Nexus of Rare Neurodegenerative Diseases (“NRND”)

Home

About Us

Vision

To become an internationally leading authority in the area of rare disease research.

Mission

Advances in medical research are often a result of concerted efforts. The mission of NRND is to foster collaboration between multi-disciplinary researchers and experts from around the globe to expand our knowledge regarding the underlying causes of rare diseases, focusing on Spinocerebellar ataxia (SCA), C9ALS/FTD, Myotonic Dystrophy and Huntington’s Disease.
We hope to develop more effective strategies to intervene the genetic inheritance of rare diseases and to contain the deterioration of diagnosed conditions, be it through developing new drugs or other therapeutic opportunities.

Values

We believe that patients diagnosed with rare diseases deserve the same level of care like patients with prevalent diseases, which means equal and fair treatment, as well as social, financial and psychological support.

We see the vital importance of active collaboration by multi-disciplinary researchers around the globe. No man is an island.

We believe that we can harness the potential of our determination and concerted efforts to achieve unprecedented success.

Our Team

NRND gathers some of the brightest minds in rare diseases research across different disciplines and different continents; all of our founders have acquired extensive research experience and have been leading their own research teams, not to mention their scientific excellence that has been recognized by the international community and authoritative journals. The goal of NRND is to create a platform to facilitate academic exchange and foster collaboration. By leveraging the potential of synergy, NRND hopes to rise above the challenge of understanding rare diseases.

Local Members

Prof. H.Y. Edwin CHAN (School of Life Sciences, The Chinese University of Hong Kong, HKSAR, China)

Professor H.Y. Edwin Chan, Founder of NRND, is a professor in the School of Life Sciences at The Chinese University of Hong Kong. He obtained his doctoral degree from the University of Cambridge. His main areas of interest are human disease modelling, cellular, genetic and biochemical analyses of RNA and protein toxicity in neurological diseases, and the therapeutic intervention of neurological diseases. He is also the director of the Laboratory of Drosophila Research and the Deputy Director of Natural Sciences Programme in the Science Faculty.

https://www.sls.cuhk.edu.hk/index.php/faculty-and-staff/teaching-staff/26-sls/faculty-and-staff/teaching-staff/85-professor-chan-ho-yin-edwin

Dr. Anne Y. Y. CHAN (Department of Medicine and Therapeutics, The Chinese University of Hong Kong/ Prince of Wales Hospital, HKSAR, China)

Dr. Chan, member of NRND, is a clinical associate professor (Honorary) in the Division of Neurology of the Department of Medicine & Therapeutics at The Chinese University of Hong Kong. She is leading the Parkinson’s Disease and Movement Disorder Unit in the division. At the Prince of Wales hospital, which is the teaching hospital of the Faculty of Medicine, Dr Chan works as an associate consultant at the Department of Medicine & Therapeutics.

http://neurology.mect.cuhk.edu.hk/anne-chan/

Prof. T.F. CHAN (School of Life Sciences, The Chinese University of Hong Kong, HKSAR, China)

Professor Chan, member of NRND, is an associate professor at the School of Life Sciences at The Chinese University of Hong Kong. He earned his doctoral degree at the Washington University School of Medicine. Professor Chan is interested in RNomics and bioinformatics in biological processes and diseases, as well as the technology and algorithm development for genomics and transcriptomics. Alongside his research and teaching duties, Professor Chan is also the associate editor of *Frontiers in Genetics* and *Frontiers in Plant Science*.

http://www.sls.cuhk.edu.hk/index.php/faculty-and-staff/teaching-staff/26-sls/faculty-and-staff/teaching-staff/98-professor-chan-ting-fung

Prof. Jonathan CHOI (Department of Biomedical Engineering, The Chinese University of Hong Kong, HKSAR, China)

Professor Choi, member of NRND, is an associate professor of the Department of Biomedical Engineering at The Chinese University of Hong Kong. He obtained his doctoral degree from the California Institute of Technology. Professor Choi's research interest lies mainly in drug delivery, nanomedicine, "bio-nano" interactions, bio-inspired nanomaterials and biological imaging. He also works as the Assistant Dean of the Faculty of Engineering.

http://www.bme.cuhk.edu.hk/jchchoi/team.php

Prof. H.M. Kim CHOW (School of Life Sciences, The Chinese University of Hong Kong)

