



# Phospholipids administration preserves the heart function after myocardial infarction

**Heart Attack Research Team – HeART**

Dr. Dr. Elisa A. Liehn

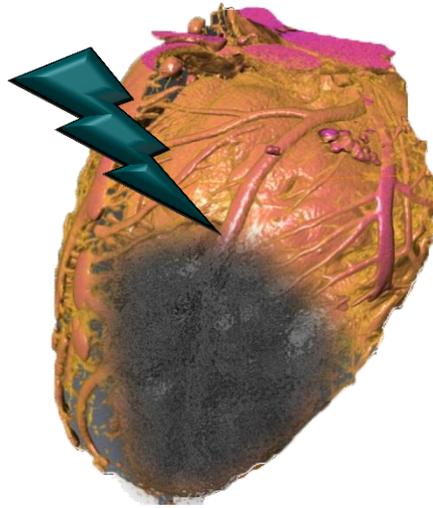


**IZKF** Interdisziplinäres  
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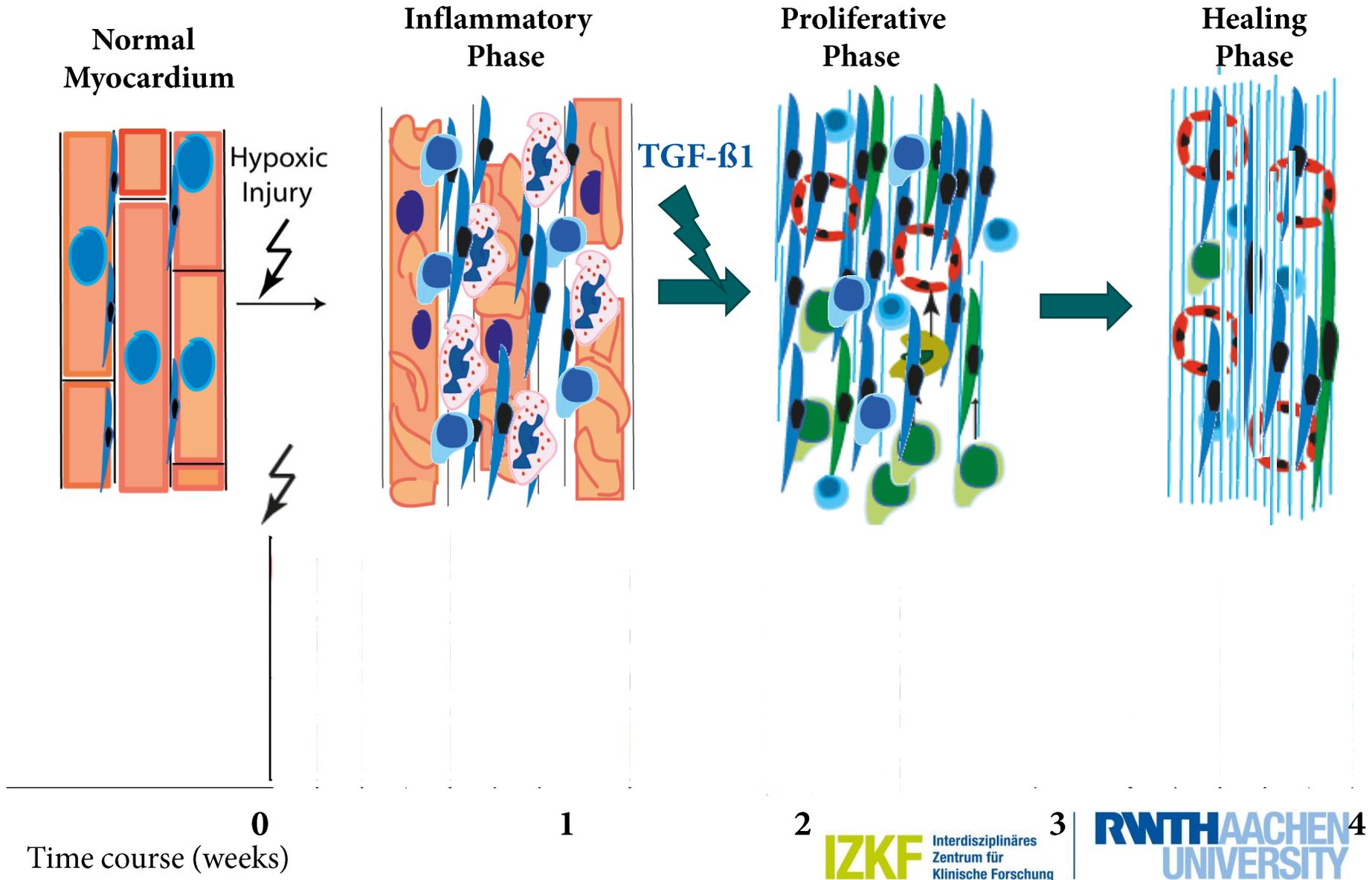
**RWTHAACHEN**  
UNIVERSITY

# Myocardial infarction

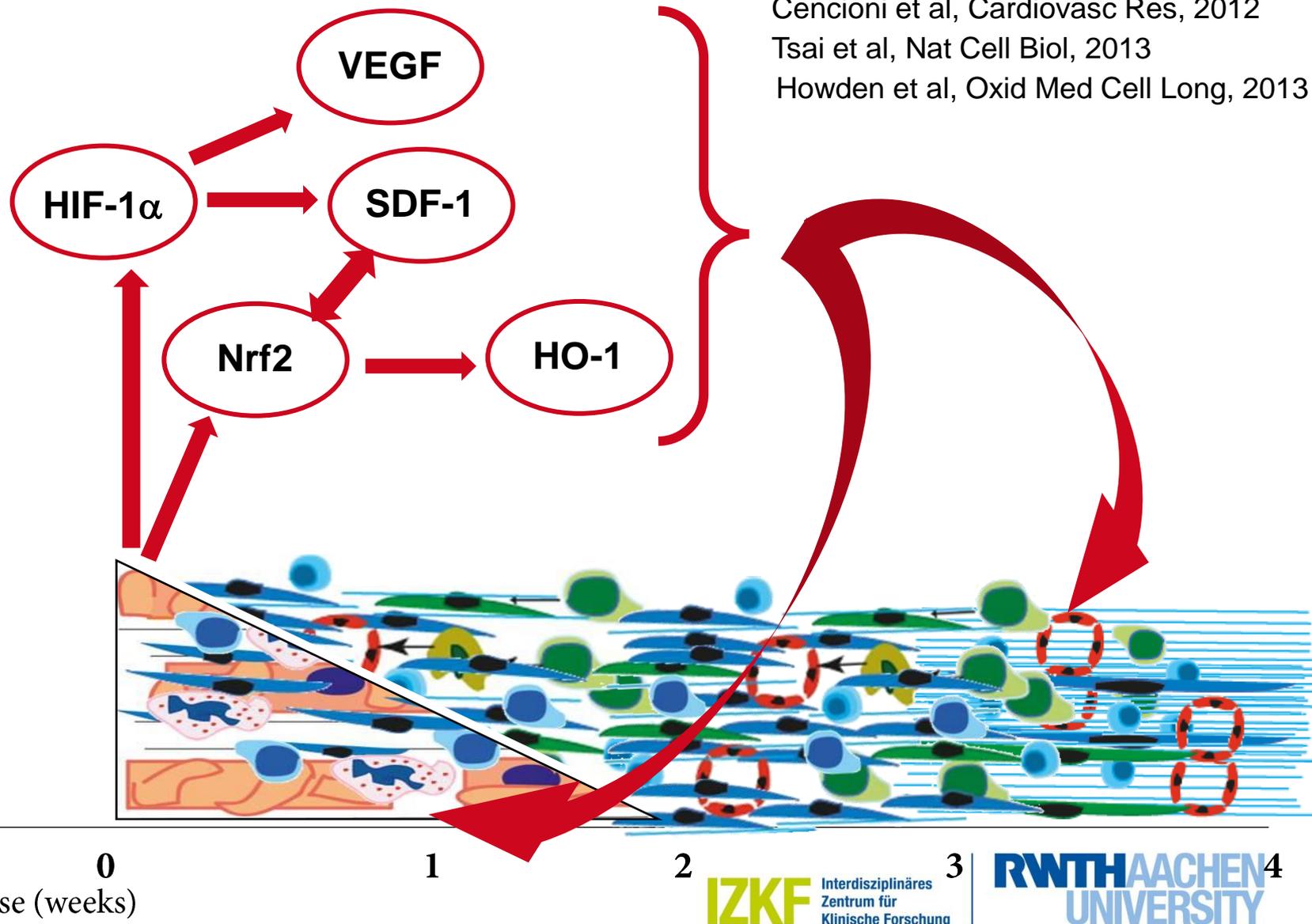
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# Myocardial infarction



