluke (*Opisthorchis viverrini*)

A public health problem in Southeast Asia (amongst many other pathogen!)

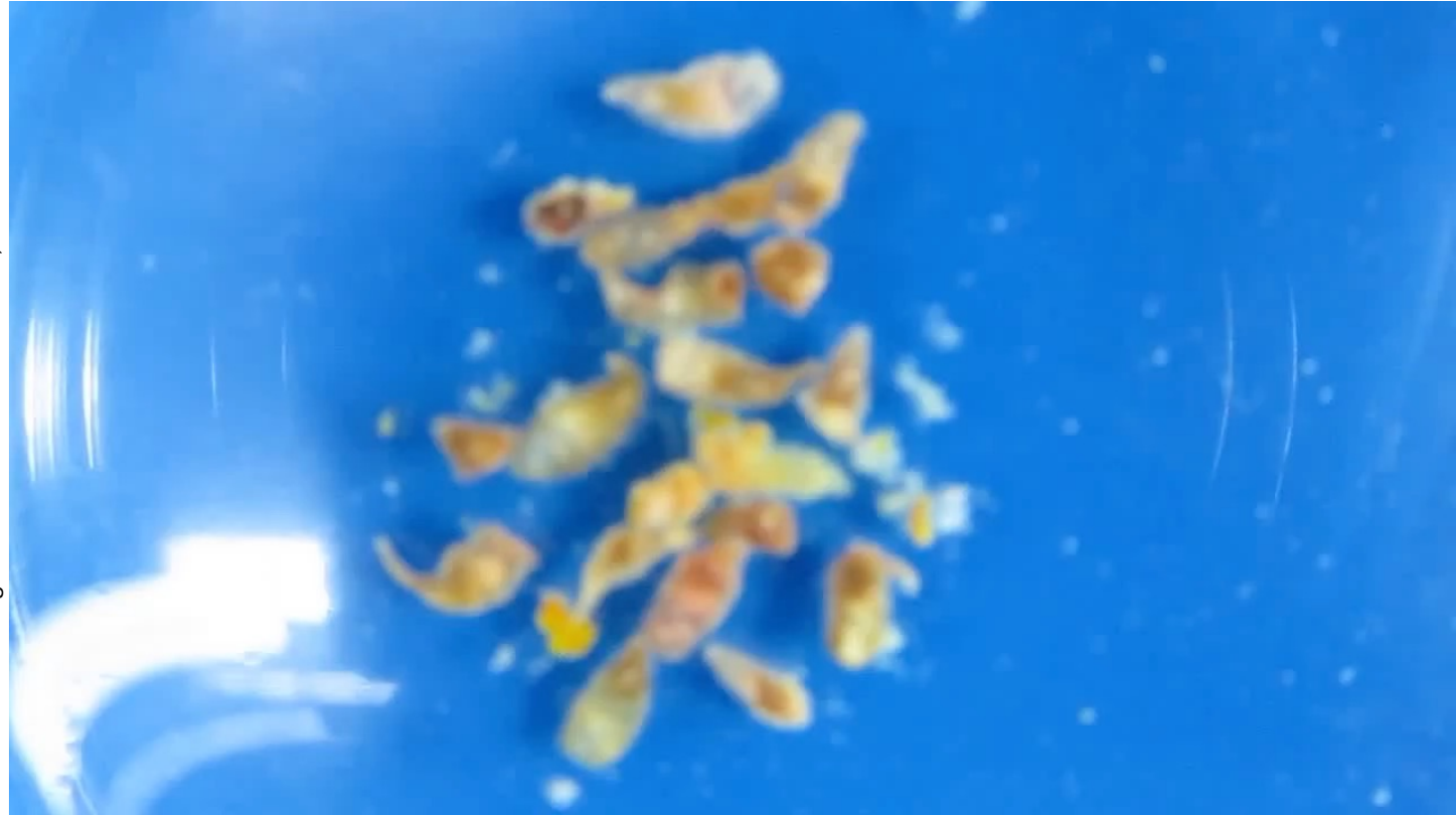
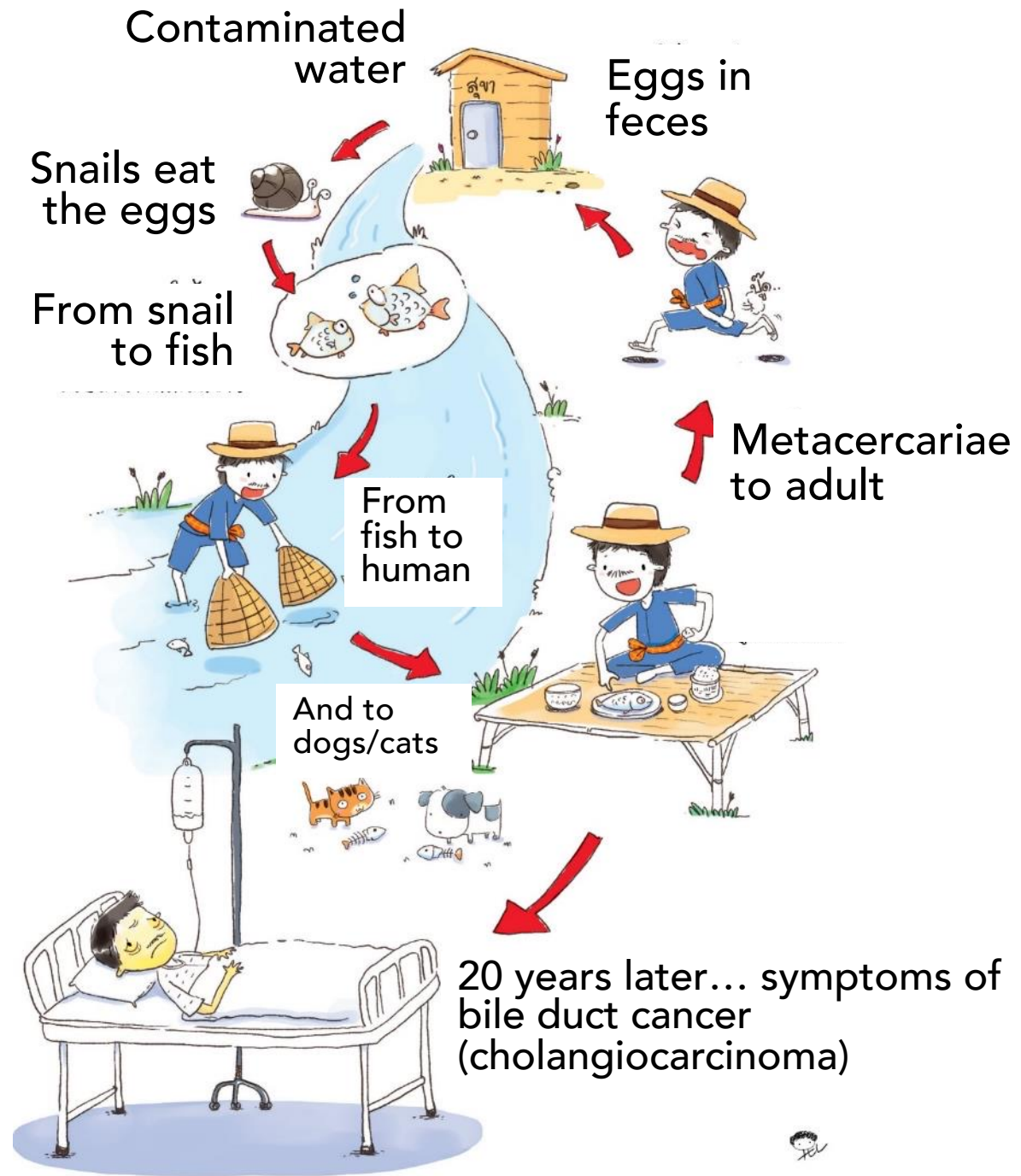