Professor Chow, member of NRND, is an assistant professor in the School of Life Sciences at The Chinese University of Hong Kong. She obtained her doctoral degree at the University of Hong Kong. Her main research interests are metabolic plasticity and neurodegenerative disorders, mitochondrial bioenergetics aging and cellular senescence. Professor Chow is a council member of the Society for Neuroscience and World Economic Forum, Global Future Council (GFC).

http://www.sls.cuhk.edu.hk/index.php/faculty-and-staff/teaching-staff/26-sls/faculty-and-staff/teaching-staff/617-professor-chow-hei-man-kim

Prof. Eileen KENNEDY (College of Pharmacy, University of Georgia, USA)

Professor Kennedy, member of NRND, is an associate professor in the College of Pharmacy in the University of Georgia. She earned her doctoral degree from the University of California, San Diego. Her research currently focuses on developing novel chemical biology strategies to synthetically disrupt protein:protein interactions (PPIs) using chemically stabilized peptides.

https://rx.uga.edu/faculty-member/eileen-kennedy-ph-d/

Prof. Owen H. KO (Department of Medicine and Therapeutics, The Chinese University of Hong Kong/ Prince of Wales Hospital, HKSAR, China)

Professor Ko, member of NRND, is an assistant professor in the Department of Medicine and Therapeutics Faculty of Medicine at The Chinese University of Hong Kong. He obtained his doctoral degree from the University College London. He is interested in the research of Visual neuroscience, Neurovascular biology and cerebral small vessels disease. Besides, he specialises in optical instrumentation, electrophysiology and image processing.

http://www.mect.cuhk.edu.hk/people/owenko.html

Prof. K.M. KWAN (School of Life Sciences, The Chinese University of Hong Kong, HKSAR, China)

Professor Kwan, member of NRND, is an associate professor in the School of Life Sciences at The Chinese University of Hong Kong. He obtained his doctoral degree from the University of Hong Kong. His main areas of interest are the genetic manipulation by transgenic and gene knockout technology, the study of Organogenesis and Tumorigensis, as well as neural development, neuronal cell biology and stem cell research.

http://www.sls.cuhk.edu.hk/index.php/faculty-and-staff/teaching-staff/26-sls/faculty-and-staff/teaching-staff/91-professor-kwan-kin-ming

Prof. S. L. LAM (Department of Chemistry, The Chinese University of Hong Kong, HKSAR, China)

Professor Lam, member of NRND, is an associate professor in the Department of Chemistry at The Chinese University of Hong Kong. He obtained his doctoral degree from The Chinese University of Hong Kong. Professor Lam's main areas of interest are biophysical chemistry of nucleic acids, development of Nuclear Magnetic Resonance (NMR) methods for structure determination of nucleic acids and the application of high-resolution NMR spectroscopy in biomedical analysis.

https://www.cuhk.edu.hk/chem/en/people/academic/lsl/index.html

Prof. K. F. LAU (School of Life Sciences, The Chinese University of Hong Kong, HKSAR, China)

Professor Lau, member of NRND, is an associate professor in the School of Life Sciences at The Chinese University of Hong Kong. He obtained his doctoral degree from The Chinese University of Hong Kong. His main areas of interest are the roles of the amyloid precursor protein (APP) interacting proteins in Alzheimer's disease, the role of APP in gene regulation, and the Molecular pathogenesis of neurodegeneration.

https://www.sls.cuhk.edu.hk/index.php/faculty-and-staff/teaching-staff/26-sls/faculty-and-staff/teaching-staff/92-professor-lau-kwok-fai

Prof. Jacky NGO (School of Life Sciences, The Chinese University of Hong Kong, HKSAR, China)

Professor Ngo, member of NRND, is an associate professor in the School of Life Sciences at The Chinese University of Hong Kong. He obtained his doctoral degree from the University of California San-Diego. He is interested in determining the structure, function and mechanism of proteins that are involved in the regulation of pre-mRNA slicing using a multidisciplinary approach, as well as the development of inhibitors for molecular targets in cancers and neurodegenerative diseases, and the structures and mechanisms of the inhibitors.

https://www.sls.cuhk.edu.hk/index.php/faculty-and-staff/teaching-staff/26-sls/faculty-and-staff/teaching-staff/101-professor-ngo-chi-ki-jacky

Prof. Faye TSANG (School of Life Sciences, The Chinese University of Hong Kong, HKSAR, China)

Professor Tsang, member of NRND, is an associate professor in the School of Life Sciences at The Chinese University of Hong Kong. She obtained her doctoral degree from The Chinese University of Hong Kong. Professor Tsang is interested in embryonic stem cells and their cardiac derivatives, ion channels and cardiovascular physiology, adult stem cells and cancer stem cells. She

also holds the position of Investigator in the State Key Laboratory in Agrobiotechnology and the Ministry of Education (MOE) Key Laboratories for Regenerative Medicine.