# Myocardial infarction



# Previous data

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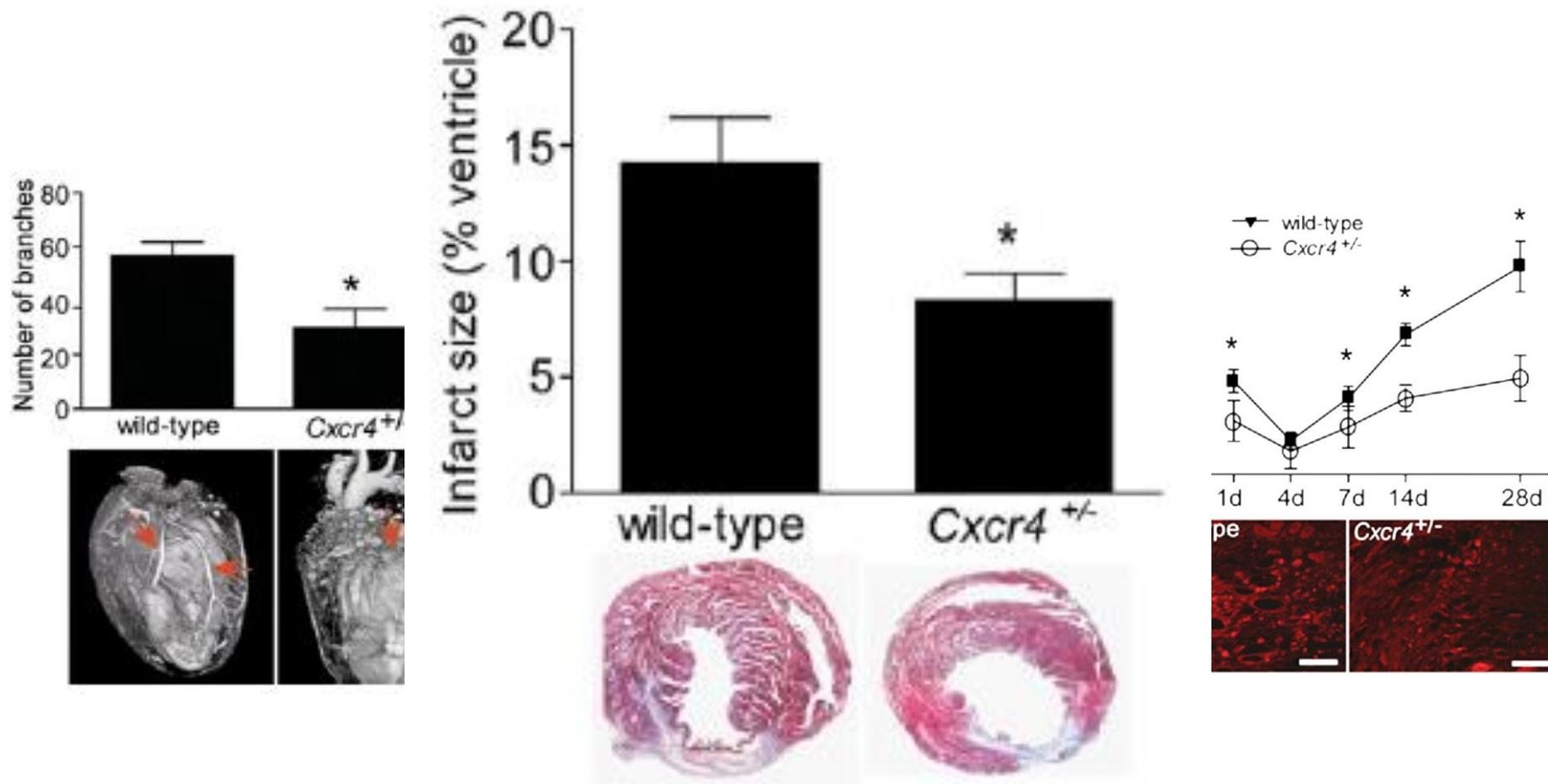
## CXCR4 +/-

= fusin

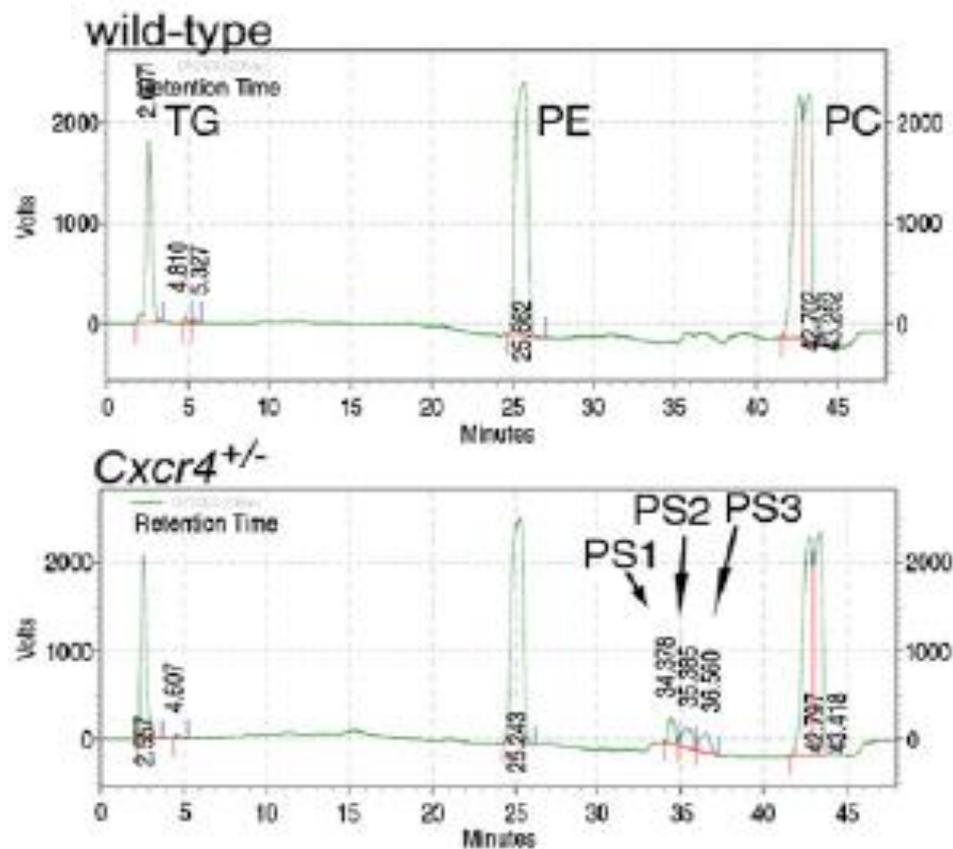
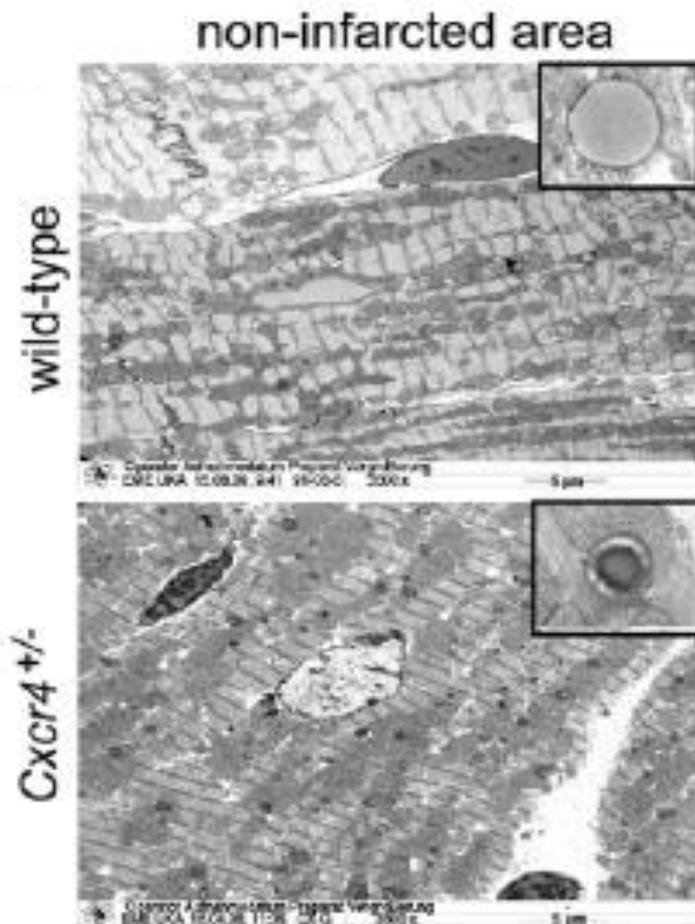
- ✓ wide cellular distribution (most of hematopoietic cells, vascular endothelial cells, neuronal/nerve cells)
- ✓ Ligand: **CXCL12** or **stromal cell-derived factor (SDF1)**

- During embryogenesis it directs the migration of hematopoietic cells and the formation of large blood vessels
- In adulthood has an important role in angiogenesis by recruiting endothelial progenitor cells
- Main factor for neoangiogenesis in carcinogenesis and after an acute hypoxic event, such as myocardial infarction