Image credits: International Herald Tribune

VDO credit: Cholangiocarcinoma Research Institute, KKU

Slide credit: adapted from Thomas Crellen

# Life-cycle of *O. viverrini* liver fluke

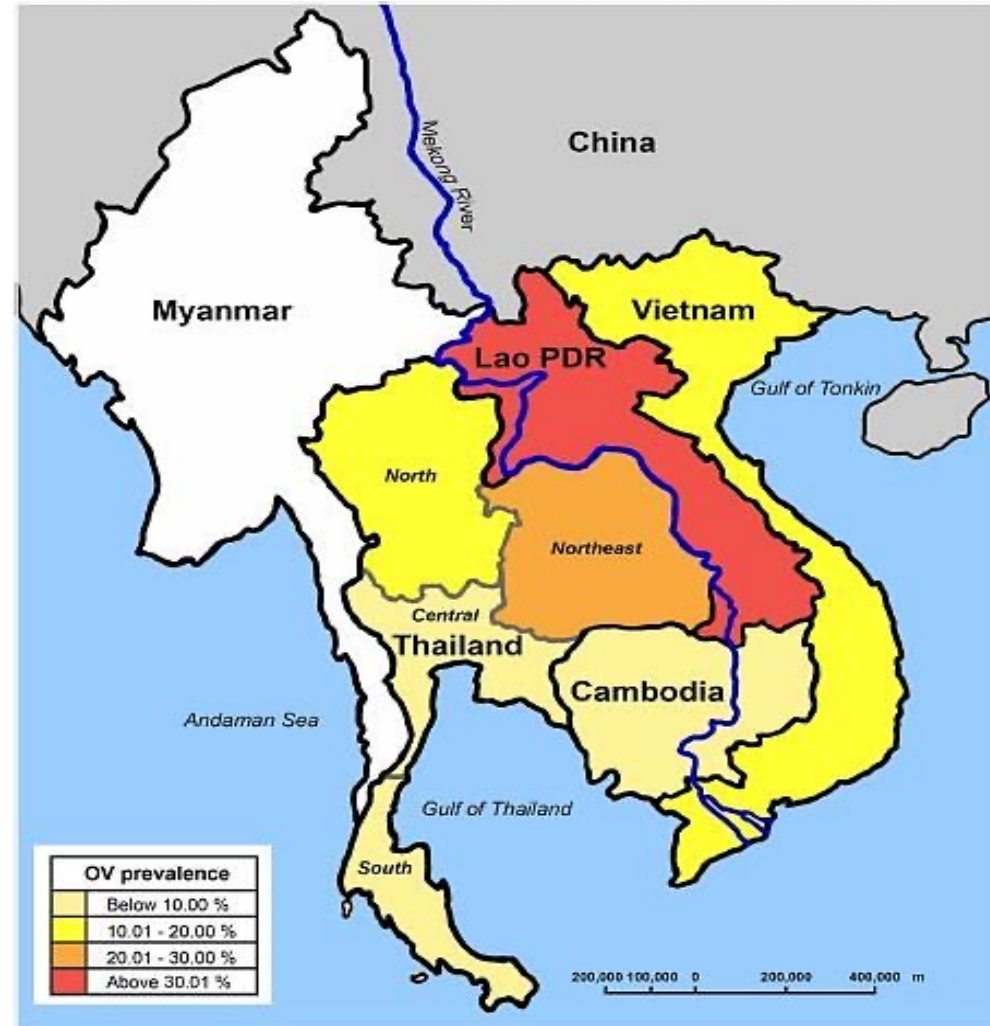




# Liver fluke in Southeast Asia

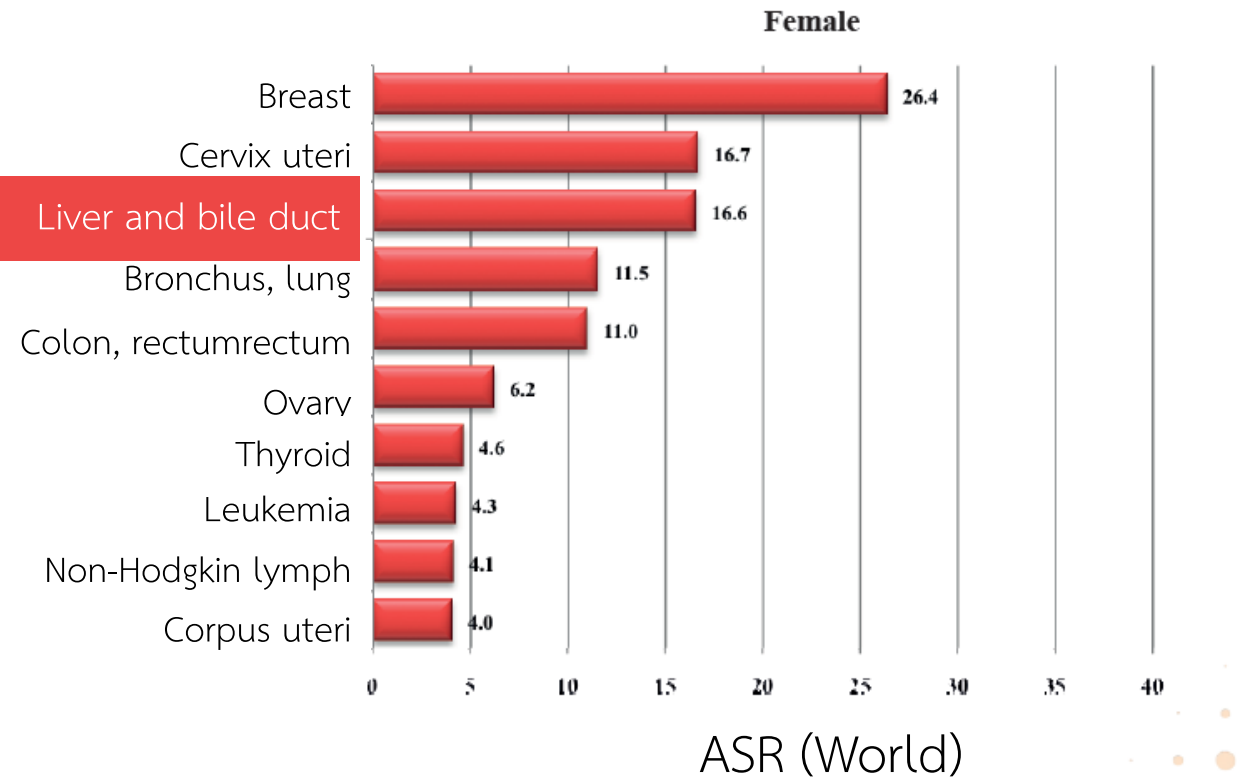
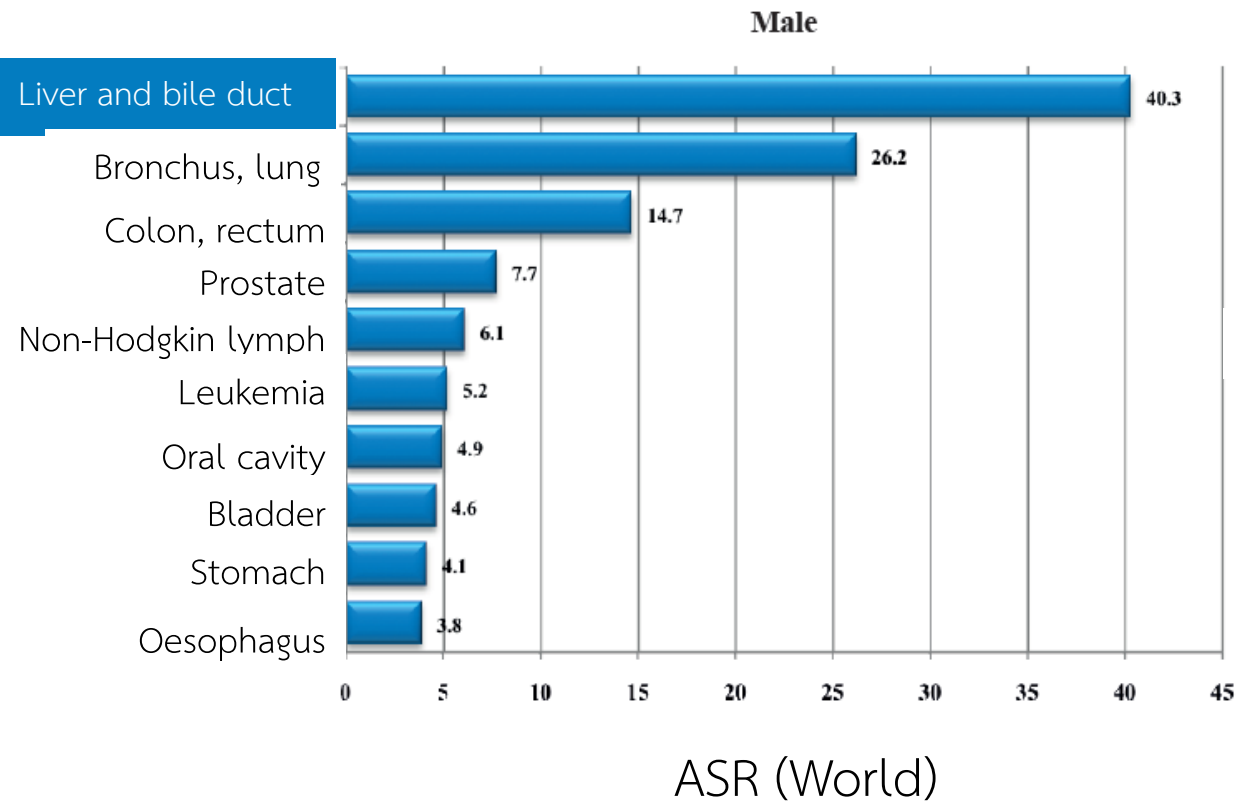


