



Evaluation of health function of spices by global cooperation between Indonesia and Japan.

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Spices and herbs with powerful health benefits

- The use of spices and herbs has been incredibly important throughout history.
- Many spices were celebrated for their medicinal properties, well before culinary use.
- Modern science has now shown that many of them do indeed carry remarkable health benefits.

We empirically know the health benefits of spices. However, scientific evaluation of their health functions is not enough.



Cumin

➤ Name : *Cuminum cyminum* L.

➤ Family : Apiaceae

➤ Use : Spice



➤ Cumin seed is one of popular spices in the world.

Several functions of cumin seed have been reported.

Lipid-soluble components (Essential oil)

p-menthe-1,4-dien-7-al, cumin aldehyde, γ -terpinene

⇒ Anti-inflammatory, anti-oxidant, anti-bacterial effects

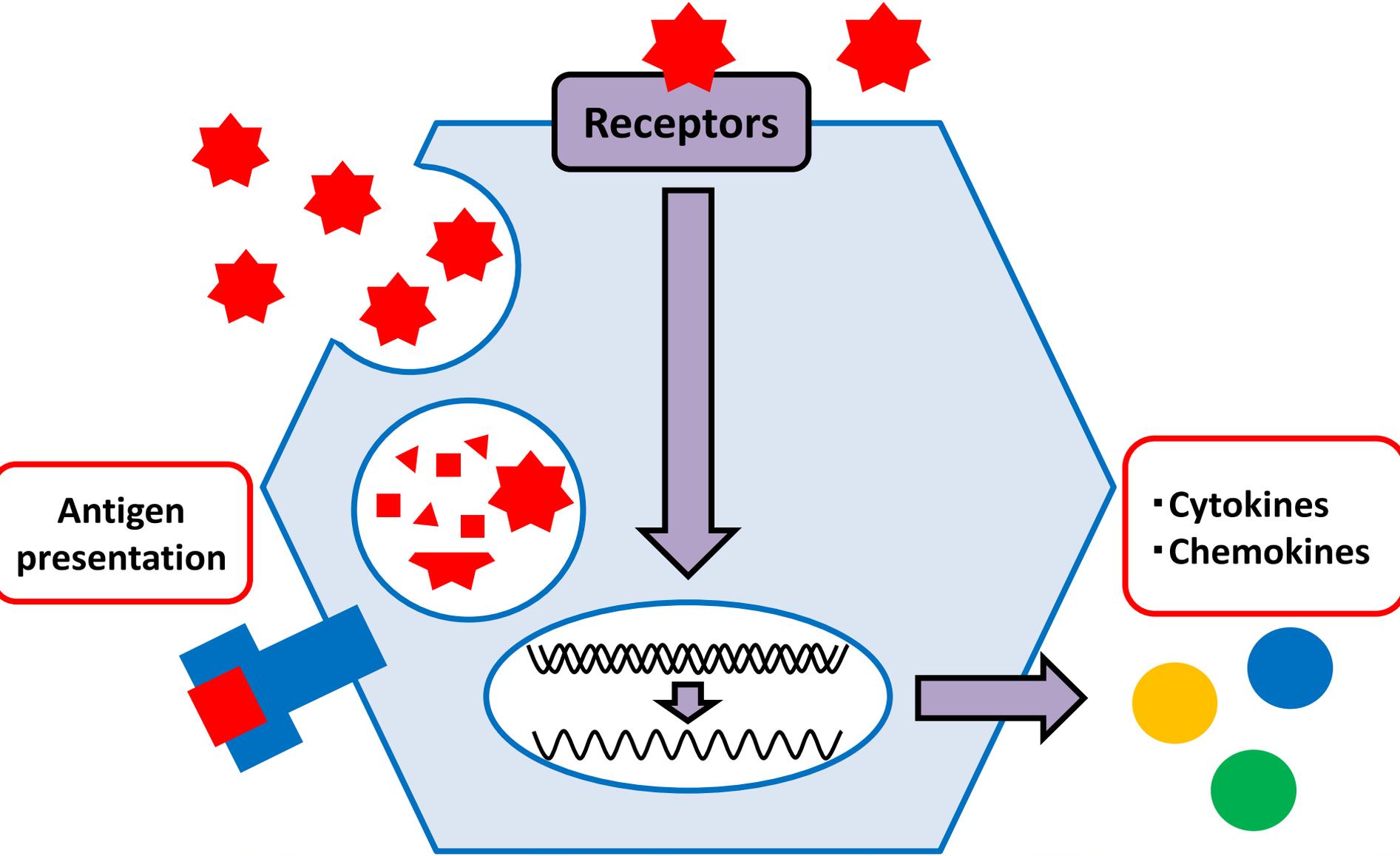
Water-soluble components

⇒ Little is known about the health functions.