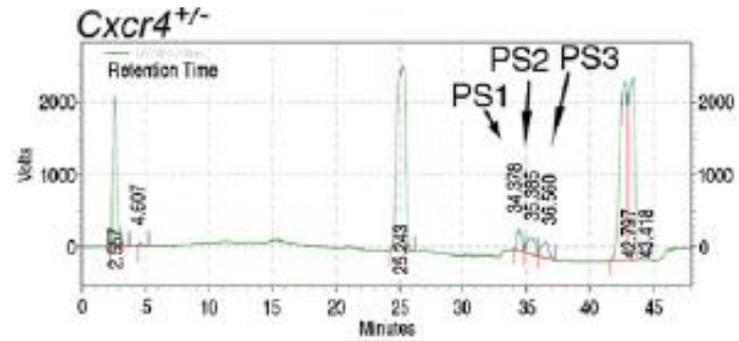
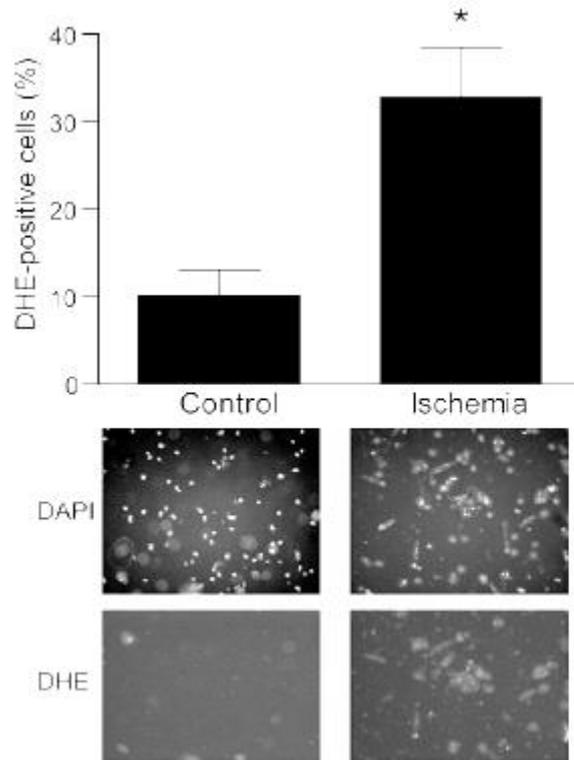
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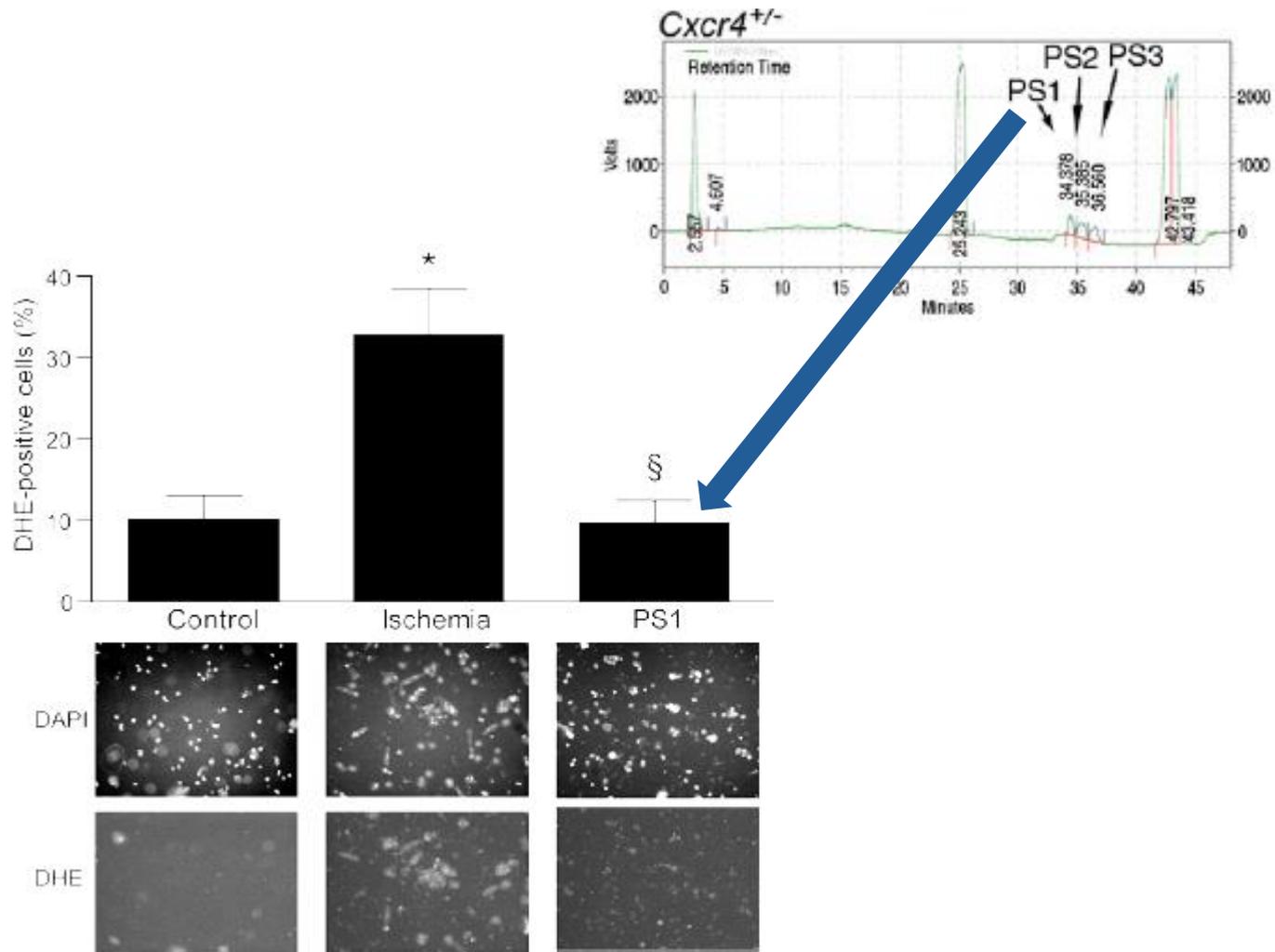
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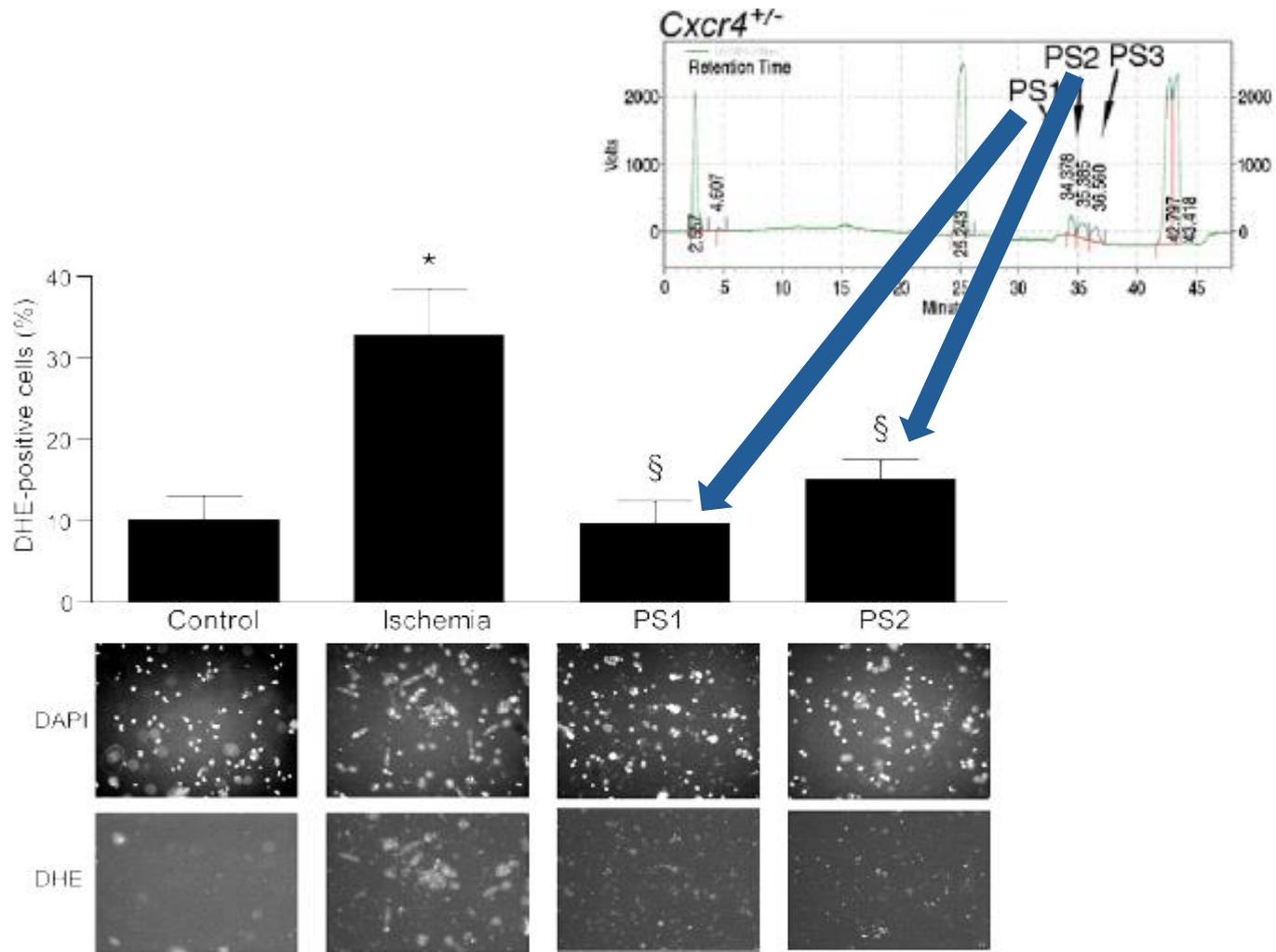
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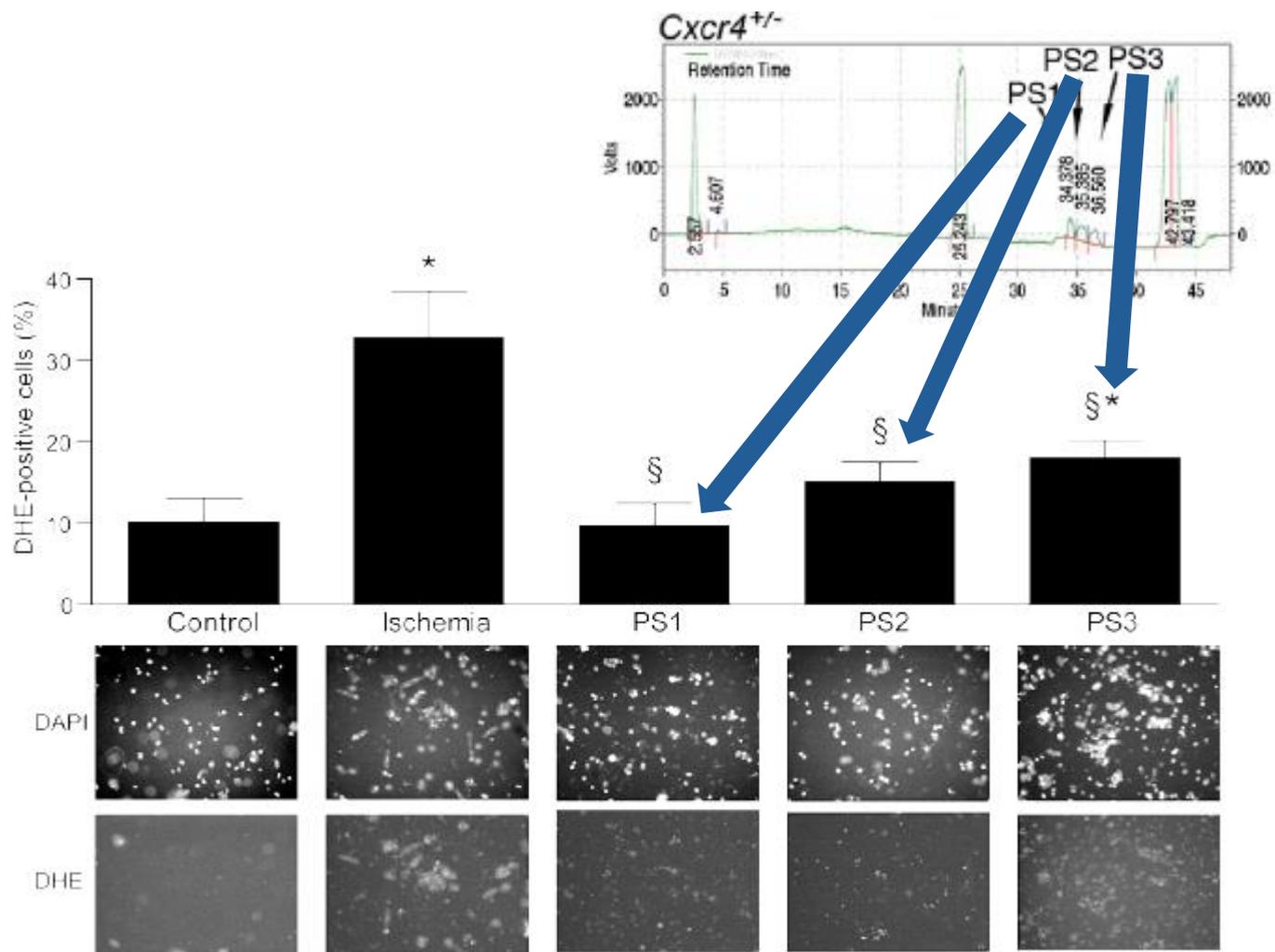
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# Previous data

