

Experimental Drug Development Centre Academic Research Organisation

EARO REVIEW 2020 - 2022

EDDC

AN INITIATIVE OF



Experimental Drug Development Centre



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ERABLERS OF DRUG DISCOVERY RESEARCH

WELCOME

The EDDC Academic Research Organisation (EARO) was launched by the Experimental Drug Development Centre (EDDC)'s leadership in mid 2020, with the primary objective of facilitating the community's access to EDDC's capabilities and technologies.

In our maiden year, we obtained invaluable feedback from our colleagues in academia, biotech and multi-national companies on how EARO could best address local capability gaps to enable the progress of drug discovery projects. With this, we began to offer three different service models from 2021:

- ACCESS where EARO provides client's staff with training and direct access to our equipment
- ASSIST where EARO provides regular consultation and shares the project execution, in addition to Access
- **COMPREHENSIVE** where EARO manages and performs projects from start to end

The three modes allowed us to provide a wide variety of services and to cater to different needs and budget requirements.

As a result, in 2021, we partnered with 34 unique research groups from all sectors of the ecosystem (Academia, Biotech, Start-up and MNC). We had added high-throughput phenomics (HTP) to our service offering, and this was met by strong demand from the community. Therefore, 2022 saw a sharp increase in the number of services delivered and a high client retention. We also started to work with an MNC on multiple projects. Through the relationship built, we also embarked on the development of a technology platform and organized a joint symposium with this company.

We are proud that EARO has become an enabler for the vibrant research community in Singapore. By engaging with our partners through the years, we have gained a greater understanding of the community's needs. We are now working towards extending our scope to address these needs.

EARO is now celebrating its third year of operation. Hence, we wanted to reflect on our achievements and share our thoughts on the future of this initiative through this report.



CHRISTOPHE BODENREIDER Executive Director, EARO

OUR MISSION AND PHILOSOPHY

EARO aims to **drive the innovation and advancement of translational drug discovery** in Singapore, and to enable our scientific community to do so **cost effectively**, by providing **access to EDDC's specialised technologies, expertise, and connections**.



EARO'S JOURNEY AND SUPPORT TO THE COMMUNITY



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SOLUTIONS FOR OPTIMAL OUTCOMES

ACCESS TO CAPABILITIES MADE EASY

To ensure that every research group in the community can make optimal use of EDDC's capabilities, we created three unique service models to address the specific needs and interests of our clients. These models range from basic technology access and project assistance to more comprehensive, tailored solutions. This allows us to fulfil our mission in an impactful way.







ISO9001:2015

EARO HAS A ROBUST QUALITY MANAGEMENT SYSTEM

DEDICATION TO EXCELLENCE

One of the achievements we are very proud of is the ISO9001 certification we received in 2022. This recognized the robust quality management system we have put in place. During the surveillance audit in 2023, we received high praise for having zero nonconformities and for the further process improvements we had made.

This certification highlights our commitment to providing the highest quality services to the research community and acknowledges that EARO is operating at international standards.







DIVERSITY IN RESEARCH

SUPPORTING ALL SECTORS OF OUR ECOSYSTEM

EARO has supported the research needs of groups or organisations from all sectors of the ecosystem - universities, hospitals, research institutes, as well as biotech, pharma and consumer health companies. This has allowed us to build strong relationships with the scientific ecosystem, leading to repeat engagements. We have supported most biomedical domains in life sciences R&D - from oncology, fibrosis, metabolic diseases, precision medicine, and rare diseases to small molecule therapies, antibodies, cell therapies, organ-on-chip technologies and digital health solutions.



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ADVANCING ACADEMIC ENDEAVORS



Resources Deployed Compound Libraries Automation Technologies Drug Discovery Expertise

A/Prof Yu Haojie's team at the National University of Singapore had discovered that an orphan GPCR was a causative factor in some cardiometabolic disease indications. A/Prof Yu wanted to further this discovery by identifying small molecules that modulate the target.



Defined Outcomes Validated Hitlist Chemical Structures IC50 Values

The HTS team at EARO has years of experience in the development of screening strategies for challenging targets. The HTS group worked hand-in-hand with A/Prof Yu's team to design the screening strategy (assay automation, choice of compound libraries) and a screening campaign is underway at the time of this publication.



