

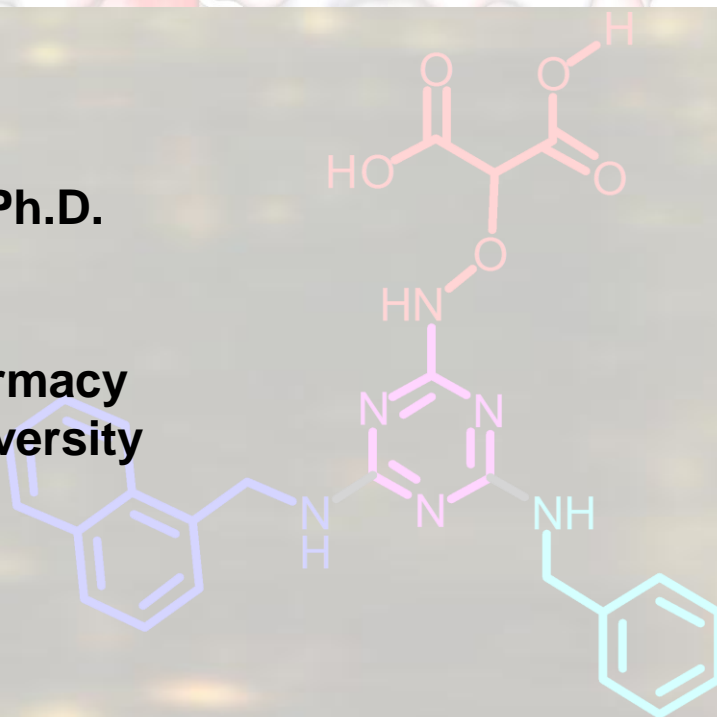
Biotechnology Trends in Korea

2013. 11. 26



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History of Biotechnology in Korea

- The Korean government had begun promoting biotechnology from the mid 1980's and then established a basic plan for the promotion of biotechnology (Biotech 2000) in 1994.

Year	Main Issue
1983	Genetic Engineering Promotion Law was established (Genetic Engineering Promotion Law changed to Biotechnology Promotion Law)
1994	Basic Plan for the Promotion of Biotechnology (Biotech 2000: 1994~2007) was established
1998	Brain Research Promotion Law was implemented and Basic Plan for the Promotion of Brain Research established (Braintech 21: 1998~2007)

History of Biotechnology in Korea

- In 2004, biotechnology (Novel Biomedicine and Organs) was selected as one of the next-generation engine for industrial growth. In 2007, the government announced The 2nd Framework Plan for the Promotion of Biotechnology (Bio-Vision 2016)

Year	Main Issue
2004	Novel Biomedicine and Organs industry was designated as one of the next-generation growth engines
2006	The 2nd Framework Plan for the Promotion of Biotechnology (Bio-Vision 2016: 2007~2016) was published
2007	The 2nd Framework Plan for the Promotion of Brain Research (2008~2017) was announced and The Master Plan for National Life Resources was established
2008	Science and Technology Basic plan 577 initiative was established and BT Committee under the National Science and Technology Council was formed

Government Commitment to Promote Biotechnology

● Korea is accelerating investment and promotion policy in order to acquire core technologies and to strengthen the industrial infrastructure in the area of biotechnology, which is rapidly becoming the key strategic industry to lead the world economy in the wake of information technology.

- Government Investment in Biotechnology (1994~2008)

[Unit : USD 100,000 \$]



*Source : Ministry of Education, Science and Technology(MEST), 2009)

Vision for Biotechnology in Korea



“Health life” and “Prosperous Bioeconomy”

• Joining the Group of Global Top 7 Biotechnology Nations •

- Bio-Vision 2016 was established for the direction of the development of Korean biotechnology over a 10-year period up until 2016 with a vision of realizing a sound “Health life and Prosperous Bioeconomy”.

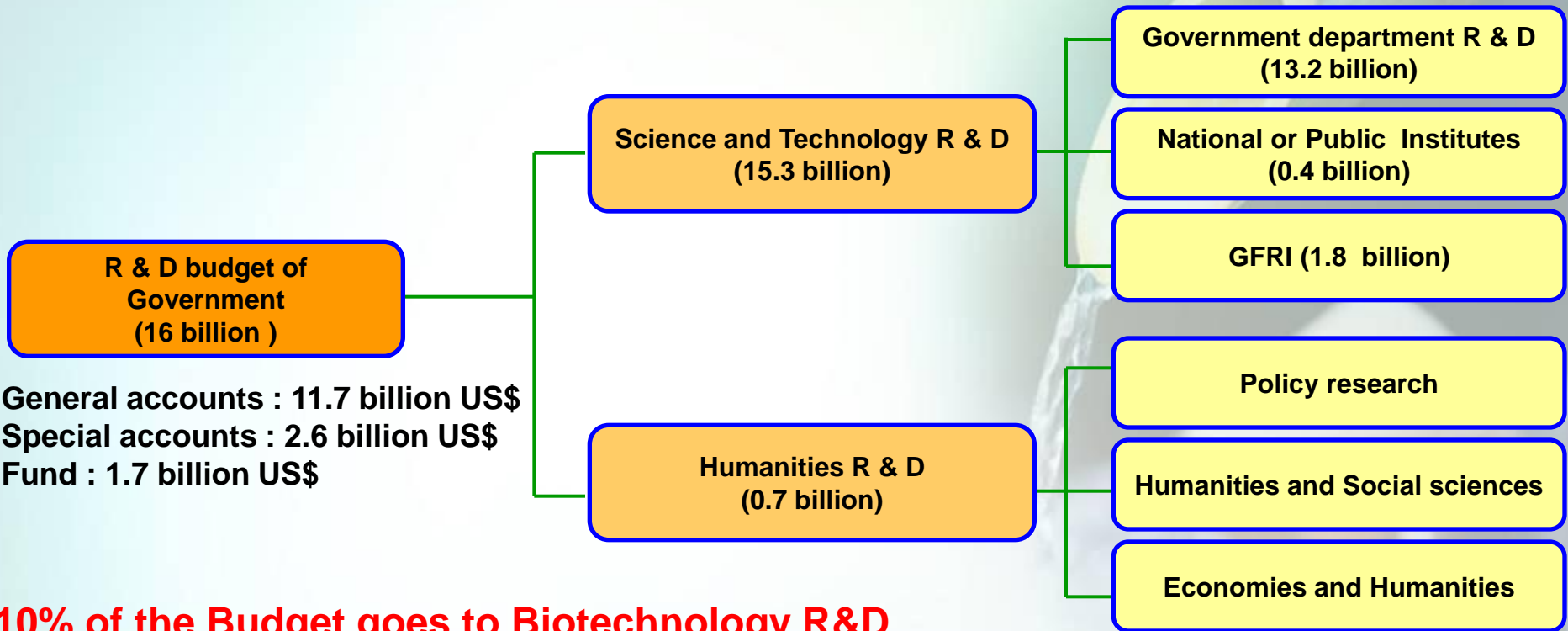
Objectives

Category	2006	2016
No. of science-technology papers published (National ranking)	12th	7th
Competitiveness in patented technology (National ranking)	15th	7th
No. of R&D manpower (Postgraduate degrees)	9,500	17,300
Industrialized market value	60 billion US\$	

* The size of the biotechnology market is expected to expand dramatically from the year 2010 onwards, as acceleration of technology convergence is likely to result in inclusion of synthetic new drugs among bio products.

