Aims and Objectives

°A study on biology and application potential of polar organisms: cold-adaptation mechanism and bioinformatics

- · To define cold-adaptation mechanism of polar organisms
- · To develop polar organisms as an application bioresource
- · To construct a hub-network of polar bioinformatic database

Research goal	Preliminary-phase (2011-2013)	First-phase (2014-2016)
Antarctic organisms: Cold-adaptation mechanism and it's application	Research based on polar genomics	Construction of polar genomic information using NGS platform
		Construction of polar proteomic information
		Construction of polar environmental genomic information
	Research based on polar proteomics	Profiling genomic and proteomic properties of cold-adapted polar organisms
		Analyses of cellular signaling and controling network
	Research based on application study using polar bioresources	Functional study of cold-adapted proteins based on 3-D protein structure
		Characterization of cold-adapted proteins
		Development of multiplex biomarkers
		Application study using polar genes and proteins
Achievements	Construction of research platform	· Establishment of bioinformatic tools for processing polar omics dataset · Determination of adaptation mechanism of polar organisms · Application study using new polar bioresources

Research Methods

°Bioinformatic study on polar biology

- · Research approaches using genetics, transcriptomics, and proteomics
- · Discovery of cold-adapted genes and proteins
- · Analysis of gene structure
- · Construction of standard proteomics maps
- · Analysis of regulatory genes and proteins

°Cold-adaptation mechanism of polar organisms

- · Analysis of cold-adapted molecular signaling mechanism
- · Analysis of differential gene expression driven by variety of different polar environmental factors
- · Analysis of protein activity and determination of 3-D protein structure

°Application study based on polar bioinformatics

- · Development of cold-tolerant organisms
- · Development of cold-active enzymes
- · Development of biomarkers involved in cold-adaptation mechanism

www.kopri.re.kr

A-Cold

Antarctic organisms

Cold-adaptation mechanism and it's application

Polar Climate Change Research

Polar Earth-System Sciences

Polar Life Sciences

Polar Ocean Environment

Arctic Research

Promotion Program

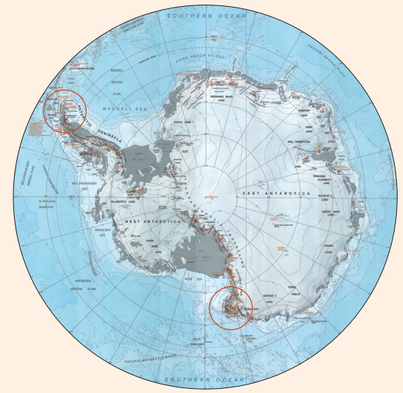
KOPRI
Korea Polar Research Institute

26 Songdomirae-ro, Yeonsu-gu,
Incheon, 406-840, Korea
Tel. +82-32-770-8400

KOPRI 극지연구소 Korea Polar Research Institute

Division of Polar Life Sciences

Principle Investigator	Park, Hyun
E-Mail	hpark@kopri.re.kr
Partner Organizations	Eight institutions in the US, Italy, Japan, and Chile.
Research Duration	2014. 1 ~ 2016. 12 (total: 3yr)
Research Area	· King George Island, Antarctica · Terra Nova Bay, Antarctica



Research Background

°Since the Convection on Biological Diversity (CBD) and ABS (Access to genetic resources and Benefit-Sharing) entered into force, the US, Japan, EU, England, Russia, China, etc are currently in talks to admit the nation's sovereignty over bioresources.

°Since most of developed countries have recognized polar organisms as strong future resources and works on application studies, their researches have been focusing on systematic screening and collection of marine organisms and a large scale of Omics research.

°Consequently, fundamental studies on polar bioresources, as well as application approaches, are considered critical subject to Korean government, operating scientific stations in both the Arctic and Antarctica.