- A.) *O. felineus*
- B.) *O. viverrini* (Ov)
- C.) *C. sinensis*



Prevalence of Ov in Southeast Asia (Khuntikeo et al., 2018)

# Cancer in Thailand (as of 2013)



Source: National Cancer Institute, 2013



เดินหน้าลุยต่อเนื่อง  
ภารกิจพิชิต  
มะเร็งท่อน้ำดี

CAR 

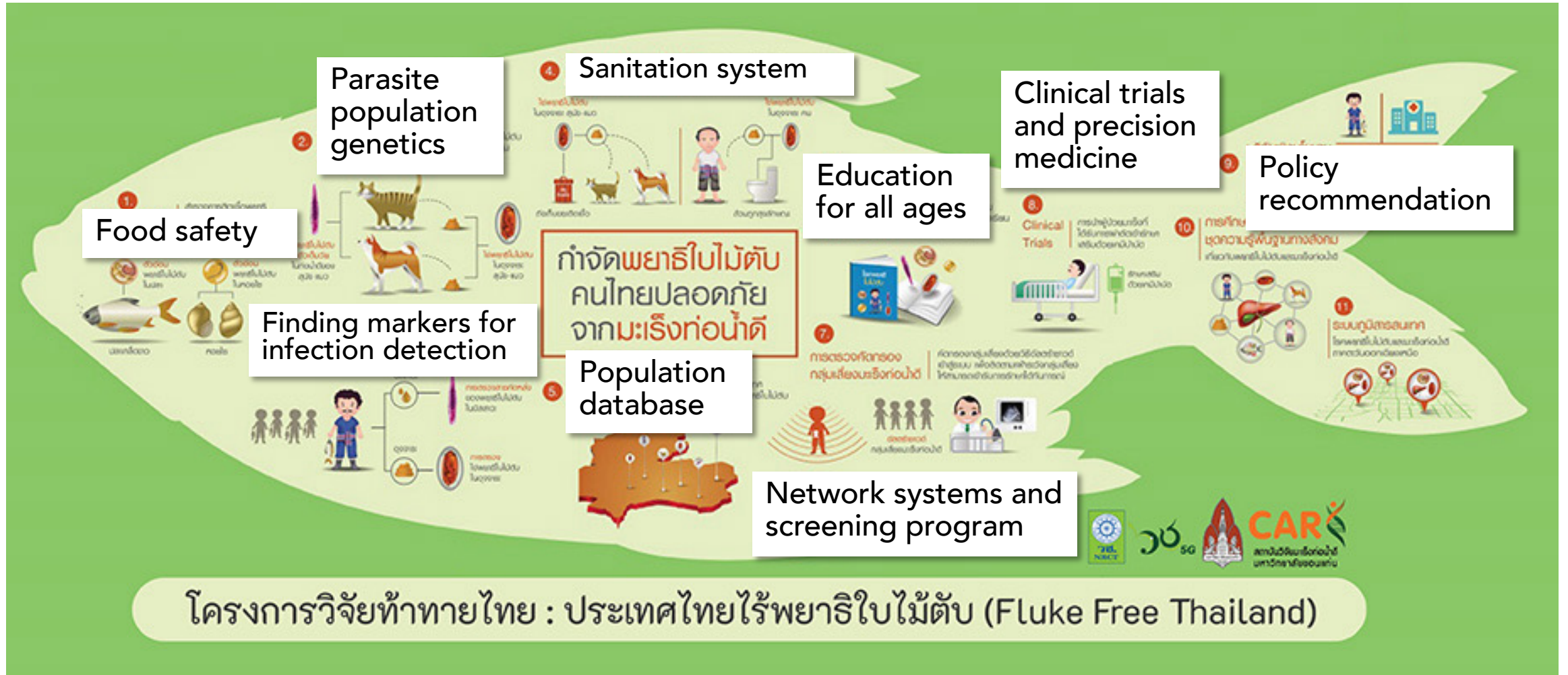
สถาบันวิจัยมะเร็งท่อน้ำดี มหาวิทยาลัยขอนแก่น  
CHOLANGIOCARCINOMA RESEARCH INSTITUTE

Keep Moving  
Forward  
to combat  
Cholangiocarcinoma

**Mission:** To enhance national and international collaboration for research, knowledge building, and technology transfer for prevention, diagnostic, and treatment of Ov-CCA in community



