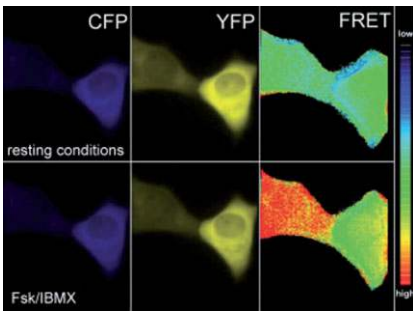
Signaling tools paper watch

Biotechnology Journal and sister journals

Functional proteomics glowing in the dark

This review aims to provide an overview of current optical procedures used in functional proteomics, investigating protein localization, protein-protein interaction, intracellular signaling events, and second messenger generation in living cells. Reporter assays using proteins tagged with fluorescent or bioluminescent moieties are discussed. Recently, intracellular biosensor assays, flow cytometry-based techniques (fluorescent cell barcoding), as well as transfected cell microarray assays involving RNA interference coupled with automated imaging were introduced and have been adopted as screening platforms for annotating small molecules, investigating signaling events, or in phenotype analysis. These novel methodological advances include improved image acquisition and processing techniques and help linking *in vitro* observations to *in vivo* processes. In addition, the acquired data are increasingly quantitative in nature and will therefore pave the way for modeling of signaling cascades and other complex cellular events, an important step toward systems biology.

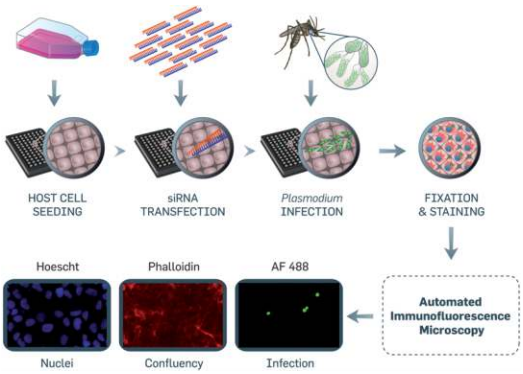


Prinz et al., Proteomics 2008, 8, 1179–1196.

http://dx.doi.org/10.1002/pmic.200700802

RNAi screens for host-pathogen interactions

Over millions of years pathogens have coevolved with their respective hosts utilizing host cell functions for survival and replication. RNA interference (RNAi) combined with recent developments in instrumentation and image analysis offers the use of high-throughput screening approaches to elucidate host gene functions exploited by pathogens. Although only a few RNAi-based screens focusing on host genes have been reported so far, these studies have already uncovered hundreds of genes not previously known to be involved in pathogen infection. Recent progress in RNAi screening approaches, highlighting both the limitations and the tremendous potential of RNAi-based screens for the identification of essential host cell factors during infection are reviewed here.

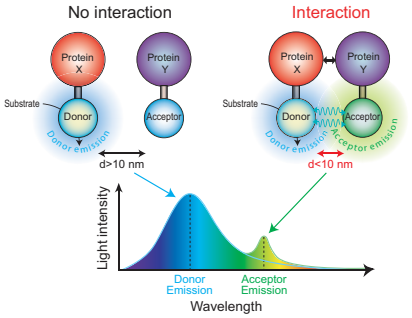


Prudêncio and Lehmann, Biotechnol. J. 2009, 4, 826–837.

http://dx.doi.org/10.1002/biot.200900071

Bioluminescent screening

Since its first description in 1999, the bioluminescence resonance energy transfer (BRET) has been described in several versions using different substrates and energy donor/acceptor couples. Today, BRET is considered as one of the most versatile techniques for studying the dynamics of protein-protein interactions in living cells. Various studies have applied BRET-based assays to screen new receptor ligands and inhibitors of disease-related proteases. Inhibitors of protein-protein interactions are likely to become a new major class of therapeutic drugs, and BRET technology is expected to play an important role in the identification of such compounds. This review describes the original BRET-based methodology, more recent variants and potential applications to drug screening.

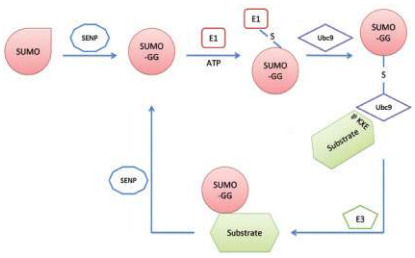


Bacart et al., Biotechnol. J. 2008, 3, 311–324.