Benefits Starting point for a drug discovery program

The screen could lead to the identification of novel inhibitors for this target. With this in hand, A/Prof Yu's team will have a valuable tool compound for pharmacological validation. This will increase the chances for the team to attract private or public funding for the initiation of a drug discovery program.

I have had the pleasure of engaging with EARO to apply their state-of-art platforms and expertise in a small molecule high-throughput screening campaign. Their resources will enable us to identify novel therapeutic molecules for cardiometabolic disease indications. We are hopeful that we can develop lead compounds targeting disease-causal orphan GPCRs in the near future. The services offered by EARO are invaluable and I would recommend them to anyone looking to advance their R&D objectives.

YU HAOJIE Assistant Professor



Yong Loo Lin School of Medicine

Sep 2021 - Oct 2022

SUPPORTING THE BIOTECH ECOSYSTEM



Resources Deployed High Content Imaging Tech Image Analysis Expertise



Defined Outcomes Novel Assay for Cellular Response



Benefits New Assay Saves Time & Cost

Engine Biosciences is a local biotech company that develops precision medicine therapeutics for oncology and other complex diseases.

Dr Sai Srinivas approached EARO for access to high-content imaging technologies to develop an alternative analysis method to validate their primary biochemical assay results. EARO began by training Engine Biosciences' staff to use our imaging technology. This then expanded into a close working relationship with Dr Srinivas to create a multiparametric image analysis algorithm. This algorithm can determine nuclear phenotype at the single cell level using just two biomarkers, allowing the detection of cell cycle stages faster than ever before. The new morphometric method validated the results obtained with the biochemical assay. Moreover, the method makes it possible to quickly predict potential toxicities and mechanisms of action for any new assets in development.

My initial interaction with EARO was to use the High Content Imaging instruments to develop a new assay. The help I received from them to develop multiplex image analysis pipelines was invaluable. I had a great experience, and we are very satisfied with the services.



Jan - Jun 2022

SUPPORTING FLEDGLING STARTUPS



Resources Deployed Imaging Technologies Technology Expertise

Nuevocor is a pre-clinical stage biotech company that develops gene therapy-based medicines for genetic cardiomyopathies using mechanobiology approaches. EARO supported Nuevocor by providing their staff access to our large, high-end equipment, thus saving the company the high capital costs required to purchase and maintain such equipment in-house.



Client Expectations Technology Training Technology Access

EARO had provided training to several scientists from Nuevocor for high-content imaging. They are now using our equipment on a regular basis to evaluate various 2D and 3D models. They have also started using other technologies available at EARO.



Benefits Infrastructure to Evaluate Complex Models

The steady growth in the types of models being evaluated and the frequency of access to EARO technologies by Nuevocor shows that the company recognizes the convenience and value EARO brings. Companies like Nuevocor also challenge us to further develop and improve our existing capabilities.

^C I'd like to give a shoutout to the EARO-HTP team for their tremendous help in training us and granting us access to the capabilities at EDDC. Thanks to the high-end instruments available there, we've been able to accelerate our workflow and enhance the efficiency of our target discovery process. Their assistance has been invaluable, and we're grateful for their support.

JIAMIN LOO Senior Director, Discovery

Sep 2022 - Present

DEEPENING RELATIONSHIPS WITH MNCS

In 2021, Ferring Pharmaceuticals engaged EARO for a pilot screening project. This initial collaboration developed into a multi-project partnership involving all EARO platforms. While working on these projects we developed a positive working relationship with the company, that culminated with the initiation of a joint technology development project and the co-organization of a drug discovery symposium in Singapore.



Ferring Pharmaceuticals is a research-driven, specialty biopharmaceutical group committed to helping people build healthy families and live better lives through leadership in reproductive medicine and maternal health, and in specialty areas within gastroenterology and urology. We use X-ray crystallography and cryo-electron microscopy to understand the mechanism of action and underlying biology of our drug targets, as well as drive rational drug development of antibodies or small molecules. Our footprint is small, and we scale resources to meet our needs through external partnerships with organizations such as EARO. We chose to partner with EARO because of its excellent crystallography technology platform, especially its access to two microfocus beamlines – excellent for small crystals. The two projects we collaborated on were professionally and satisfactorily executed and provided valuable data to jump start drug discovery efforts on a therapeutically important target.