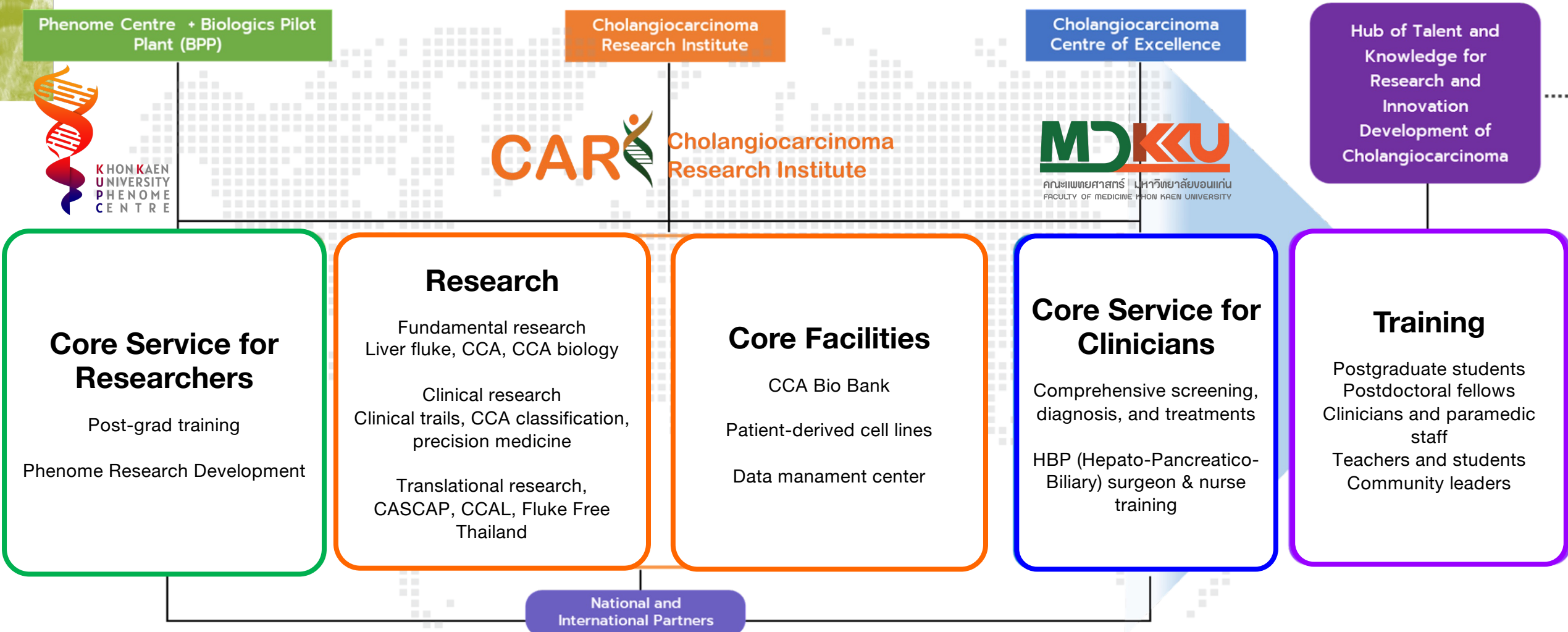
# One problem, many solutions





# Operating structure of CARI : Collaborative forces

Research, Facilities, Clinical and public health service, Frontier research service, Training and technology transfer



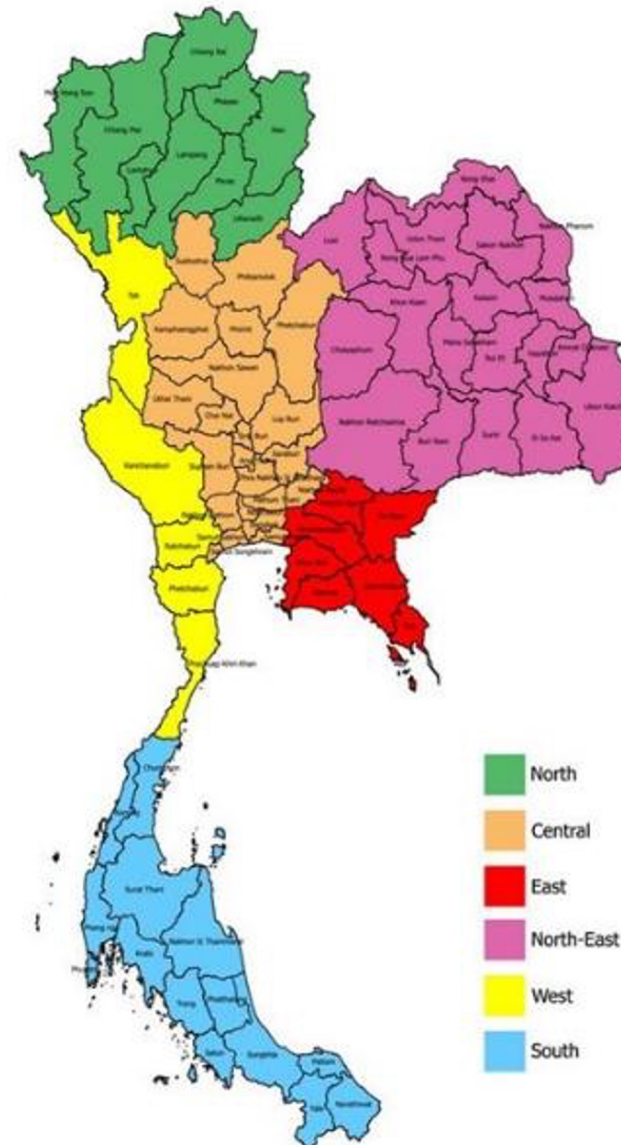
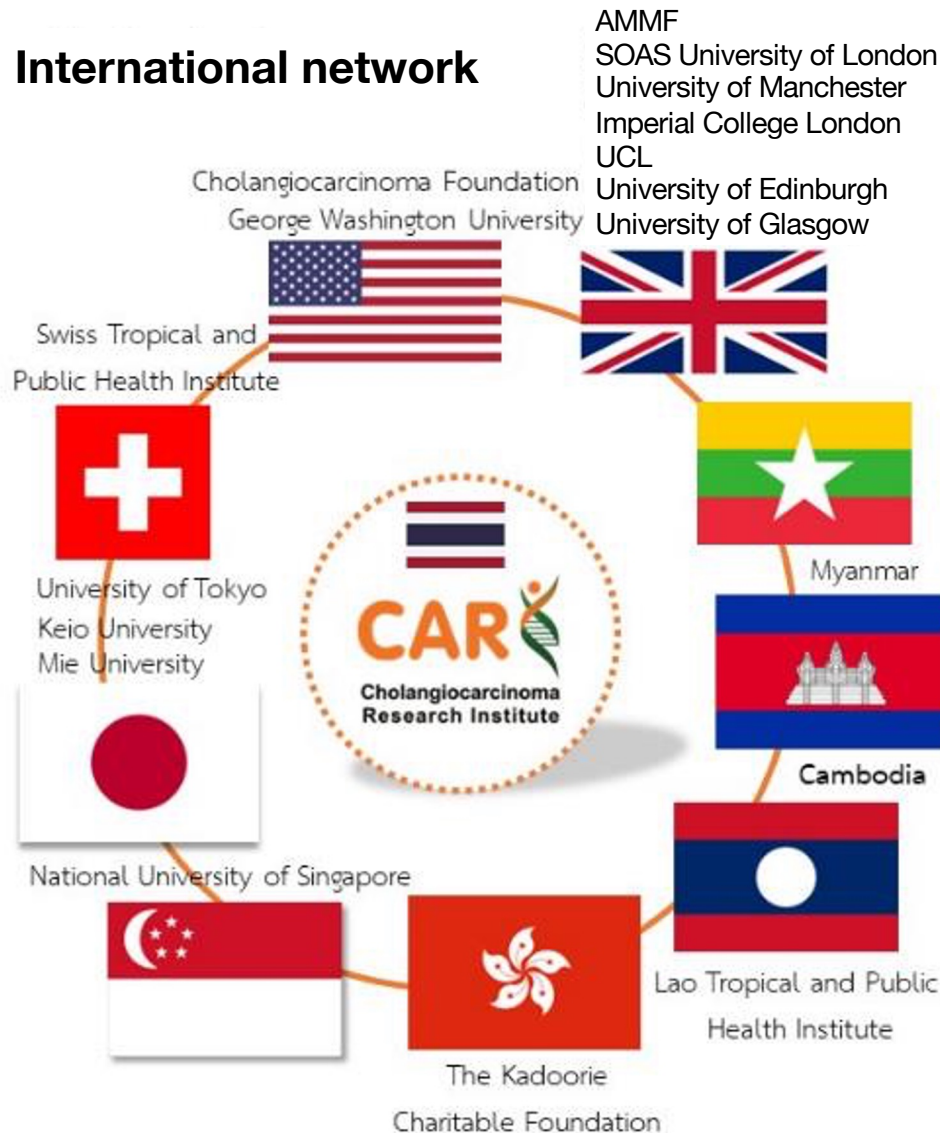
With main sponsorship from: Ministry of Higher Education, Science, Research and Innovation (Thailand), National Research Council of Thailand, Office of Thailand Science Research and Innovation