R & D budget of Korean government (2013)

✓ Major R & D : 10.9 billion (US\$)



- General accounts : 11.7 billion US\$
- Special accounts : 2.6 billion US\$
- Fund : 1.7 billion US\$

10% of the Budget goes to Biotechnology R&D

[Unit : US\$]

- ❖ Total national R & D : 64.8 billion (Gov/Priv = 25/75)
- ❖ Based on performers : GFRI 38.4 %, National or Public Institutes 4.9 %, Universities 25.4 %, Companies 21.7 %
- ❖ Based on research stage : Basic research 30.7 % (40 % until 2017), Applied research 20.1 %, Developmental research 49.2 %

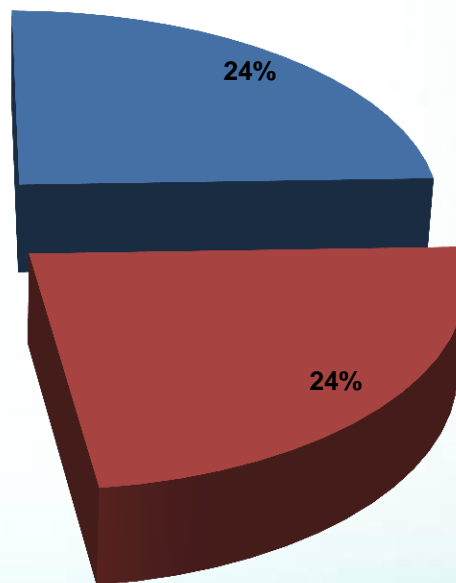
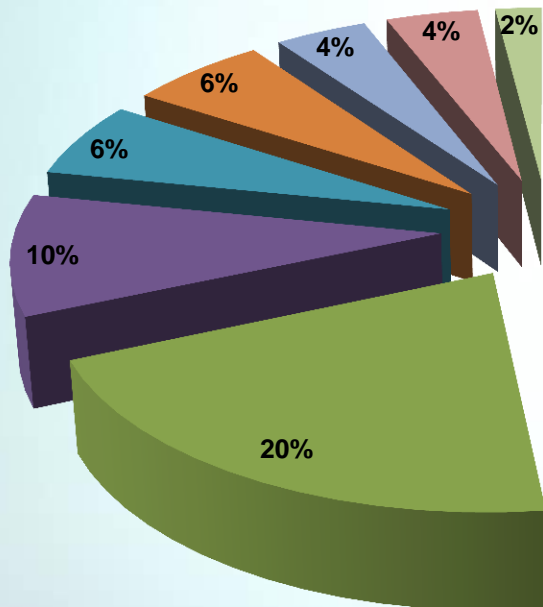
Major R & D budget in Biotechnology (2014)

Major R & D?

- Large scale and long-term work (over 5 years), creation of main power for future development, basic sciences
- Investment for research facilities and equipments

1,800 million US\$ (6.9 % increase compared to 2013)

Distribution and adjustment of major R & D budget in Life and Health (2014)



- Future planning
- Rural development
- Welfare
- Agriculture forestry
- Trade, industry and energy
- Oceans and fisheries
- Forest service
- Food and drug safety
- Et cetera

❖ Total R & D in Life and Health (2014) : 2,700 million US\$

Life science : 900 million
 Health and Medical Science : 1000 million
 Agriculture forestry fisheries : 900 million

[Unit : US\$]