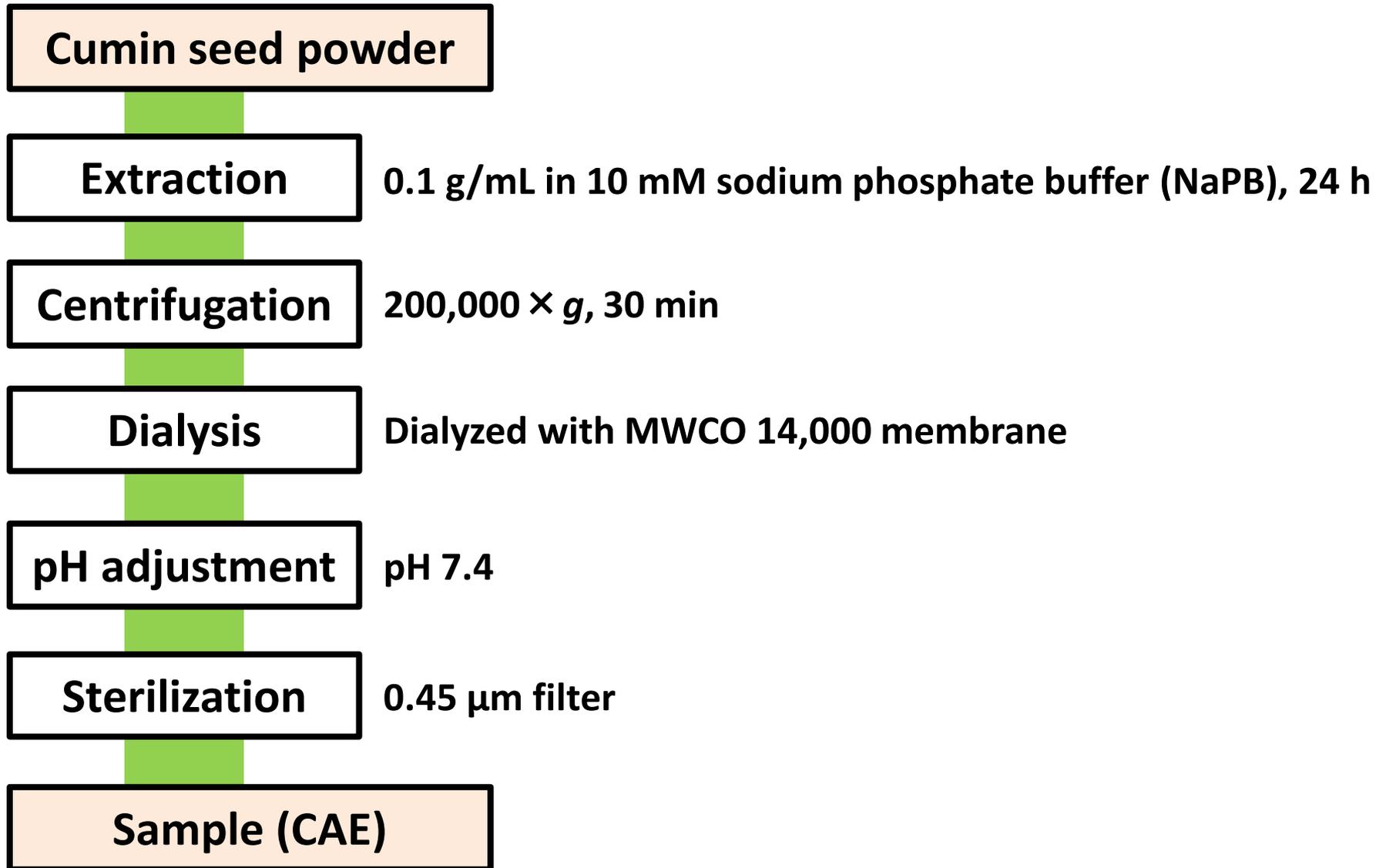
We focused on the functions of water-soluble substances in cumin.

Immunostimulatory effect of cumin seed aqueous extract

Macrophage



Sample preparation



Cells

- Mouse macrophage cell line; RAW264.7 cells
- Mouse peritoneal macrophages (P-Mac)

