



Mahidol University
Faculty of Science
Department of Biotechnology

Em.Prof. Dr.Skorn Mongkolsuk

Asst.Prof. Dr.Adisak Romsang

Center for Emerging Bacterial Infections

หน่วยวิจัยโรคอุบัติใหม่และอุบัติซ้ำแบคทีเรีย



Fac. Science, Mahidol University
คณะวิทยาศาสตร์ มหาวิทยาลัยมหิดล

Wisdom of the Land



Mahidol University
Faculty of Science
Department of Biotechnology



In collaboration with
CRI, MURA-EG-VT, KMUTT, SUT, CU, FSU, OU

Center for Emerging Bacterial Infections





Productivity (13-year)

• Articles in International Journals (40)

2550
(2)

2551
(2)

2552
(5)

2553
(5)

2554
(3)

2555
(2)

2556
(2)

2557
(1)

2561
(4)

2562
(2)

2563
(2+)

2559
(3)

2560
(3)



• Book chapters in International Journals

2559 จำนวน 2 เรื่อง Book in Wiley Journal

• National and International Conferences

2556 (6)

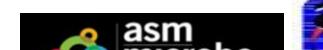
2557 (6)

2558 (3)

2559 (8)

2560 (8)

2561 (5+)



Since 2007...

> 40 articles

> 50 presentations

> 20 grad students

-> train & consultancy

--> service & support



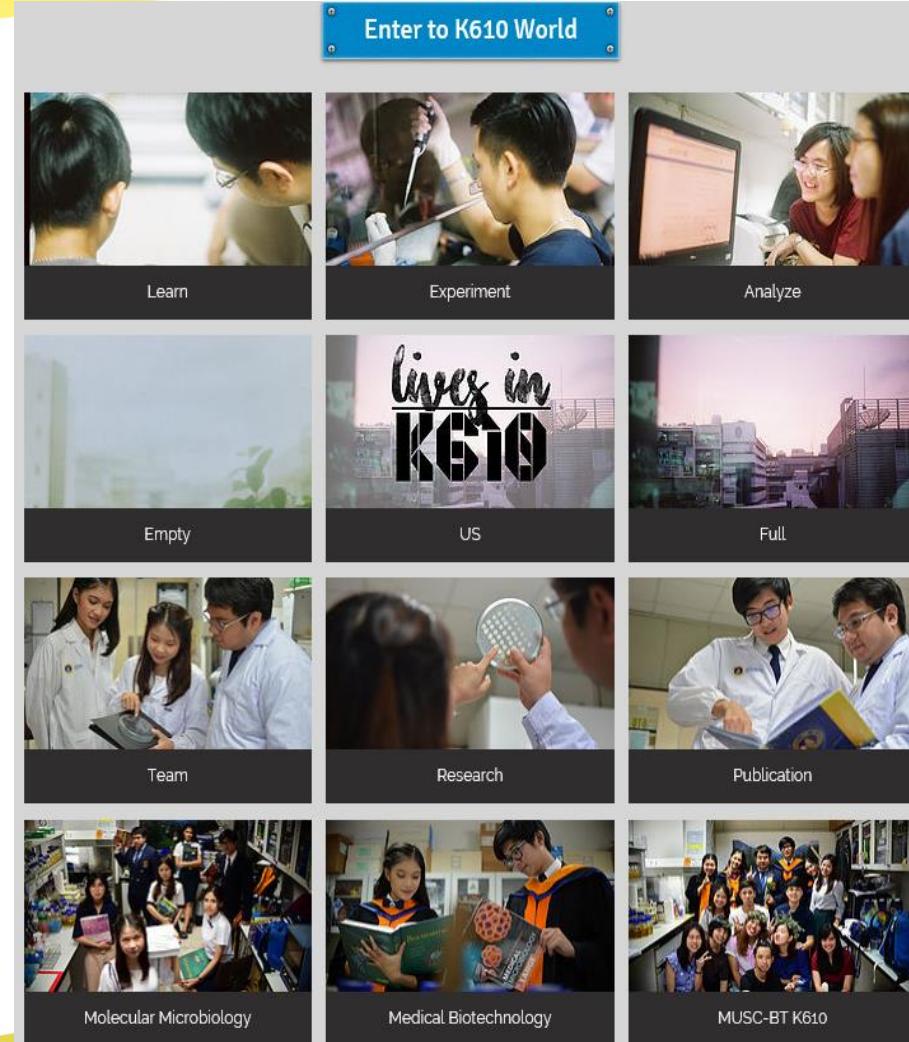
Human Resources

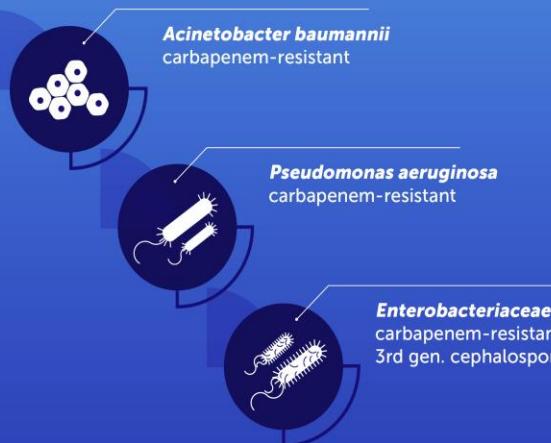
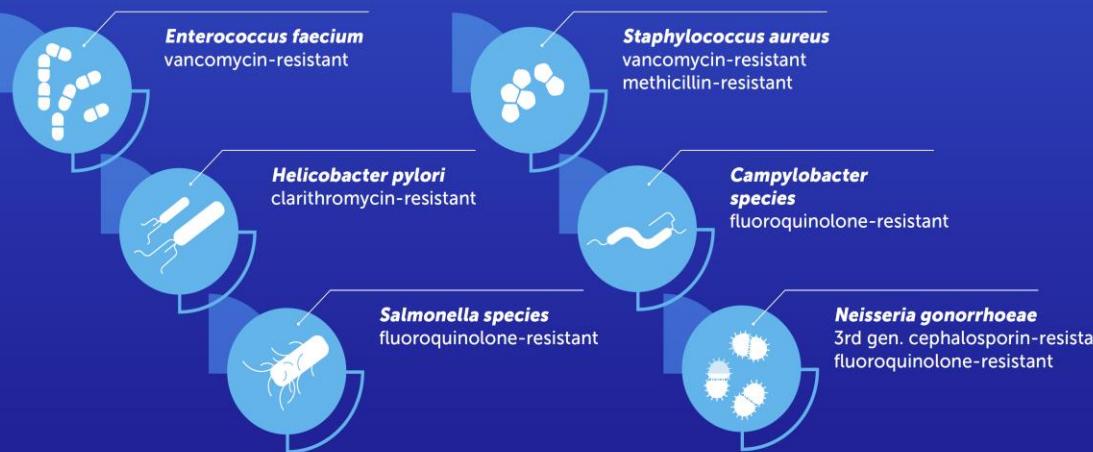
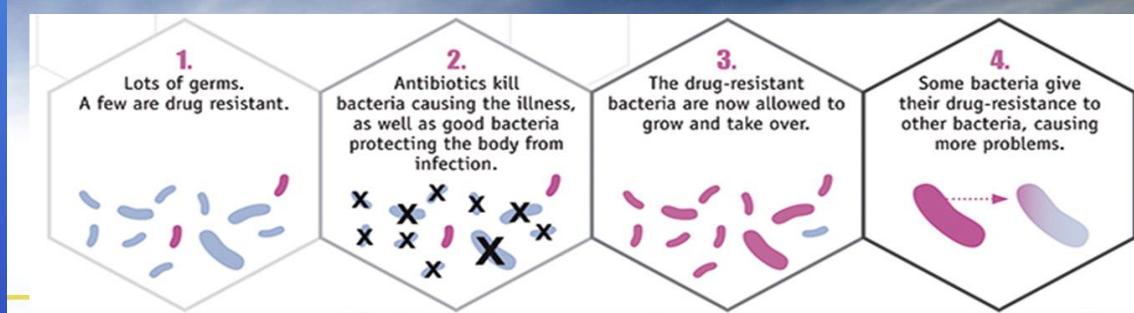
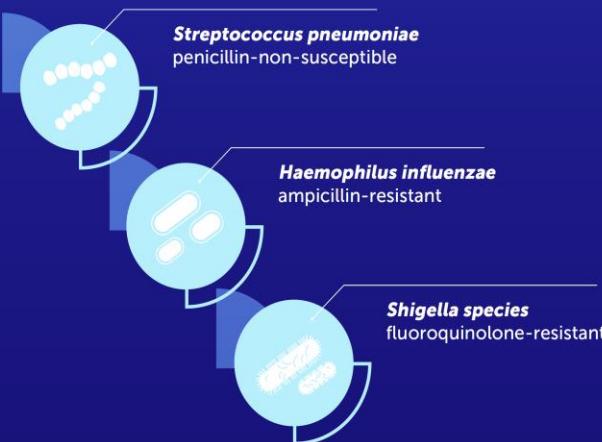
- Ph.D. **10 + 3**
- M.Sc. **14 + 2**
- Undergrad **20 + 4**
- Visiting students **3**