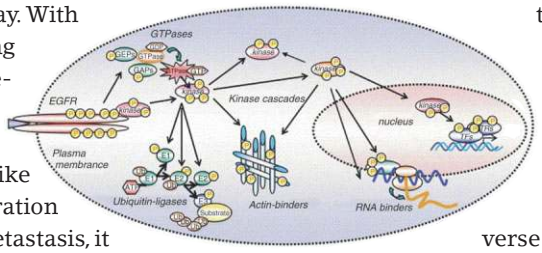
http://dx.doi.org/10.1002/biot.200700222

SUMOylation and cell signalling

SUMOylation is a highly transient post-translational protein modification. Like phosphorylation, acetylation and ubiquitination, SUMOylation has been associated with a number of



cellular processes. In addition to its nuclear role, important sides of mitochondrial activity, stress response signalling and the decision of cells to undergo senescence or apoptosis, have now been shown to involve the SUMO pathway. With ever increasing numbers of reports linking SUMO to human disease, like neurodegeneration and cancer metastasis, it is highly likely that novel and equally important functions of components of the SUMOylation process in cell signalling pathways will be elucidated in the near future. Recent advancements are reviewed here by researchers from Crete, Greece.



Andreou and Tavernarakis, Biotechnol. J. 2009, 4, 1740–1752.

http://dx.doi.org/10.1002/biot.200900219

Cell-based assays in GPCR drug discovery

G protein-coupled receptors (GPCRs) transmit extracellular signals into the intracellular space. They play key roles in the physiological regulation of virtually every cell and tissue and are a major class of drug targets. Sandra Siehler (Novartis, Basel, Switzerland) reviews cell-based assays for screening GPCR drugs. In the past receptor binding assays comprised the main readout for receptor activity but these approaches are now complemented by measurement of the intracellular responses to receptor activation. This allows for better discrimination of agonism and antagonism and investigation of those receptors for which labeled ligands are not readily available. The sheer number of assay readouts for these receptors highlights how basic biological knowledge intertwines with drug discovery and characterization.

Siehler, Biotechnol. J. 2008, 3, 471–483.

http://doi.wiley.com/10.1002/biot.200800001

Phosphoproteomics

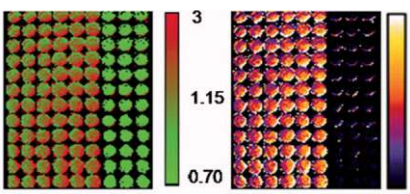
Current analytical protein methods show phosphorylation to be the most ubiquitous, evolutionary conserved post-translational modification. The reversible and transient nature of protein phosphorylation allows signal transduction pathways to carry out diverse cellular functions. Phosphorylation controls a variety of events at many biological levels including: housekeeping activities controlled by single cells such as DNA transcription, cell-cycle regulation, and energy metabolism; and cellular processes that involve signaling between cells or the environment including such as neuronal migration and immune system recognition. This review by authors from Boston (MA, USA) summarizes state-of-the-art proteomics technologies available to study phosphorylation in biological systems. The most recent steps that allow quantitative global analyses are highlighted while caveats in experimentation are pointed out.

Ozlu et al., WIRES Systems Biology and Medicine 2010, in press.

http://dx.doi.org/10.1002/wsbm.41

BRET for biosensors

Bioluminescence resonance energy transfer (BRET) systems have been dominated by use of blue-green *Renilla luciferase* (Rluc) as the energy donor. Although effective in many cases, the expense and unfavorable biochemical attributes of the substrate (phenylcoelenterazine) limit utility of Rluc-based BRET systems.



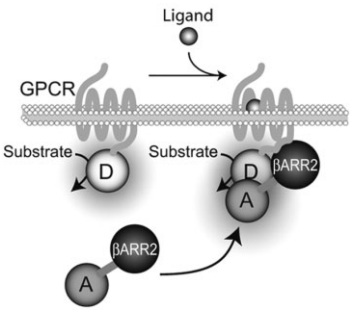
Researchers from Seattle (WA, USA) report a series of novel BRET pairs based on luciferases that utilize D-luciferin, resulting in red-shifted photonic outputs, favorable biochemical attributes, and increased efficacy. In addition a prototypical single-chain protease biosensor, capable of reporting on executioner caspase activity in live cells and real-time was generated. This biosensor can for example be used to monitor apoptosis *in vivo*.

