



*Experimental Medicine Research Center,
Tehran University of Medical Sciences*

“ IN THE NAME OF GOD ”

*Nanobiomimetic principles:
from drug delivery to therapeutic effect*

ALIREZA PARTOAZAR

Ph.D. of medical nanotechnology

<http://emrec.tums.ac.ir>

Why use biomimicry ?

The evolution of nature led to the introduction of:

- ☞ *highly effective and power efficient biological mechanisms.*
- ☞ *durability*
- ☞ *performance*
- ☞ *compatibility*
- ☞ *.....*

Biomimetic principles



Physical function



Biological effect

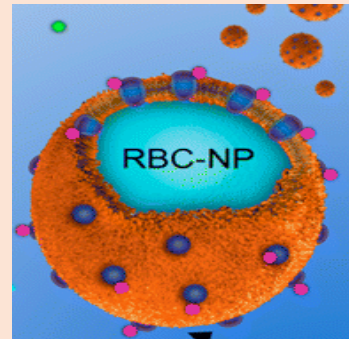
Chemical activity

An artificial cell mimics one or many functions of a biological cell

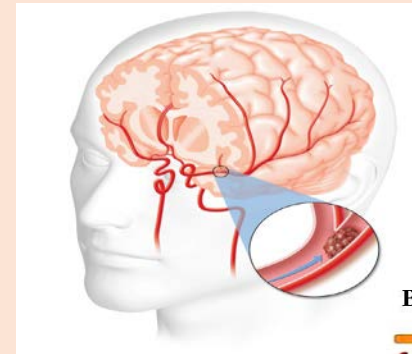


Blood transfusion without:

- allergic reactions
- transfusion reactions
- embolism
- circulatory overload
- Coagulation
- disturbances
- blood borne diseases transmission such as AIDS and hepatitis

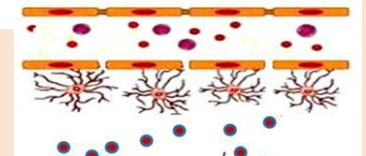


Hemoglobin vesicles mimics membrane enclosed cellular structure of red blood cells as an oxygen carrier.



**OXIGEN DELIVERY:
STROKE**

Blood brain barrier disruption



Problem: Immunosuppression and side effects

- organ transplantation
- lupus
- psoriasis
- rheumatoid arthritis
- Crohn's disease
- multiple sclerosis
- alopecia areata
- hypersensitivity

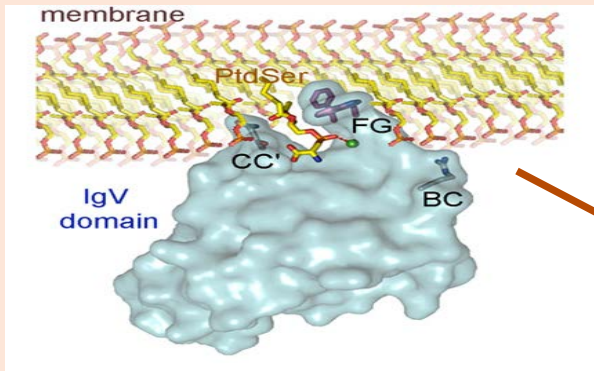
Side Effect Profiles of Immunosuppressive Drugs

	CsA	Tac	Srl	Ster	MMF
Hypertension	++	+	∅	++	∅
Hyperglycemia	+	++	∅	+++	∅
Renal insufficiency	++	++	∅	∅	∅
Hyperlipidemia	++	+	+++	++	∅
Hyperkalemia	+++	+++	∅	∅	∅
Tremor	∅	+	∅	∅	∅
Hirsutism	+	∅	∅	∅	∅
Gingival hyperplasia	+	∅	∅	∅	∅
Hypophosphatemia	++	++	+	∅	∅
Osteoporosis	±	±	∅	+++	∅
Malignancy	+	+	?	∅	+