***Research Institutes
Medical Schools***

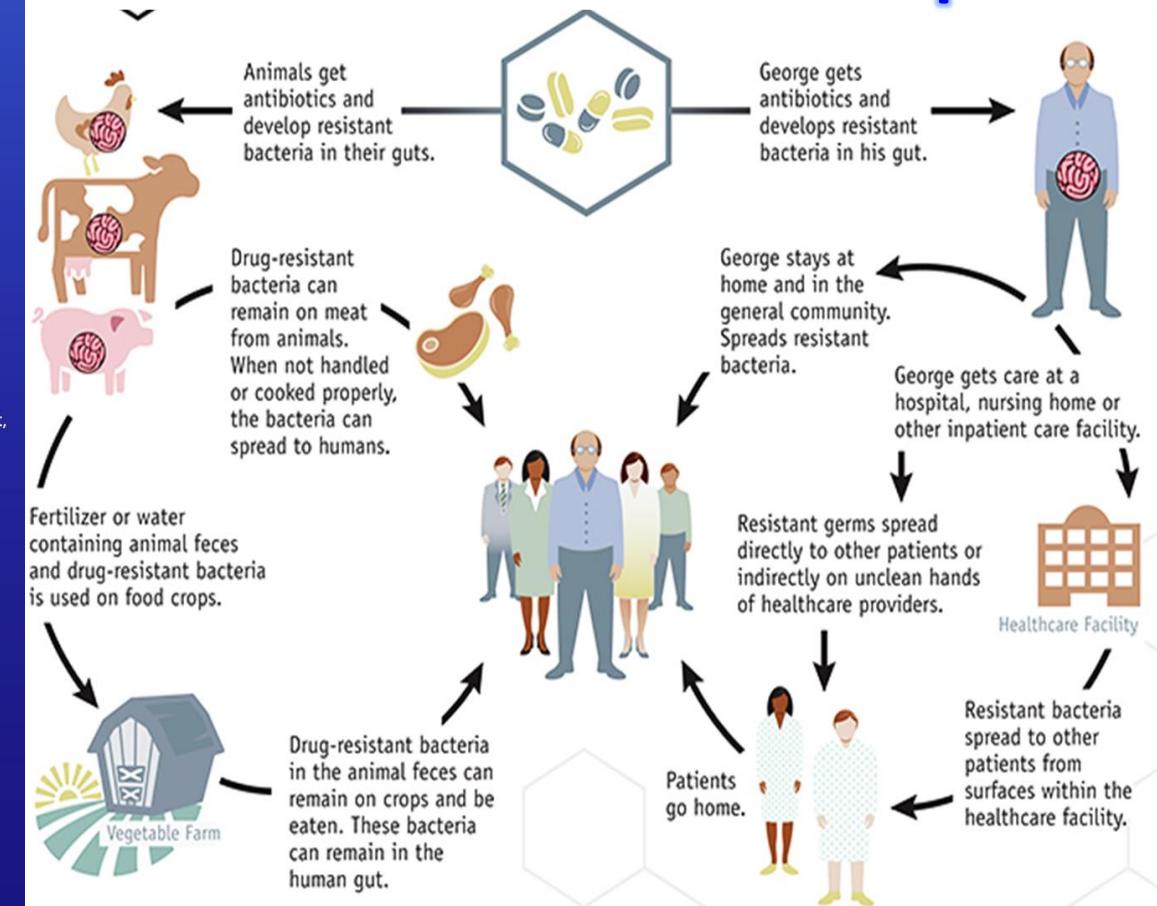
***Research Agencies
Universities
Private companies***

Recent Academic Activities (2020)



Critical Priority**High Priority****Medium Priority**

How antibiotic resistance spreads



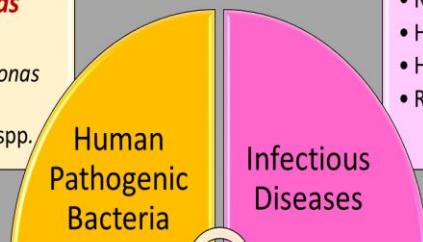
*Simply using antibiotics creates resistance.
These drugs should only be used to treat infections.*



Treatment of Bacterial Infectious Diseases “from Basic Science to Cure”