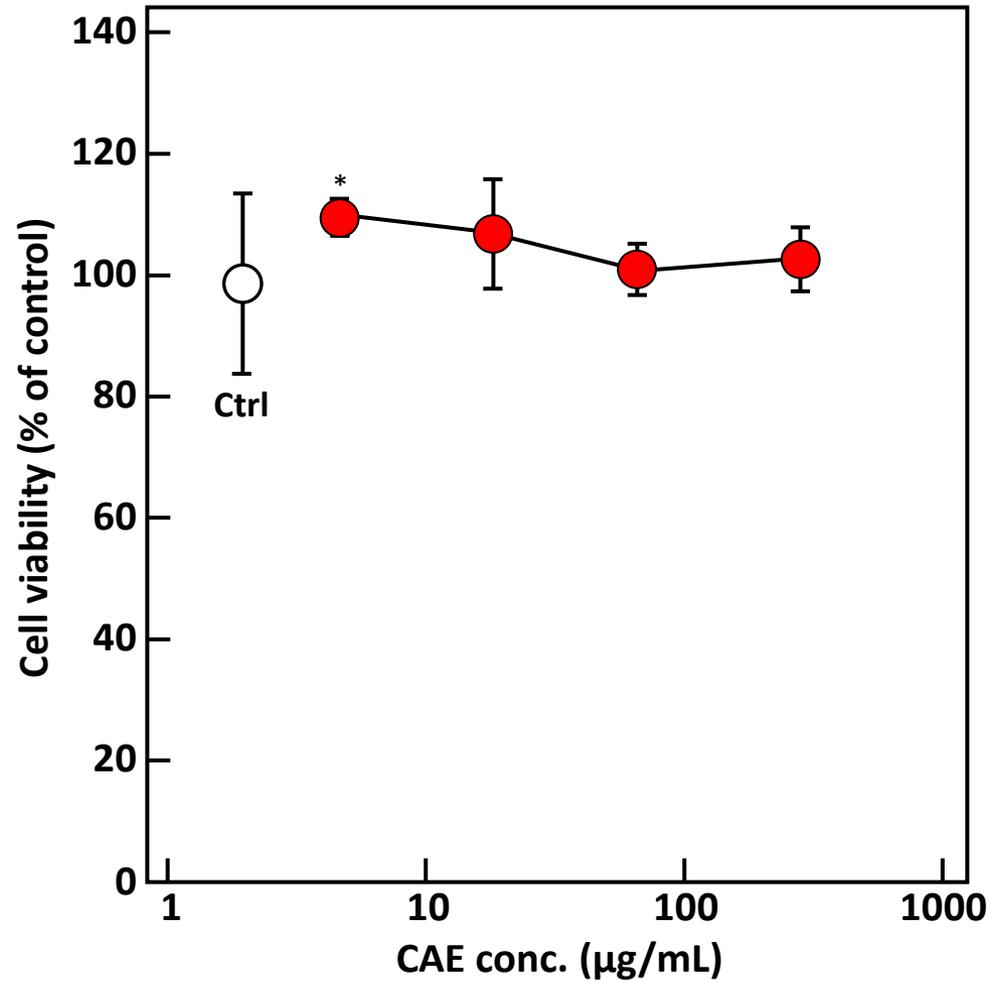
Media

- 10% Fetal bovine serum (FBS)-DMEM medium
- 10% FBS-RPMI 1640 medium

Evaluations

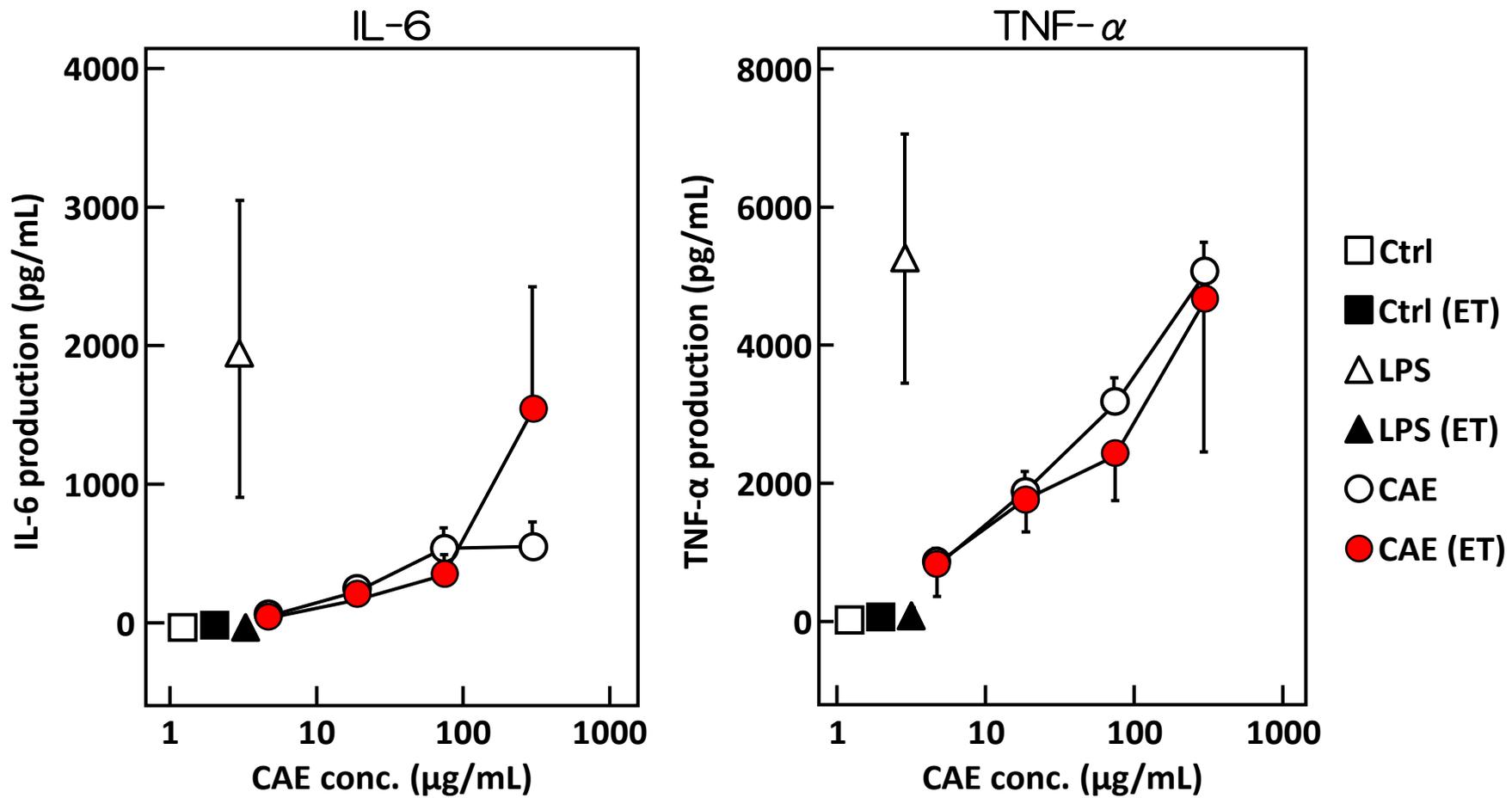
- Cell viability
- Cytokine production
- Gene expression
- Intracellular signal transduction
- Phagocytotic activity