http://www.sls.cuhk.edu.hk/index.php/faculty-and-staff/teaching-staff/26-sls/faculty-and-staff/teaching-staff/96-professor-tsang-suk-ying-faye

Prof. Yi WANG (Department of Phyiscs, The Chinese University of Hong Kong, HKSAR, China)

Professor Wang, member of NRND, is an associate professor at the Department of Physics at The Chinese University of Hong Kong. She earned her doctoral degree from the University of Illinois at Urbana-Champaign. Her research focus lies in computational biophysics, more specifically the molecular dynamics simulations of membrane systems, selectivity of antimicrobial peptides and receptor-ligand binding affinity calculation.

http://www.phy.cuhk.edu.hk/people/wang-yi.html

Prof. Jack WONG (School of Life Sciences, The Chinese University of Hong Kong, HKSAR, China)

Professor Wong, member of NRND, is an assistant professor in the School of Life Sciences at The Chinese University of Hong Kong. He obtained his doctoral degree from The Chinese University of Hong Kong. Professor Wong's main areas of interest are vascular and metabolic biology, stem cell biology and cardiovascular regeneration. He is also active in the publishing field as a member of the editorial board of multiple journals, such as Annals of Vascular Medicine and Research, Vascular Medicine, Dataset Papers in Medicine and World Journal of Pharmacology.

https://www.sls.cuhk.edu.hk/index.php/faculty-and-staff/teaching-staff/26-sls/faculty-and-staff/teaching-staff/497-professor-wong-wing-tak-jack

Prof. Joan ZUO (School of Pharmacy, The Chinese University of Hong Kong, HKSAR, China)

Professor Zuo, member of NRND, is the Director and Professor of the School of Pharmacy at The Chinese University of Hong Kong. She obtained her doctoral degree from the University of Alberta. Professor Zuo's research focuses on biopharmaceutics, pharmacokinetics, pharmaceutical analysis and drug delivery technology, particularly that of herbal medicine, as well as herb-drug interactions investigations. Professor Zuo serves as journal reviewer for more than 50 international peer reviewed journals.

http://www.pharmacy.cuhk.edu.hk/1/about-us/academic-staff/joanzuo/

Overseas Members

Dr. Agnieszka CHARZEWSKA (Institute of Mother and Child, Poland)

Dr. Charzewska, member of NRND, is an independent researcher in the Medical Genetics Department of the Institute of Mother and Child in Poland.

http://www.imid.med.pl/en/clinical-activity/departments/departments/medical-genetics-department

Prof. Knud. J. JENSEN (University of Copenhagen, Denmark)

Professor Jensen, member of NRND, is a professor at the Department of Chemistry at the University of Copenhagen, where he obtained his doctoral degree. His research interests lie mainly in the self-assembly of peptides, small proteins, and peptide-oligonucleotide conjugates at the nanoscale, as well as peptide medicinal chemistry, chemoselective carbohydrate chemistry and chemical glycobiology. Professor Jensen is a member of the editorial board of ChemBioChem, ChemistrySelect and Journal of Peptide Science.

https://chem.ku.dk/ansatte/alle/?pure=en%2Fpersons%2Fknud-joergen-jensen(816e7a29-7615-4a4e-bfd2-f98150c116ab)%2Fcv.html

Prof. Sheng-han KUO (Columbia University Medical Center, USA)

Professor Kuo, member of NRND, is an assistant professor and principle investigator in the Department of Neurology, Division of Movement Disorders, at the University of Columbia. His primary clinical interest is ataxia, including hereditary ataxias, neurodegenerative ataxias, and acquired causes of ataxia. He has published articles in Neurology, Movement Disorders, and the Journal of Neuroscience.

http://www.columbianeurology.org/profile/shkuo

Prof. Florence MASCHAT (University of Montpellier, France)

Professor Maschat, member of NRND, is a professor at the Molecular Mechanisms of Neurodegenerative Diseases (MMDN) unit at the University of Montpellier. She obtained her doctoral degree at the University of Paris. Professor Maschat's research team focuses on Huntington's disease by studying neurophysiopathology in drosophila and mice. Since 2000, Professor Maschat works as the Research Director of the French National Centre for Scientific Research.

https://mmdn.umontpellier.fr/images/cv/cv-maschat.pdf

Prof. Maria Elena REGONESI (University of Milano-Bicocca, Italy)