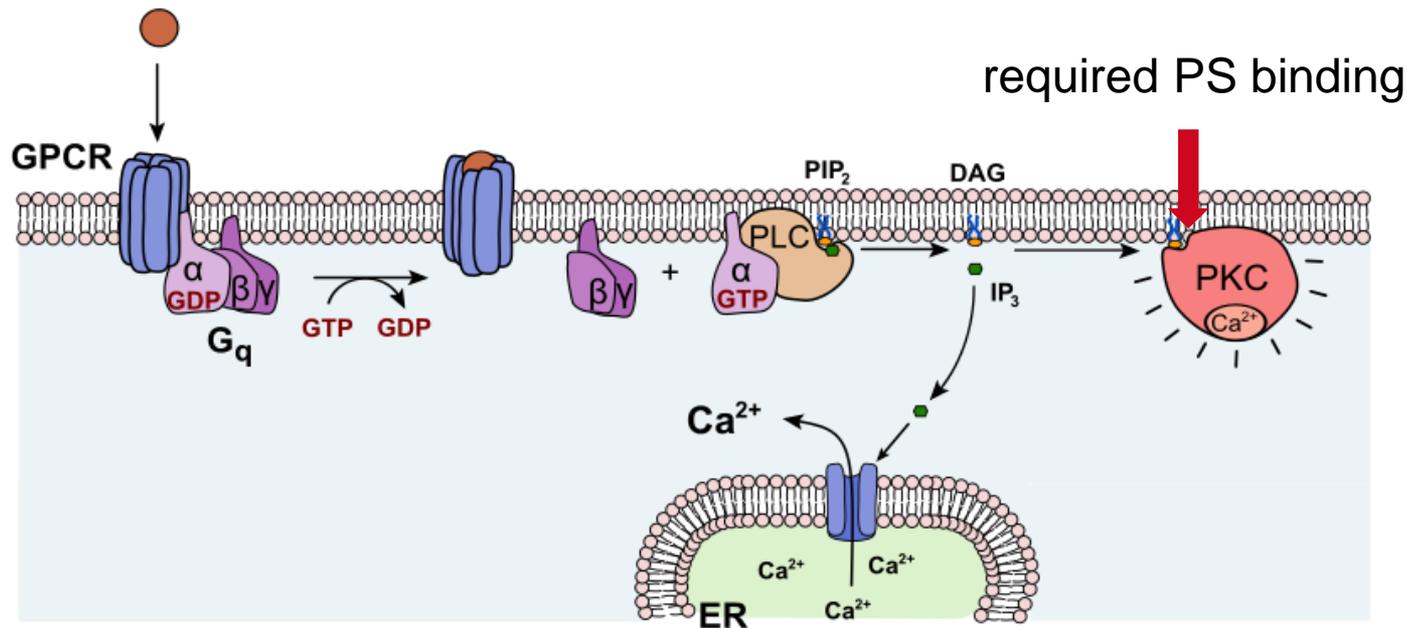
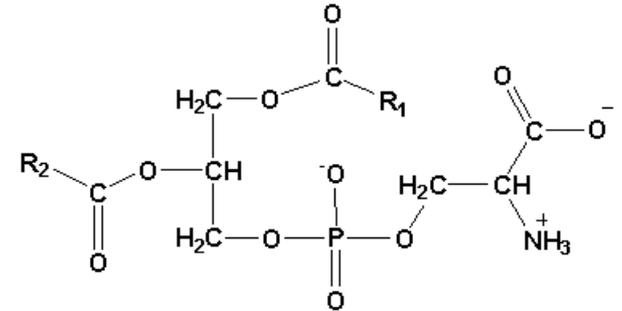


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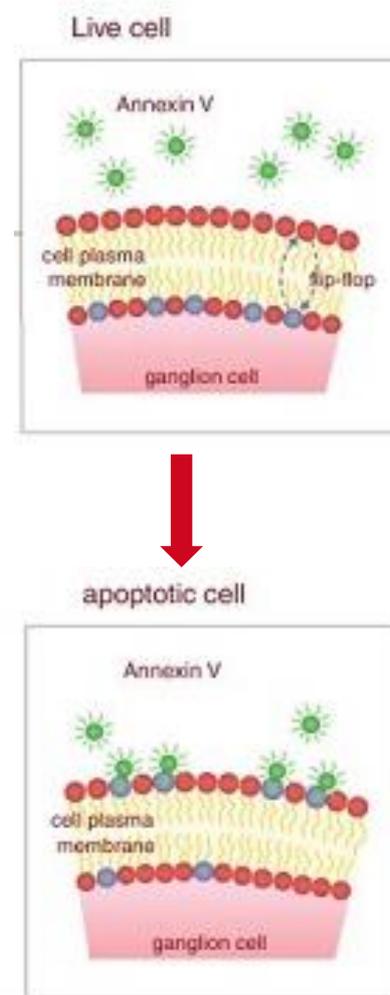
# Phosphatidylserine ???

- an important phospholipid membrane component
- plays a key role in cell cycle signaling – activators of Protein Kinase C



# Phosphatidylserine ???

- Phospholipids on the cytosolic (inner) side of the cell membrane
- when a cell undergoes apoptosis, phosphatidylserine flip to the extracellular (outer) surface of the cell and act as a signal for macrophages to phagocyte the cells



# Phosphatidylserine ???

Fernholz et al, Med Sci Sports Exer, 2000  
Benton et al, Nutr Neurosci, 2001  
Kingsley et al, Med Sci Sports Exer, 2005  
Kingsley et al, Med Sci Sports Exer, 2006  
Starks et al, J Int Soc Sport Nutr, 2008

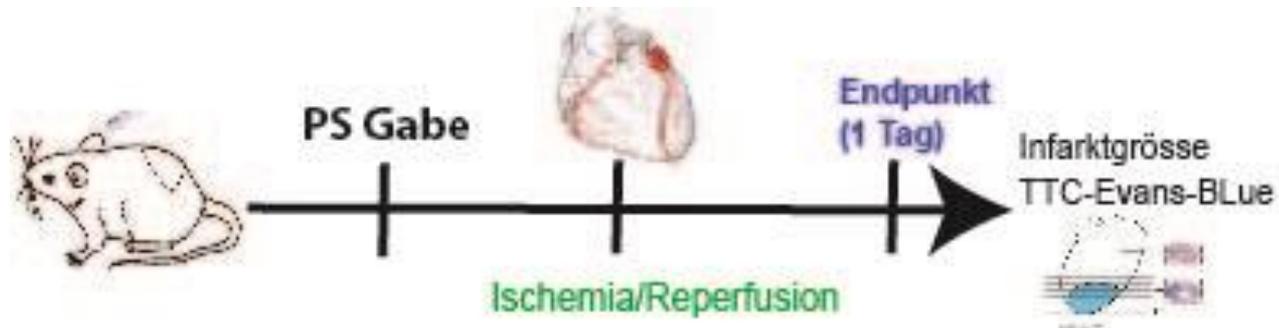
“...potential ergogenic property...”

“...phosphatidylserine has been shown to improve performance, ... decrease muscle damage in athletes ...and might attenuate the physiological deterioration that accompanies overtraining and/or overstretching.”