Gammon et al., Biotechnol. Prog. 2009, 25, 559–569.

http://dx.doi.org/10.1002/btpr.144

BRET assays in all colors

G protein-coupled receptors (GPCRs) play a central role in the signal transduction of an enormous array of bio-



logical stimuli. GPCR activation initiates their feedback desensitization mediated by GPCR kinases and β-arrestin (β-ARR) proteins. Researchers from France present and evaluate highly sensitive bioluminescence resonance energy transfer (BRET) assays with optimized donor/acceptor couples. Energy donors from Renilla luciferase (Rluc) were combined with the acceptors yellow fluorescent protein, the YPet variant and the Renilla green fluorescent protein (RGFP). Different donor/acceptor couples were tested in well-established assays measuring ligand-induced intramolecular rearrangements and recruitment to GPCRs. The results show increased sensitivity with Rluc8/YPet and Rluc8/RGFP couples and measured previously undetectable BRET signals. These tools improve existing

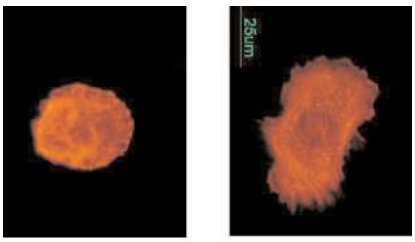
β-ARR assays and offer new options for the development of future BRET assays.

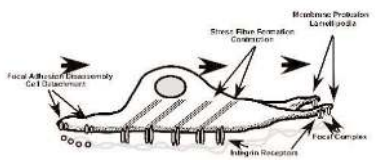
Kamal et al., Biotechnol. J. 2009, 4, 1337–1344.

http://dx.doi.org/10.1002/biot.200900016

Label-free cell-based assays for drug discovery

Cell-based assays are an important part of the drug discovery process. Conventional label and reporter-based cell assays may be more prone





to artifacts due to considerable manipulation of the cell either by labeling or overexpression of targets or reporter proteins. Cell-based label-free technologies preclude the need for cellular labeling or over expression of reporter proteins, utilizing the inherent morphological and adhesive characteristics of the cell as a physiologically relevant and quantitative readout for various cellular assays. Furthermore, these technologies utilize non-invasive measurements allowing for time resolution and kinetics in the assay. In this article, researchers from San Diego (CA, USA) review the various label-free technologies that are being used in drug discovery settings.

Xi et al., Biotechnol. J. 2008, 3, 484–495.

http://doi.wiley.com/10.1002/biot.200800020

FRET *vs.* BRET

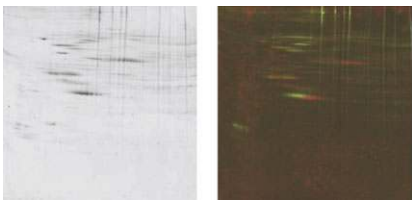
Since most of the functions in cells are mediated by multimeric protein complexes, the determination of protein-protein interactions is an important step to study cellular signaling. The traditional methods start with screening for possible target interactors for example by a yeast two-hybrid screen. However, several methods are needed to validate the initial result before carrying out functional experiments. Nowadays, non-invasive fluorescence-based methods like Bioluminescence Resonance Energy Transfer (BRET) and Fluorescence Resonance Energy Transfer (FRET) are widely used in the study of protein-protein interactions in living cells. Here, authors from Barcelona, Spain, address the individual strengths and weaknesses of both RET approaches, providing information on their possible future use in the study of G protein-coupled receptor oligomerization.

Gandía et al., BioEssays 2008, 30, 82–89.

http://dx.doi.org/10.1002/bies.20682

Fluorescence switch for S-nitrosylation

Protein S-nitrosylation is a reversible post-translational modification of protein cysteines that is increasingly being considered as a signal transduction mechanism. The biotin switch technique marked the beginning of



the study of the S-nitrosoproteome. It is based on the specific replacement of the S-nitrosylation by biotin allowing for detection and purification. However, its application for proteomic studies is limited by its relatively low sensitivity. Therefore, Antonio Martínez-Ruiz and co-workers developed a fluorescence switch technique that can be coupled to 2-D proteomic methodologies. They have applied this new method to detect S-nitrosylated proteins in endothelial cells identifying already known as well as potential novel target proteins. This fluorescence switch approach can now be used to identify further S-nitrosylated proteins in different cells and physiological settings.

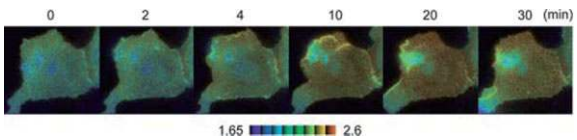
Tello et al., Proteomics 2009, 9, 5359–5370.

http://dx.doi.org/10.1002/pmic.200900070

Signaling methods in Current Protocols

In vivo imaging with FRET

Genetically encoded FRET probes enable us to visualize a variety of signaling events such as protein phosphorylation and G-protein activation in living cells. This unit in *Current Protocols* focuses on FRET probes wherein both the donor and acceptor are fluorescence proteins and incorporated into a single molecule, *i.e.*, a unimolecular probe. Advantages of these probes lie



http://www.currentprotocols.com

in their easy loading into cells, simple acquisition of FRET images, and clear evaluation of data. The authors from Kyoto, Japan, have developed FRET probes for Ras-superfamily GTPases,

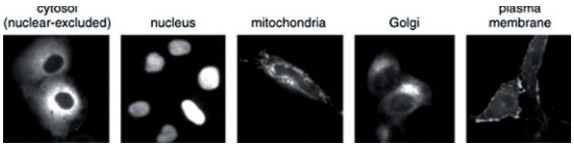
designated Ras and interacting protein chimeric unit (Raichu) probes. Here they discribe strategies to develop Raichu-type FRET probes, procedures for their characterization, and acquisition and processing of images. Although improvements upon FRET probes are still based on trial-and-error, practical tips for their optimization are provided and the theory and applications of unimolecular FRET probes are discussed.