JEREMIAH JOSEPH Project Leader



BROADENING ALLIANCES WITH MNCS



Resources Deployed Assay Development Imaging Technologies Phenomics Expertise

Stella Wang from P&G's Innovation Centre was interested in evaluating the effect of a natural substance on a certain protein in skin cells. She sought the help of EARO in this endeavour. We deployed our expertise in high content imaging to validate her hypothesis.



Expected Outcomes Protein Expression Profile Validation Reports

The HTP team not only determined the protein's cellular abundance and distribution in response to the natural substance; they also discovered that it promotes the development of a morphological phenotype that resembles the protective layers of real epidermis.



Benefits Novel Evaluation Method

Stella Wang's team was delighted that EARO had brought new insights which were greater than what they had expected from this study. The results were published on EARO's website.

In partnership with EARO, we successfully explored a new territory of scientific research for our skincare technology.

Leveraging EARO's strong scientific capabilities, we validated our internal hypothesis for the potential of an active skin care ingredient (Glycoxyl[™]). EARO experts utilized their expertise with advanced technology to develop a comprehensive test protocol in collaboration with us. The original idea was to address the impact of the ingredient on protein levels. During the exploration of the ingredient's properties, EARO experts offered professional recommendations to enable us to fully capture the intricacies of the complex biological phenomenon that occurs during cornification. They continuously improved the test throughout the journey. In the end, the results greatly enlightened us by verifying our hypothesis and led the discovery of new insights.

This break-through result inspired new perspectives for future skin care product development and science communication.



STELLA WANG

ADVANCING TRANSLATIONAL RESEARCH

Clients who have benefitted from EARO's screening services



High Throughput Screening (COMPREHENSIVE)

Dr Azhar at Cancer Science Institute had derived cell lines from clinical samples in order to discover new line therapies for treatment-resistant lung carcinomas. He turned to EARO to find hit compounds against the disease phenotype. Hopefully, the screen results will help the team to move the project further.

We have engaged EARO team for their comprehensive service in delivering a cell-based small molecules differential therapeutic-sensitive screening project. Their team was incredibly efficient and professional . They swiftly set up the pilot screen and standardized all the statistical parameters. Moreover, they completed the entire screening process within the stipulated timeframe and provided us with all the necessary information. We look forward to engaging and continuing our partnership with HTP in the future!

AZHAR BIN ALI Senior Research Scientist



Sep 2022 – Feb 2023



Dr Amos Loh at KK Women's and Children's Hospital and Prof Chen Zhi Xiong at National University of Singapore engaged EARO for a screening campaign to find hits against a protein prevalent in specific cancers. EARO assisted by offering guidance on assay optimisation, access to technologies, and data analysis.

I'm very pleased with the professional service provided by EARO scientists. We have worked with them for the optimization of novel target-based screening campaign using small molecule libraries. They provided excellent scientific support in areas of assay biology and assay miniaturisation. We would definitely engage EARO-HTP team for a larger screening campaign next time!

AMOS LOH HONG PHENG Sr. Consultant, Dept. of Pediatric Surgery



Aug 2022 - Present

EMPOWERMENT THROUGH TRAINING

At EARO, we don't just provide access to advanced technologies – we also equip our clients' staff with the necessary training for them to get the most out of their research and so enable innovation in Singapore.



Imaging Flowcytometry & Histopathology

Gur team had a wonderful experience using the Akoya-PhenoImager HT system for digital histopathology at EARO. The whole on-boarding and training process was very well-organised. The staff members were friendly and attended to our queries swiftly. All in all, it has been of great value.

JOE POH SHENG YEONG

Principal Scientist



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High Content Screening & Library Management



SHAN QUAH Senior Scientist

A*STAR Skin Research Labs A*SRL Apr 2022 - Present



High Content Imaging

My team is very satisfied with the scientific services from EARO team. They have always responded to all our queries, and their on-site support for setting up our High Content Imaging instruments and training my team members was highly efficient. Access to these instruments, at this stage of our startup, has been of absolute help.

SENIOR SCIENTIST Local Biotech Startup

Sep 2022 - Present

Nov 2021 - Present

ENABLING THROUGH INFRASTRUCTURE SUPPORT

EARO provides access to technologies and facilities to allow companies or research groups that are just starting up to kick start their research, even while they are still setting up in-house infrastructure. This allows these fledgling groups to save time and extend their resources to advance their projects further.