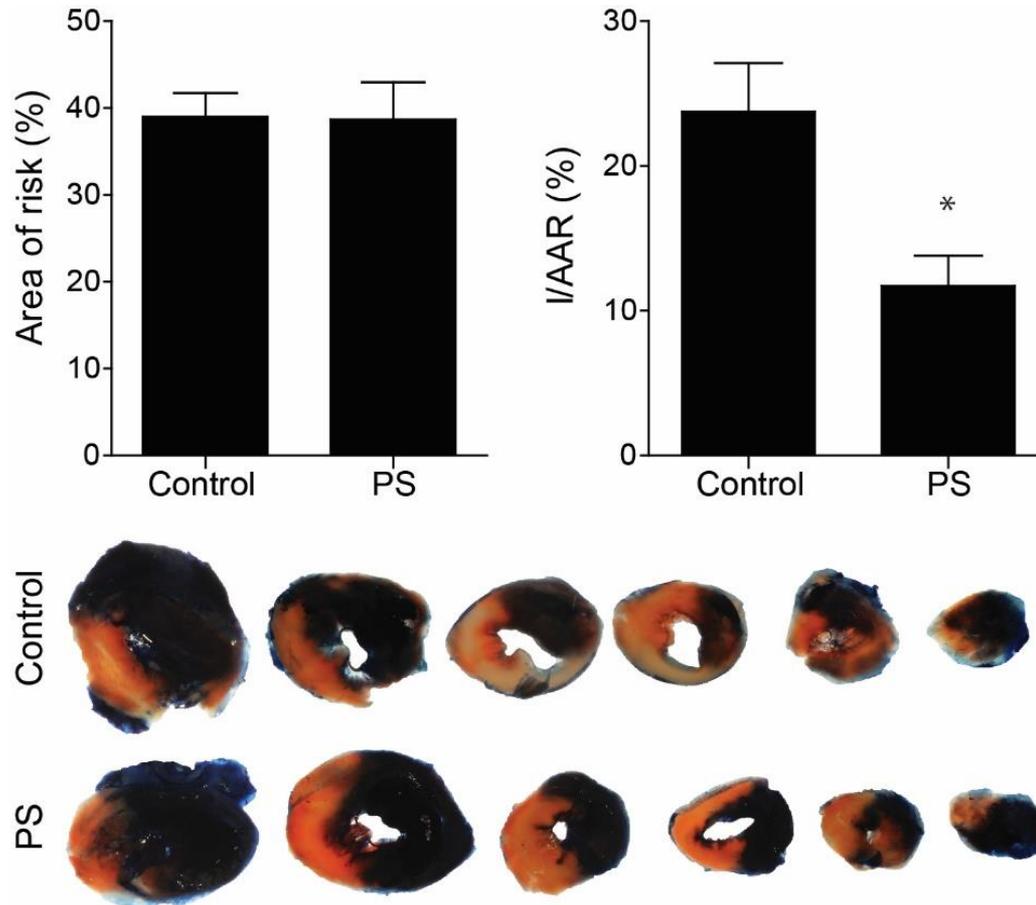


# Experimental Settings

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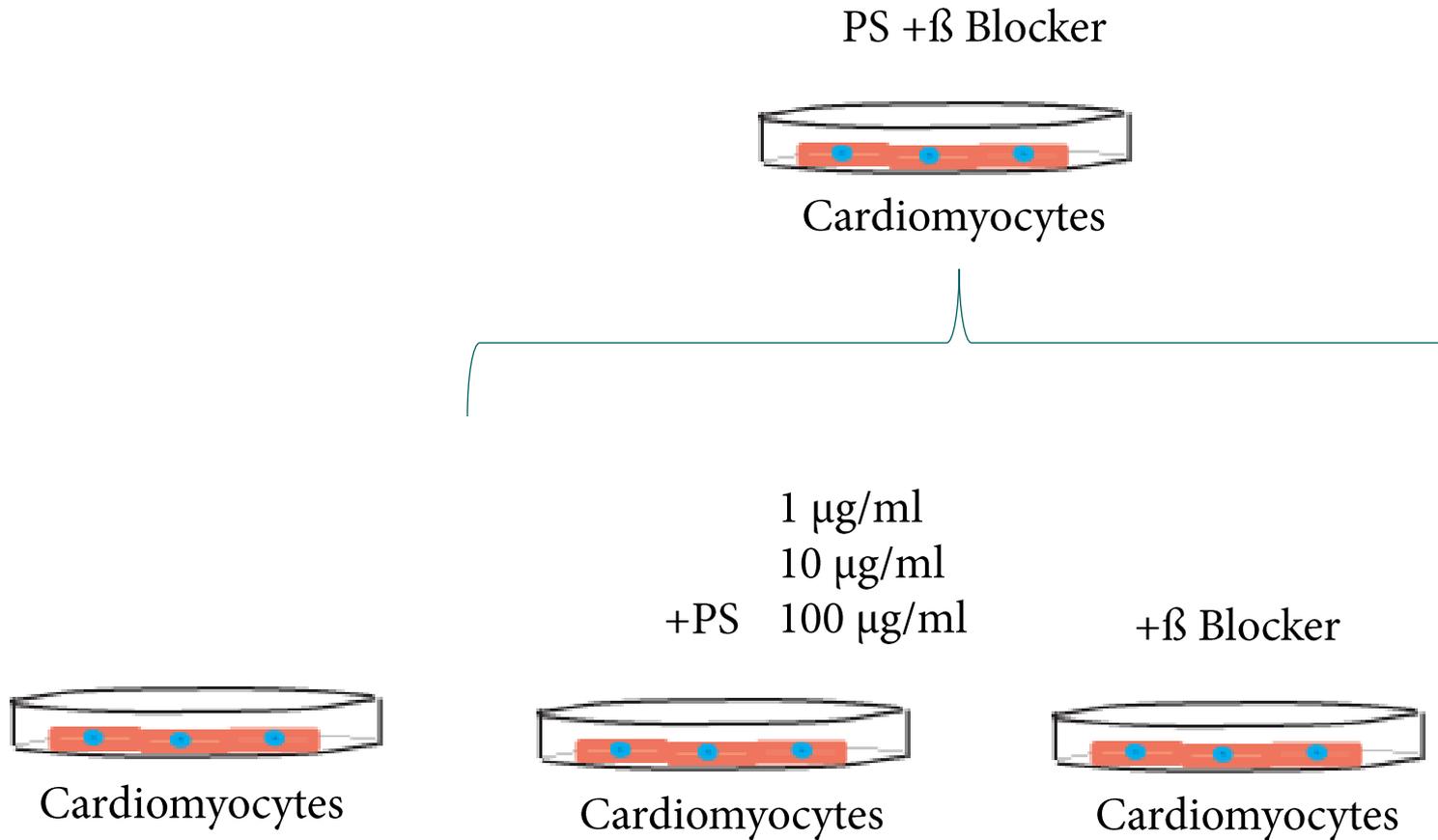


# In vivo results

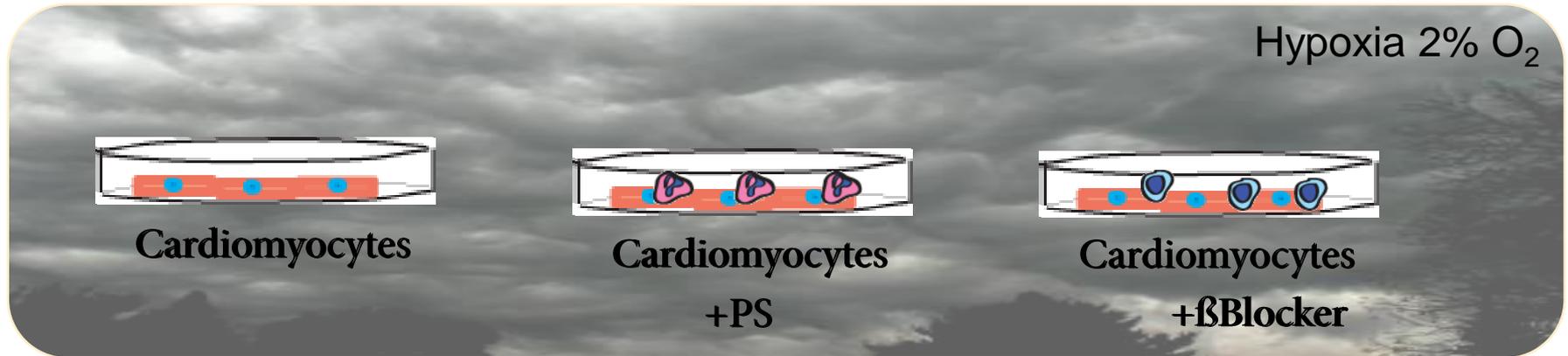


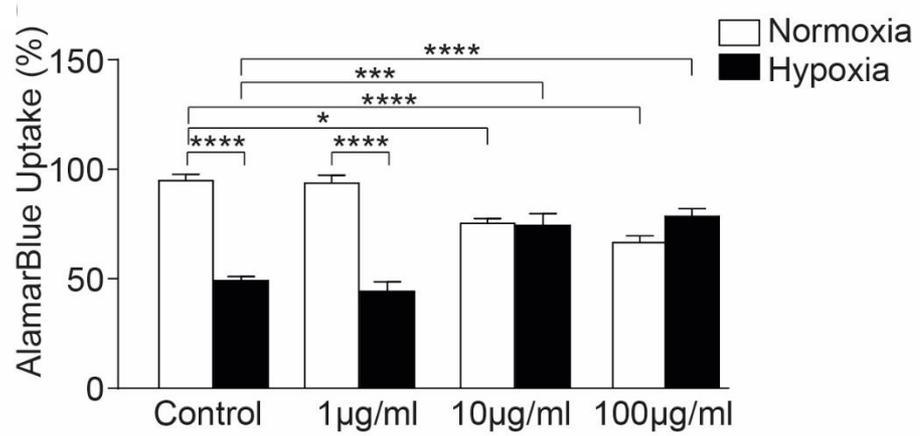
# Experimental Settings

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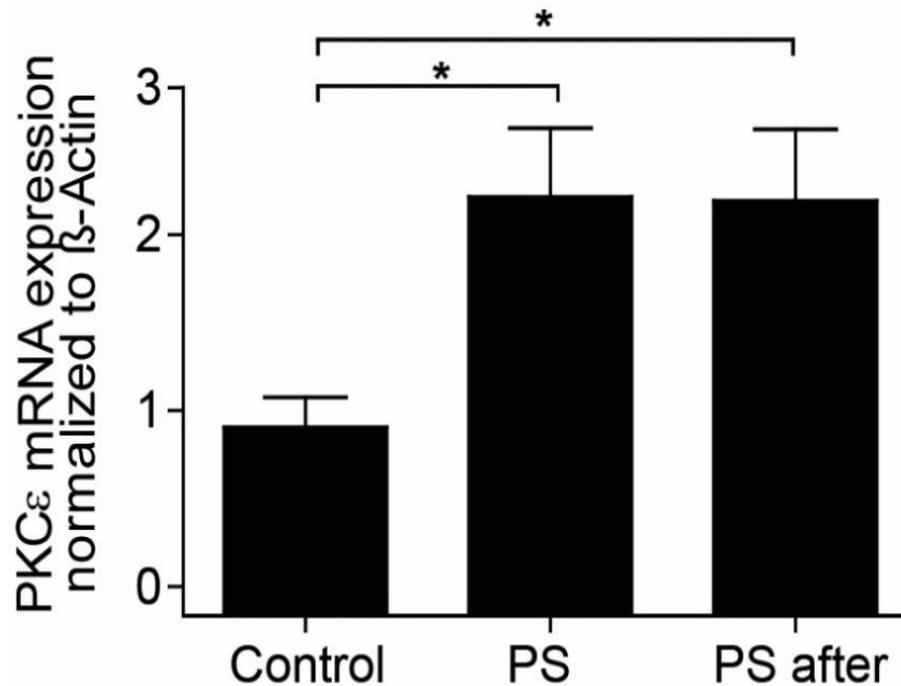
# Experimental Settings