Professor Regonesi, member of NRND, is an assistant professor at the Department of Biotechnology and Bioscience at the University of Milano-Bicocca, where she obtained her doctoral degree. Her main areas of interest are mechanisms governing stability, turnover and processing of bacterial mRNA. She is also interested in investigating the mechanisms of aggregation and toxicity of proteins responsible for neurodegenerative diseases. She is a member of the Milan Center for Neuroscience and of the Bicocca Center of Science and Technology for Food.

https://www.unimib.it/maria-elena-regonesi

Prof. Tiziano TUCCINARDI (University of Pisa, Italy)

Professor Tuccinardi, member of NRND, is an associate professor at the Department of Pharmacy at the University of Pisa, where he also obtained his doctoral degree. He is interested in drug and lead discovery, with a focus on computer-assisted approaches and medicinal chemistry, including synthesis of small molecules, virtual and biomolecular screening. He is a member of the editorial advisory board of various journals such as Drug Development and Therapeutics and Journal of Enzyme Inhibition & Medicinal Chemistry.

http://www.mmvsl.it/wp/group-members/tuccinardi/

Prof. Steven C. ZIMMERMAN (University of Illinois Urbana-Champaign, USA)

Professor Zimmerman, member of NRND, is a professor in the Department of Chemistry at the University of Illinois Urbana-Champaign. He obtained his doctoral degree from the Columbia Uni-

versity. Professor Zimmerman and his research team are interested in bio-organic chemistry, synthetic chemistry, dendrimers as drugs and drug delivery systems, as well as the design, synthesis, and evaluation of small molecules and polymers as drugs, drug and cell delivery agents, and imaging agents etc. He is also a professor of Biophysics and Computational Biology.

https://chemistry.illinois.edu/sczimmer

Other Non-academic Collaborators

Codex Genetics
Founded in 2013 and with the prime focus on managing genetic diseases, Codex aims to provide holistic, clinically-actionable disease management solutions to patients suffering from neurological disorders or cancers, through AI-powered analytics on both genetic and clinical data. Three products form the pillar of Codex's services: CoGenesis™ – Drug Response Test, CoGenesis™ Neuro - Genetic Screening Test, and CoGenesis™ Cancer – molecular profiling of tumors.

https://www.codexgenetics.com

Hong Kong Alliance for Rare Disease (HKARD)

HKARD was founded in 2014 as a support group for patients of all rare diseases, as well as their caretakers and families. With the support from experts and academics from the field, HKARD aims to improve policies and services for rare disease patients, raise public awareness and strengthen the community's support for patients. HKARD believes in the fundamental rights of rare disease patients to receive healthcare, social support and education.

http://www.hkard.org

Hong Kong Spinocerebellar Ataxia Association (HKSCAA)

Established in 2007, HKSCAA is an organization dedicated to improving the lives of spinocerebellar ataxia patients and their families. HKSCAA organizes activities to provide patients with social, emotional and educational support, at the same time representing their voices in social welfare and policies. HKSCAA also strives to boost public awareness about spinocerebellar ataxia and foster scientific research on the disease.

https://www.hkscaa.org

Our Work
Our Research Projects

1. Identification of novel gene mutations that cause rare neurodegenerative and neuromuscular diseases

After more than 4 years of research, Professor Edwin Chan and his colleagues identified a novel genetic mutation that leads to spinocerebellar ataxia (SCA). By means of next generation sequencing, the team first tracked down candidate disease-causing polymorphisms in the patients' genomes. With concerted experimental and bioinformatic effort, the researchers finally confined the SCA mutation to the coiled-coil domain containing 88C (CCDC88C) gene. Carriers of this gene mutation will develop SCA40.

This newly discovered form of SCA has been recognized as 'SCA40' by the Human Genome Organization Gene Nomenclature Committee and their accomplishment was published in the prestigious *Journal of Medical Genetics*. This further leads to identification of additional mutation in the same gene from Poland.

Identification of the novel gene mutation tremendously expands academic understanding on the underlying causes of SCA and opened up opportunities for scientists to provide genetic testing and counselling services to patients. It has also shed light on the potential cure of SCA.

Main publications:

Lenska-Mieciek, M., Charzewska, A., Krolicki, L., Hoffman-Zacharska, D., Chen, Z.S., Lau, K.F., Chan, H.Y.E., Gambin, T. and Fiszer, U. (2019) Familial ataxia, tremor, and dementia in a polish family with a novel mutation in the CCDC88C gene. Mov. Disord. 34, 142-144.