Identification of Regulators of Apoptosis and Inflammation



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2013.11

- Facilities – Instrumental Analysis Center



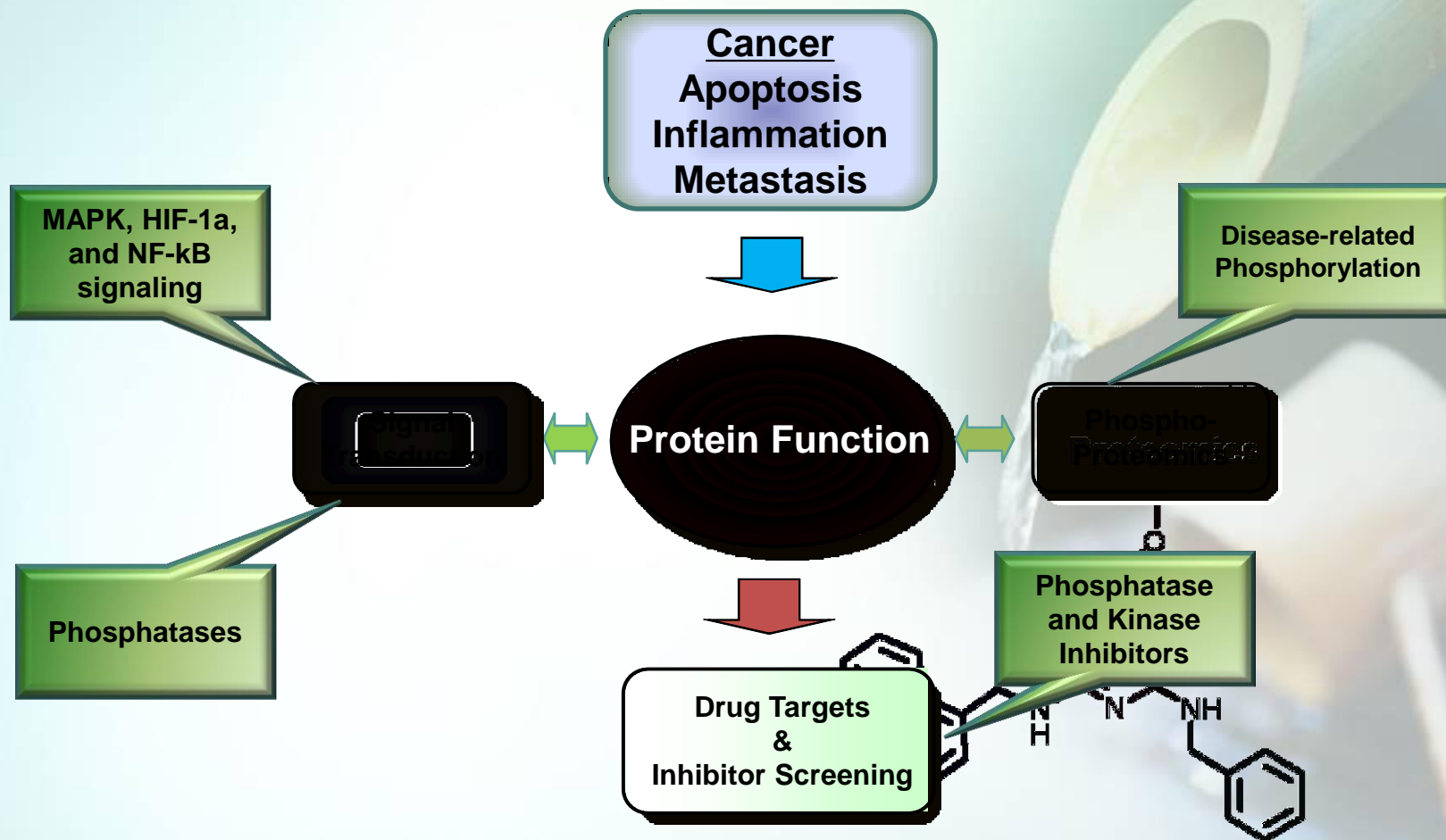
Medicinal Plants Garden



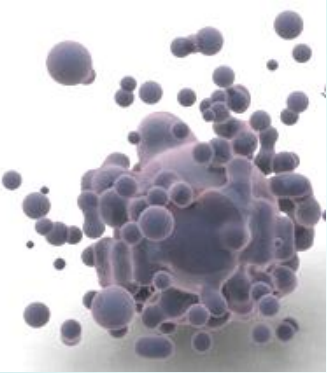
My Lab. – Molecular and Pharmacological Cell Biology



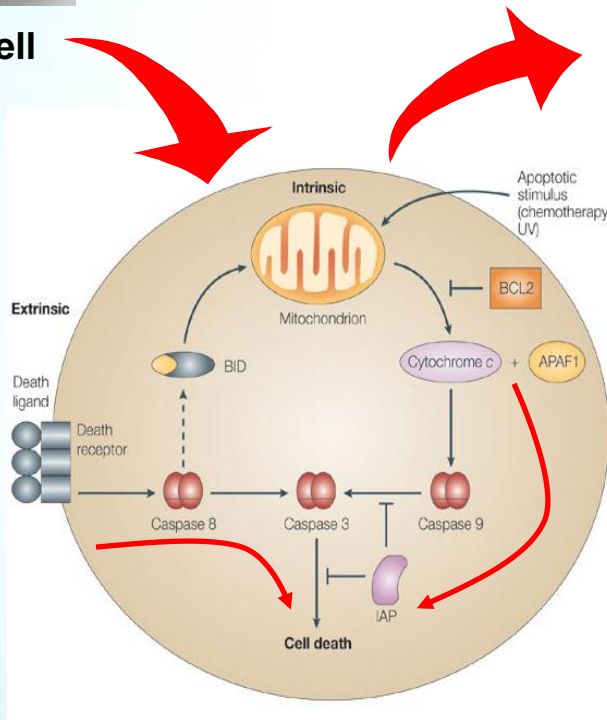
Research of interest in my Lab



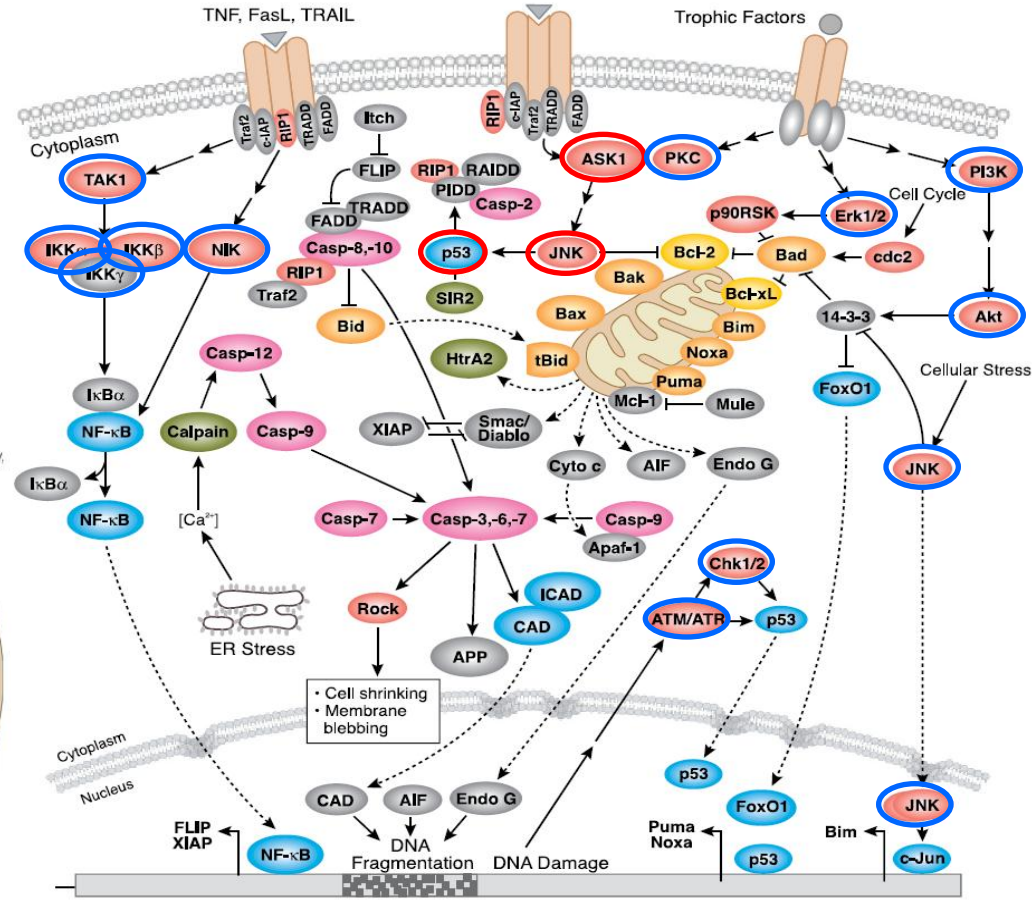
Apoptosis signalings and phosphorylation