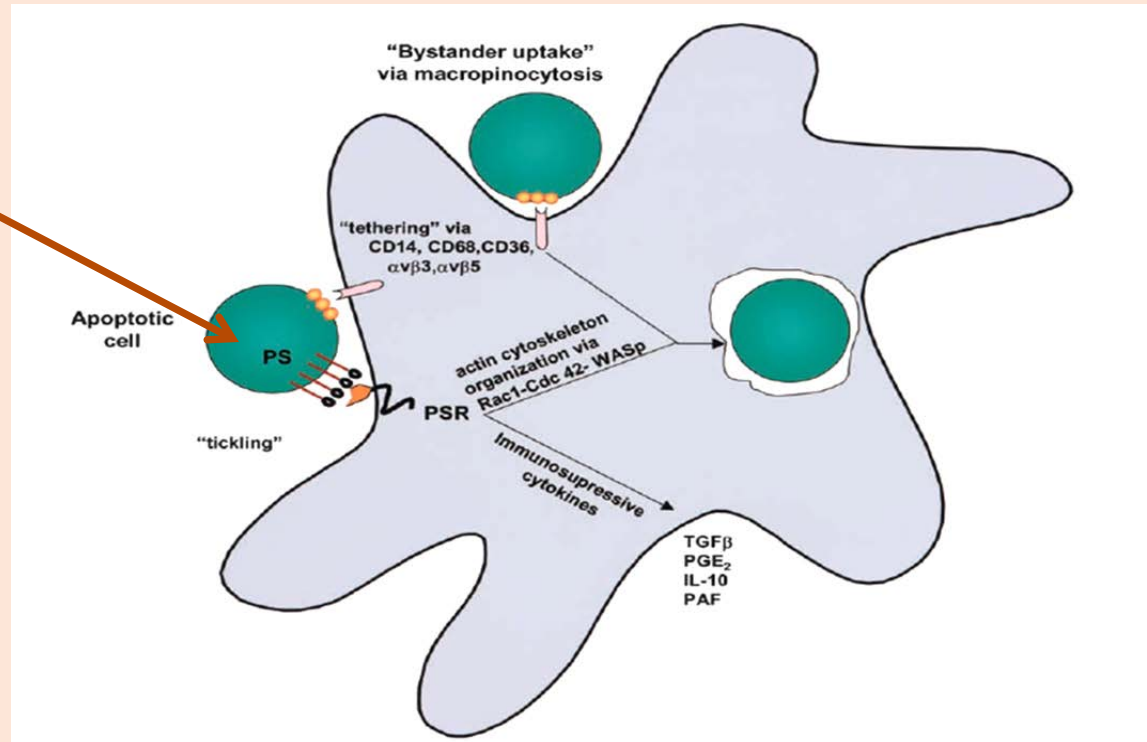
CsA, cyclosporin; Tac, tacrolimus; Srl, Sirolimus; Ster, Steroids; MMF, mycophenolate mofetil.

Nature analogy: Apoptotic mimicry through phosphatidylserine

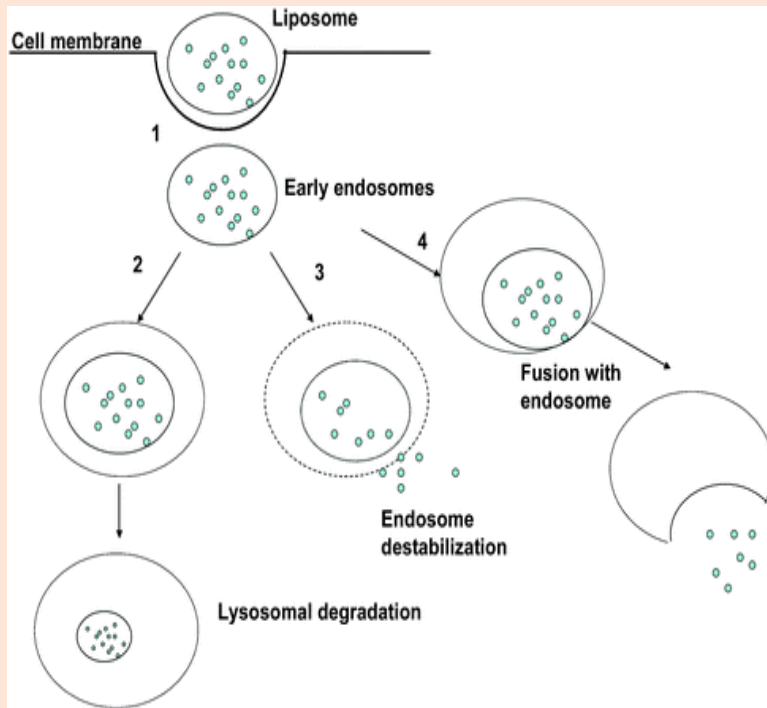
Model for TIM protein binding to PtdSer in a membrane