Pseudomonas aeruginosa

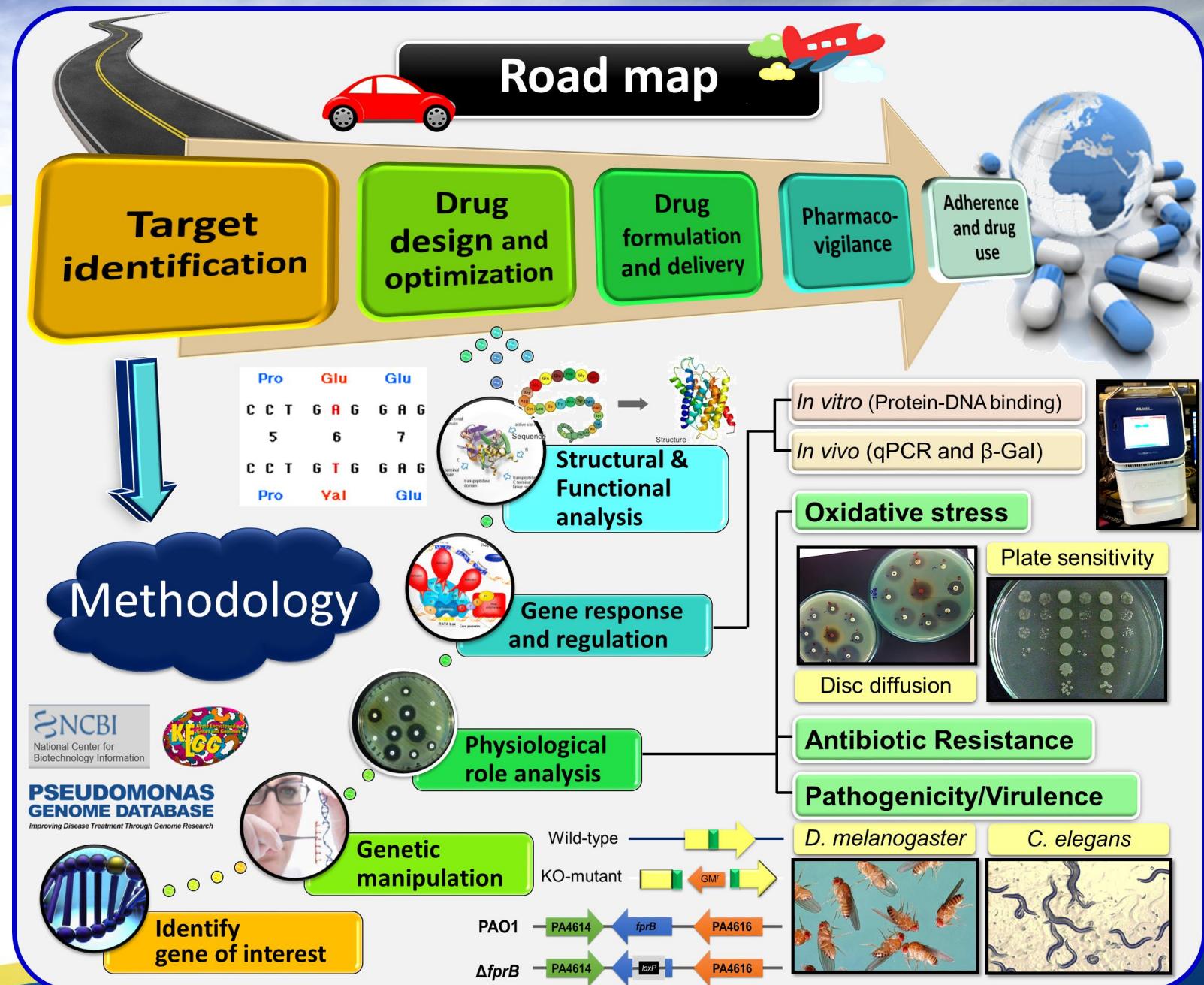
- *Pseudomonas aeruginosa*
- *Stenotrophomonas maltophilia*
- *Acinetobacter* spp.



- Virulence factor
- Antibiotic resistance mechanism
- Novel drug targets: Genes/Proteins

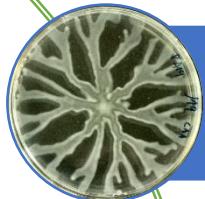
- Nosocomial infections
- Hospitalized infection
- High lethality
- Rapid adaptation

- Drug target identification
- Novel drugs from natural products
- Rapid diagnostic development

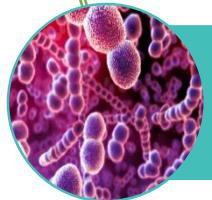




Insight into genome analysis and development of alternative therapies against emerging bacterial pathogens causing hospital-acquired and elders' Infections



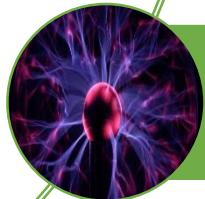
In-depth functional analysis of drug-targeting genes and their virulence networking in *Pseudomonas aeruginosa* against host-generated stresses



Insight study of pathogenesis of *Streptococcus* Group B infection in Thai elderly using comparative genome analysis



Gene analysis and engineering of bacteriophage endolysins for control of hospital-acquired *Clostridium difficile*



Air and surface decontamination in nursing homes and hospitals using innovative non-thermal cold plasma technique

Hospital acquired infections are associated with

\$96–\$147 billion

direct and indirect costs in U.S. acute-care hospitals annually²

\$10,375

additional in-hospital care costs per patient³

3.30 days

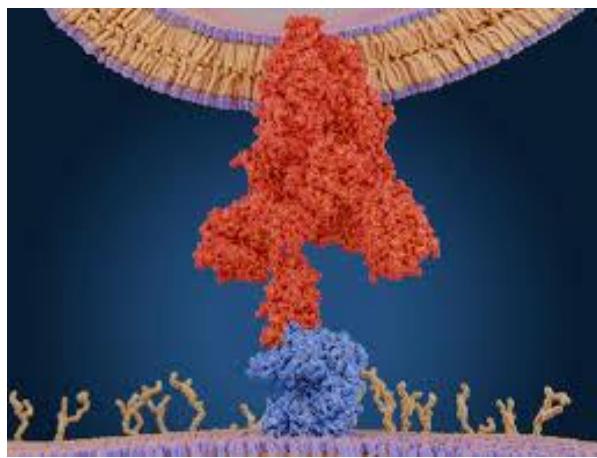
added to the length of stay³

\$45,814/case

For central line-associated bloodstream infections, the most costly HAIs⁴



PROJECT: Insight into genome analysis and development of alternative therapies against emerging bacterial pathogens causing hospital-acquired and elders' infections