Cytotoxicity of CAE on RAW264.7 cells



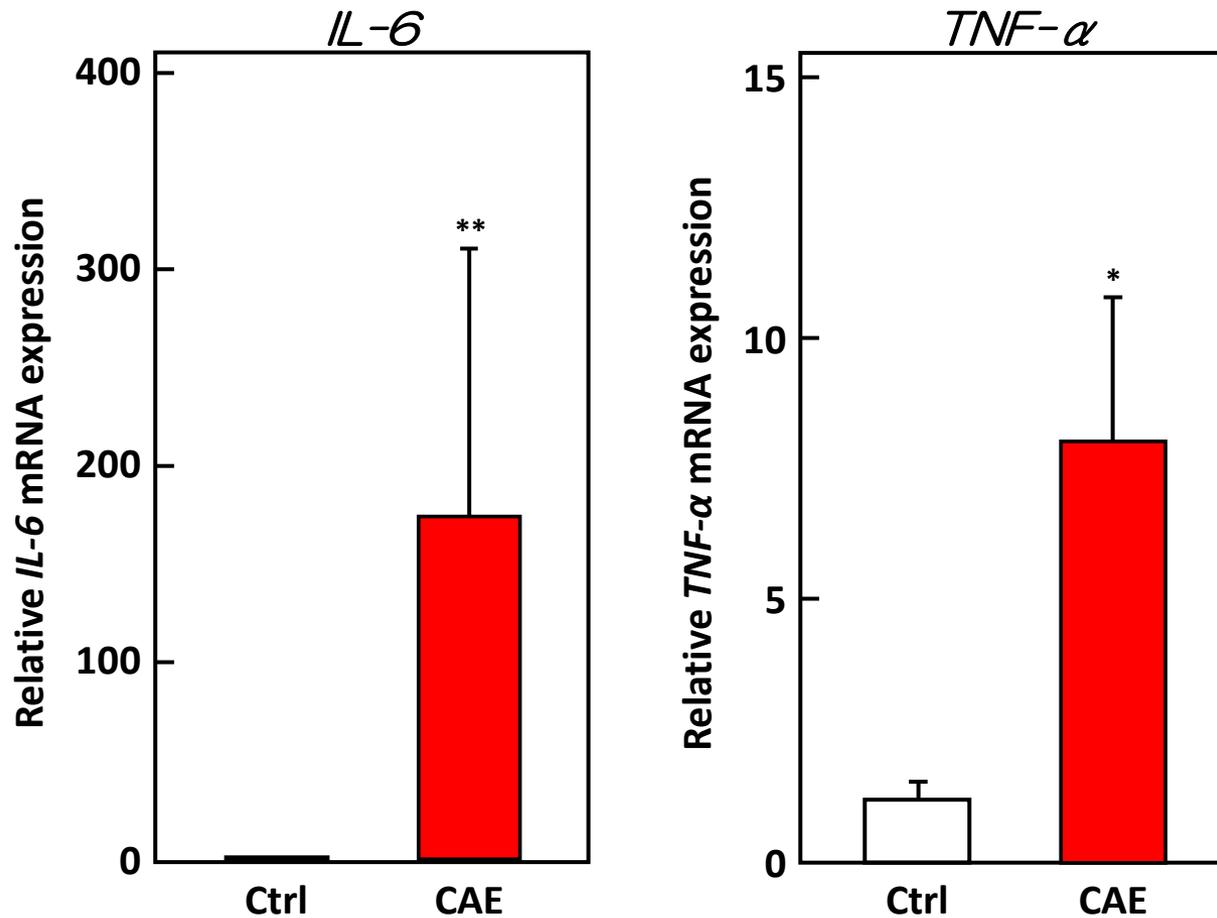
* $P < 0.05$ vs. control

Effect of CAE on cytokine production by RAW264.7 cells



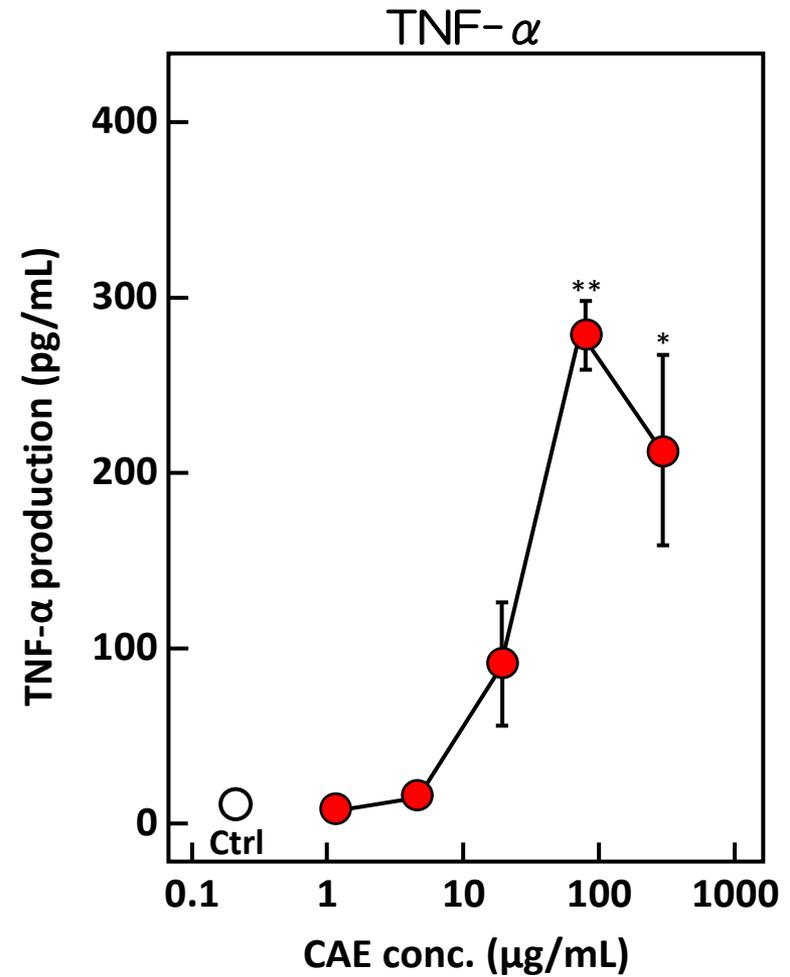
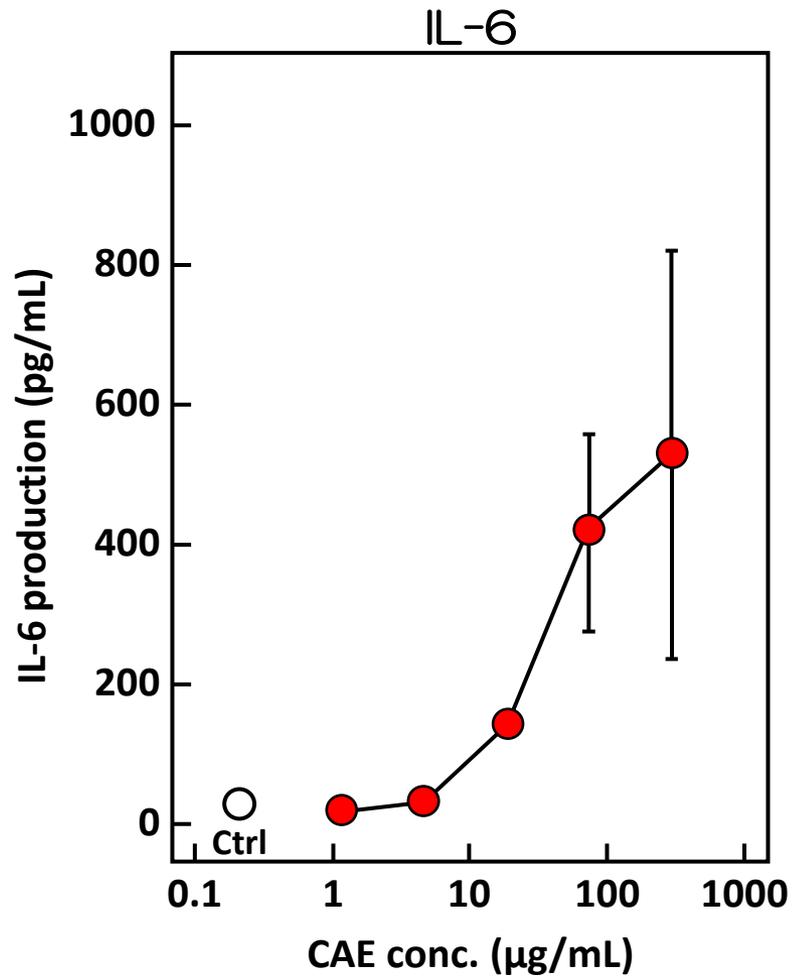
ET: EndoTrap treated