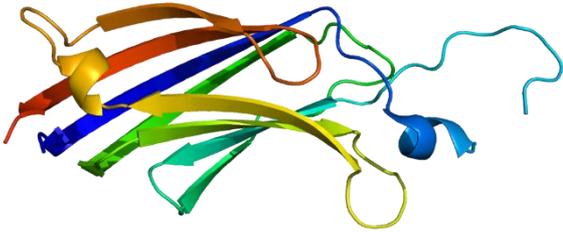
# Phospholipids in Cardioprotection

## Preconditioning



# PKC $\epsilon$

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Akita et al, J Biochem, 2002

Waza et al, Cell Sign, 2015

Budas et al, Circ J, 2012

Pyle et al, Circ Res, 2002,

Newton et al, Biochem J, 2010

Alavian et al, PNAS, 2014

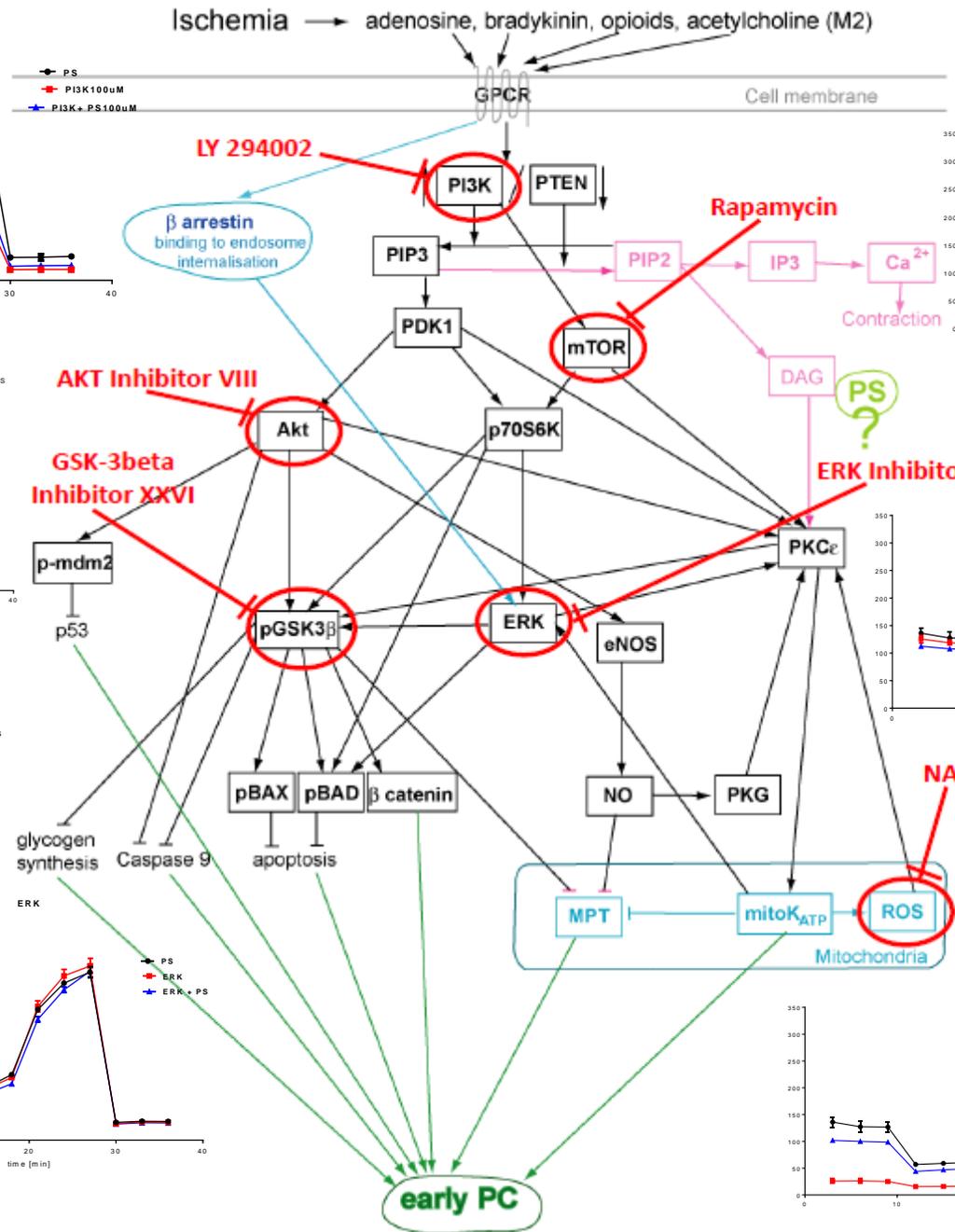
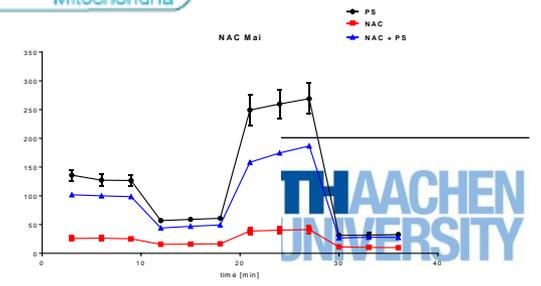
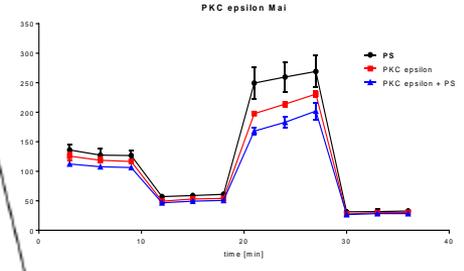
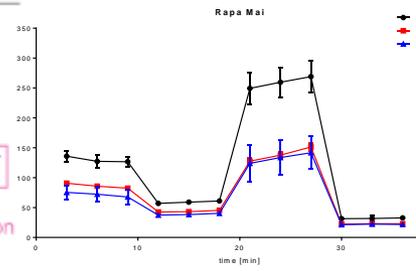
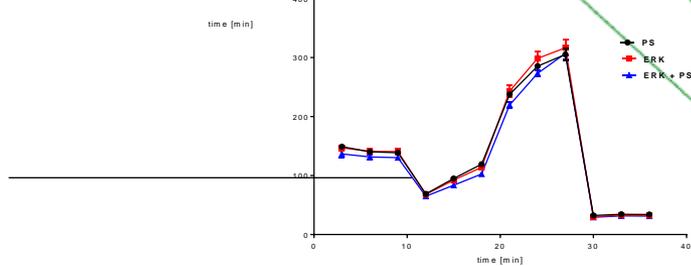
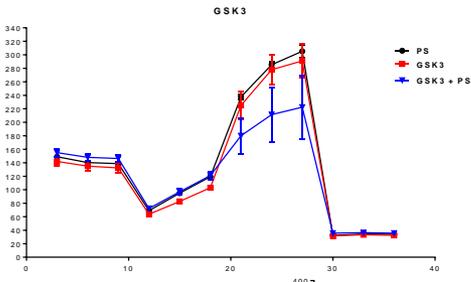
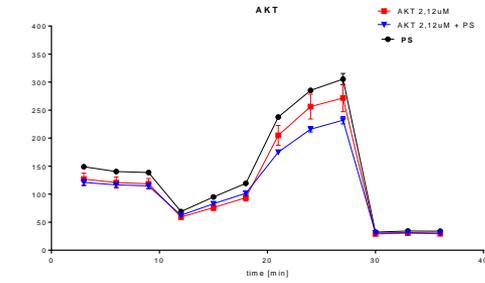
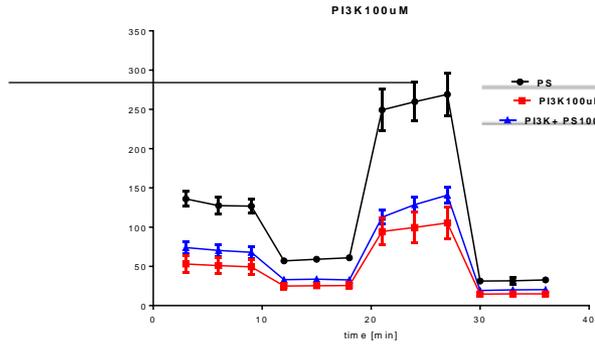
Bonora et al, Cell Cycle, 2013