Nakamura and Matsuda, Curr. Protoc. Cell Biol. 2009, 45, 14.10.1-14.10.12.

http://dx.doi.org/10.1002/0471143030.cb1410s45

Visualizing kinase signaling

The advent of genetically encoded FRET-based kinase activity reporters has opened up a new era of signal transduction research. Such reporters allow the direct monitoring of kinase activity in live cells at specific locations, providing unprecedented information on the spatiotemporal dynamics of kinase signaling. Specifically, FRET-sensitive conformational changes in the reporters following phosphorylation serve as a direct readout of kinase activity. These genetically encoded reporters allow not only temporal resolution of kinase activity, but also spatial resolution: by fusing appropriate targeting sequences, reporters can be positioned at specific subcellular locations. Authors from



the University of California, La Jolla (CA, USA) presented a strategy to generate and target kinase activity reporters to discrete intracellular regions to measure kinase signaling in live cells.

Kunkel and Newton, Curr. Protoc. Chem Biol. 2009, 1, 17–28.

http://dx.doi.org/10.1002/9780470559277.ch090106

Signaling book highlights

Bacterial signaling

Reinhard Krämer and Kirsten Jung (Eds.)
Wiley-VCH, Weinheim 2010, 513 pp.
ISBN: 978-3-527-32365-4

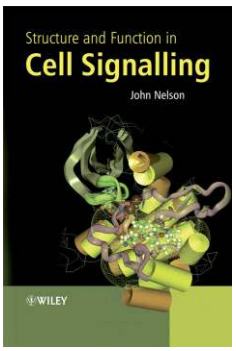
Not only cells are capable of cellular signaling, but also bacteria. This book entiteled *Bacterial Signaling* is providing a comprehensive insight into cellular signaling processes in bacteria. It is the first book to cover intercellular, transmembrane, as well as intra-cellular signaling and its relevance for biofilm formation, differentiation, host pathogen interactions, symbiotic relationships, chemotaxis and various stress responses. In addition, the book deals in detail with principal bacterial signaling mechanisms – making this a valuable resource for all advanced students in microbiology. While the editor Reinhard Krämer is an expert in intracellular signaling and its implications for biotechnology processes, Kirsten Jung is interested in intercellular communication and transmembrane signaling.

http://eu.wiley.com/WileyCDA/WileyTitle/productCd-3527323651.html

Reinhard Krämer is chair in Biochemistry at Cologne University, Germany. During his scientific career, R. Krämer has focused on different aspects of membrane transport proteins, both in mitochondria and in prokaryotes, as well as on stress response in bacteria, in particular osmotic stress.

Kirsten Jung is professor and chair for Microbiology at the Ludwig-Maximilians-Universität Munich. Research of Kirsten Jung is focused on the molecular mechanisms of stimulus perception by sensor kinases involved in environmental stress response.

Structure and function in cell signalling

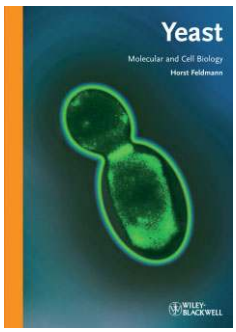


John Nelson
John Wiley & Sons, Chichester 2008, 410 pp.
ISBN: 978-0-470-02551-2

This book is a concise and accessible introduction to the dynamic but complex field of signal transduction. Rather than simply cataloguing all signalling molecules and delineating every known pathway, this book aims to break signalling down into common elements and activities – the 'nuts and bolts' of cellular information exchange. With an emphasis on clarity of presentation throughout, the book teaches the basic principles focusing on a mature core of knowledge, providing students with a foundation of learning in this complex and potentially confusing subject. It also addresses the issue of variation in the numbering of key amino acids as well as featuring interaction with RasMol software, and exercises to aid understanding. The book includes (i) an accessible introduction to the complex field of cell signaling; (ii) it interacts with RasMol software – freely downloadable for viewing structures in 3D (iii) it includes exercises and clear instructions in the use of RasMol and (iv) well illustrated in full colour throughout. *Structure and Function in Cell Signalling* is an invaluable resource to students across a range of life science degree programmes including biochemistry, cell and molecular biology, physiology, biomedicine and oncology. This book provides a clear, accessible introduction to this rapidly expanding field.