Apoptotic cell

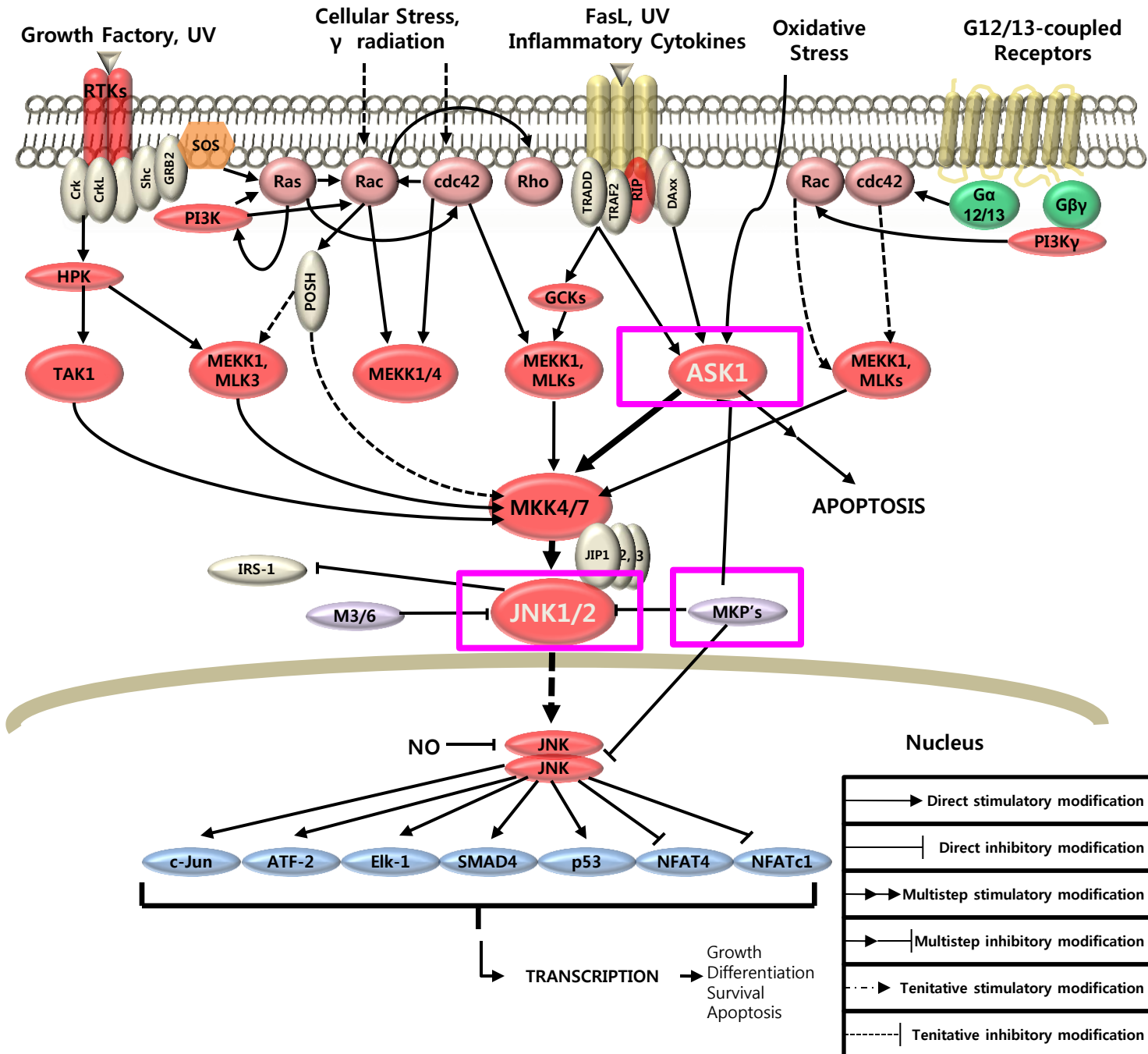


Apoptosis Pathways



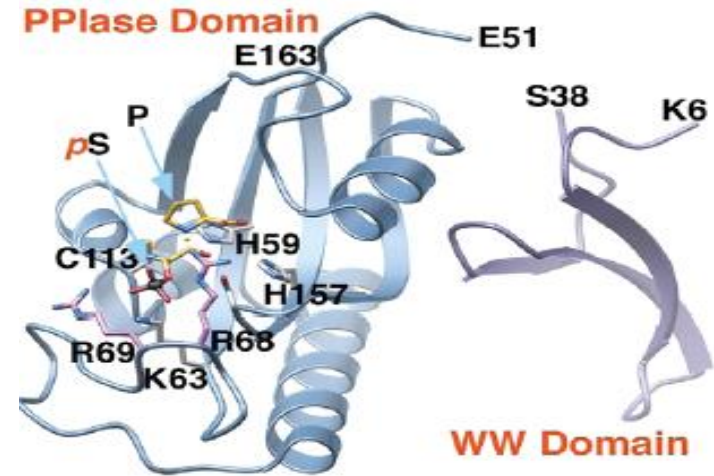
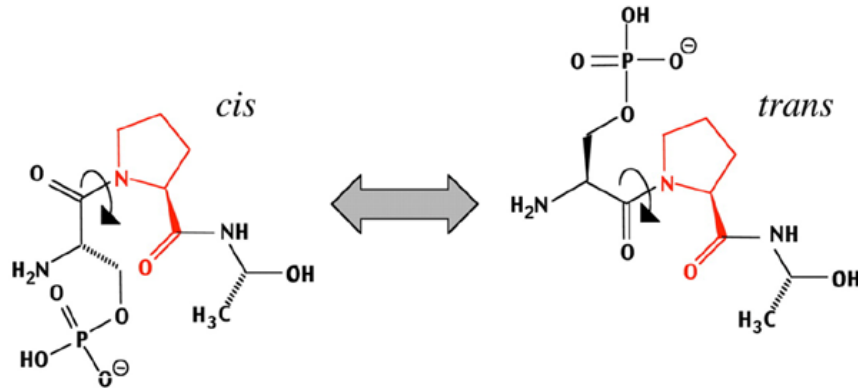
Apoptosis Signal Transductions

JNK Signaling Cascades



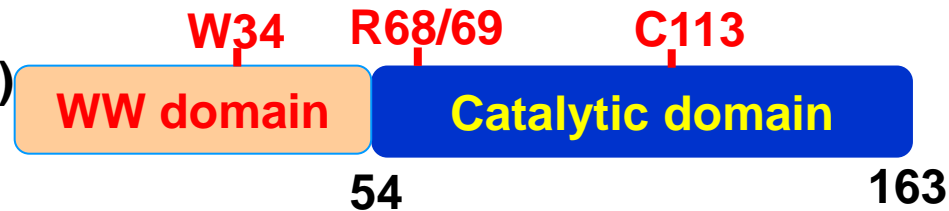
Pin1

- ▶ catalyzing pSer/Thr-Pro cis/trans isomerization.