Georgio et al, PNAS, 2013

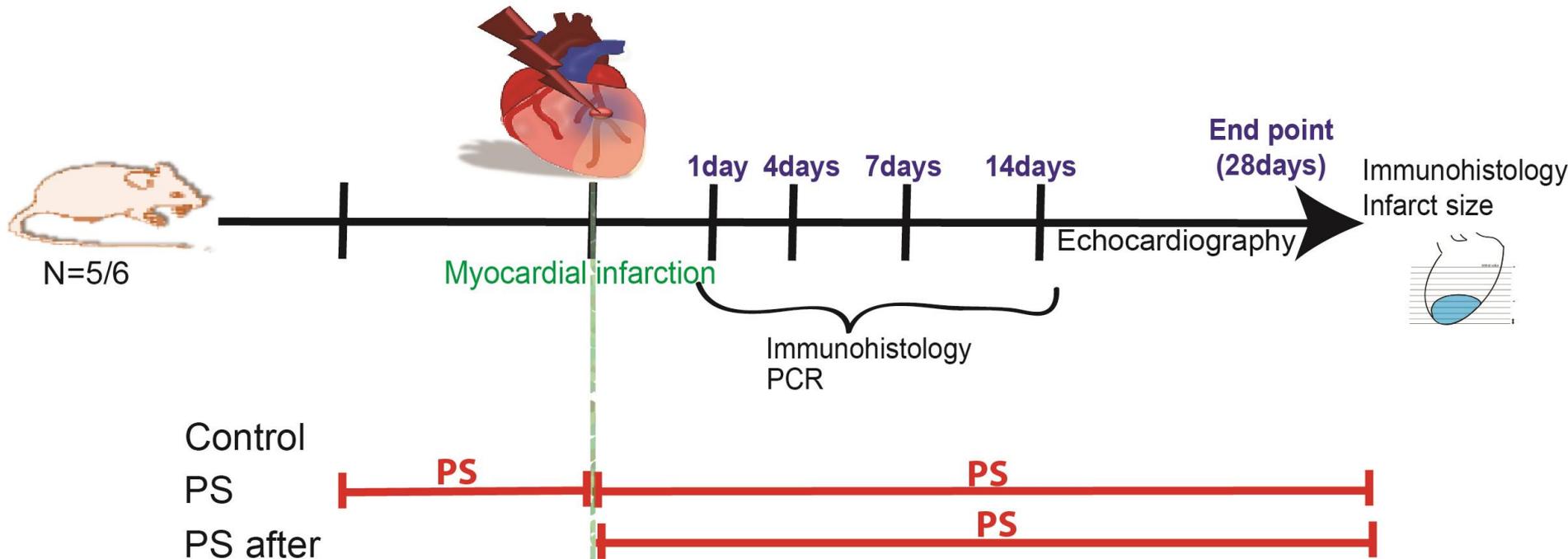
Baines et al, Nat Cell Biol, 2007

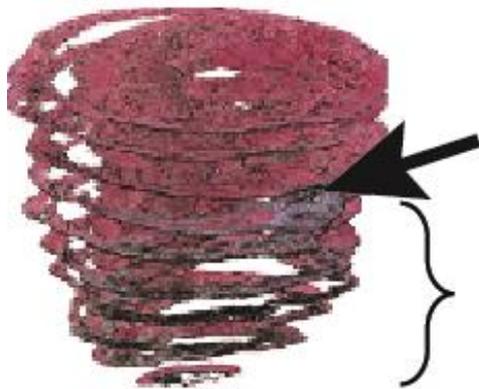
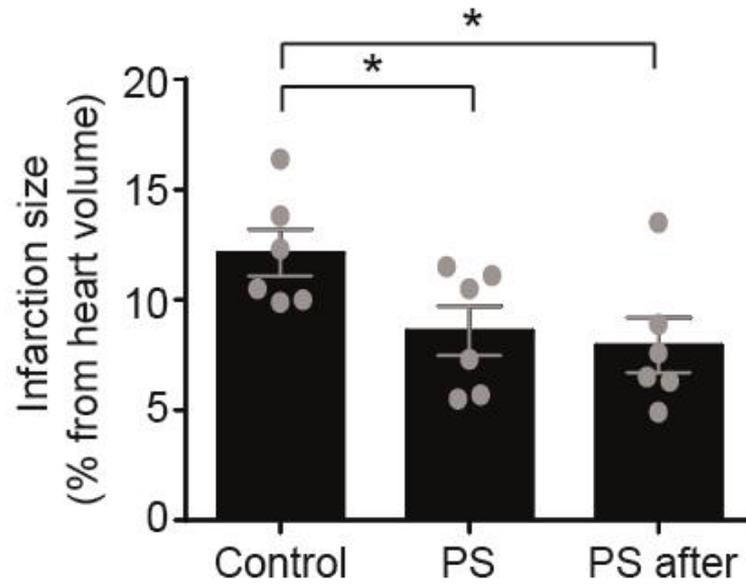
Kokoszka, Nature, 2004

- ❖ is abundantly expressed in adult cardiomyocytes
- ❖ has a wide variety of substrates, including ion channels, other signalling molecules and cytoskeletal proteins
- ❖ central player in cardioprotection against ischemic injury
- ❖ translocates to cardiac muscle sarcomeres and modulates contractility of the myocardium
- ❖ targets cardiac mitochondria, at the inner mitochondrial membrane, binding several mitochondrial proteins involved in glycolysis, beta oxidation, and ion transport



# Permanent ligature

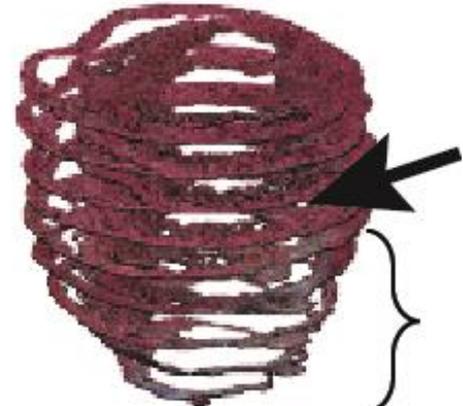




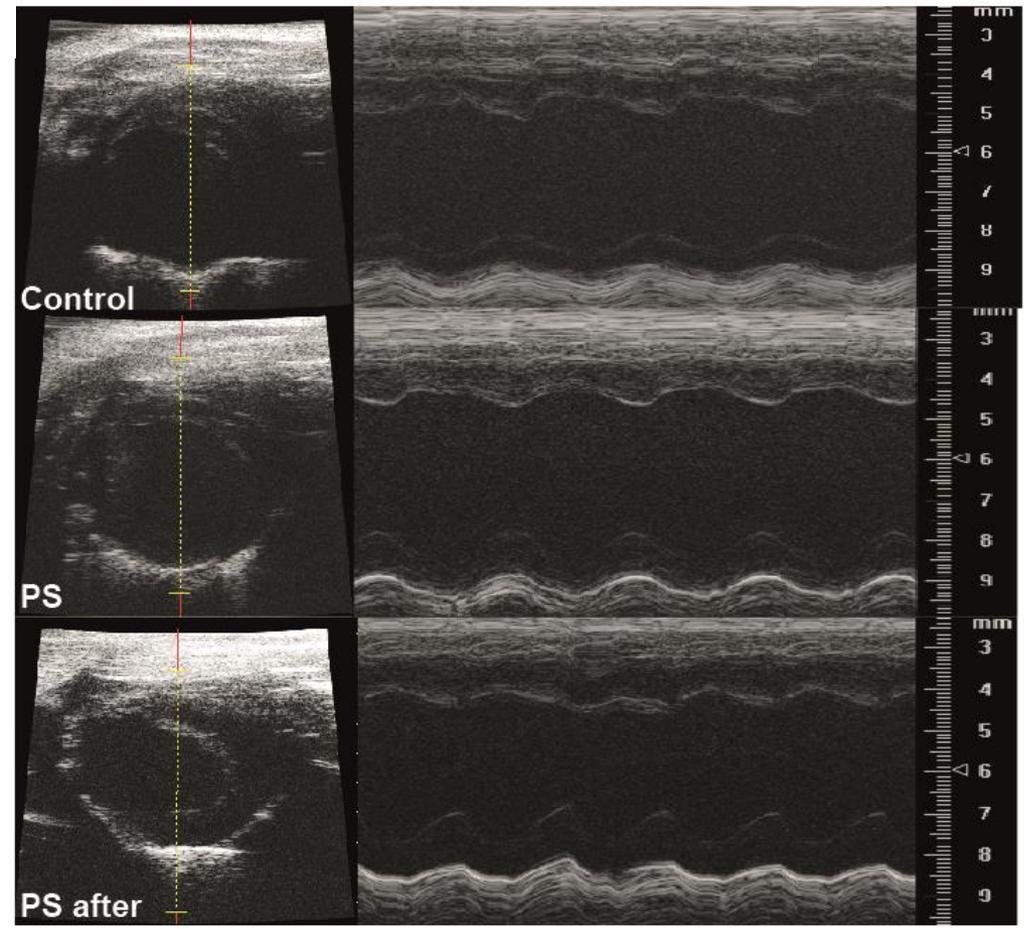
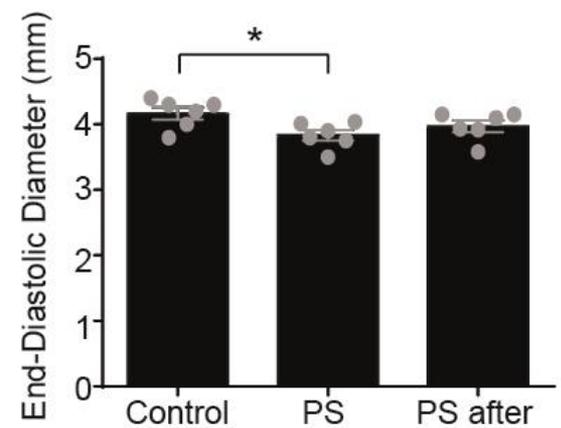
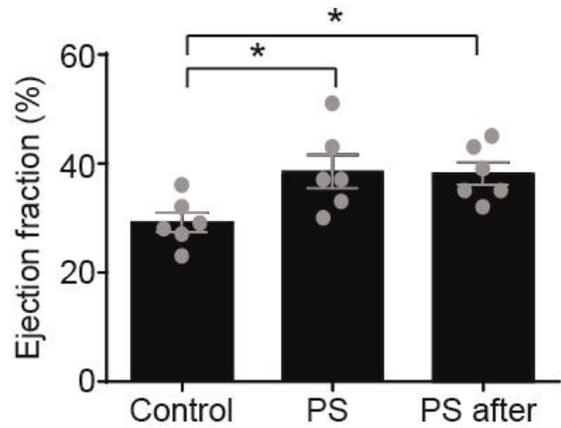
Control