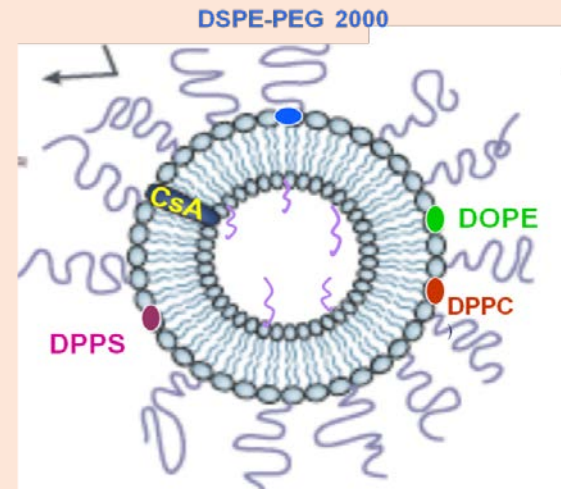
Interaction between Phosphatidylserine and the Phosphatidylserine Receptor Inhibits Immune Responses



Designing : Tissue and cell targeting as well as immunosuppressive activity

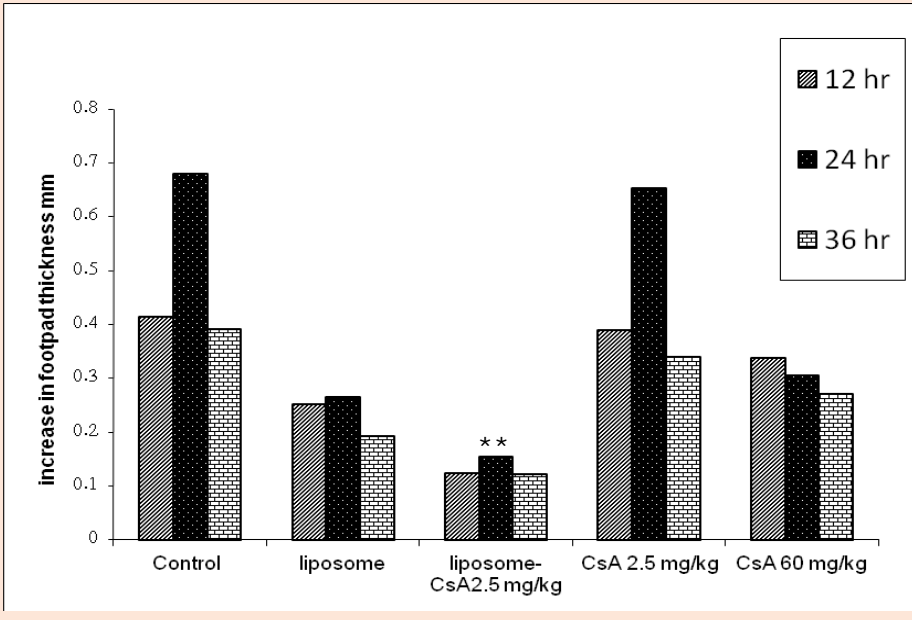
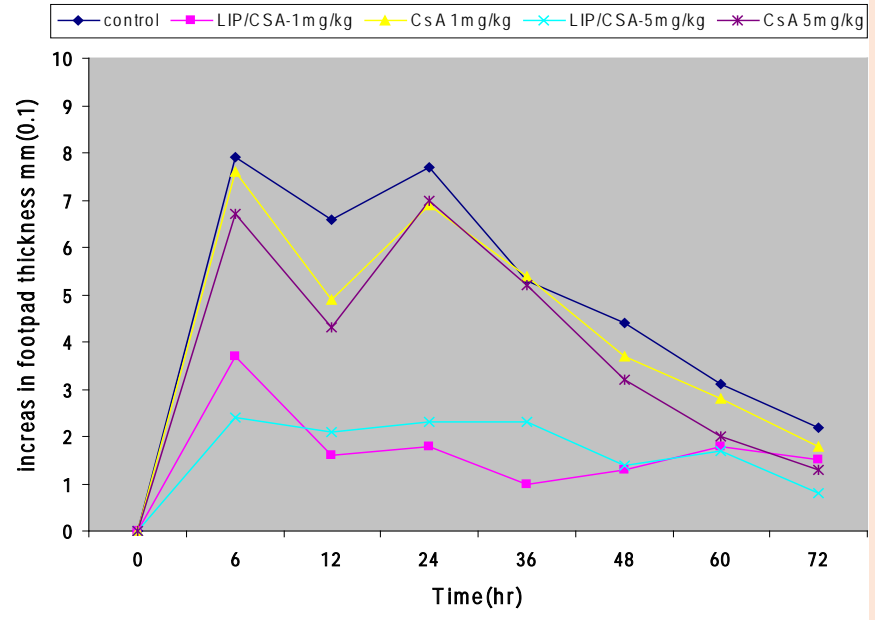