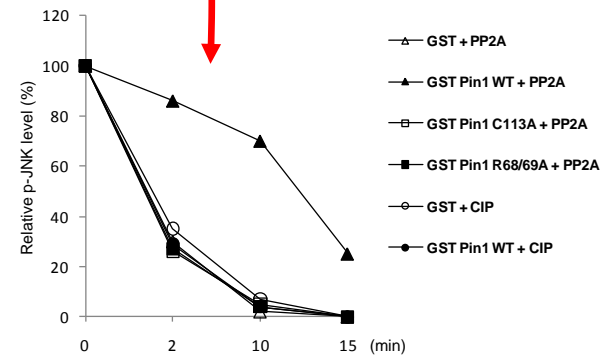
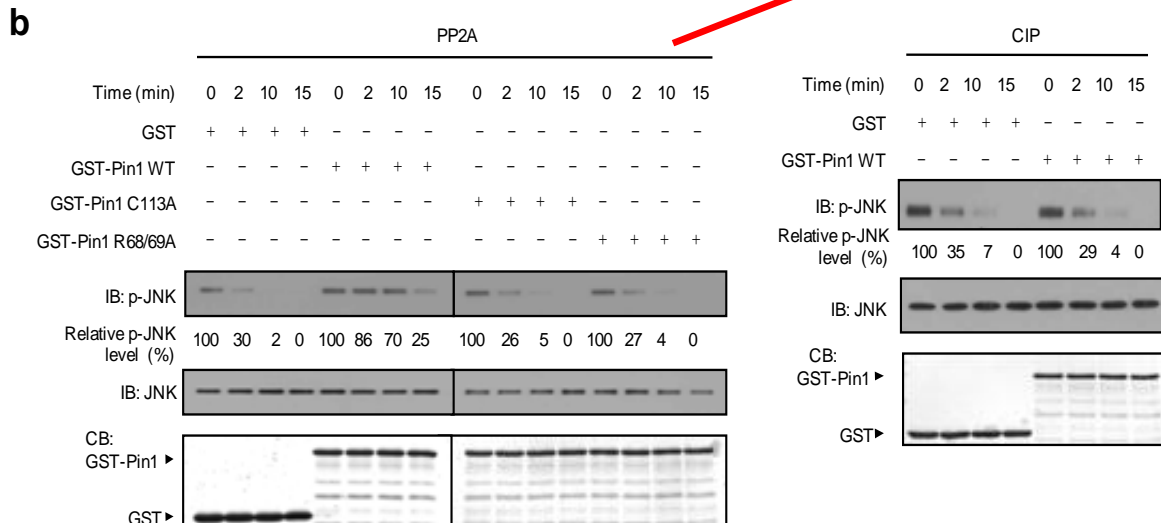
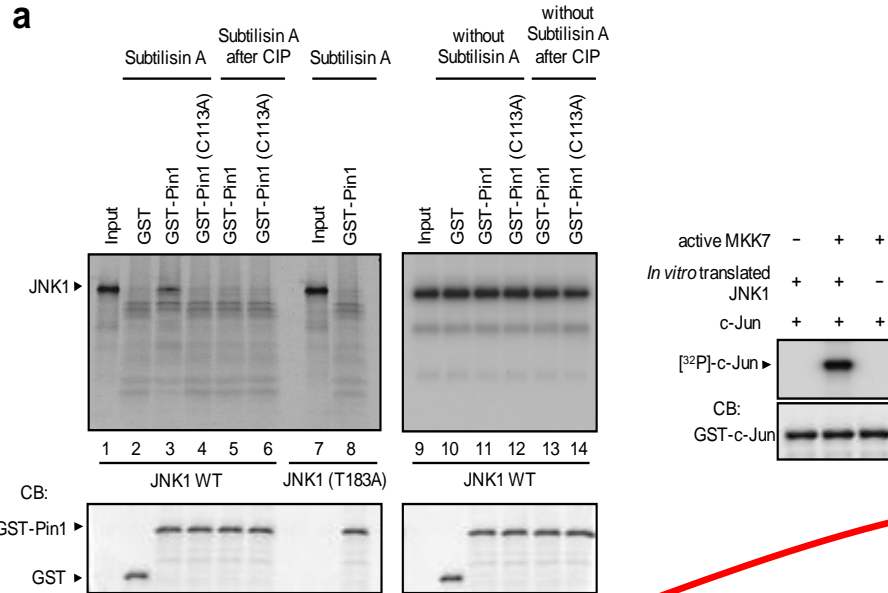
- ▶ Pin1 is made of two domains :

- * WW domain (substrate binding)
- * catalytic domain (rotamase)

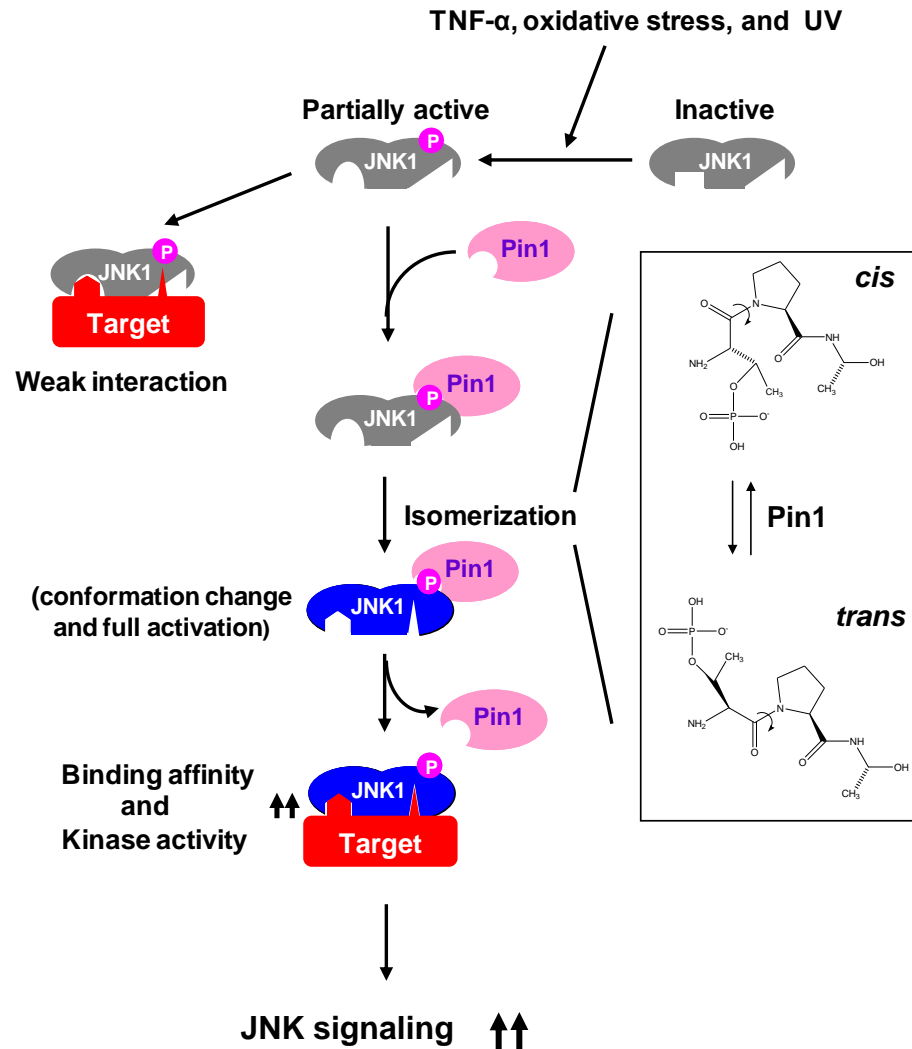


- ▶ overexpressed in several human cancers, including colon cancer, lymphomas, melanoma, prostate and brain tumors
- ▶ activates the tumor suppressor protein p53