# CARI Network

and expanding – for pathogen genomics too



## International network



## Domestic network

- Ministry of Health
- Ministry of Agriculture
- Ministry of Education
- Local sectors - over 3800 hospitals and 260 health offices)
- Various universities and Faculties (from health science to social science, education to engineer)
- Private sectors (e.g. banks, construction companies)
- Professional communities (surgeon, nurses)
- CCA Foundation of Thailand

“Everyone can have something to contribute”







**Research & Innovation Development**

Integrative and interdisciplinary  
Training Hub  
Monitoring and Evaluation



**Routine applications**

Problem Solving  
Expansion

# Results since the program started (data as of 2021)

Declining incidents and improved patients' life



Ov infection rate

42% > 13.4% > 7.7% > 1%



Early CCA detection

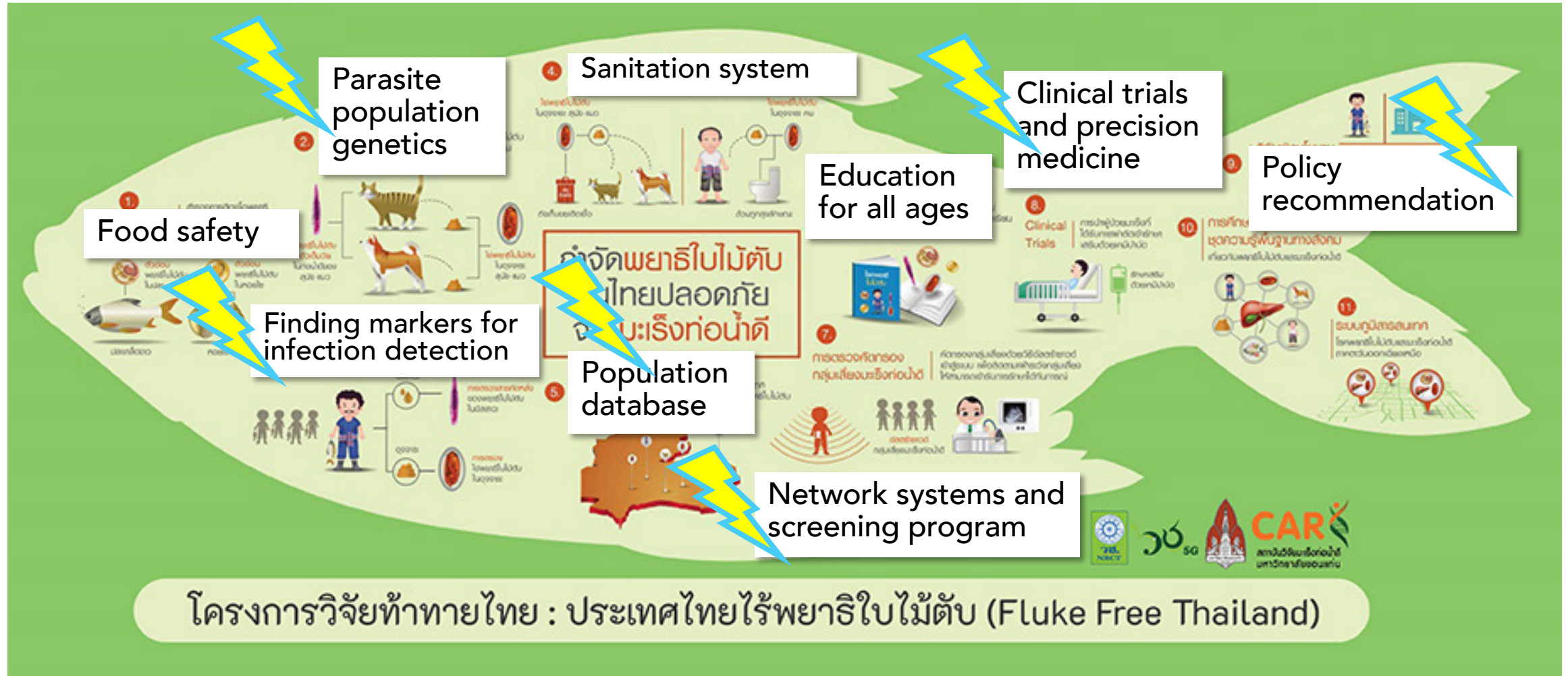
21.8% > 84.5%



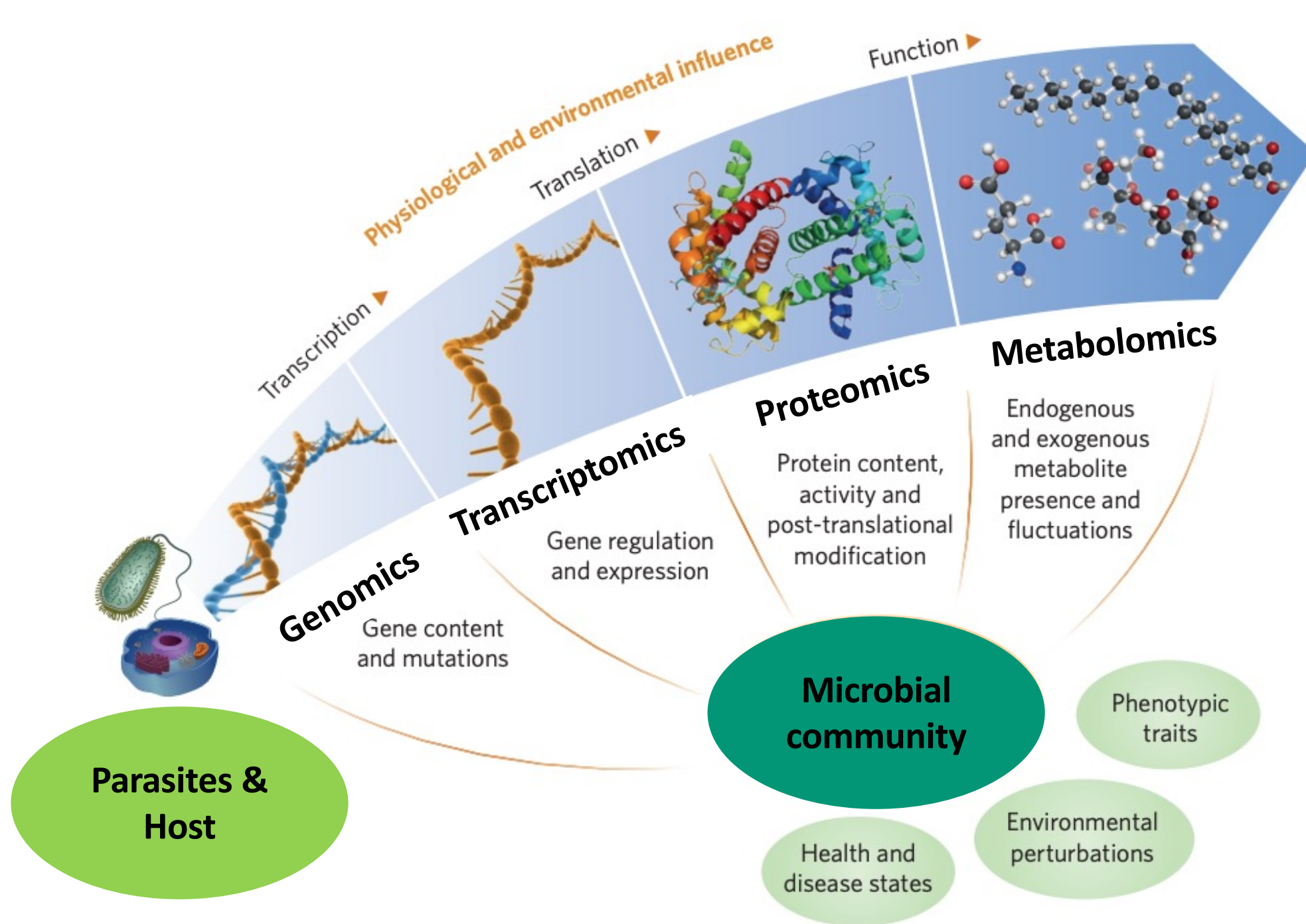
Patients 5 years survival

17.3% > 48.3%

# Integrating multi-omics in healthcare and intervention



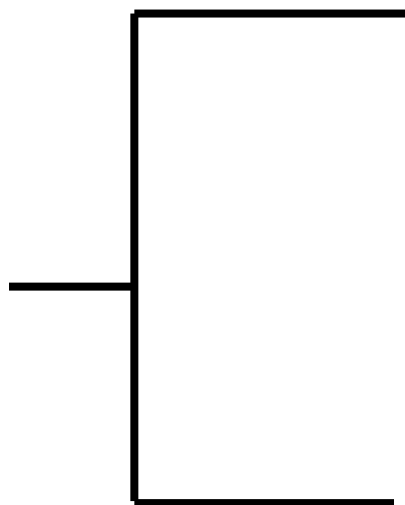






- ✓ Service
- ✓ Training
- ✓ R&D

## Phenome Education and Capacity-building Unit (PECU)

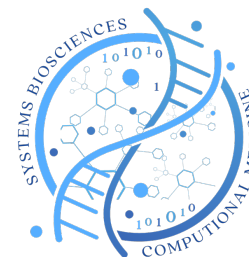


### Non-degree Programs

- CliNaP-M (Metabolomics short course)
- SARS-CoV-2 Bioinformatics
- Helminth Bioinformatics x 2
- High-throughput Technology and Data Safety (Hi-Tech-DS)

### Degree Programs

- MSc and PhD in Health and Medical Sciences (Systems Biosciences)





# Local impact, international collaborations

## Training portfolio

5 in-house metabolomics short courses

3 joint bioinformatic short courses with Wellcome Connecting Science

Both focused on postgraduate students, early career researchers



CliNaP-M: Clinical and Natural Product Metabolomics



# Metabolomics short courses



Short Course in Advanced  