Tsoi, H., Yu, A.C., Chen, Z.S., Ng, N.K., Chan, A.Y., Yuen, L.Y., Abrigo, J.M., Tsang, S.Y., Tsui, S.K., Tong, T.M., Lo, I.F., Lam, S.T., Mok, V.C, Wong, L.K., Ngo, C.K., Lau, K.F., Chan, T.F.* and Chan, H.Y.E.* (2014) A novel missense mutation in CCDC88C activates the JNK pathway and causes a dominant form of spinocerebellar ataxia. J. Med. Genet. 51, 590-595.

Related news articles:

http://www.cuhk.edu.hk/english/features/professor-edwin-chan.html
https://www.scmp.com/news/hong-kong/article/1599657/discovery-new-gene-mutation-may-improve-ataxia-patients-lives
https://www.neurodegenerationresearch.eu/de/2014/09/hunting-down-a-gene-mutation-that-causes-a-novel-form-of-spinocerebellar-ataxia/
https://www.asianscientist.com/2014/09/in-the-lab/gene-spinocerebellar-ataxia/

2. Pathogenic mechanism studies of rare neurodegenerative and neuromuscular diseases.

Having dedicated years of work into pathogenic mechanisms, Professor Chan and his team have made remarkable progress in understanding the underlying causes of rare diseases. These new discoveries have made great contributions to biomedical sciences.

One case in point is the discovery of the role of Fuz protein in polyglutamine (polyQ) diseases, such as SCA and Huntington's disease. The team has unveiled the process through which the over-expression of Fuz protein leads to the death of neurons. A similar mechanism was also found in Alzheimer's disease, which shows that Fuz-mediated cell-death may play some common roles in neurological disorders. Professor Chan and his team are now searching for compounds that can bring Fuz dysregulation back down to a normal level. This would entail a cure for polyQ and Alzheimer's diseases.

Another of their research focuses lies on polyalanie (polyA) diseases, which include diseases such as oculopharyneal muscular dystrophy (OPMD) and congenital central hypoventilation syndrome (CCHS). In 2017, the team located the causes of the protein mislocalization that impairs the normal production of proteins, causing polyA diseases. Having identified this process, the team found out how to rectify it – by manipulating the protein eEF1A1. This discovery will provide insights into new therapeutic approaches to combat polyA diseases. This work was published in the prestigious scientific journal, *The Journal of Biological Chemistry*.

Publications:

Chen, Z.S., Li, L., Peng, S., Chen, F.M., Zhang, Q., An, Y., Lin, X., Li, W., Chan, T.F., Lau, K.F., Ngo, J.C., Wong, W.T., Kwan, K.M. and Chan, H.Y.E.* (2018) Planar cell polarity gene Fuz triggers apoptosis in neurodegenerative diseases. EMBO Rep. 19, e45419

Li L., Ng, N.K. Koon, A.C., Chan, H.Y.E.* (2017) Expanded polyalanine tracts function as nuclear export signals and promote protein mislocalization via eukaryotic translation elongation factor 1 alpha 1. J. Biol. Chem. 292, 5784-5800

3. Drug development for rare neurodegenerative and neuromuscular diseases

The first step to the lengthy process of developing a new drug is the discovery of drug candidate – a compound that shows therapeutic potentials. The study of pathogenic mechanism of rare diseases at NRND have led to some major breakthroughs in understanding polyQ diseases, presenting great potential for developing drugs to restrain and treat degeneration.

Professor Chan and the international team of collaborators (Ho Yu Au-yeung, Maria Elena Regonesi, Steven C. Zimmerman) discovered a small molecule compound termed AQAMAN in 2019,

which can potentially help patients of polyQ diseases, especially Machado-Joseph Disease, the most common form of spinocerebellar ataxias (SCAs).

Another promising discovery the novel drug candidate P3 (Edwin Chan, K.F. Lau, P.P. Li, Jacky Ngo, S. Peng, D.D. Rudnicki, H. Tsoi, Q. Zhang). P3 is a 13-amino acid peptide for poly-glutamine diseases, which include Huntington's Disease and several types of spinocerebellar ataxias. P3 is the first inhibitor in the world that can potently mitigate neurodegeneration in these diseases through neutralising toxic RNA. In recognition of this achievement, the US Patent and Trademark Office has granted this technology a patent.