Effect of CAE on mRNA expression in RAW264.7 cells



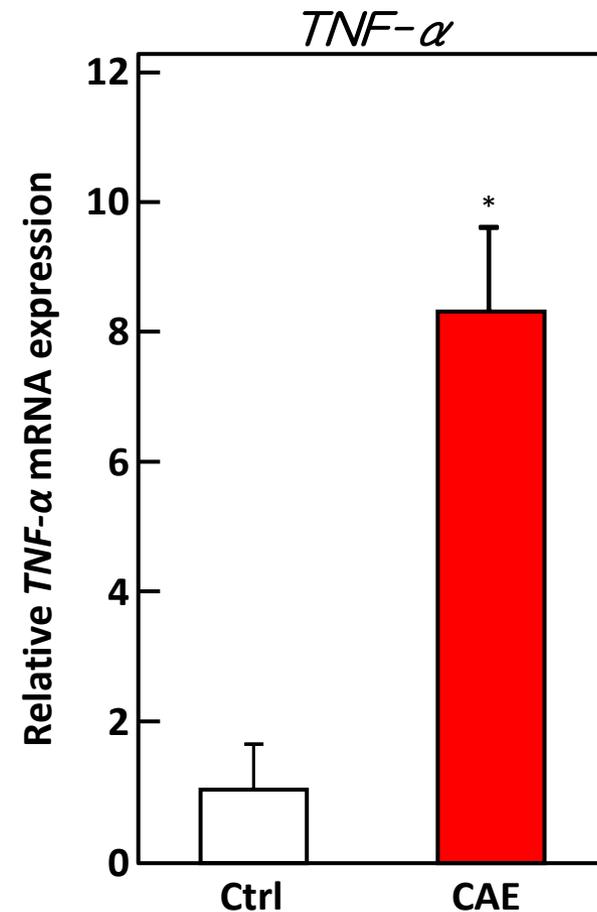
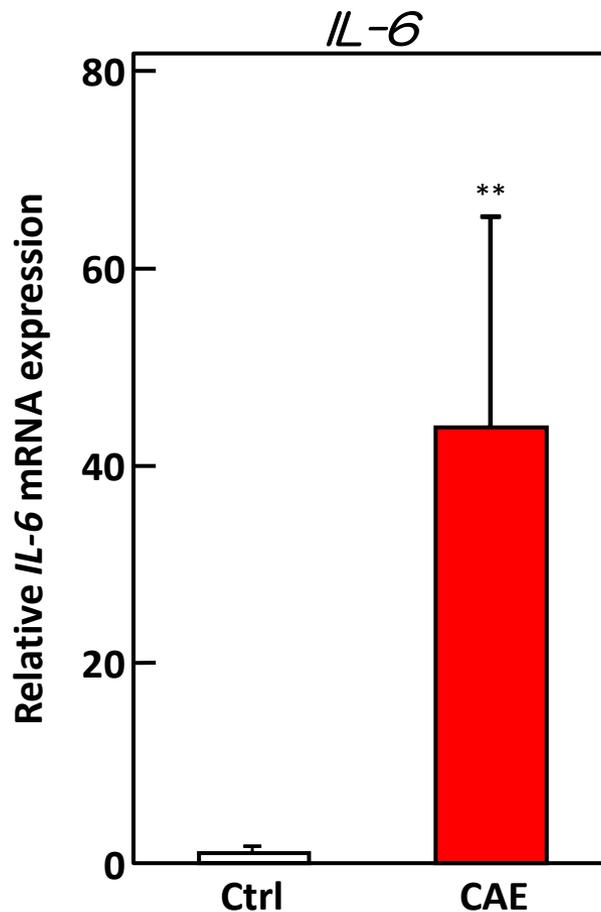
* $P < 0.05$, ** $P < 0.01$ vs. control