Pin1-activated JNK1 undergoes conformational changes and is resistant to dephosphorylation by the *trans* pSer/Thr-Pro isomer-specific phosphatase PP2A

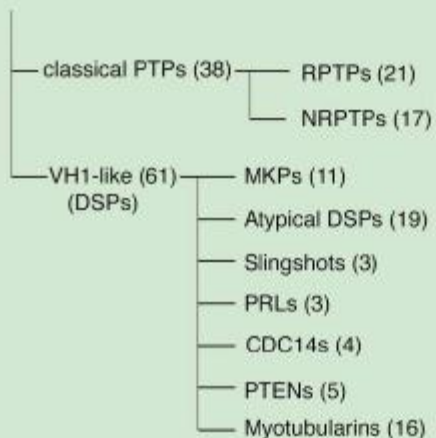


Hypothetical model for the role of Pin1 in JNK1 activation



Protein Tyrosine Phosphatases (PTPs) and Their families

A Class I Cys-based PTPs



SUBSTRATE SPECIFICITY

PTyr
PTyr
PTyr, PThr
PTyr, PThr, mRNAs
PSer
PTyr
PSer, PThr
D3-phosphoinositides
PI(3)P

B Class II Cys-based PTPs (1)

LMPTP (1)

PTyr

C Class III Cys-based PTPs (3)

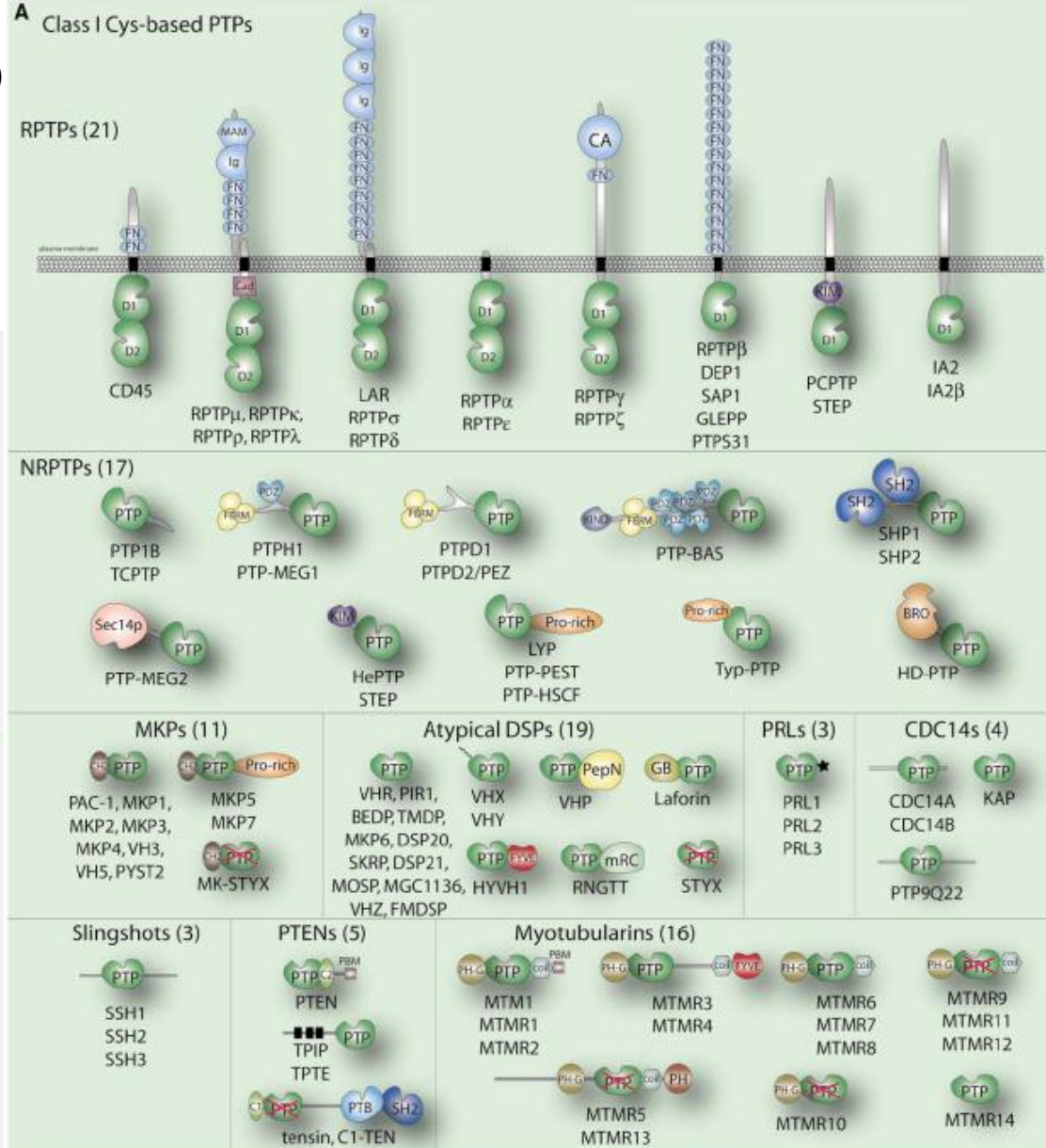
CDC25 (3)

PTyr, PThr

D Asp-based PTPs (4)

EyA (4)

PTyr, PSer?