Apart from P3, BIND can also suppress neurodegeneration in diverse polyQ diseases as well as C9ALS/FTD. Professor Chan and his colleagues (Jonathan Choi, Knud Jensen, Jacky Ngo, Yi Wang, Joan Zuo) are endeavouring to improve the stability of BIND in order to bring the study to the pre-clinical stage soon.

The discovery of AQAMANN, P3 and BIND is a major step forward in the development of therapeutics of rare diseases at its early stage. Once other institutions or pharma companies show interest in bringing these drug candidates into the clinical stage, members of NRND is happy to guide them, as consultants, on the long process of clinical validation and approval.

Publications:

Aggregation for Machado-Joseph-Associated Neurodegeneration (AQAMAN):
Hong, H., Koon, A.C., Chen, Z.S., Wei, Y., An, Y., Li, W., Lau, M.H.Y., Lau, K.F., Ngo, J.C.K., Wong, C.H., Au-Yeung, H.Y., Zimmerman, S.C., Chan, H.Y.E.* (2019) AQAMAN, a bisamidine-based inhibitor of toxic protein inclusions in neurons, ameliorates cytotoxicity in polyglutamine disease models. J. Biol. Chem. 294, 2757-2770 (Featured on the cover of the issue)

P3:
Zhang, Q., Tsoi, H., Peng, S., Li, P.P., Lau, K.F., Rudnicki, D.D., Ngo, J.C. and Chan, H.Y.E.* (2016). Assessing a peptidylic inhibitor-based therapeutic approach that simultaneously suppresses polyglutamine RNA- and protein-mediated toxicities in patient cells and Drosophila. Dis. Model. Mech. 9, 321-34

Beta-structured inhibitor for neurodegenerative diseases (BIND):
Zhang, Q., Chan, Z.S., An, Y., Liu, H., Hou, Y., Li, W., Lau, K.F., Koon, A.C., Ngo, J.C.K.* and Chan, H.Y.E.* (2018). A peptidylic inhibitor for neutralizing expanded CAG RNA-induced nucleolar stress in polyglutamine diseases. RNA 24, 486-498.

Zhang, Q., An, Y., Chen, Z.S., Koon, A.C., Lau, K.F., Ngo, J.C.* and Chan, H.Y.E.* (2019) A peptidylic inhibitor for neutralizing r(GGGGCC)exp-associated neurodegeneration in C9ORF72-associated amyotrophic lateral sclerosis and frontotemporal dementia. Mol. Ther. Nucleic Acids 16, 172-185

Publication

http://www.sls.cuhk.edu.hk/index.php/faculty-and-staff/teaching-staff?id=85:professor-chan-ho-yin-edwin&catid=26:teaching-staff)

Knowledge Transfer Activities

The lack of awareness and knowledge about rare diseases often lead to delayed diagnosis. Many patients and doctors mistake early symptoms as signs of common diseases and therefore miss the golden opportunity for a timely treatment. Recognizing that knowledge is power, Professor Chan and his colleagues initiate public awareness campaigns to empower the local community through

the dissemination of knowledge. Increasing public awareness is also a way to garner support for political advocacy and therefore instrumental in improving social security and life standards of patients.

What's next

- Promote the upcoming event or symposium scheduled for end Feb to early March

Technology Transfer Activities

Technology transfer is also a kind of knowledge transfer that aims at disseminating new knowledge so that as many people as possible can benefit from cutting-edge innovations developed by researchers. Moreover, technology needs to be transferred to pharmaceutical institutions with interests as well as the financial means to further develop a certain technology. An important step for technology transfer is to register the innovation through patents. Founder of NRND, Professor Edwin Chan has obtained U.S. Patents for two of his innovations and many other patent applications from various members of NRND are filed and pending.

Furthermore, when institutions express interest in developing a new drug with the patented technology, researchers of NRND could work as consultants throughout the clinical processes. Technology transfer ensures that innovations developed for further exploration are made available to the public and therefore maximises the benefits.

Rare Diseases Knowledge
FAQ

About Rare Diseases

1. Is there a definition of "rare disease"?
   The definition of rare disease differs from country to country, but it generally refers to diseases with between one to eight patients for every 10,000 people.[1]
   The government of Hong Kong has not established any official definitions of rare disease. The lack of definition denies many patients of a timely diagnosis, publicly funded medication and adequate social support.
2. How many rare diseases are there?
   There are between 6,000 and 8,000 rare diseases that are now recognised by the international community, among which 467 were identified in Hong Kong as of 2016. New types of rare diseases continued to be discovered every year worldwide.[2]
3. What causes rare diseases?
   Nearly all rare diseases are caused of genetic defects or mutation.[3] These can be passed onto one generation from the other.
   A very small minority of rare diseases can be caused by a variety of reasons including but not limited to rare forms of infection, allergies and environmental factors.
   In many cases, the exact cause remains unknown.
4. What are some examples?
   Some rare diseases identified in Hong Kong include Mucopolysaccharidosis, Pompe Disease, Infantile Cutaneous and Articular Syndrome, Tuberous Sclerosis Complex, Myelofibrosis, Marfan Syndrome, Rett Syndrome, Spinocerebellar Ataxia, Fabry Disease, Gaucher