Effect of CAE on cytokine production by P-Mac



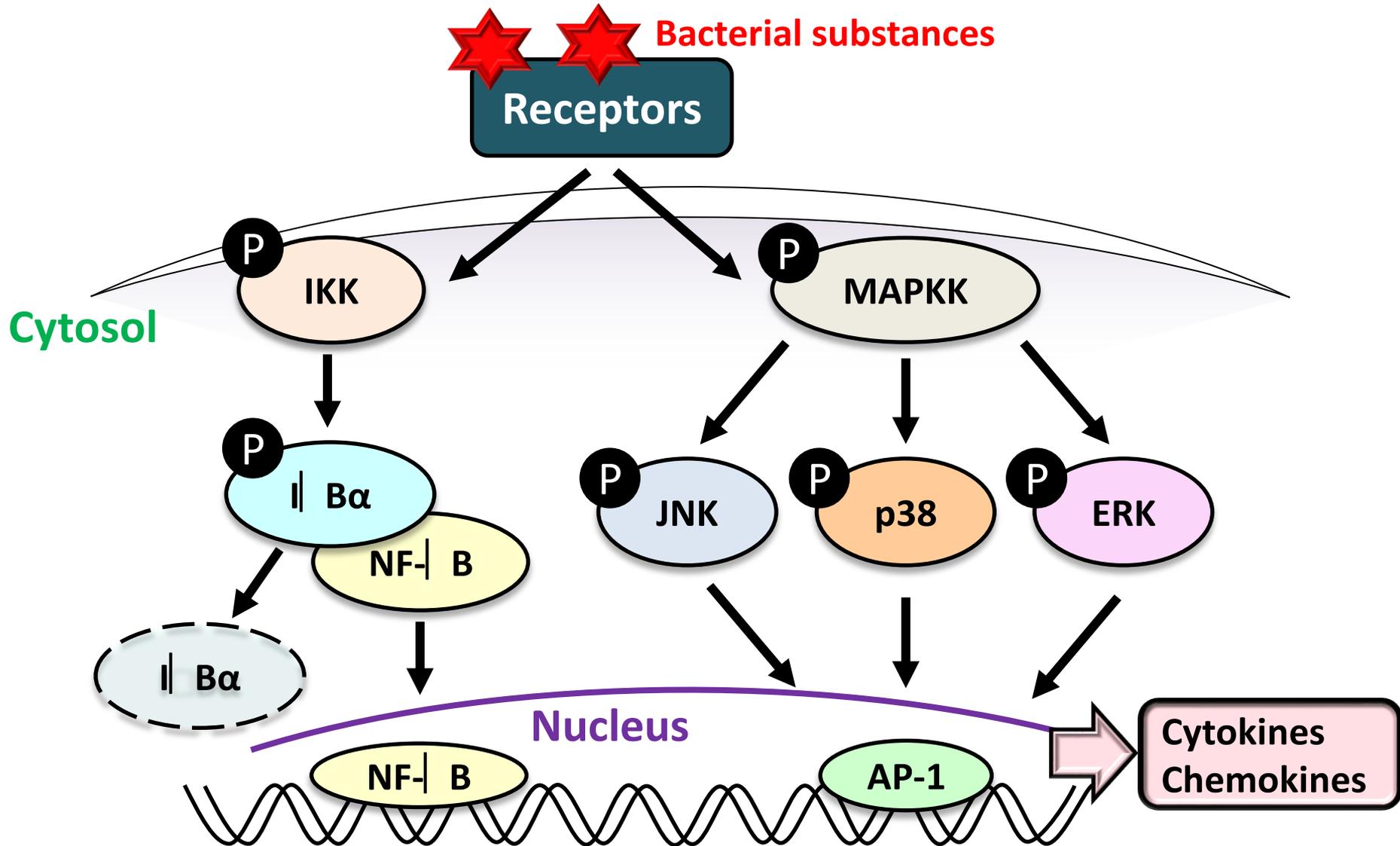
* $P < 0.05$, ** $P < 0.01$ vs. Ctrl

Effect of CAE on mRNA expression in P-Mac

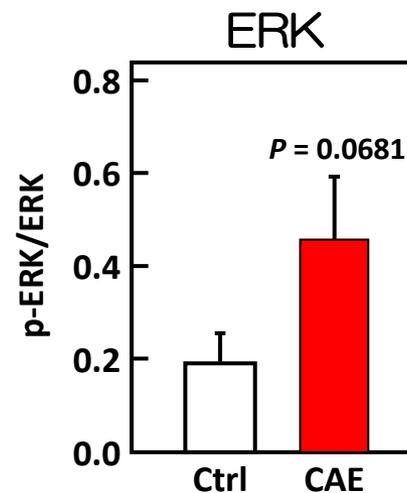
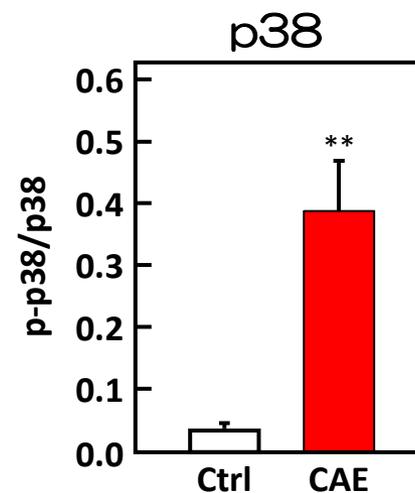
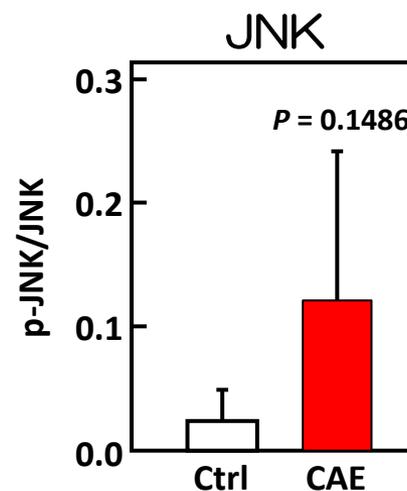
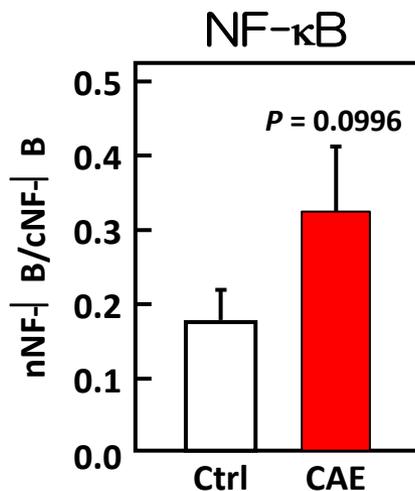
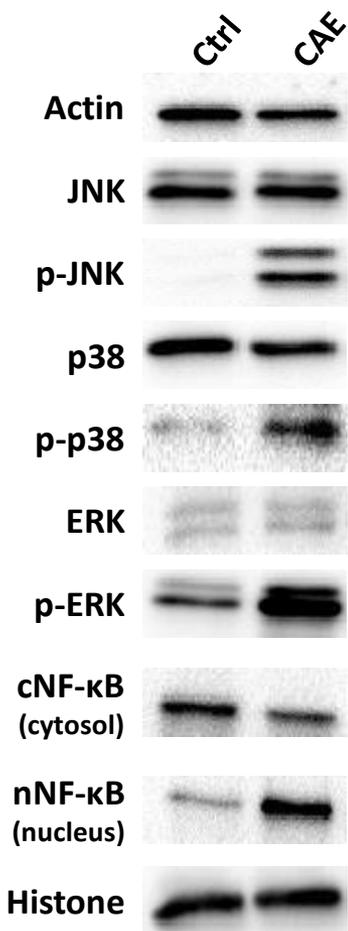