**CLiNaP-M**  
 CLINICAL AND NATURAL PRODUCT METABOLOMICS  
**FOODOMICS**  
 Hybrid learning

**ONLINE COURSE**  
 INTRODUCTION TO METABOLOMICS  
 EXPERIMENT DESIGN,  
 PRINCIPLES OF LC-MS AND NMR  
 DATA PROCESSING AND ANALYSIS

**ONSITE COURSE**  
 HANDS-ON SAMPLE PREPARATION AND  
 DATA ANALYSIS WITH HELP FROM  
 EXPERIENCED INSTRUCTORS

**ONLINE COURSE OPEN FOR REGISTRATION - EARLY 2022**

**ONSITE COURSE 3-5 APRIL 2022  
 @KKU SCIENCE PARK**

**SAVE THE DATE**

FOLLOW KKUIPL AND CLINAP PAGE FOR UPDATES  
 ON REGISTRATION OPENING AND OTHER DETAILS

 SCAN ME

 CLINAP SHORT COURSE SERIES  
 KHON KAEN UNIVERSITY INTERNATIONAL PHENOME LABORATORY  
 CLINAPSHORTCOURSESERIES@GMAIL.COM

bit.ly/CLINAP2022



**CLiNaP-M**  
 CLINICAL AND NATURAL PRODUCT METABOLOMICS  
**"Phenomics for Precision Medicine"**

**This short course will cover:**

- Study design and sample preparation considerations ✓
- Understanding the NMR pulse sequence ✓
- Understanding NMR data acquisition ✓
- Managing NMR data handling and preprocessing ✓
- A crash course in coding ✓
- Working on omics data analysis ✓
- Working on NMR metabolite identification ✓
- LC-MS validation of metabolite assignment ✓
- Understanding gut microbiota profiling ✓
- Understanding gut microbial profile analysis ✓

**February 7-10, 2023**  
 Northeastern Science Park,  
 Khon Kaen University,  
 Khon Kaen, Thailand

**Registration fee**  
 Students/Postgraduate students\*  
**6,500฿**  
\*This rate is available for the first 10 seats.

**Standard Registration**  
**8,500฿**

**REGISTER NOW**  
 Before January 30, 2023



<https://forms.gle/e4xuEb6U7oE6hXEX6>

 shorturl.at/abgX9  063-238-9297  
 @kkuipl  @clinapshortcourseseries  
 clinapshortcourseseries@gmail.com





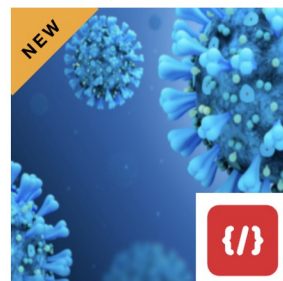
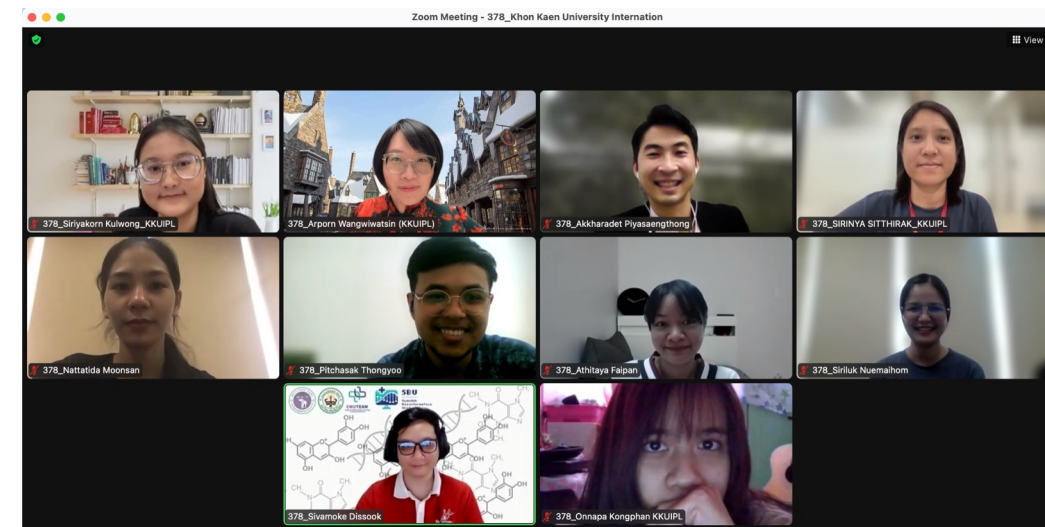
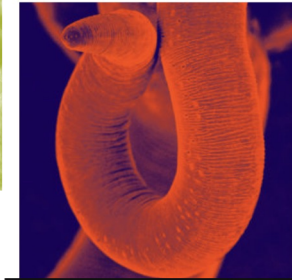