Intracellular delivery

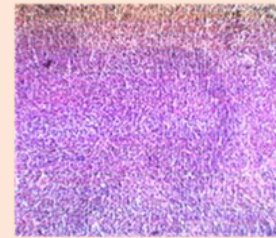
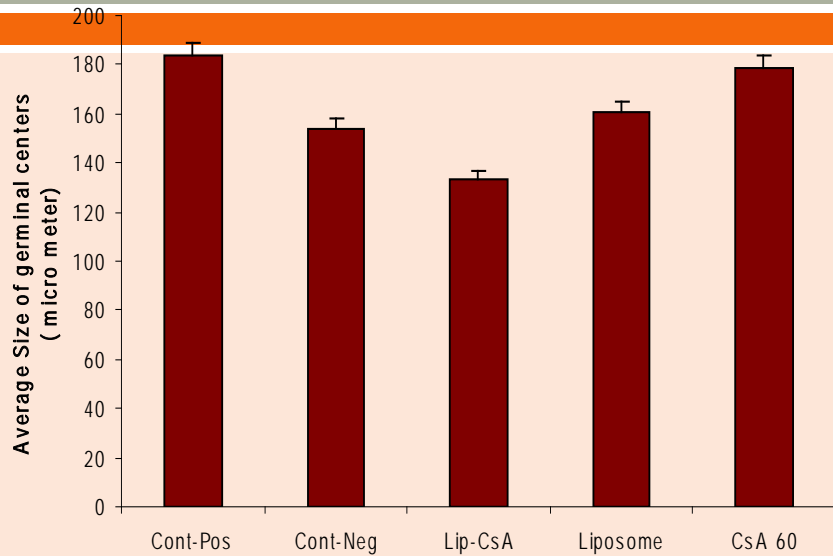


120nm

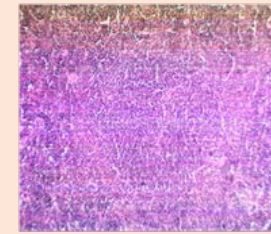
Analyzing: Effects of compounds 12, 24 and 36 hr after immunization on DTH responses to SRBC.



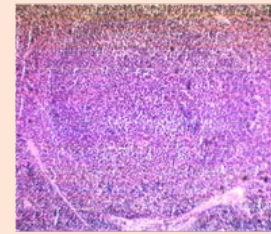
Analyzing: Effects of compounds 24 hr after sensitization on average size of mice's germinal centers.



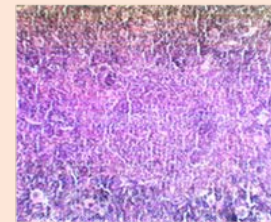
Positive Control



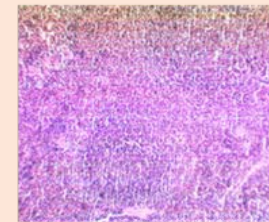
Negative Control



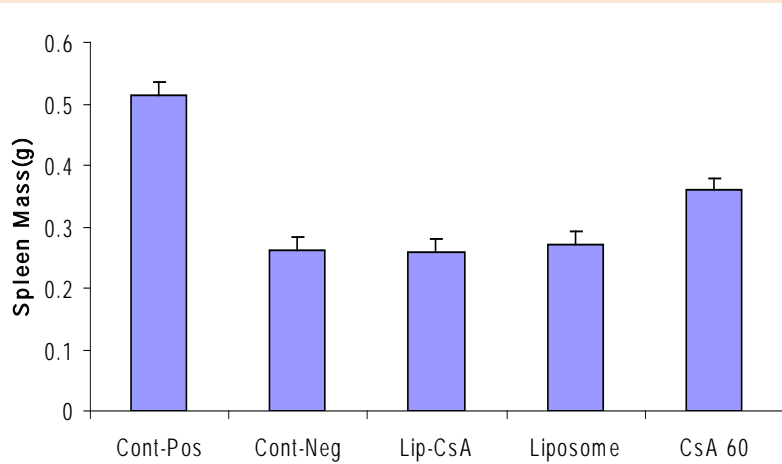
Cyclosporin A 60



Lipo-CsA 2.5



Liposome



Finding

Compound	CsA Dose (mg/Kg)	Inhibition (%)		
		at 12 h	at 24 h	at 36 h
Control(Vehicle)	—	0	0	0
Liposome	—	39	61	51
CsA	60	18	55	30
CsA	2.5	—	—	—
Liposome-CsA	2.5	70%	77%	68%

Results of Immunosuppressive activity of compounds in mice

Compound	Mortality %
liposome	—
Liposome-CsA (2.5 mg/kg)	—
Cyclosporin A (60 mg/kg)	30 (approximately)
Vehicle (CsA-Cre)	—

Results of mortality percentage after administration of compounds

با سپاس از توجه شما