* $P < 0.05$, ** $P < 0.01$ vs. control

Macrophage-activating signaling

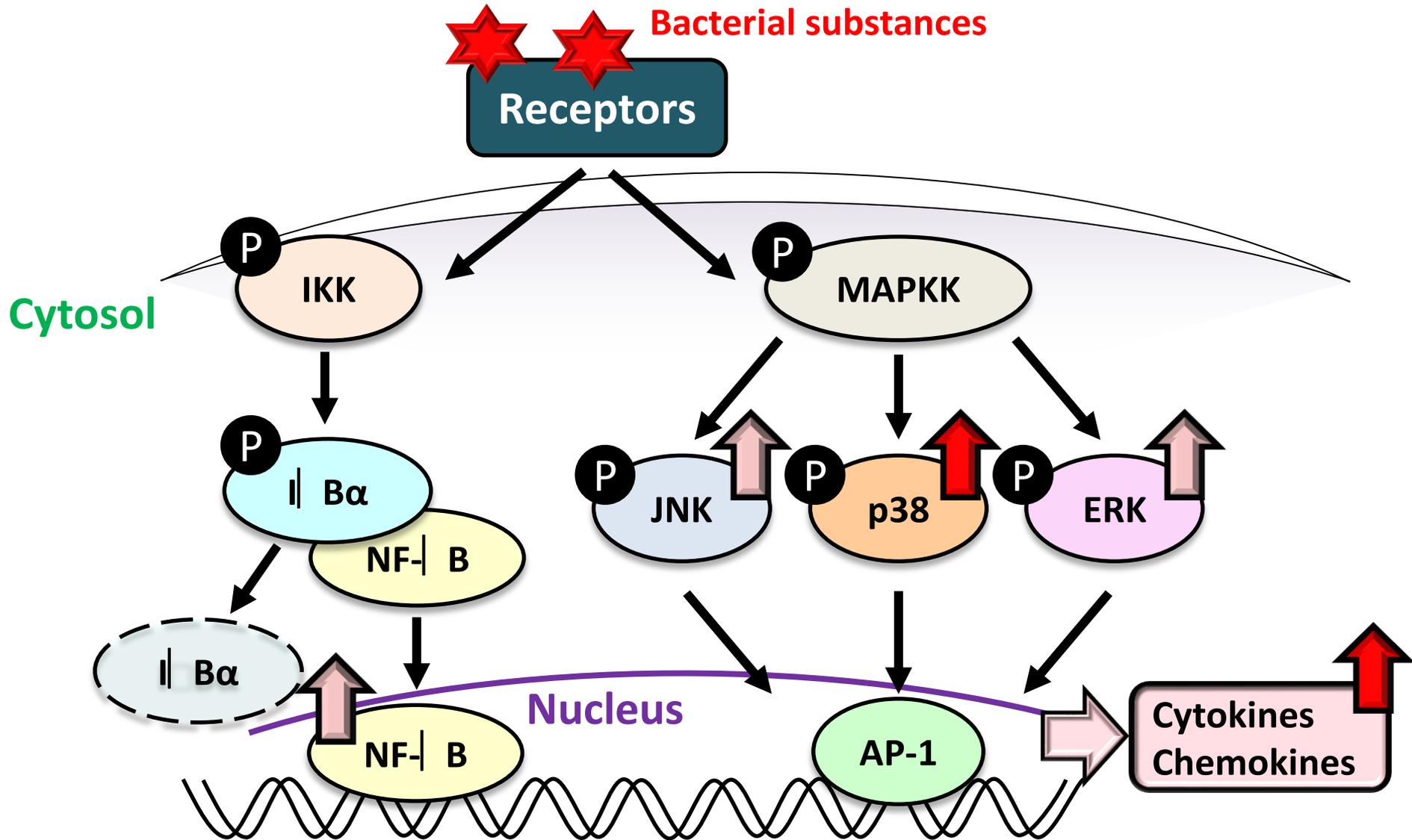


Effect of CAE on MAPK and NF- κ B pathways

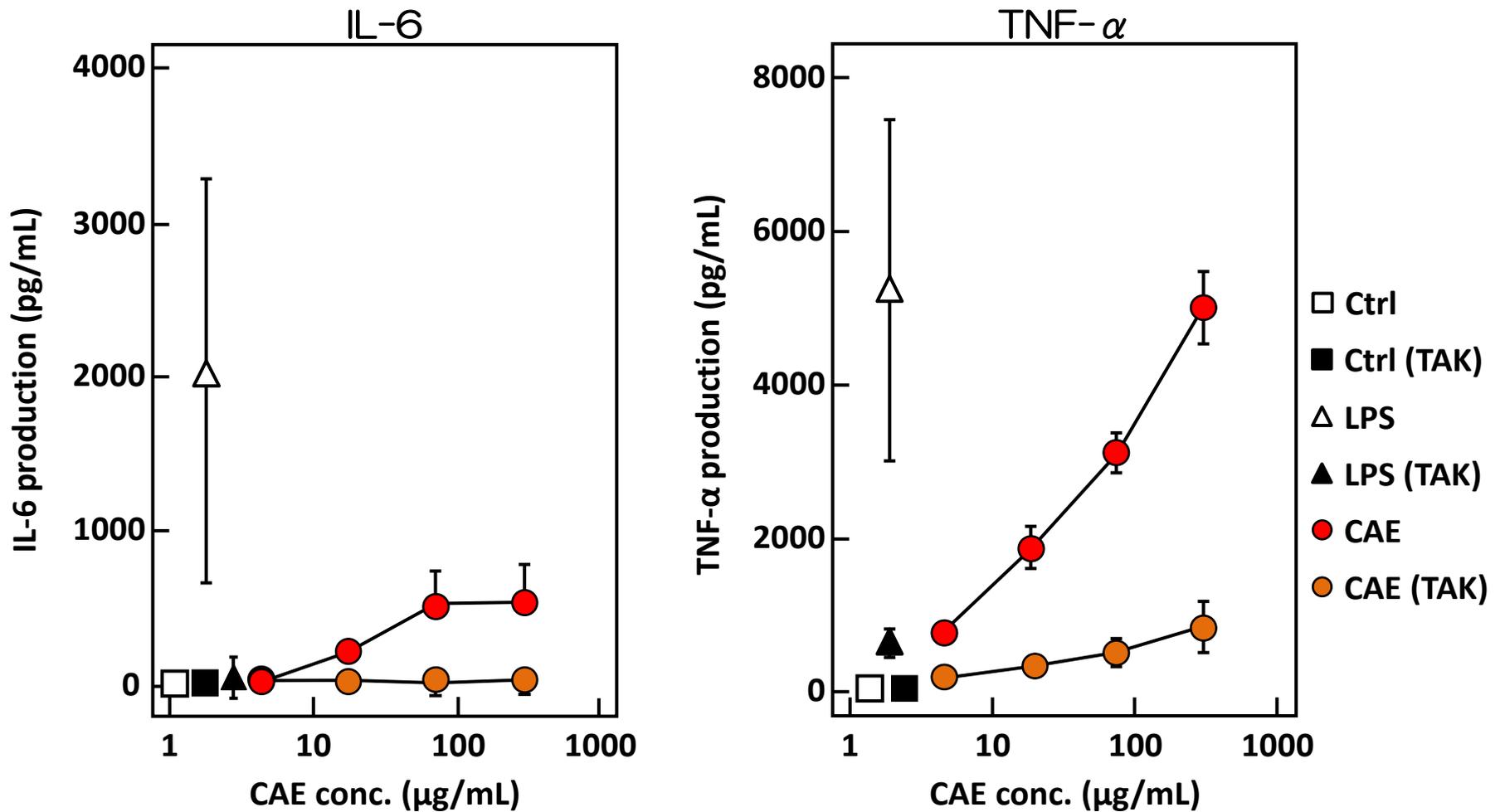


** $P < 0.01$ vs. control

Mode of action of CAE

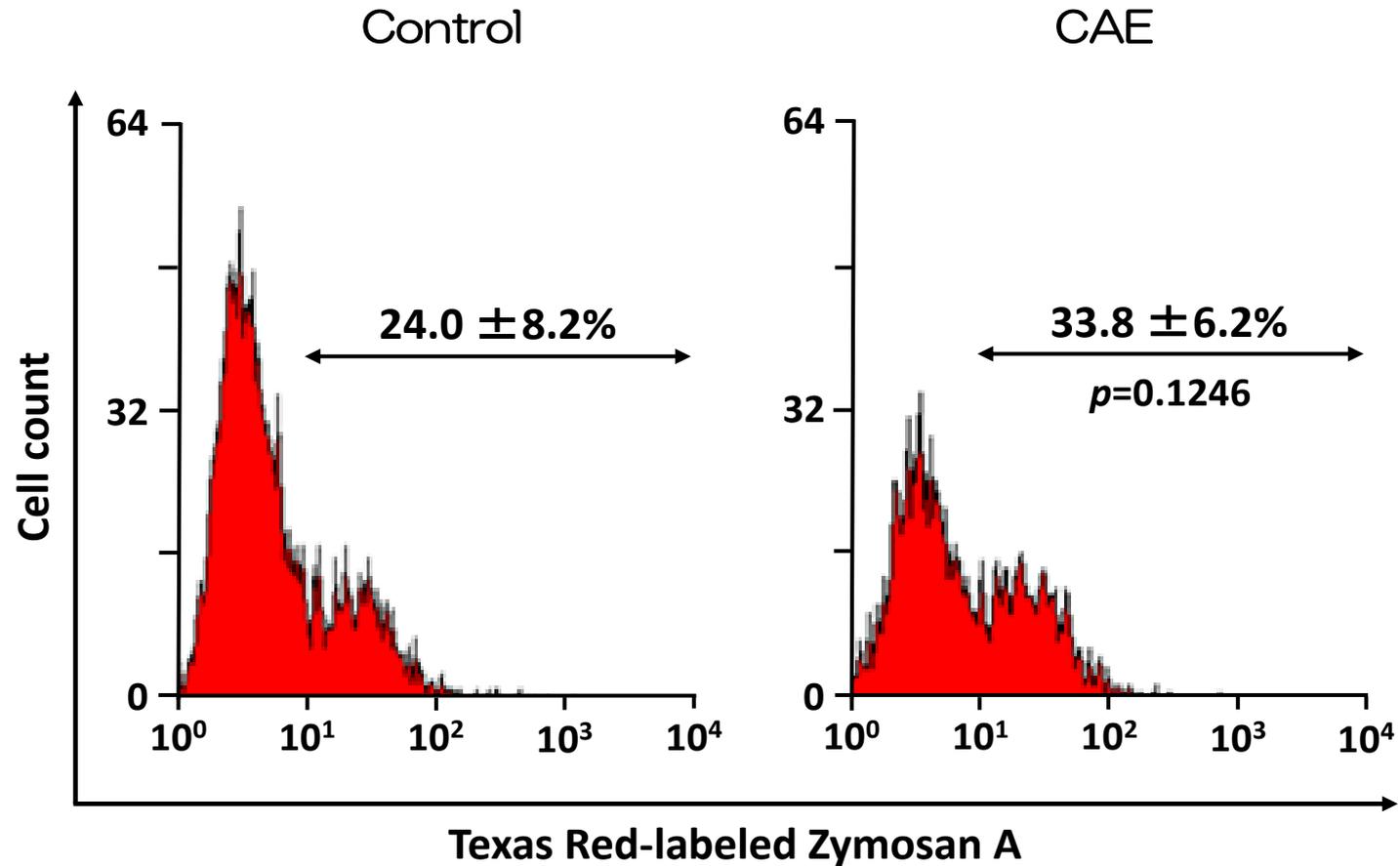


Effect of CAE on cytokine production under TLR4 inhibition



TAK: TLR4 inhibitor, TAK-242

Effect of CAE on phagocytosis of RAW264.7 cells



Collaboration with Indonesia

Evaluation of function of Indonesian food stuffs



Arrowroot



Bengkoang



Snake fruit



Kedawung



Pornag



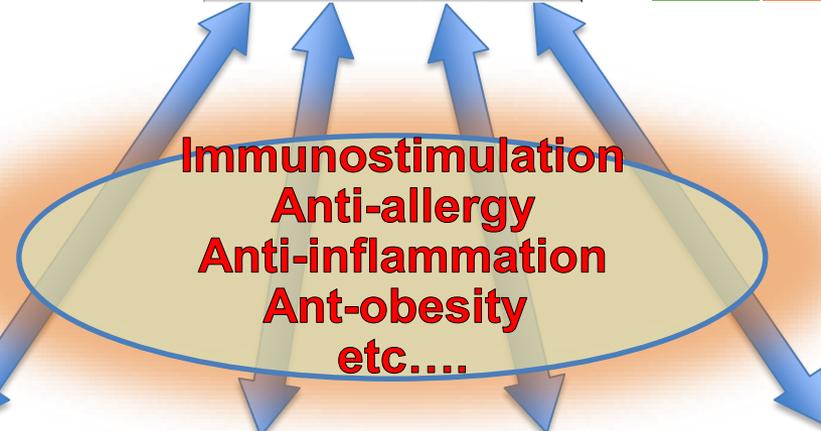
Red fruits



Oncom



Hakoi



Gadjah Mada Univ.



Univ. of Papua



Jember Univ.



Indonesia International Institute for Life Sciences

- *Cytotechnology*, 64, 131-137, 2012
- *J. Funct. Foods*, 5, 582-589, 2013
- *Cytotechnology*, 66, 75-85, 2014
- *Food Funct.*, 5, 1403-1408, 2014
- *Am. J. Drug Discov. Dev.*, 4, 90-101, 2014
- *Cytotechnology*, 68, 1737-1745, 2016
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- *Canrea Journal*, 2, 136-142, 2018

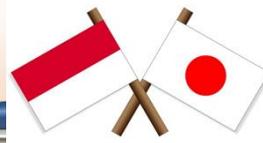
Collaborative development of functional foods



Academia



Spices



Herbs



- Evaluation of health function of spices
- Evaluation of the mode of action

- *J. Sci. Food Agr.*, 97, 4727-4736, 2017
- *Cytotechnology*, 71, 599-609, 2019



Development of functional foods both in Indonesia and Japan using same evidences

Academic papers

International patents



Food industry

Conclusion

- Cytokine production-promoting effect of CAE was not derived from contamination of endotoxin.
- CAE activates NF- κ B and MAPK signaling pathways to stimulate cytokine gene expression.
- CAE tended to enhance phagocytosis activity of RAW264.7 cells.
- CAE may interact with TLR4 to induce macrophage activation.

**Cumin seed also has potential as
Immuno-stimulatory functional food.**



Terima Kasih !