B Class II Cys-based PTPs (1)

LMPTP

C Class III Cys-based PTPs (3)

CDC25A
CDC25B
CDC25C

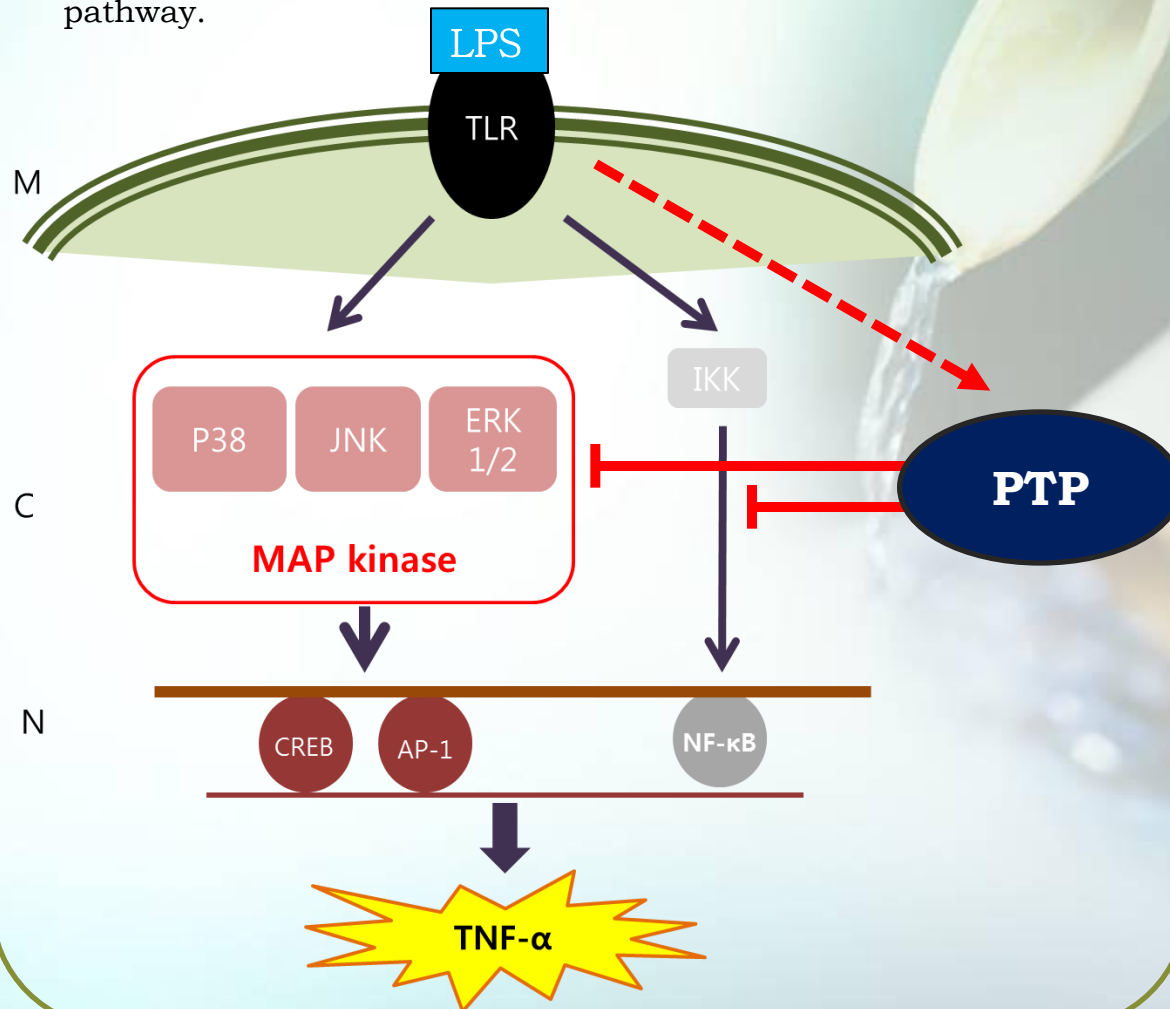
D Asp-based PTPs (4)

EyA1
EyA2
EyA3
EyA4

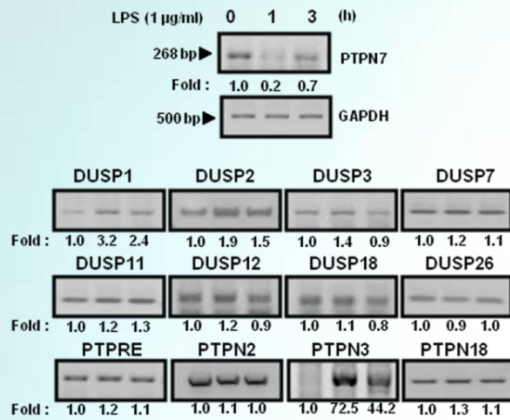
Inflammatory signal transduction pathways

Cytokine expression pathways

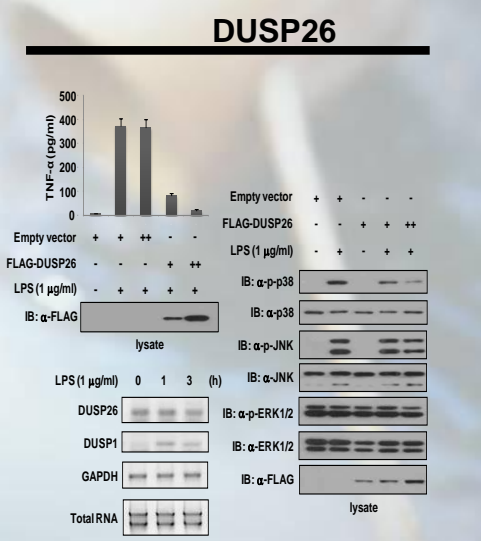
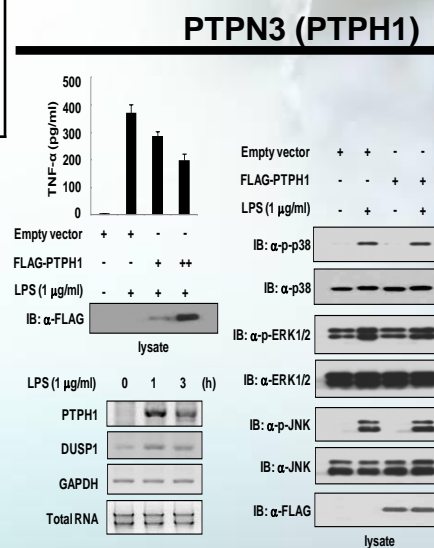
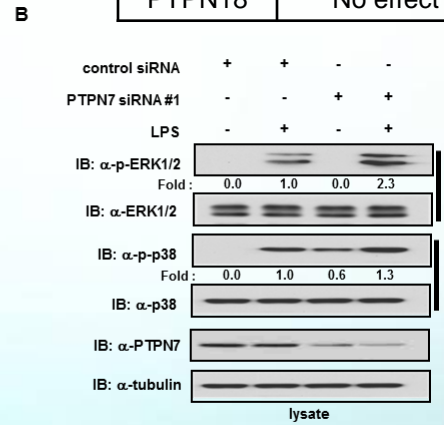
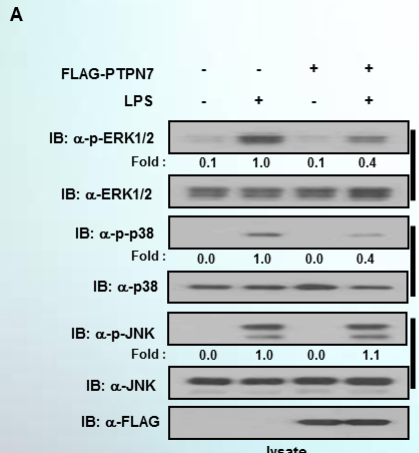
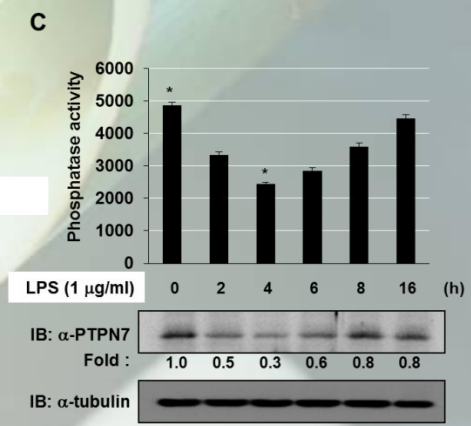
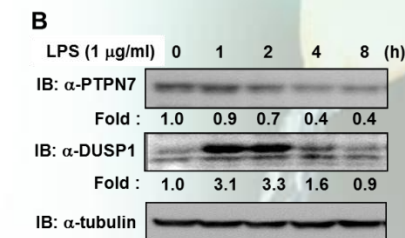
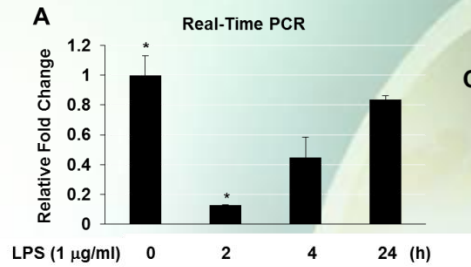
Proinflammatory cytokine production is regulated by two major signaling pathways that are MAPK and Nuclear factor- κ B (NF- κ B) pathway.