Hospital-acquired infections

Recent emerging elders' infections

Gene & Genome analysis

Bioinformatics
& NGS analysis



Pathogen Genome
Databases



Literature reviews
& safety datasheet



Research in ABSL-2

Study in specific genes

Omics analysis in
pathogenic bacteria



Potential
drug-targeting
mechanisms
and designs

Scientific articles

Technicians/Experts

Prototype products

Public health policies

Human health &
economic gain

Development of Alternative Therapies

Chemical Control

metal-chelating
agents & essential
protein inhibitors

Biological Control

Toxin from
bacteriophage
particularly infect in
bacteria

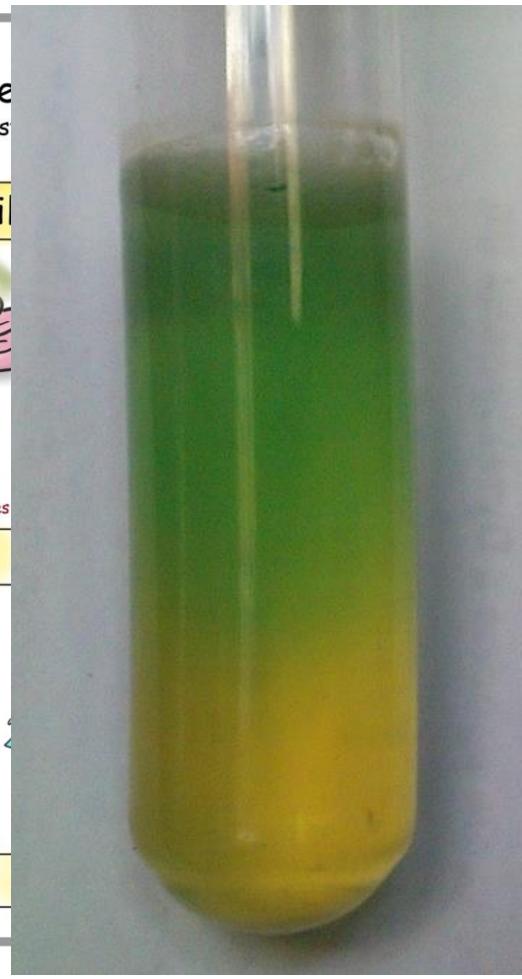
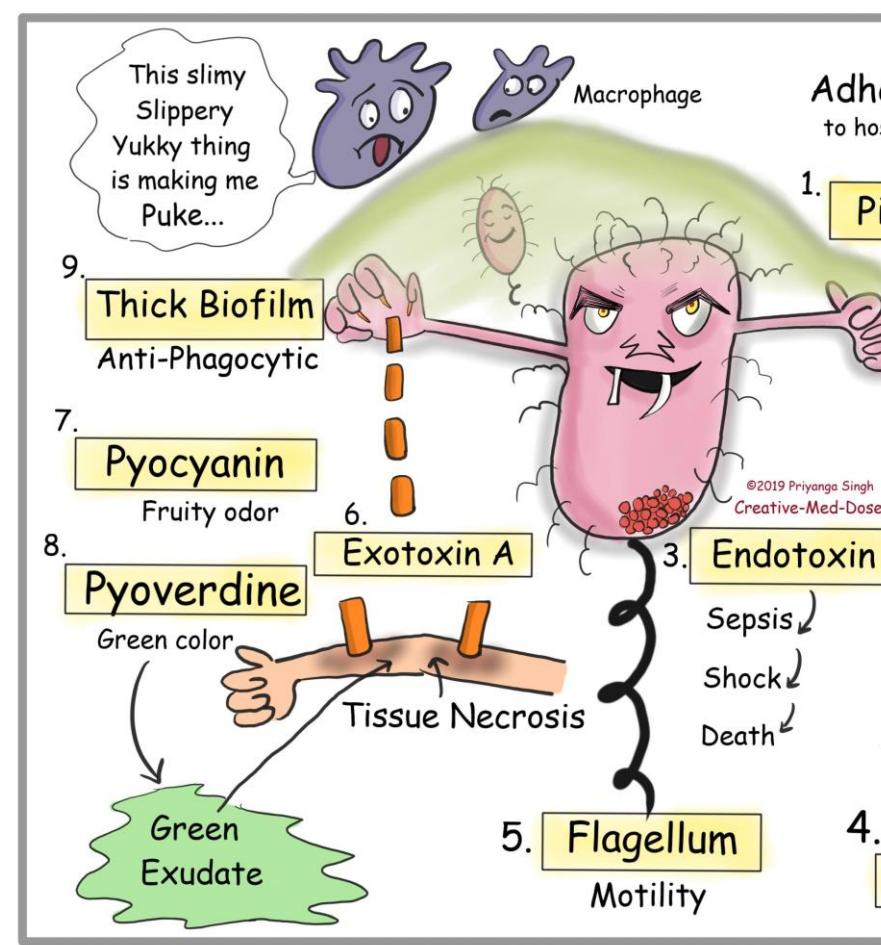
Physical Control

Non-thermal
cold plasma,
Microwave, UV-ray



Pseudomonas aeruginosa

Leading cause of HAI

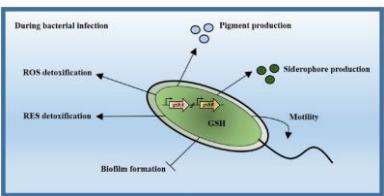




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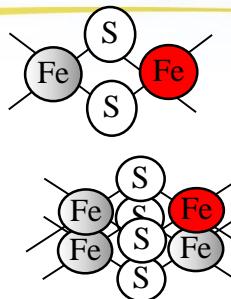
GSH

Wongsaroj et al, 2018



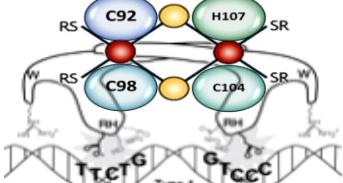
ROS

→ damaged [Fe-S]



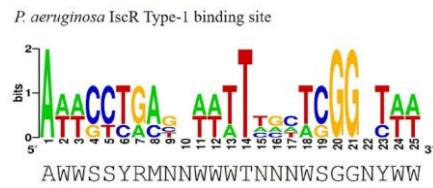
RcsRA 2020 +

Type I

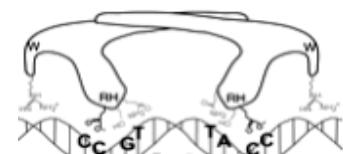


Romsang et al, 2014

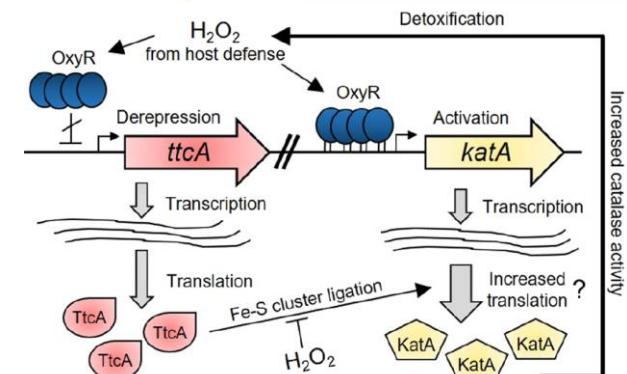
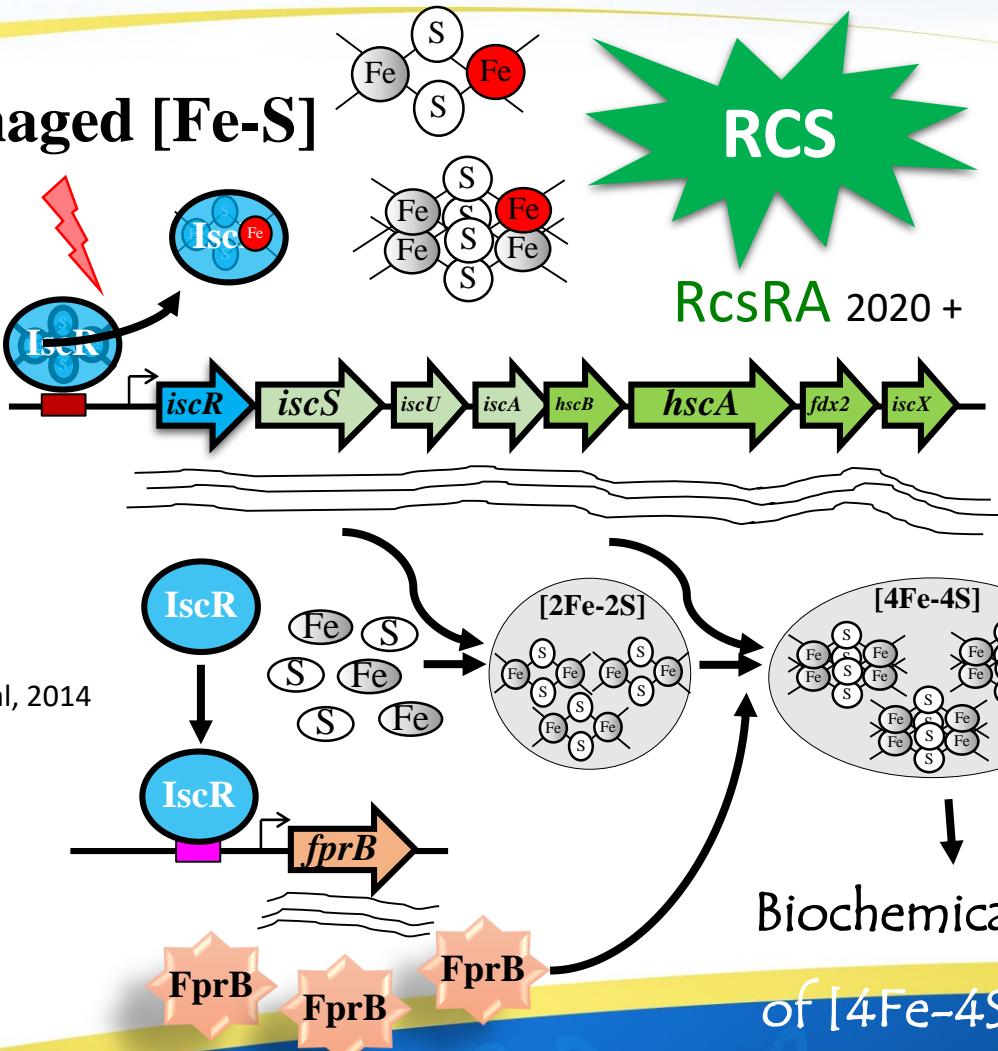
IscR Binding Site
Saninjuk et al, 2019