eu.wiley.com/WileyCDA/WileyTitle/productCd-0470025514.html

Yeast: Molecular and cell biology



Horst Feldmann
Wiley-VCH, Weinheim 2009, 348 pp.
ISBN: 978-3-527-32609-9

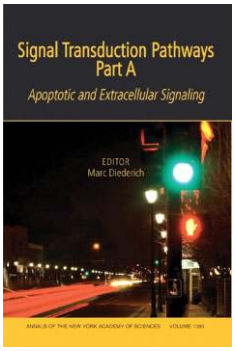
Yeast is one of the oldest domesticated organisms and has both industrial and domestic applications. In addition, it is very widely used as a eukaryotic model organism in biological research and has offered valuable knowledge of genetics and basic cellular processes including cellular signaling. In fact, studies in yeast have offered insight in mechanisms underlying ageing and diseases such as Alzheimers, Parkinsons and cancer. Yeast is also widely used in the lab as a tool for many technologies such as two-hybrid analysis, high throughput protein purification and localization and gene expression profiling. The broad range of uses and applications of this organism undoubtedly shows that it is invalubale in research, technology and industry. This book is an up-to date resource providing a comprehensive account of yeast biology and its use as a tool and model organism for understanding cellular and molecular processes of eukaryotes. Topics covered range from the fundamentals of yeast biology such as cell structure, biochemistry, genetics and signaling, to current approaches and applications such as metabolomics, disease models and uses in biotechnology. Written by a top expert in the field, this book offers an invaluable companion to beginners and experts in yeast research.

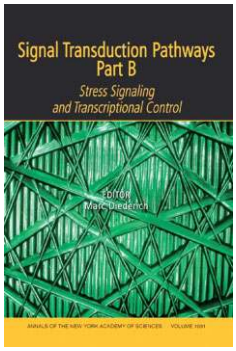
http://eu.wiley.com/WileyCDA/WileyTitle/productCd-352732609X.html

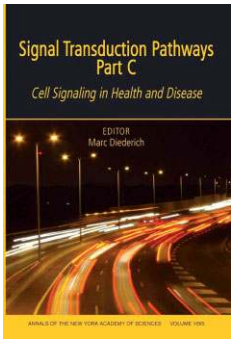
Horst Feldmann studied Organic Chemistry in Cologne and did his PhD in this discipline. After working at the Institute of Genetics in Cologne he became Professor of Physiological Chemistry at the Medical Faculty in Munich in 1974. His pioneering research included sequencing yeast tRNA. He extensively studied tRNA and protein biogenesis, yeast retrotransposons and mitochondrial genome.

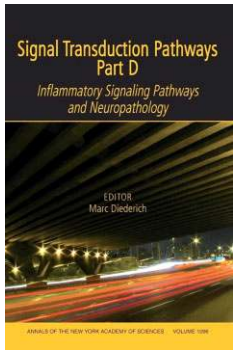
BTJ-FORUM

Signal transduction pathways









Annals of The New York Academy of Sciences
Marc Diederich (Ed.)
Wiley-Blackwell 2007

Part A – Apoptotic and extracellular signaling
ISBN: 978-1-57331-645-3, 400 pp.

Part B – Stress signaling and transcriptional control
ISBN: 978-1-57331-647-7, 400 pp.

Part C – Cell signaling in health and disease
ISBN: 978-1-57331-695-8, 592 pp.

Part D – Inflammatory signaling pathways and neuropathology
ISBN: 978-1-57331-697-2, 288 pp.

Keynote speakers at the *Cell signaling meeting* in Luxembourg have provided chapters on hypoxia signal transduction, phosphoserine/threonine-binding domains, targeting of polycomb repressive complexes, conserved signaling mechanisms in innate immunity, and signal transduction by stress-activated MAP kinases. Other topics included among these reports on recent research are receptor signaling, protein kinase cascades as therapeutic targets, cell death in cancer, inflammation-specific signaling, cell signaling pathways leading to regulated chromatin modifications, and transcriptional control. The chapters have been published in four volumes (Part A to D), offering a comprehensive overview about this exciting topic.

Part A: This first focuses on basic research, and the chapters are divided into the following sections: apoptotic cell signaling mechanisms, extracellular matrix interactions, and MAP kinases.

Part B: This second volume focuses on basic research, and the chapters are divided into the following sections: oxidative stress, transcriptional control, HDAC, and novel technological and therapeutic approaches.

