

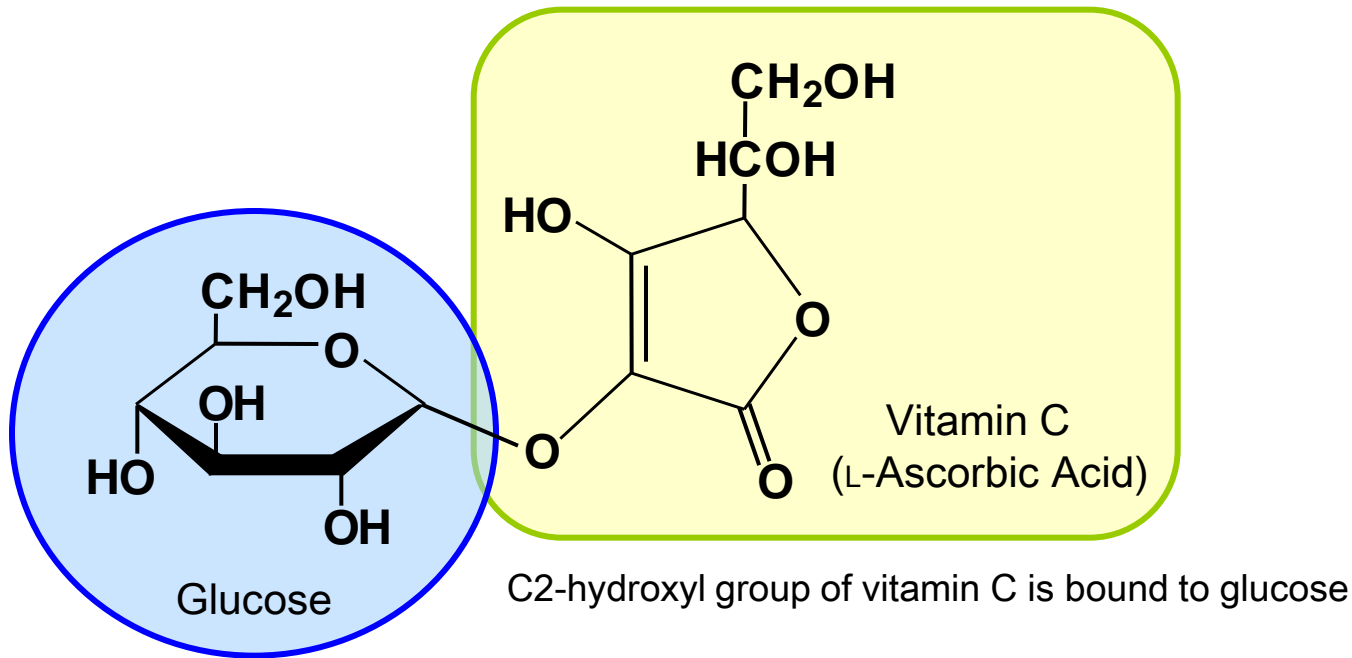
**AA2G<sup>TM</sup>**

**L-Ascorbic Acid 2-Glucoside**

**HAYASHIBARA CO., LTD.**



# What is AA-2G ?



**AA-2G**  
**L-Ascorbic Acid 2-Glucoside**

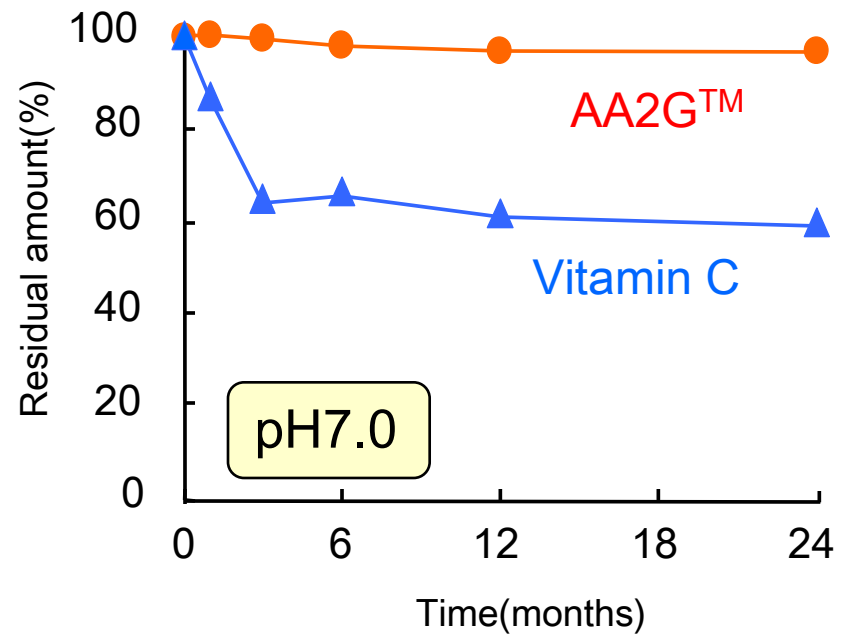
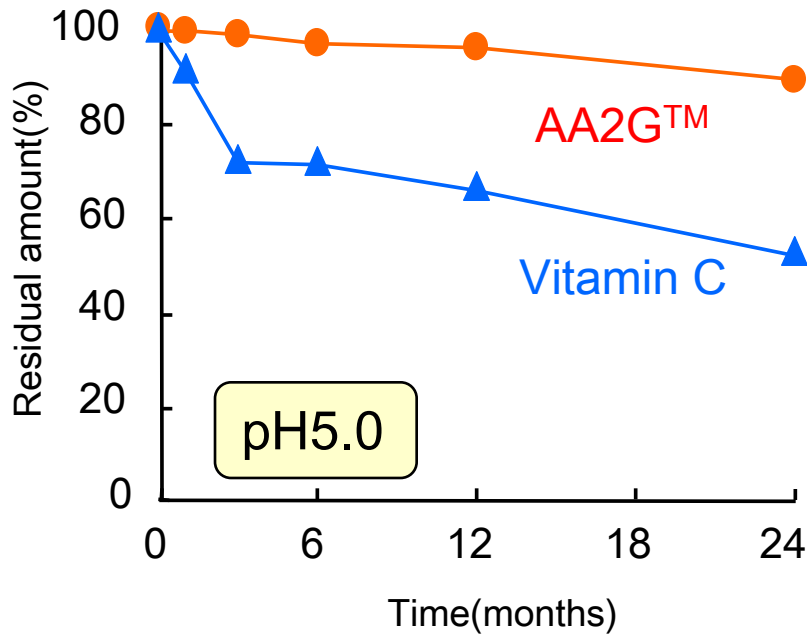
# Why AA2G™ ?

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- ◆ It is a **stable** vitamin C derivative