Type II



Romsang et al, 2015



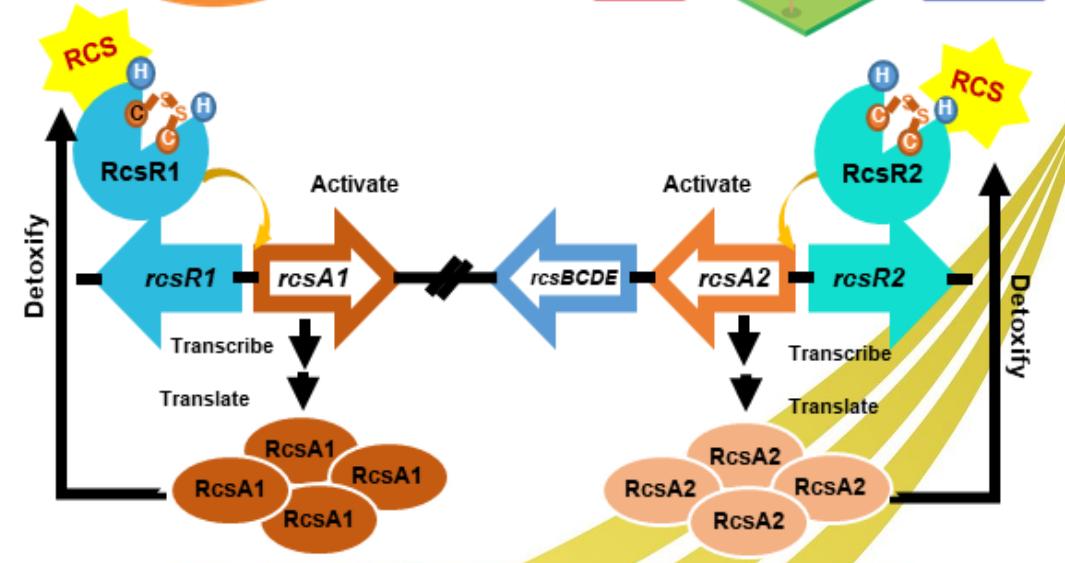
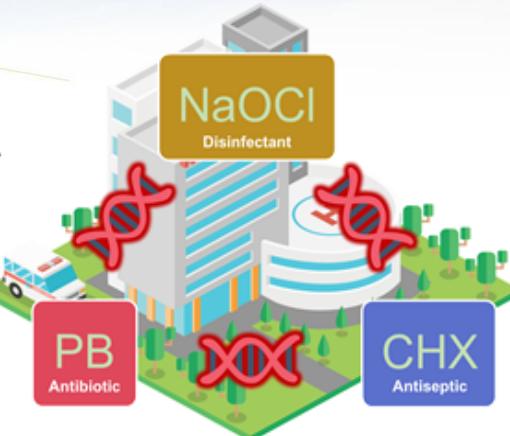
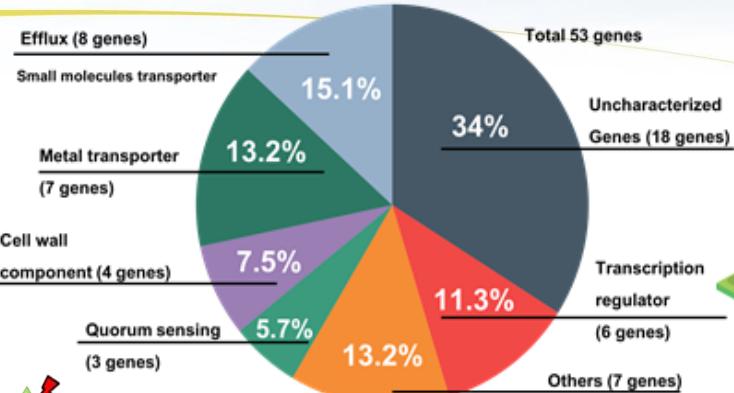
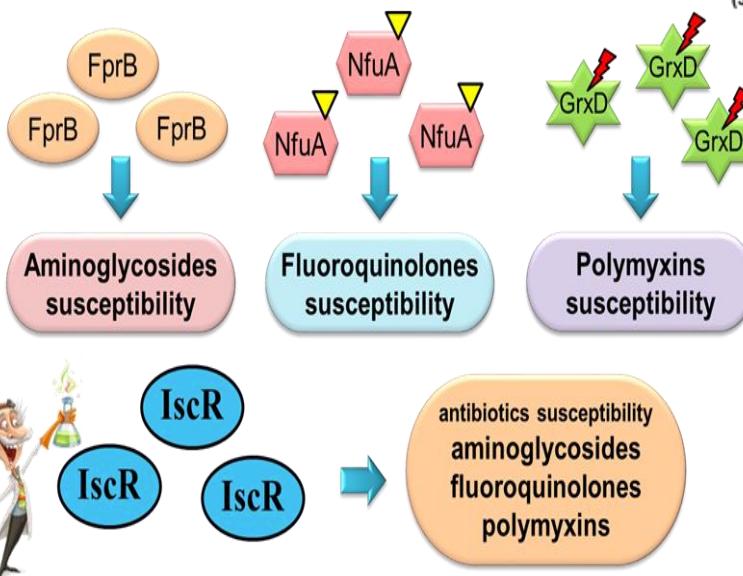
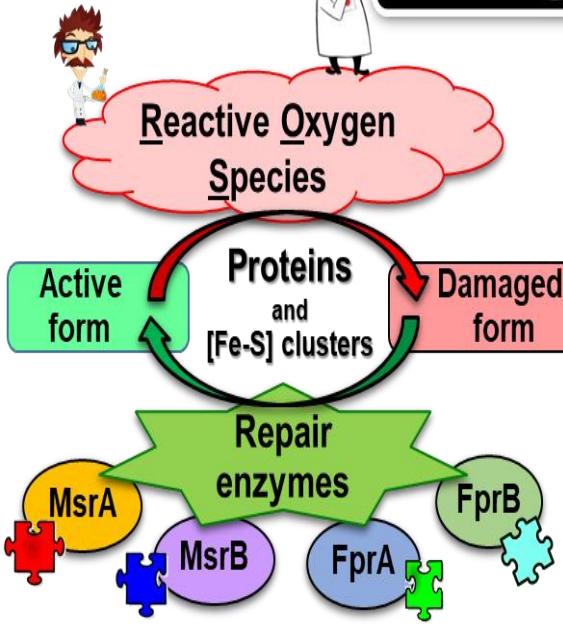
TtcA

Romsang et al, 2018
Sci Rep.

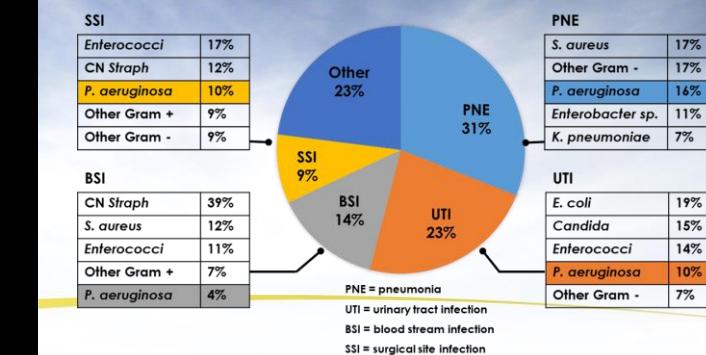


Important findings

Drug Target Identification



Wisdom of the Land



2017



➤ Epidemiology and risk factors for XDR-PA infections in Thailand. Palavutitotai, Nattawan, et al, PloS one 13.2 (2018): e0193431.