While in the process of building up our own infrastructure and facilities, EARO was able to provide us access to critical equipment that allowed us to jump-start our research and save valuable time. The entire process was, timely, smooth, and professional.



Nov 2022 - Present



Access to Multiple Platforms

Being a member of EARO enabled our team to access state-of-the-art equipment at EDDC, which greatly facilitated our experimental workflow, for example, high-throughput testing, and validation of RNA-targeted small molecules or antisense oligonucleotides predicted by the Genetic Leap computational platform. Working with the staff at EARO/EDDC is a joy, as they are knowledgeable and generous in sharing their experience, welcoming and flexible in exploring solutions tailored to our workflow.

ANDY NG Head of Research Genetic Leap

Dec 2021 - Present



C The team at EARO understood our needs and was accommodating of our tight timelines.

The entire process was efficient, seamless and the after sales service was particularly on point. This enabled us to quickly validate the various virus screening platforms available in A*IDL. We will definitely engage EARO again for the development of new screening assays for the different pathogens at A*IDL.

> ADELINE CHUA Senior Scientist

> > Feb 2023

PERCEIVED COMPETENCE

HOW OUR CLIENTS RATED US

Our post-service feedback survey revealed that our clients are satisfied with the quality and effectiveness of services provided by EARO. We strive to be the best service provider for drug discovery in Singapore.

100% rated us EXCELLENT for DOMAIN EXPERTISE

>95% rated us EXCELLENT at ADDRESSING ENQUIRIES PROMPTLY

>90% RESEARCH GROUPS have engaged our services MORE THAN ONCE

>80% ranked us EXCELLENT among SIMILAR SERVICE PROVIDERS

100% would RECOMMEND EARO to others



BEHIND THE SUPPORT

EARO PLATFORMS AND TEAMS



SCREENING



BIOPHYSICS



HIGH THROUGHPUT SCREENING (HTS)

UNIQUE IN SOUTHEAST ASIA

EDDC's High Throughput Screening (HTS) platform has a unique drug screening set of equipment in South-East Asia. It operates an advanced storage system with close to half a million structurally diverse compounds and a complete automation setup for large scale drug screening projects.

The goal of HTS is simple yet powerful: measure the effect of thousands of compounds on various biological systems through a range of biochemical, biophysical and cell-based assays to rapidly identify chemical hits.

Perform a Multitude of Off-the-Shelf Assays

Biochemical, Biophysical, or Cell-based Screening Assays

Up to 16,000 compounds/day Up to 50 microplates/day

Cherry-picking Compounds Up to 100 compound plates/day

Compound Libraries

- Curated collection of >400,000 compounds
- Regularly reviewed & revised by in-house chemistry team
- Up-to-date with the **latest trends in drug discovery**
- Stratified into **diversity & focused sets** to fit specific project needs

HIGH THROUGHPUT SCREENING





JACKIE ANG PLATFORM HEAD Wine Scholar



JUSTINA FULWOOD RESEARCH MANAGER Fitness Enthusiast



RIAZUL RAZIQ RESEARCH MANAGER Games, Movies, Al News



DORIS TEE SENIOR RESEARCH ASSOCIATE Hiking, Movies



WONG MEI YEE RESEARCH ASSOCIATE Pond Prawning, Crocheting



CHERYL TAN RESEARCH ASSOCIATE Baking Delicious Desserts



HIGH THROUGHPUT PHENOMICS (HTP)

A PICTURE IS WORTH A MILLION NUMBERS

By combining automated imaging and quantitative data analysis methods with high-content screening (HCS), the HTP platform is enabling large-scale applications that can be used in drug discovery and systems biology.

High Content Screening

- A high-throughput imaging method to screen compounds in complex cellular systems
- Tailored analysis algorithm designs and assay parameters specific for disease biology
- Customized assays for specific cellular function



Assays for Cellular Function & Disease Biology

- Cell Painting an unbiased, phenotypic approach for drug discovery and development
- Neurite outgrowth
- Marker expression
- Cellular migration
- Heterogenous co-culture modeling
- 3D Spheroid characterization
- and more...