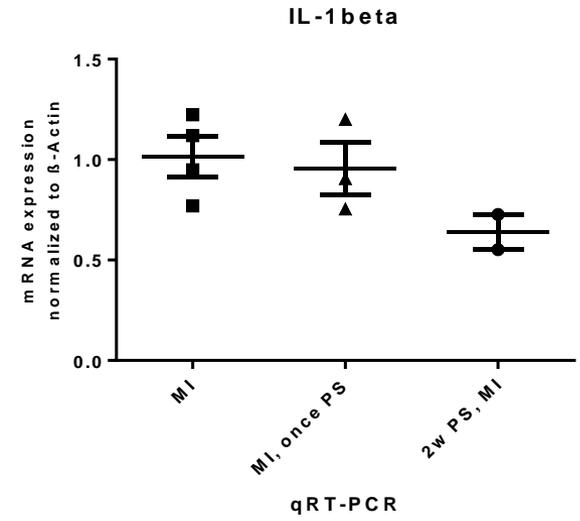
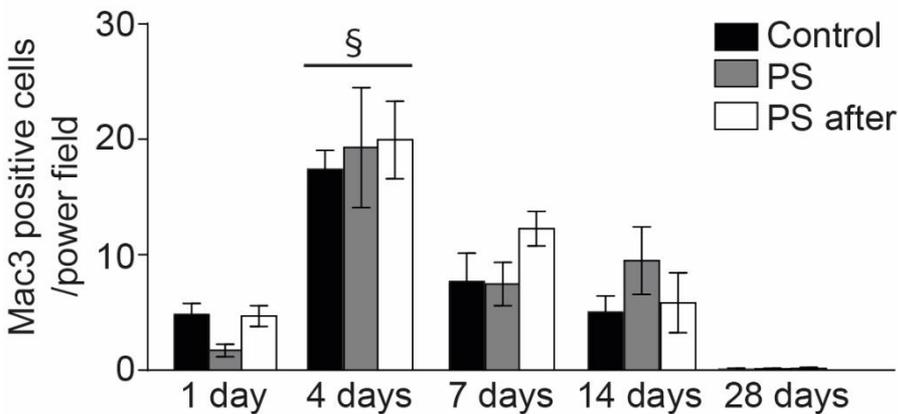
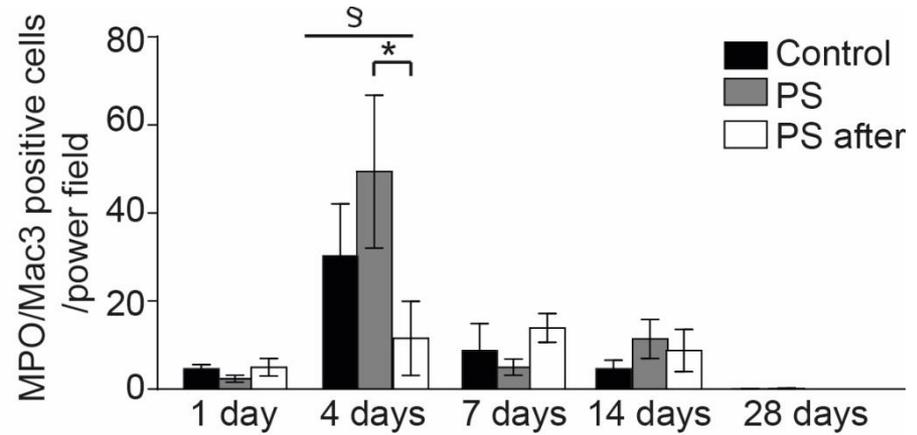
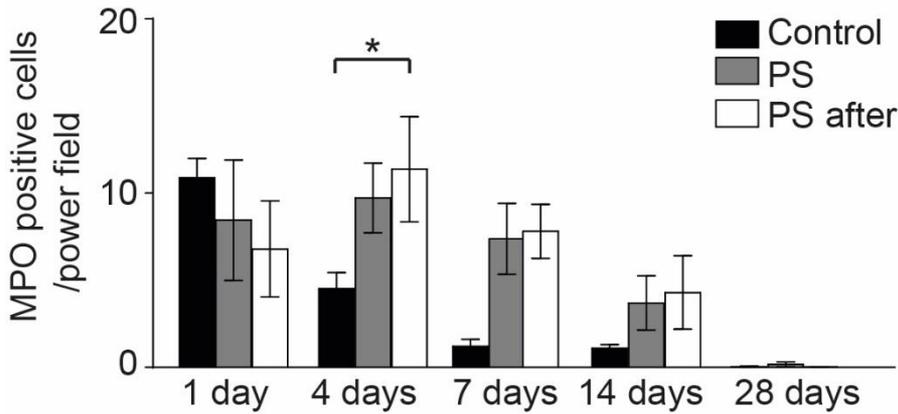


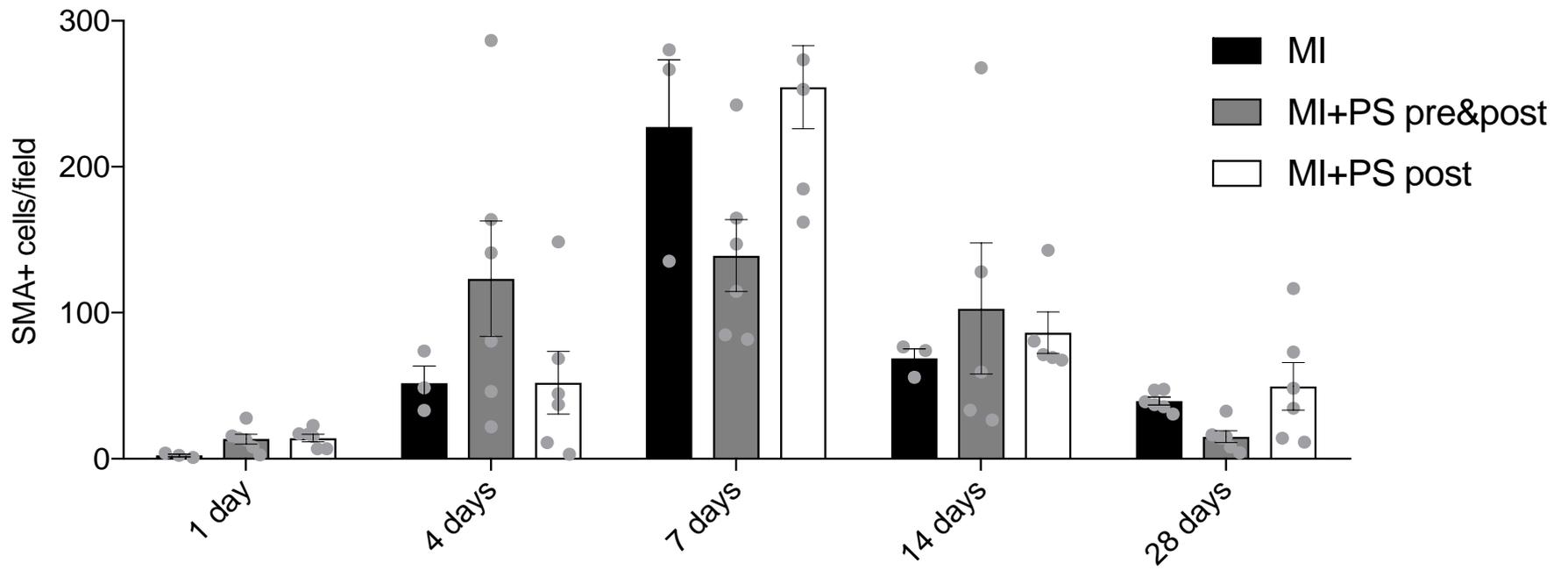
PS



PS after

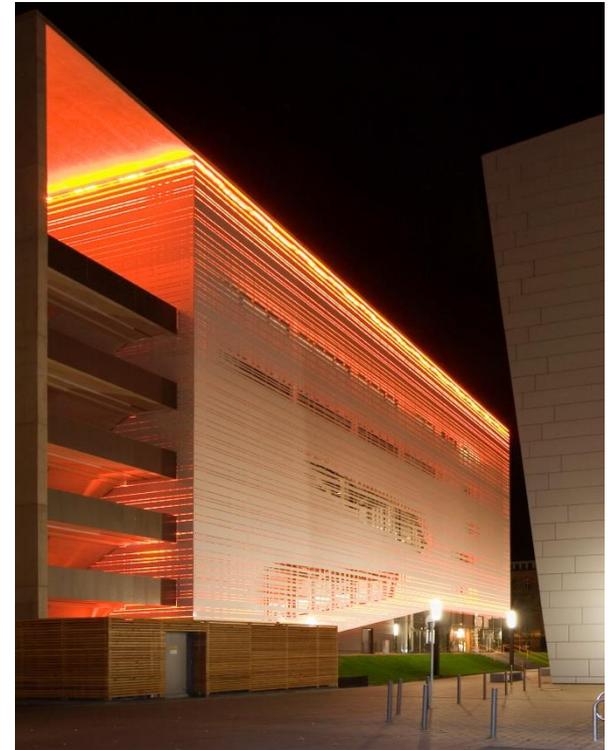
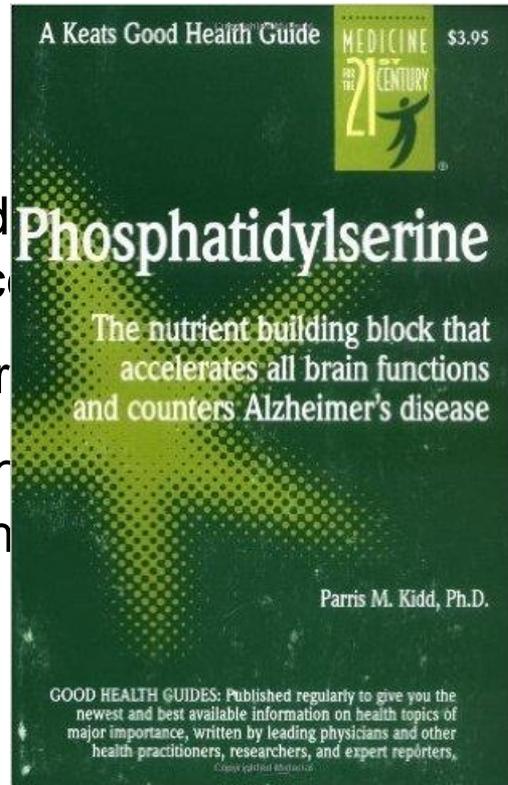






# Conclusions

- ❖ **PS** are already in clinical use for some cognitive diseases
- ❖ **PS** are comfortable with minimal side effects and discomfort at high doses, supervision being necessary
- ❖ **PS** protect the heart from cardiovascular complications
- ❖ **PS** could be for a heart clinical implication.





# Vielen Dank für Ihre Aufmerksamkeit

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**Thank you for your attention !**