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These germs are public health threats that require prompt and sustained action:



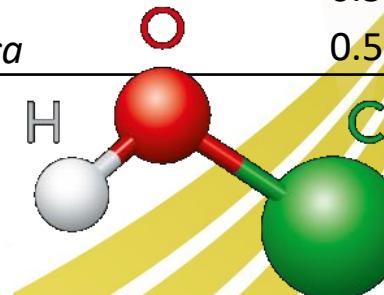
Serious Threats

MULTIDRUG-RESISTANT
PSEUDOMONAS AERUGINOSA



NaOCl toxicity without organic loading

Strains	MBC (mg/L)
<i>Pseudomonas aeruginosa</i>	8
<i>Burkholderia pseudomallei</i>	6
<i>Klebsiella pneumoniae</i>	4
<i>Acinetobacter baumannii</i>	4
<i>Staphylococcus aureus</i>	2
<i>Bacillus cereus</i>	1
<i>Escherichia coli</i>	0.5
<i>Salmonella enterica</i>	0.5

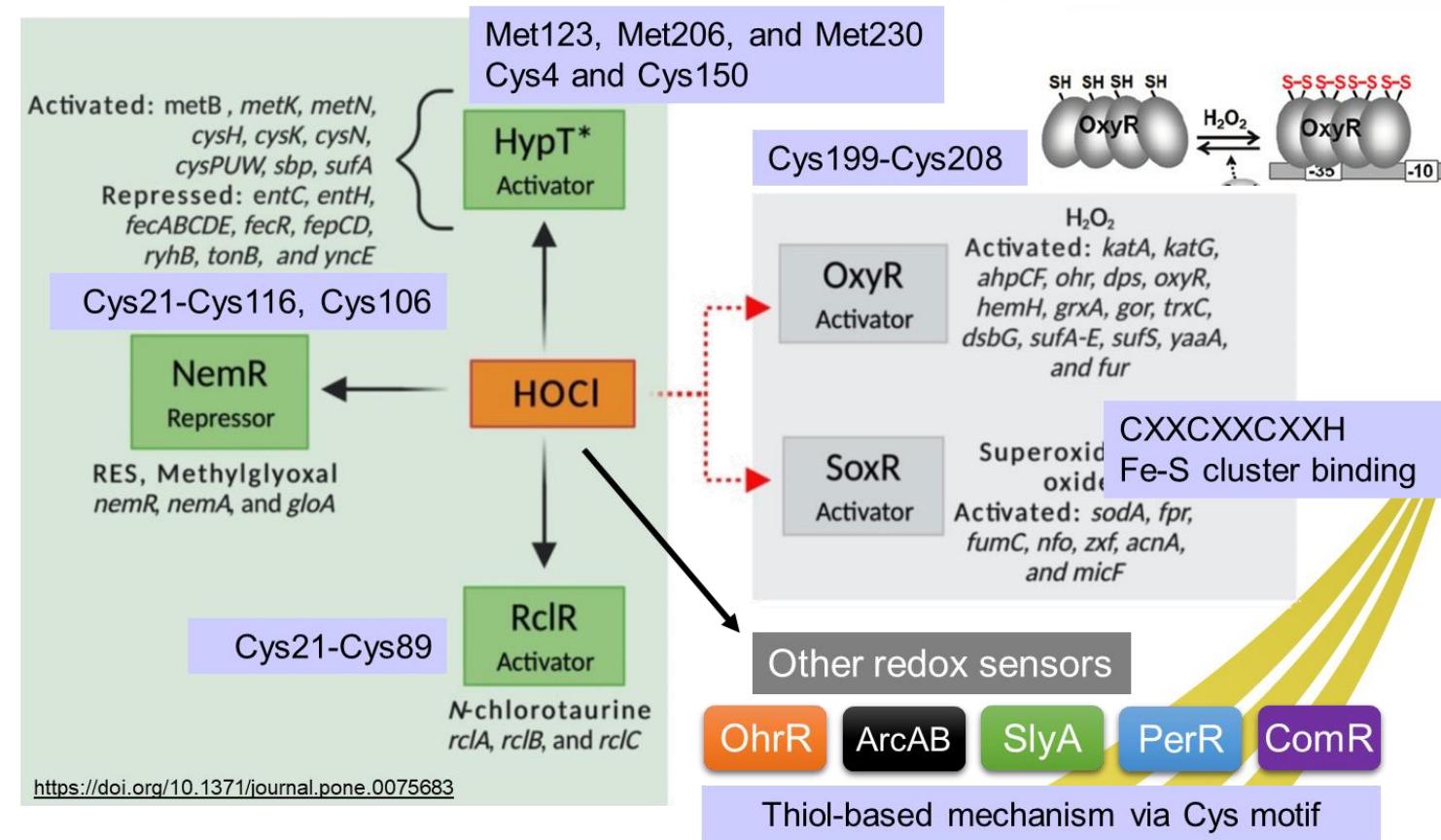
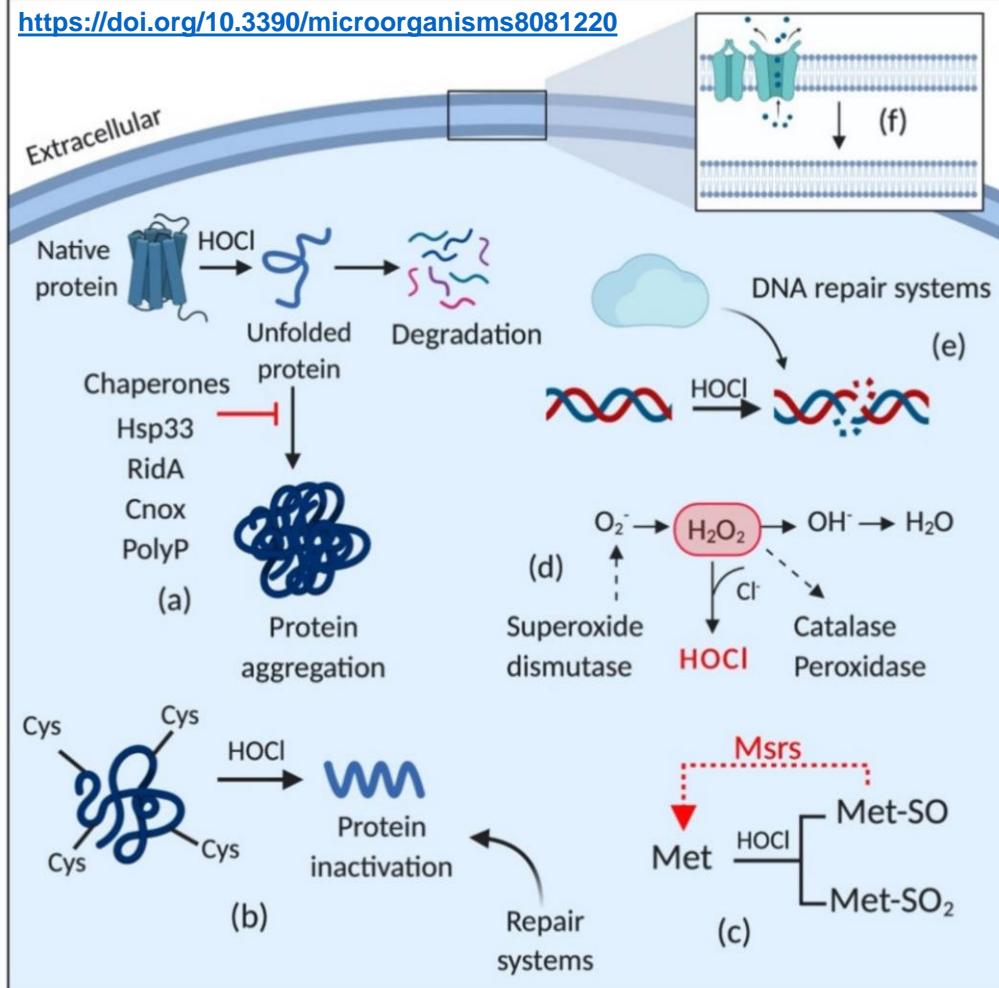