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[1] Aronson, J. K. (2006). Rare diseases and orphan drugs. British Journal of Clinical Pharmacology, 61: 243-245. doi:10.1111/j.1365-2125.2006.02617.x

[2] Chiu, A., Chung, C., Wong, W., Lee, S. L., & Chung, B. (2018). Healthcare burden of rare diseases in Hong Kong - adopting ORPHAcodes in ICD-10 based healthcare administrative datasets. *Orphanet journal of rare diseases*, *13*(1), 147. doi:10.1186/s13023-018-0892-5

[3] Abbott, A. (2011). Rare-disease project has global ambitions, 472: 17. doi:10.1038/472017a

Disease, Achondroplasia, various forms of Osteochondrodysplasias, C9ALS/FTD, Myotonic Dystrophy and Huntington's Disease.

5. Can rare diseases be treated?
   Most rare diseases are unfortunately without treatment. For a lot of pharmaceutical companies, the number of patients of specific rare diseases is too small for the research and development of orphan drugs to be cost effective. The development of treatment therefore relies on public funding, government initiatives and private donations, which makes it an uphill battle. Although most rare diseases cannot be cured, for many cases an early diagnosis and proper medication can help control the disease and drastically slow down deterioration.
6. What is being done by NRND to develop treatments?
   Developing patient registry is the cornerstone of all medical research studies. Patient registries gather essential data for theoretic and clinical research. Since 2010, NRND has put in considerable effort in establishing a patient registry for SCA. Through the patient registry, dozens of patients obtained a definite diagnosis and new mutations have even been identified (See Our Research Project). The registry also gives researchers access to a larger gene pool, with which much research can be done to better understand the diseases. NRND hopes to expand the patient registry to other diseases, which will extensively aid researchers to study the underlying causes of rare diseases.

   Another important facet of the work of NRND is of course the research and development of novel drug candidates. Apart from P3, AQAMAN and BIND, members of NRND have also discovered the following drug candidates and are assisting in their drug development:

   For C9ALS/FTD:
   - BIND

   For myotonic dystrophy type 1:
   - Oligomer 4
   - PLG50-1/5, PDG50-1/5, PDLG50-1/5
   - 1a and 2a
   - Ligand 3
   - Ligand 5, 6 and 9

   For multiple polyQ diseases, such as Huntington's disease and several types of spinocerebellar ataxias
   - DB213

7. How long does it take to develop a new drug?
   Developing a new drug from conception to approval for marketing takes around 15 to 16 years.

   Upon finding a novel drug candidate, which takes several years of research, pre-clinical studies are initiated to evaluate its potential effectiveness. These studies are carried out in vitro (within the laboratory) as well as in animals and would normally take 5-6 years.[4] This stage is called "pre-clinical studies" and makes up the everyday work of NRND. Once various parameters are assessed (safety, carcinogenicity etc), clinical studies will begin.

   Clinical studies are phases of studies on human that focus on different pharmaceutical aspects. Phase 1 focuses on the safety of the drug candidate, its performance and effects on the body, and the determination of dosage. Phase 1 may take several months or more. Phase 2 focuses on the effectiveness of the drug, whether it does what it intends to on patients with the targeted disease and with what kind of side effects. This phase can take up

[4] Coloma, Preciosa. (2013). Phase 0 clinical trials: Theoretical and practical implications in oncologic drug development. Open Access Journal of Clinical Trials. 5. 119-126. 10.2147/OAJCT.S32978.

to a few years. The third phase of clinical studies is to confirm the drug's efficacy, evaluate safety and prove that regulatory requirements are met. It is an extensive process that typically takes several years, in multiple medical institutions and with as many patients as possible.[5] This drug can be marketed when the third phase clinical test is passed, and the drug approved. All three phases of clinical trials take eight to ten years on average.[6] Some drugs are required to undergo on-going post-market surveillance.