# Pathogen genomics courses

## Helminth Bioinformatics (Asia) (Virtual)

28 June–2 July 2021

Virtual Course



## SARS-CoV-2 Bioinformatics for Beginners

31 October–2 December 2022

Distributed Classrooms across Asia, Latin America, and Africa





# Bioinformatics AND engagement training



Helminth Bioinformatics - Asia

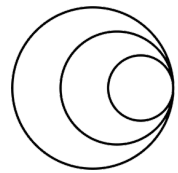
21-27 May 2023

Khon Kaen University, Thailand





# WCS HELMINTH BIOINFORMATICS AND PUBLIC ENGAGEMENT – ASIA 2023 @ KHON KAEN UNIVERSITY



**wellcome  
connecting  
science**



**KKU**  
KHON KAEN UNIVERSITY



คณะแพทยศาสตร์ มหาวิทยาลัยขอนแก่น  
FACULTY OF MEDICINE KHON KAEN UNIVERSITY



KHON KAEN  
UNIVERSITY  
PHENOME  
CENTRE

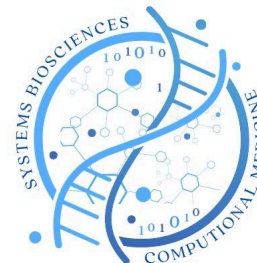


CCA FOUNDATION

**Office of Digital Technology**  
University Digital Infrastructure

**MUSEUM  
& LIFELONG  
LEARNING CENTER**

Khon Kaen University  
ศูนย์พิพิธภัณฑ์และแหล่งเรียนรู้ตลอดชีวิต  
มหาวิทยาลัยขอนแก่น



**Parasitology**  
Faculty of Medicine, Khon Kaen University



COMPUTATIONAL AND PRECISION MEDICINE  
RESEARCH GROUP



BAYASITA @KKU



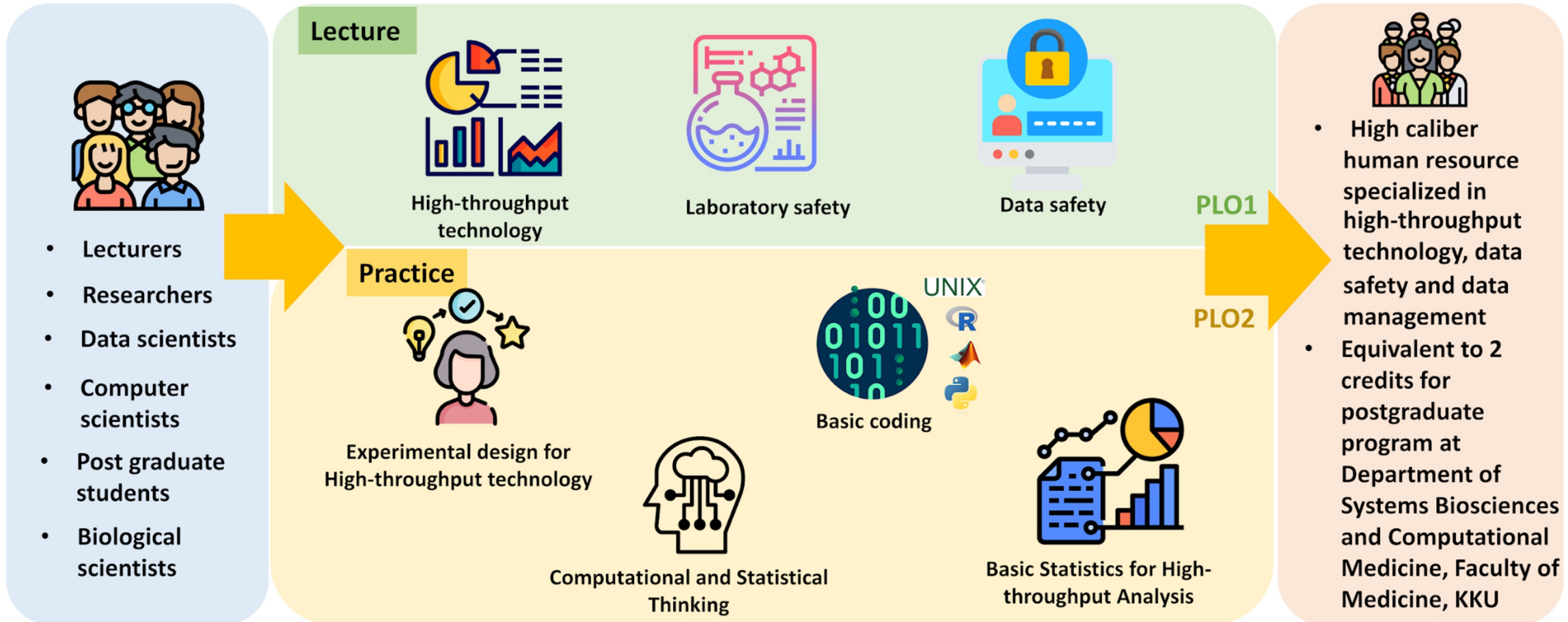
# High-Throughput Technology and Data Safety short Course

## Hi-Tech-DS

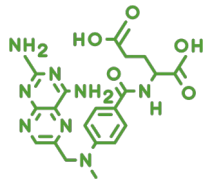


### Hi-Tech-DS short course

Target learner ————— Non-degree lifelong education program ————— High caliber human resource