Screening of phosphatases that regulate inflammation



Gene	Induction by LPS treatment
PTPN7	Reduced
DUSP1	Induced
DUSP2	Induced
DUSP3	No effect
DUSP4	Induced
DUSP6	No effect
DUSP7	No effect
DUSP10	Induced
DUSP11	No effect
DUSP12	No effect
DUSP14	No effect
DUSP18	No effect
DUSP22	No effect
DUSP26	No effect
PTPRE	No effect
PTPN2	No effect
PTPN3	Induced
PTPN18	No effect



Recommended Research Areas for collaboration between Chile and Korea

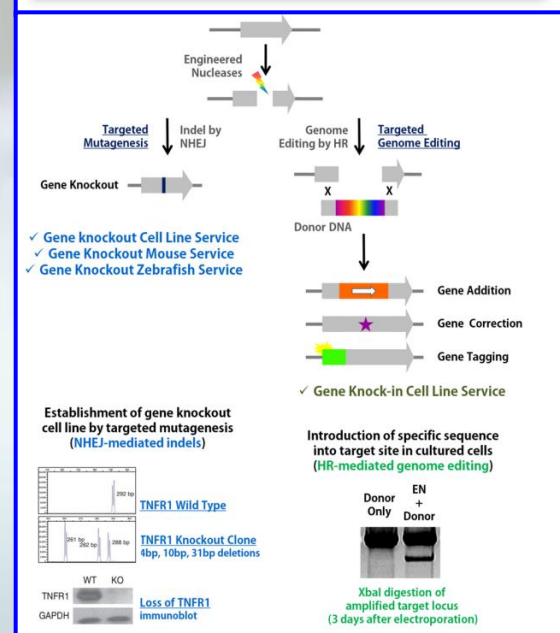
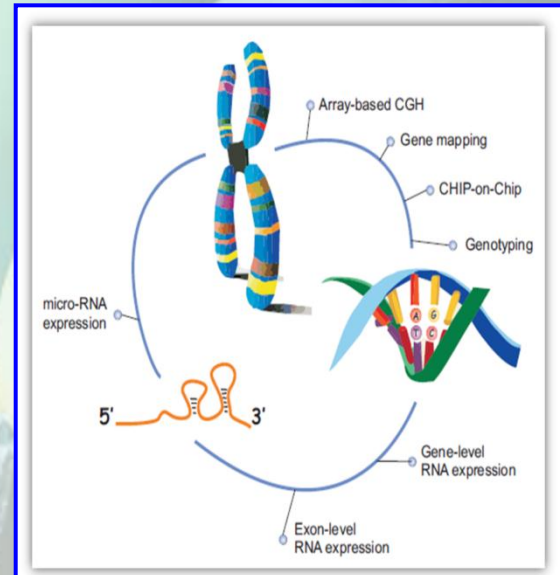


GENOMICS

- ❖ KOGO (Korea Genome Organization)
- ❖ Investment for the progression of proteomics (2002 - 2012) (21C Frontier R & D Program- Functional Microbial Genomics Center)
- ❖ The National Project for Personalized Genomic Medicine (PGM21) from 2011
- ❖ Participation to ICGC (International Cancer Genome Consortium) (Samsung Seoul Hospital)

Gene Knockout

- ❖ Toolgen Inc. (www.toolgen.com)
- : Development of engineered nucleases - essential tools for editing genetic information

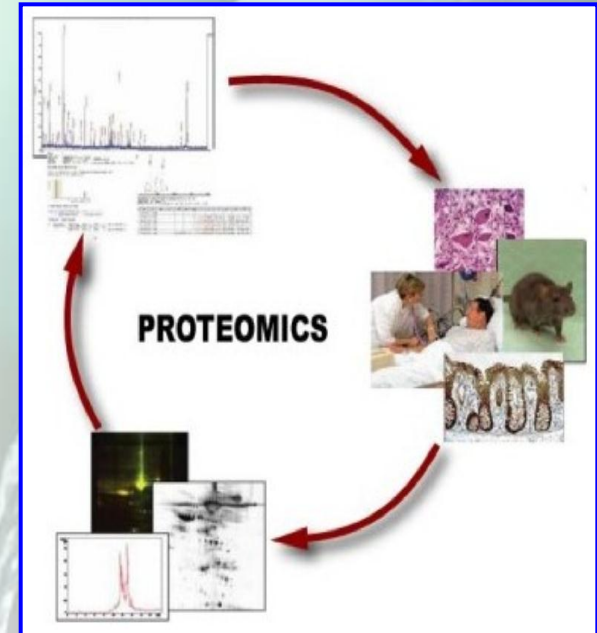


Recommended Research Areas for collaboration between Chile and Korea



PROTEOMICS

- ❖ KHUPO (The Korean Human Proteome Organization)
- ❖ R & D centers
 - Proteomics & Biomarker Lab (College of Medicine, Seoul National Univ.)
 - Yonsei Proteome Research Center
- ❖ Investment for the progression of proteomics (2002 - 2012) (21C Frontier R & D Program- Functional Proteomics Center)



Drug Screening and Translational Researches

- ❖ KDRA (Korea Drug Research Association)
- ❖ KRIBB
- ❖ KIST
- ❖ Many labs in colleges of pharmacy and medicine in Korea