From initial discovery to the marketplace, introducing a new medicine successfully takes therefore 15 to 16 years. Many studies come to a halt during clinical studies because of scientific or bureaucratic hurdle. Indeed, only around 13.8% of drug development programmes make it from Phase 1 Clinical Studies to marketing, not to mention those that fail pre-clinical studies before clinical studies even begin.

See picture "developing a new drug.png"

8. How do I find out if I am prone to a rare disease?
   An early diagnosis of inherited rare diseases often means a timely treatment and improved care for patients of rare diseases and their family. If you have family members who have histories of rare diseases, genetic testing can ensure an early diagnosis.

About NRND

1. Why was NRND established?
   Nexus of Rare Neurodegenerative & neuromuscular Diseases (NRND) is a multi-disciplinary research network. NRND gathers a group of courageous scientists and clinicians with collegial and creative mindsets. We are devoted to unveiling novel genetic causes of rare neurodegenerative and neuromuscular diseases, to understand the pathogenesis of these rare disorders, as well as developing novel treatment strategies for these diseases. We provide up-to-date R&D information of rare neurodegenerative & neuromuscular diseases to patient support groups in the Asia-Pacific region.
2. When was NRND established?
   The collaborators have been working together since 2012. The network was formalized and named NRND in 2018.
3. What has NRND achieved so far?
   NRND helped develop a patient registry for SCA together with HKSCAA. Furthermore, Professor Chan and his colleagues have discovered and developed various novel approaches in treating different kinds of rare diseases. For more details of these projects, see "Our Research Projects".
4. How can NRND help patients of rare diseases and their families?
   NRND is devoted to uncovering the underlying causes of rare diseases. Only when the pathogenic mechanisms of the diseases are understood can treatment strategies be developed. In this way, NRND takes upon itself to improve medical care for patients of rare diseases.
5. How can I support NRND?
   Thank you for your interest in NRND! Please visit this page to find out how you can support the work of NRND.

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[5] Institute of Medicine (US) Committee on Accelerating Rare Diseases Research and Orphan Product Development; Field MJ, Boat TF, editors. Rare Diseases and Orphan Products: Accelerating Research and Development. Washington (DC): National Academies Press (US); 2010. 5, Development of New Therapeutic Drugs and Biologics for Rare Diseases. Available from: https://www.ncbi.nlm.nih.gov/books/NBK56179/

[6] Coloma, Preciosa. (2013). Phase 0 clinical trials: Theoretical and practical implications in oncologic drug development. Open Access Journal of Clinical Trials. 5. 119-126. 10.2147/OAJCT.S32978.

When diagnosed with a rare disease…

1. What can I do and what should I know?
   Being diagnosed with a rare disease is definitely a frightening experience for you and your family. However, it is important to know that you do not have to walk the journey alone. First of all, take the time to adjust and evaluate the situation. Join an organization which will connect you with other patients, with whom you can share information, support and experience. It is also important to learn about your disease and research as much as possible, through reading related materials and consulting a medical expert of the disease. Sign up for patient registries because they connect you with scientists who might be doing clinical trials. Last but not least, stay positive and do not hesitate to seek counselling when you are overwhelmed with grief and frustration.
2. Where can I find sources of financial support?
   The government subsidizes patients of six specified types of lysosomal storage disorder. The Community Care Fund Medical Assistant Programmes offer financial support for a small selection of rare diseases (For more information about the programme, see http://www.ha.org.hk/visitor/ha_visitor_index.asp?content_id=208076)
3. Where can I find sources of social support?
   Patients groups such as Hong Kong Alliance for Rare Diseases and Hong Kong Spinocerebellar Ataxia Association offer community programmes that foster mutual help and self-empowerment.
4. Can I sign up for clinical trials?
   Yes, participating in clinical trials can facilitate the development of treatments. You can first join a patient registry. Once clinical trials opportunities arise, you will be promptly contacted.

Global RD Updates

Media Coverage
- Updated (the latest six months)
- Past (on or before the latest six months)

Join Us

Thank you for your interest in NRND! Your financial support is crucial to our research programmes in rare diseases. Only with enough resources can we attract and work with the best scholars and experts around the world and to provide them with the technical support they need. Therefore, every contribution, no matter big or small, will directly impact the discovery and development of therapeutics for rare diseases – pathing the way to more breakthroughs and saved lives. You can support us by donating cash or doing voluntary work:

- **Donation**

- **Collaborators**
- ## **Clinicians & Researchers**
- **## Patient Groups**

- **Contact Us**

Icons
Social media (FB, Wechat, Youtube)