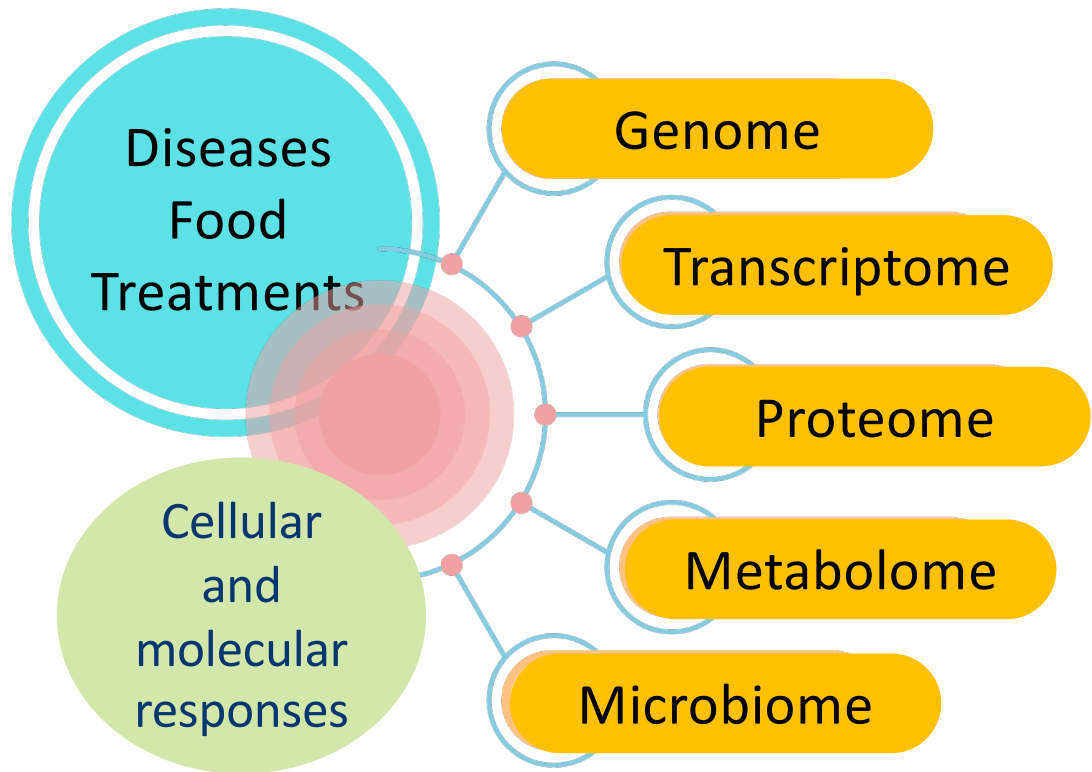
PLO = Program Learning Outcome



fx



Medical Biochemistry	Molecular Biology	Data Science	Mathematics	Statistics
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HIGH-THROUGHPUT TECH

- Precision and personalised medicine
- Precision nutrition
- Bio-economy enhancement

# MSc & PhD SYSTEMS BIOSCIENCES PROGRAMS

(Part of Health & Medical Sciences Graduate Program)

- Cells and Molecular Biology
- Biological Chemistry
- **Laboratory Skills** in Molecular Biosciences
- **Researcher Skill** Development
- **Coding** for Systems Bioscientists
- Molecular Biosciences
- Foodomics
- **Computational Analysis** of Biological Data
- Teaching Skills in Systems Biosciences
- Technology Creativity and Innovation for Systems Bioscientists



# Something to look forward to

**THAILAND BIOINFORMATICS RESEARCH NETWORK (#TBRN23): TALENT POOL AND STAKEHOLDER ENGAGEMENT**

11-12 Oct 2023, 1st Fl, Srisavarindira Bldg. Siriraj Hospital

PMU-B สกสว

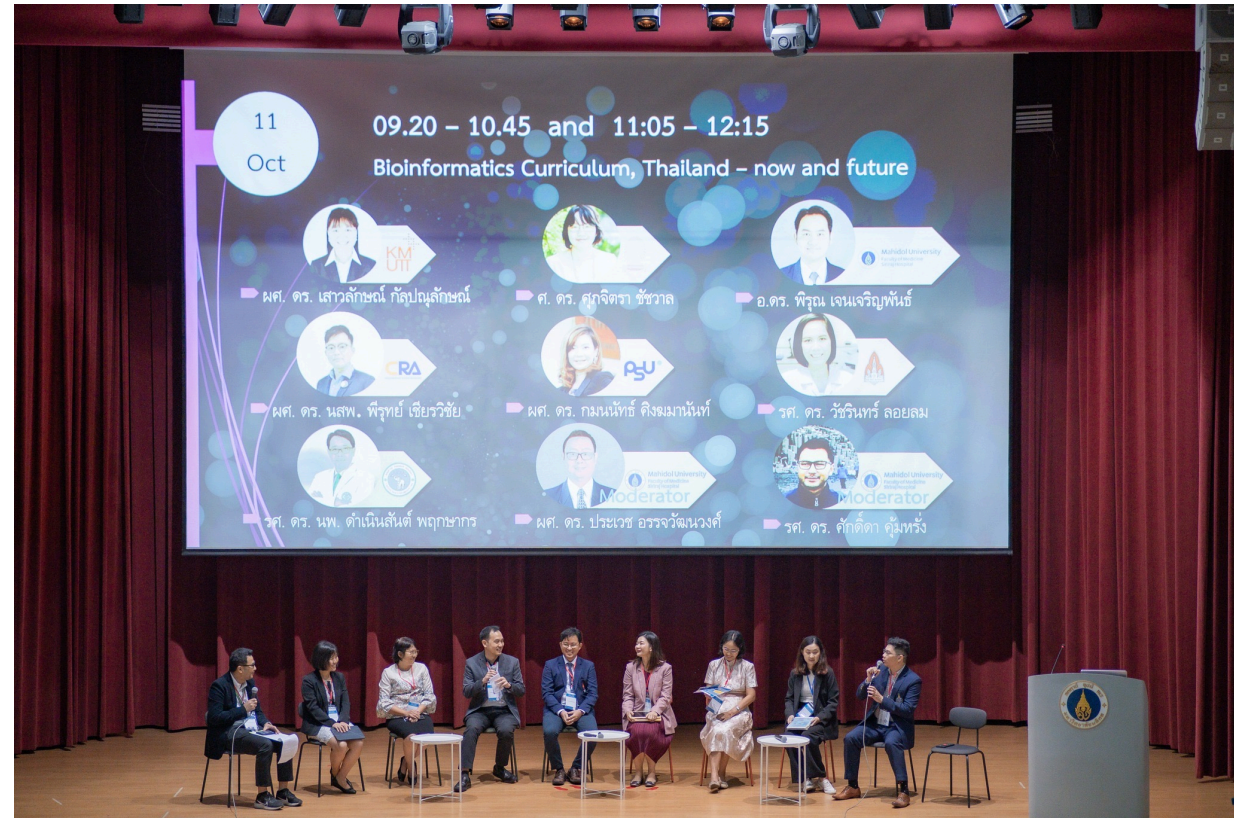
**SAVE THE DATE Multi-Omics Short Course** 18-2 Jan Feb 2024

**Dates and Venues**

**18 - 19 Jan 2024**  
1st Floor SIMR Building  
Si-LoL, Faculty of Medicine Siriraj Hospital, Mahidol University  
Topic 6

**22 Jan - 2 Feb 2024**  
KKU Science Park  
KKU Phenome Centre, Faculty of Medicine, Khon Kaen University  
Topics 1-5

**Full Scholarships**  
Supported by PMU-B





# Lessons Learned and Future Directions

- Interdisciplinary
  - Collaboration, partnership, mutual/fair benefit
  - Preference of application-focused research
  - Online learning as supplement, not substitute, to face-to-face
  - Professional skills development, value addition
  - May need to train multiple times / in multiple modes
  - You are never too young to mentor and train others
  - Content needs are evolving – keep getting feedbacks
- 
- What are everyone doing / wanting to do?
  - When to work with existing network or to establish your own track?
  - What more can be done of to strengthen capacity building initiatives?
  - How to make the effort sustainable?
  - How to organise the resources?
  - Who should be involved? Who should be driving the initiative?







# Current limitations and challenges

## HELMINTH RESEARCH

- Specimens can be hard to acquire
- Often available in tiny amount
- Maintaining life cycle is not always feasible
- Specimen quality for high-throughput techniques vs risk & cost
- The variations with environment, climate changes, intervention

## GENOMICS

- Access to capital equipment
- Skills in sample and library preparation
- Cost of sample library preparation
- Cost of sequencing
- Access to computing infrastructure
- Data handling, management, analysis, presentation
- Keep updated with fast-moving trends VS conventional administrative process

## Solution?

# Find out more & keep in touch



Graduate program: <https://www.facebook.com/systemsbiosciences>

KKU Phenome Center: <https://www.facebook.com/KKUPhenomeCentre>

Liver fluke and bile duct cancer: <https://www.facebook.com/Carikhonkaen>

Thai Bioinformatics: <https://www.facebook.com/groups/217299258320806>

X @akoiwang

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