Part C: This third volume focuses on the therapeutic potential for targeting cell signaling mechanisms with particular attention to cell signaling in healthy systems as well as in disease. Cancer therapies and the important area of chemoprevention are included.

Part D: This fourth volume focuses on inflammatory signaling pathways and the role of signaling pathways in neuropathological conditions including depression, schizophrenia, Alzheimer's disease, and other senile dementias.

http://eu.wiley.com/WileyCDA/WileyTitle/productCd-1573316458.html

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BioEssays highlights

http://www.bioessays-journal.com

Cover story: Imaginal discs

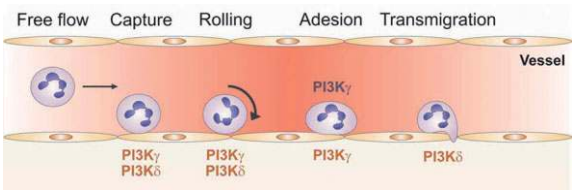
Could imaginal discs in insects prove to be an important model for regenerative biology? Authors from Barcelona, Spain, present a summary of current research into imaginal disc regeneration and discuss the power of this tissue as a tool for understanding the genetics of regeneration. See the review *Imaginal discs: Renaissance of a model for regenerative biology* Images show blastema formation in wing discs that have been cultured for 2 days. Immunostaining reveals mitotic cells (red, stained with anti-HP3), JNK activation (green, staining of puckered (puc) expression) and the dorsal-ventral boundary (blue, stained with anti-Senseless).

Bergantiños et al., Bioessays 2010, 32, 207–217.

http://dx.doi.org/10.1002/bies.200900105

PI3k inhibition in inflammation

Inflammation is one of the first responses to bodily insult or injury, the characteristic red marks showing shortly afterward, as part of the innate response to immune challenges. The stars in this drama include four heteroduplex enzyme complexes: phosphotidylinositol 3-kinases PI3Kα, β, γ, and δ. Their principal job is to rally the leukocytes at the scene of the crime by phosphorylating phosphoinositides, which serve as chemoattractants. The authors from Torino, Italy, review the enzymes' performance on several stages simultaneously – attracting leukocytes and mast cells to the site of wounds, autoimmune diseases (rheumatoid arthritis, lupus), asthma, and cardiovascular diseases that all can be modulated by restraining the appropriate PI3K players.

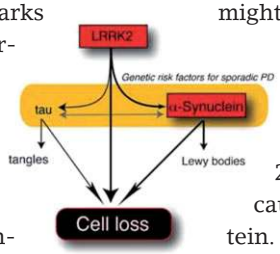


Ghigo et al., Bioessays 2010, 32, 185–196.

http://dx.doi.org/10.1002/bies.200900150

A three-legged stool for Parkinson's disease?

For some diseases it is fairly clear what the cause is. Bacterial and viral infections obey Koch's postulate. They are like the one-legged stool my grandmother used when milking cows – you only had to knock out the one leg and your brother was on his back. Knock out one virus type and you've beat a flu pandemic. Other "sporadic" diseases are more challenging to explain. Given two similar diseases, a genetic form might (or might not) help explain a sporadic form. Parkinson's disease presents as both genetic and sporadic. Two genes – a-synuclein and leucine-rich repeat kinase 2 (LRRK2) contribute to the cause, along with tau, a third protein. Now to explain how…

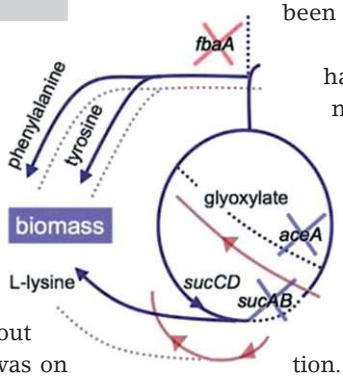


Taymans et al., Bioessays 2010, 3, 227–235.

http://dx.doi.org/10.1002/bies.200900163

Alternative metabolic routes

As a metabolite in a hurry, you don't want to know that your target enzyme is knocked out or that there has been a perturbation. The cell does have some alternate routes. The last time this happened, productivity went up due to a compensatory perturbation. Shutting down a bypass kept the system running. The availability of alternative routes, redundancy, and room for improvement all contribute to survival. At maximum efficiency for a particular set of conditions, an organism would only need 300 genes but would have no flexibility. The concepts of network perturbation presented here will help in drug design, improved industrial productivity, brain development research, and other areas of biomedicine.