... of the land



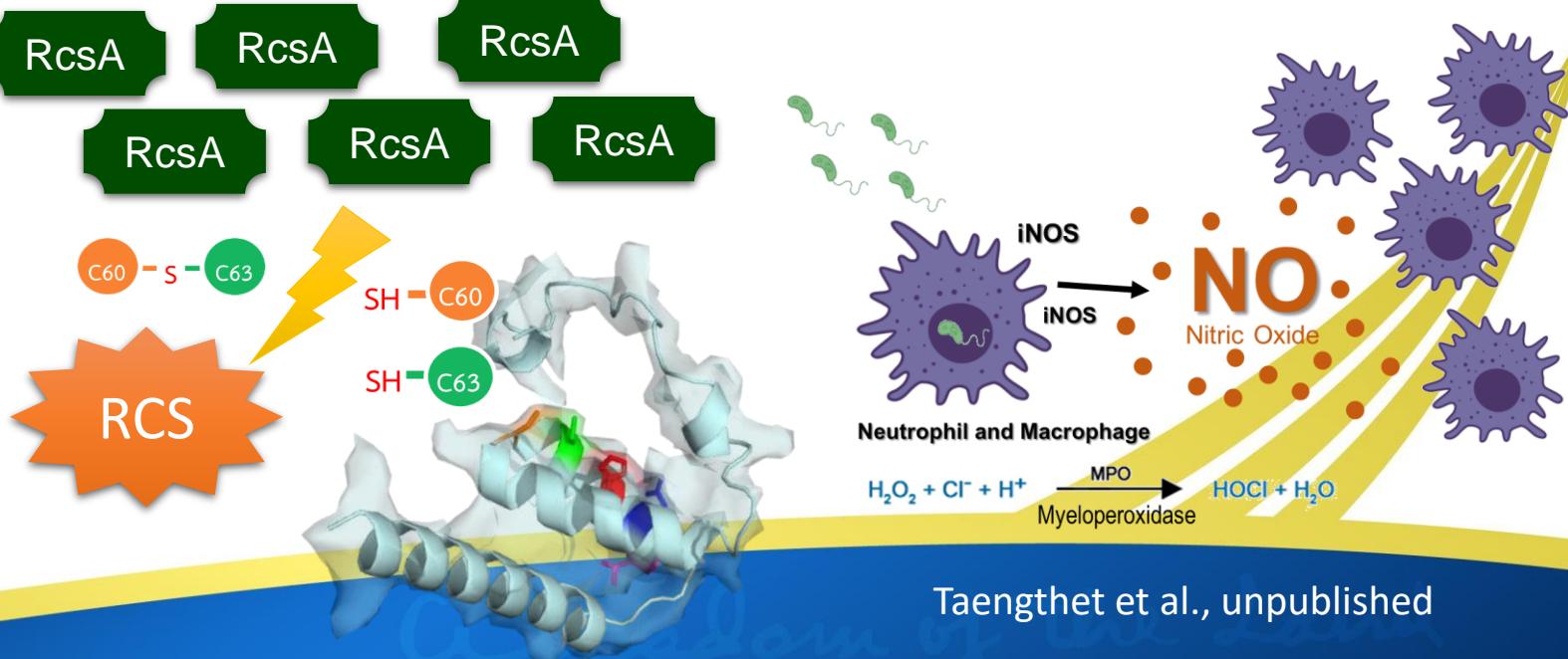
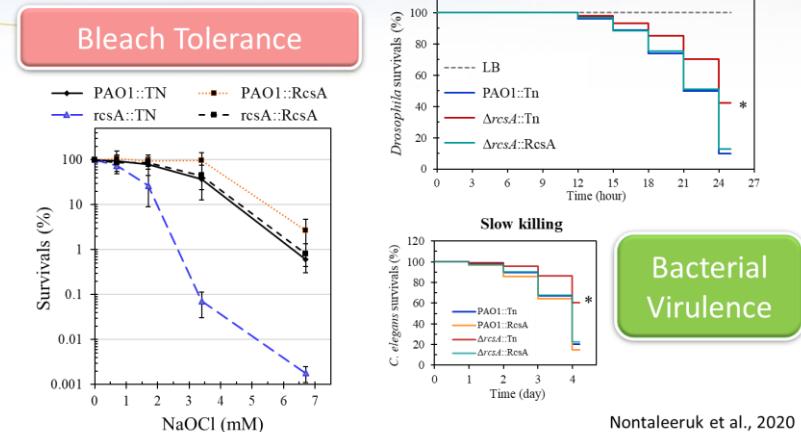
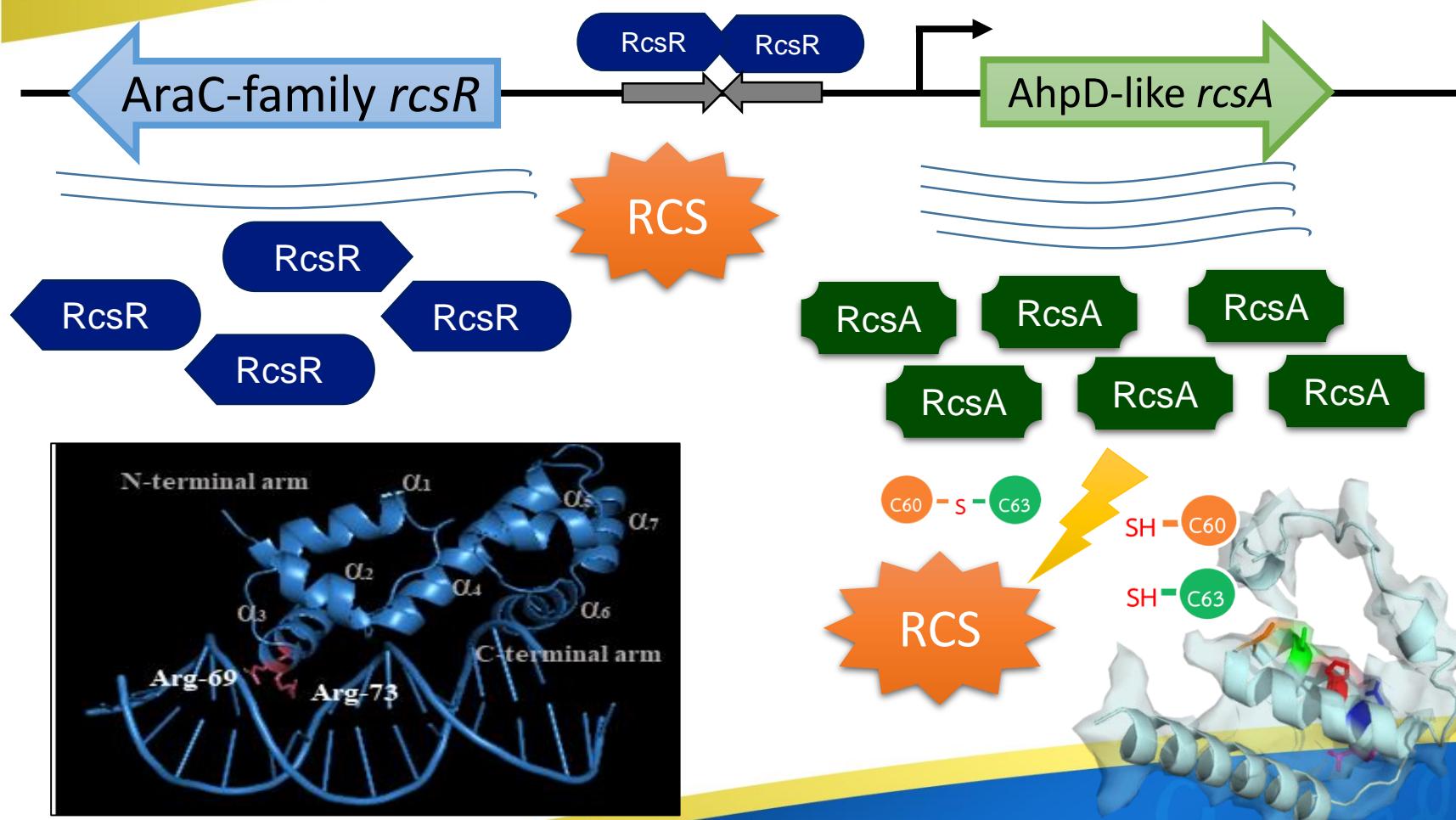
Thiol-based circuit for RCS