Personnels

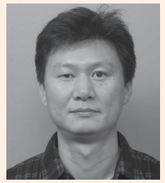
Principal Investigator

Park, Hyun

· Polar genomics
· hpark@kopri.re.kr

Kim, Dockyu

· Environmental microbiology
· envimic@kopri.re.kr



Kim, Han-Woo

· Protein engineering
· hwkim@kopri.re.kr

Lee, Hyoungseok

· Plant Biology
· soulaid@kopri.re.kr

Lee, Jungeun

· Plant genomics
· jeleef@kopri.re.kr

Lee, Jun Hyuck

· Protein structural biology
· junhyucklee@kopri.re.kr

Lee, Sung Gu

· Polar proteomics
· holynine@kopri.re.kr

Seo, Tae-Kun

· Evolutionary biology
· seo.taekun@kopri.re.kr

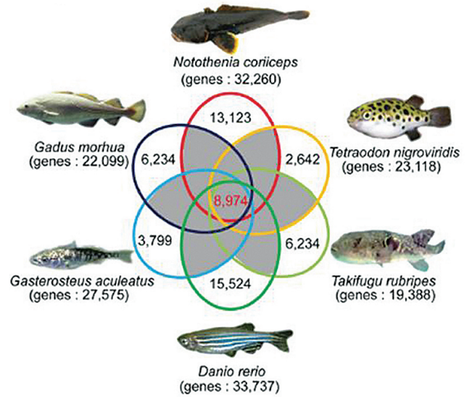
Shin, Seung Chul

· Genomics
· ssc@kopri.re.kr

Overall Outcomes

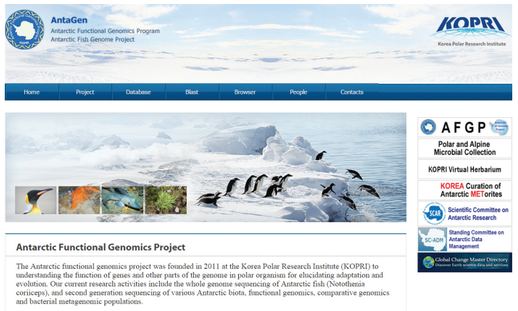
° Complete genome of Antarctic fish, the first case for the Antarctic higher animal

· Sequenced 650 Mb complete genome of the Antarctic cod
· Identifed 13,000 unique genes comparing other fish
· Published to the Genome Biology (IF 10.5, JCR rate 2.4%)



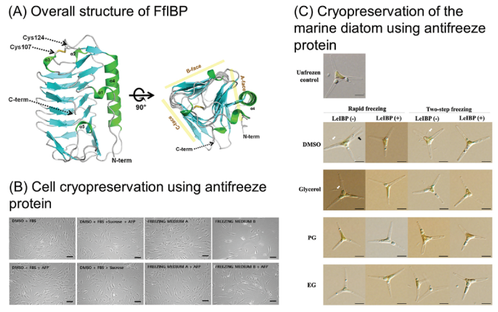
° Constructed the genomic database of the Antarctic cod

· Established intra- and international collaboration platform
· http://antagen.kopri.re.kr



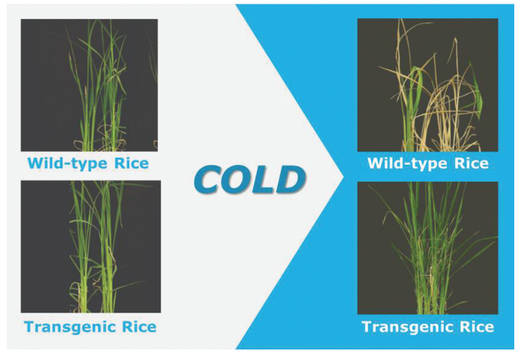
° Determined the three-dimenstional protein structure of the antifreeze protein from a glacial bacterium

· Developed application possibility to utilize as a cryoprotectant for animal cells and diatom
· Published to the Acta Crystallographica Section D (IF 14.1, JCR rate 2.4%)



° Developed a cold-tolerant crop by using genes from an Antarctic hairgrass

· The first transgenic crop resistant against environmental stress developed using genes from Antarctic plant
· Suggested new application potential of polar genetic resource for developing cold-resistant crop
· Domestic patent pending and published to the Plant Science (IF 4.1, JCR rate 9.5%)



Future Plans

° Draws big picture of bioadaptation mechanism and suggestion of evolutionary evidence for cold environmental organisms

° Drives polar researches by providing polar biological information on genomics and proteomics

° Leads international research collaborations by polar bioinformatic hub-network system using genome and proteome data

° Suggests application potential of polar genomic and proteomic data for new bioresource developments in the field of health and medical improvements