Motter, Bioessays 2010, 3,236–245.

http://dx.doi.org/10.1002/bies.200900128

Biotechnol. J. 2010, 5, 347–356

Biotech round the world: Indonesia

Facts and figures

The Republic of Indonesia is located in Southeast Asia and Oceania compromising of more than 17 000 islands. It is the world's fourth most populous country with around 230 million people. The nation's capital city is Jakarta. The country shares land borders with Papua New Guinea, East Timor, and Malaysia. Other neighboring countries include Singapore, Philippines, Australia, and the Indian territory of the Andaman and Nicobar Islands. Indonesia consists of distinct ethnic, linguistic, and religious groups with the Javanese as the largest and most politically dominant ethnic group. The majority of the people are muslims.

In contrast to its large popupulation and densely populated regions, Indonesia has vast areas of wilderness with the world's second highest level of biodiversity. Although the country is richly endowed with natural resources, poverty remains widespread in contemporary Indonesia. On the other hand, Indonesia has a high agricultural strength and doubled the cereals production between 1979 and 2004, and almost quadrupled meat production for the same time period. Yet the Indonesian archipelago is affected by severe natural disasters including earthquakes and tsunamis.

http://www.fao.org/countries/55528/en/idn
https://www.cia.gov/library/publications/the-world-factbook/geos/id.html

Biotech instituts

IndoBIC – The Indonesian Biotechnology Information Centre

The IndoBIC (Indonesian Biotechnology Information Centre) was established initially in 2003 as the cooperation between the International Service for the Acquisition of Agri-biotech Applications (ISAAA) and the Southeast Asian Regional Centre for Tropical Biology (SEAMEO BIOTROP). IndoBIC, as one of the regional network of Biotechnology Information Centres (BIC) in Southeast Asia, is expected to strengthen the links it has made and the partnerships being established. While focusing on effective communication strategies to bring across information on biotechnology, it hopes to explore further other tools to widen its reach, and maintain its credibility so that it can be the regional hub of relevant and accurate information on agricultural biotechnology.

Special programs include

- Seminars/workshops/conferences for decision-makers, journalists, researchers, industries and public, depending on their needs and competencies
- Training courses for researchers, teachers, journalists and university staff in popularizing scientific information on biotechnology
- Production of communication material for television, radio, newspapers (video/cassettes, CD-ROM, printed materials) and development of websites
- Support for scientific journals, proceedings and semi-popular publications on biotechnology such as organized by the Indonesian Association of Agricultural Biotechnologists (PBPI)
- Article-writing competitions on biotechnology perception and appreciation for high school and university students, the public and journalists.

http://www.indobic.or.id

The Indonesian Center for Biodiversity and Biotechnology (ICBB)

The Indonesian Center for Biodiversity and Biotechnology (ICBB) is a member of World Federation of Culture Collection and Word Data Center for Microorganisms. The center encourages research, conservation, utilization, policy and management of Indonesian biodiversity and biological resources. This center was created after several years of experience on developing concepts, strategies, and policies for resource development

and biotechnology research. Current developments (between 2009 and 2013) aim to continue the inventory of all terrestrial species found in Indonesia, and explore marine biological resources and their potential for biotechnology industry, to enhance utilization and promotion of biological richness. Other research topics include all areas related to biodiversity and development of biological resources in the area of antibiotic research, development of metagenomic libraries, enzymology, agriculture, environmental risk assessment of transgenic plants and development of environmental biotechnology.

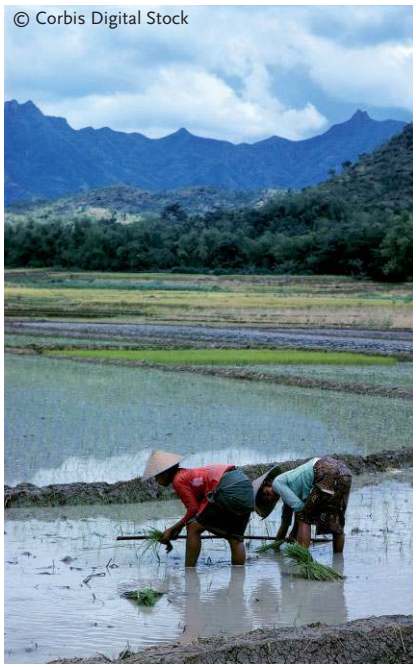
Collaborations and strategic alliances: As a key mission the ICBB sets up strong collaborations strategic alliance with private and public institutions, government and non-government organizations, profit and non-profit, at national as well as international level. Current collaborations include:

- The German Research Center for Biotechnology (GBF), Braunschweig, Germany
- Pharma Research Center, Life Science Center Natural Product, Bayer AG, Germany
- The College of Pharmacy, Oregon State University, Corvallis, US
- Bogor Agricultural University, Bogor, Indonesia
- Kehati Foundation, Jakarta, Indonesia
- Nastari Foundation, Bogor, Indonesia
- PT Saraswanti Anugerah Makmur, Surabaya, Indonesia

Biotech companies

For the pupose of maintaining and conducting research activities the ICBB also established profit organizations:

PT Saraswati Indo Genentech (PT SIG): The PT SIG works on the detection of genetically modified organisms in plants, grains, foods and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feeds. In 2004 the company was certified by National Accreditation Committee (KAN) as the first and the only company in Indonesia that has capacity for detection of GMO. During 2004–2005, PT SIG expanded its capacity and became one of the leader company in the field of food analysis.