<https://doi.org/10.3390/microorganisms8081220>





PAE-RcsRA Mechanism



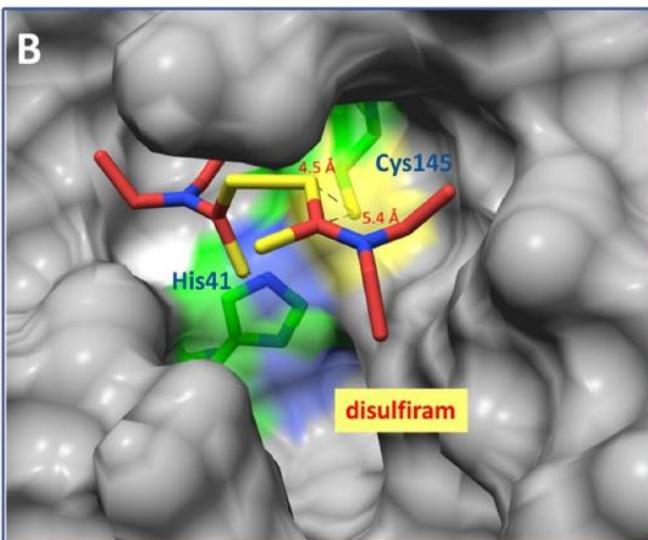
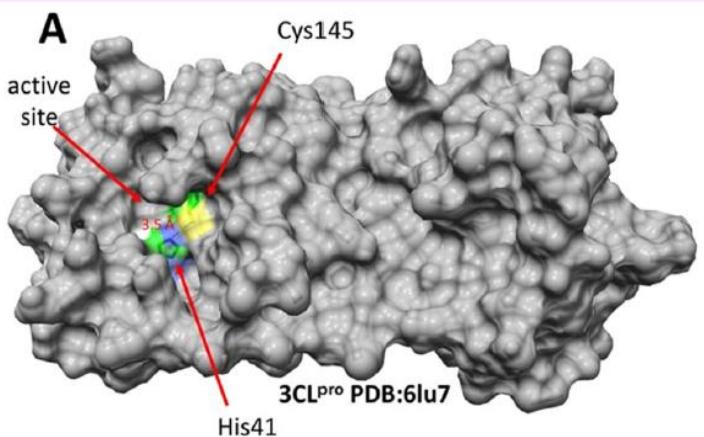
Thiols play a critical role in biochemical systems an antioxidants.

FDA-approved thiol-reacting drugs
that potentially bind into the SARS-
CoV-2 main protease, essential for
viral replication

JOURNAL OF BIOMOLECULAR STRUCTURE AND DYNAMICS
<https://doi.org/10.1080/07391102.2020.1764393>

Disulfiram and its metabolites not only block aldehyde dehydrogenase-2, as it has also been recognized as an inhibitor of other cysteine-dependent enzymes, such as betaine aldehyde dehydrogenase from *P. aeruginosa* (PaBADH, an ALDH9 member) (Zaldivar-Machorro et al., 2011).

Drug	Disulfiram
Possible side effects	Contraindicated in hypersensitivity, liver and kidney failure
Treatment for	
Doses per day	
References	Alcoholism 800 mg/200 mg (Yoshimura et al., 2014)
Recommended to be tested for SARS-CoV-2	Yes



Virulence



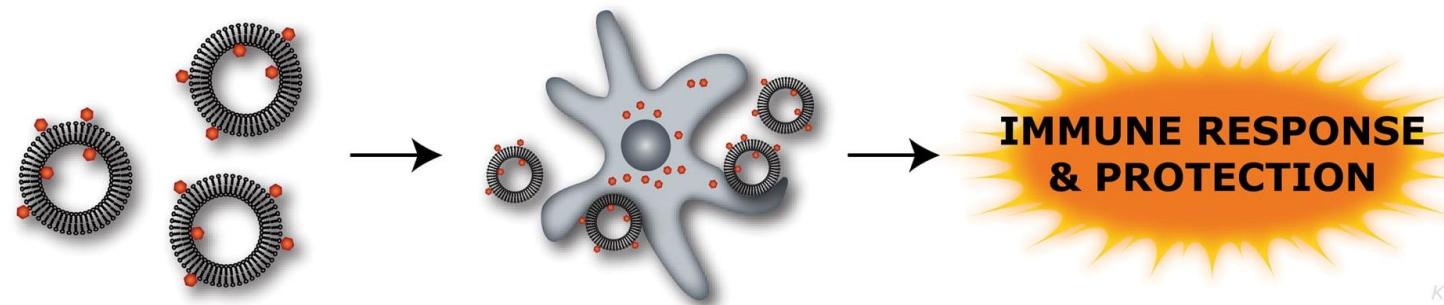
Nontaleeruk et al., 2020

significant findings

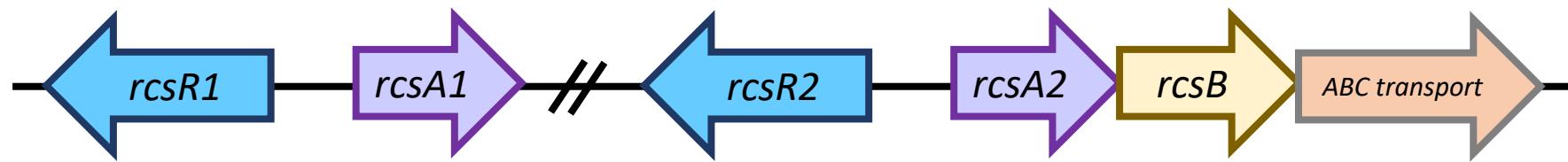


Future plan for this project

1. Bacteria-Macrophage Interactions and Response Mechanisms



2. Multiple copies of *rcsR*-*rcsA* in *P. aeruginosa* genome



3. Molecular transcriptional regulations and their applications

4. Cross-activity and -regulation between RCS and other antimicrobials



EBI Senior



EBI : In Progression





...Thank you...



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Wisdom

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