HIGH THROUGHPUT PHENOMICS





GIRIDHARAN PERIYASAMY PLATFORM HEAD Spiritualist



HARAN ASAMY TH RM HEAD RE cualist

MATAN THANGAVELU RESEARCH MANAGER Marathoner

SHIVAJI RIKKA RESEARCH MANAGER Biohacker



HONG YUN CHANG RESEARCH MANAGER City Adventurer



LINNA LYU POST DOCTORAL FELLOW Swimmer, Runner, Hiker



YI LIN GIAN RESEARCH ASSOCIATE Explorer of New Cities



CONNIE CHONG RESEARCH ASSOCIATE Food & Travel Enthusiast



PROTEIN STRUCTURE & BIOPHYSICS (PSB)

VISUALIZING MACROMOLECULES IN ACTION

Understanding protein-ligand interactions is pivotal for accelerating compound optimization through structure guided design. Our team of experts at the Protein Structure & Biophysics (PSB) platform support the determination of high-resolution structures of proteins and protein-ligand complexes.

Access to both in-house diffractometers and commercial beamline at synchrotrons allows the team to consistently deliver fast turnaround on projects.

Tools of Our Experts

Construct Design & Cloning for optimal protein expression
Protein Expression & Scale Up in *E.coli* expression systems
Protein Purification for high-throughput crystallization
Crystallization Condition Screening to increase chances of success
Biophysics Assays to determine target-ligand engagement
Epitope Mapping to determine binding sites on target antigen proteins
Fragment Based Drug Discovery for finding high quality hits against challenging target proteins and to find novel allosteric/cryptic pockets

PROTEIN STRUCTURE & BIOPHYSICS





NITHYA BABURAJENDRAN PLATFORM HEAD Runner, Hiker, Traveler JOTHI ANANTHARAJAN SENIOR RESEARCH FELLOW Food & Travel Enthusiast





EARO BUSINESS OPERATIONS

The Business Operations team is essential to the success of EARO. They play an integral role in making sure that all processes are running smoothly, that partners are engaged and have their needs met, and that services are provided with quality and within a legal framework.

To further ensure the initiative's success, they survey the local ecosystem regularly to gain a better understanding of what Singapore based companies need. This helps them strategize for future implementations of new technologies so that EARO can continue to be successful.

In 2021, EARO partnered with A*STAR Research Support Centre (RSC) to leverage its wellestablished network to the local research community and utilise their marketing and administrative support services to assist with EARO's commercial operations.

Thanks to this partnership, EARO can outsource important standard business tasks like signing service contracts and invoicing customers. This has allowed EARO to remain lean and focused on developing and providing the best drug discovery scientific solutions to meet its clients' needs and deliver smooth service experience.

Key Roles

- Project Management
- Liaise Legal Agreements
- Client Engagement

- Costing Strategy
- Commercial Activities
- Quality Management System

EARO BUSINESS TEAM





CHRISTOPHE BODENREIDER EXECUTIVE DIRECTOR Outrigger Canoeist



SRAVANTHY MANESH BUSINESS OPERATIONS MANAGER Family Vacationer



KAY LIN GOH BD & ALLIANCE MANAGER Animal & Nature Enthusiast



SHIVAJI RIKKA MARKETING MANAGER X-country Rider AMELIA YAP

COMPLIANCE MANAGER

Jetsetter





STRENGTHENING OUR SERVICE OFFERING EXPAND SUPPORT FOR DRUG DEVELOPMENT

EARO's core offering has been centred around the early phases of drug discovery. In the coming months and years, we aim to bridge the gap towards pre-clinical drug development by expanding our service offerings to the following areas:

COMPOUND LIBRARIES

The HTS and HTP teams will continue to enrich our compound libraries to optimize the chances of success of our screening campaigns.

PREDICTING TOXICITY

The teams at EARO and EDDC are working on developing novel assays to predict toxicity with morphometric and genomic read-outs. Theses assays will also inform on the mechanism of toxicity.

ANTIBODY DEVELOPMENT

EARO will offer services to characterize antibody functionality and developability. This will address the needs of the increasing number of start-up companies developing large molecules.

MEDICINAL CHEMISTRY

On an ad-hoc basis, EARO will provide support to design small molecules during hit-to-lead and for lead optimization.

IN VIVO PK

EARO will continue to offer support for in vivo assessment of compound stability and metabolism.







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