PT Inti Cipta Biotek Bijana (PT ICBB): To utilize and commercialize research products of the Indonesian Center for Biodiversity and Biotechnology as well as broad experties of ICBB's members, the ICBB has established the PT ICBB. It provides high quality, selected clones and seeds of Jatropha curcas and plants for forest rehabilitation, ornamental plants as well as traditional medicinal plants. The company produces also humic acid for enhancing plant growth and develop water based renewable energy (micro-hydro) and conducts bioremediation of crude oil and heavy metals contaminated areas and wastes. In the field of consultancy, the company doing services for sustainable agriculture, resource management, environment, water and solid waste management and renewable energy.

http://icbb.or.id

The Indonesian Culture Collection of Microorganisms

During the early development of the ICBB, the main activity is to develop the *Indonesian Culture Collection of Microorganisms*. With almost 10 000 isolates in the ICBB-Culture Collection it is now the largest collection of microorganisms in the whole country. 2926 of the isolates have been studied in more detail and 1188 strains were already identified by conventional as well as 16S ribosomal RNA gene sequencing

http://icbb.or.id

The Indonesian Agency for Agricultural Research and Development (IAARD)

The Indonesian Agency for Agricultural Research and Development (IAARD) is the research arm of the Indonesian Ministry of Agriculture. It is consisting of eleven research and development centers in which each of them has the main function to manage research and development on food crops, horticulture, estate crops, livestock, veterinary, soil and agro-climate, agro-socio economics, machinery development, post-harvest, biotechnology and agricultural technology assessment. Within these centers, the IAARD manages 15 research institutions, 3 research stations and 31 assessment institution located throughout the provinces in the country.

http://iaard.go.id/about


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LIPI – Research center for biotechnology

The LIPI is called *Lembaga Ilmu Pengetahuan Indonesia* and is the Indonesian Institute of Sciences, the governmental authority for science and research in Indonesia. It consists of 47 research centers in the fields ranging from social to natural sciences.

This research center for biotechnology at the LIPI was established in January 1986 within the framework of the development and use of biotechnology in Indonesia. Since then it has developed into a leading center of agricultural biotechnology.

The LIPI provides

- Preparation of material for research policy studies
- Formulation of guidelines, guidance, and providing technical assistance in the field of biotechnology
- Implementation of plans, programs, and implementation of biotechnology research.
- Monitoring biotechnology research
- Service for science and technology in the field of biotechnology
- Evaluation and compilation of biotechnology research report.
- Implementation of administrative affairs.

http://biotek.lipi.go.id
http://www.lipi.go.id

Indonesia's Biosafety Clearing House (BCH)

The Biosafety clearing house is one of the requirements to be implemented for countries ratifying the *Cartagena Protocols on Biosafety* to the Convention on Biodiversity, in accordance with article 20 of the Protocol. Indonesia has ratified the protocol and has issued Government Regulation No.21 (2004) on biosafety to the convention on biological diversity. In a meeting of the taskforce on biosafety organized by the Ministry of Environment and the meeting on the cartagena protocol organized by an NGO, Yayasan KEHATI, The Indonesian Institute of Science (LIPI), which is a neutral scientific and research institution, was proposed as the appointed host for the Indonesia Biosafety Clearing House. For more information visit:

http://www.indonesiabch.org

Drug companies enter Indonesia

An increasing number of Pharmaceutical (Pharma) companies are targeting emerging markets. Indonesia is starting to gain considerable attention due to their burgeoning healthcare systems. A recent report by the independent market analyst Datamonitor shows that Pharma's interest in Indonesia and the Philippines will rise as both are currently reforming and expanding their respective healthcare systems.

Since Indonesia is the fourth most populated country in the world, it has a large patient population. The introduction of a full universal health insurance is a needed step to increase access to healthcare, given that only 26% of the Indonesians are covered by health insurance and the fact that they often find medications to be unaffordable. This is one of the primary aims of the government, which targets to cover all its citizens by 2013. However, given the large size of its population and the low current coverage, opportunities for the Pharma industry will likely only be seen in the long run. Indonesians without coverage opt for cheaper drugs, namely branded generics that are usually produced by the local industry. In the long run, Indonesia will offer a larger market where multinationals can better position its high-value drugs due to a more Western disease pattern.

http://www.datamonitor.com

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