- ◆ It extends **bioavailability**
- ◆ It functions as **vitamin C** in body
- ◆ It is **easy** to formulate



# Stability in Solution

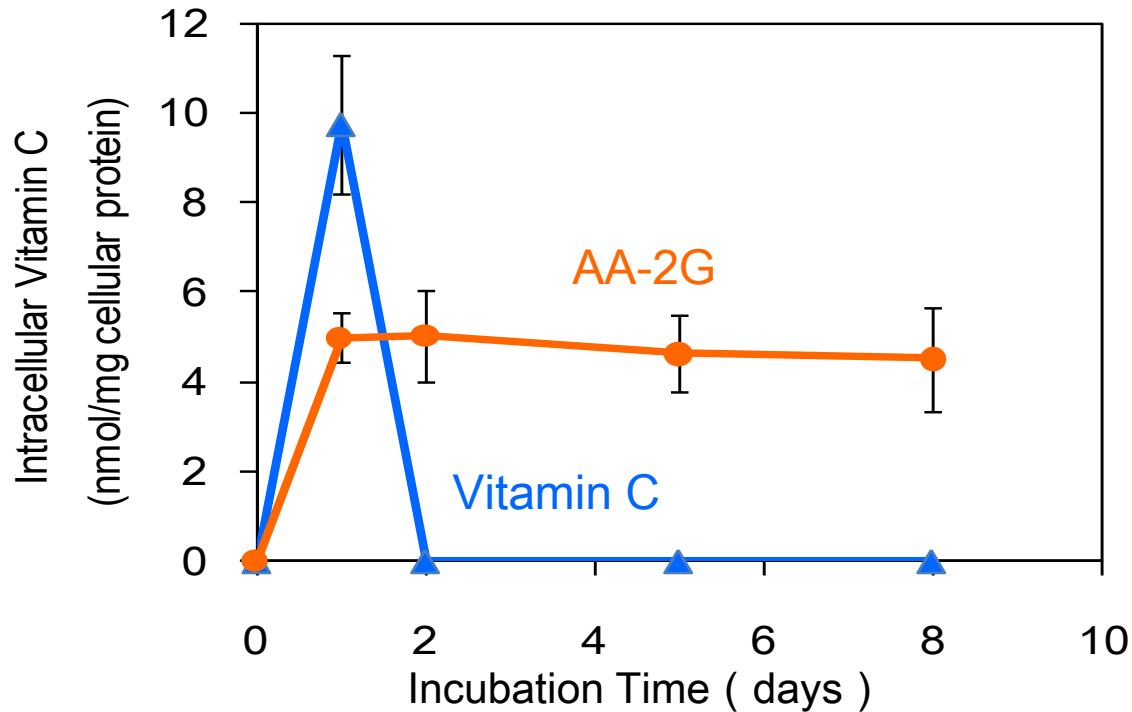


◆2%(w/v) aqueous solutions were stored in the dark at 25°C

★ AA2G™ is more stable than vitamin C.

# Cellular Vitamin C Uptake

Experiment using human dermal fibroblast

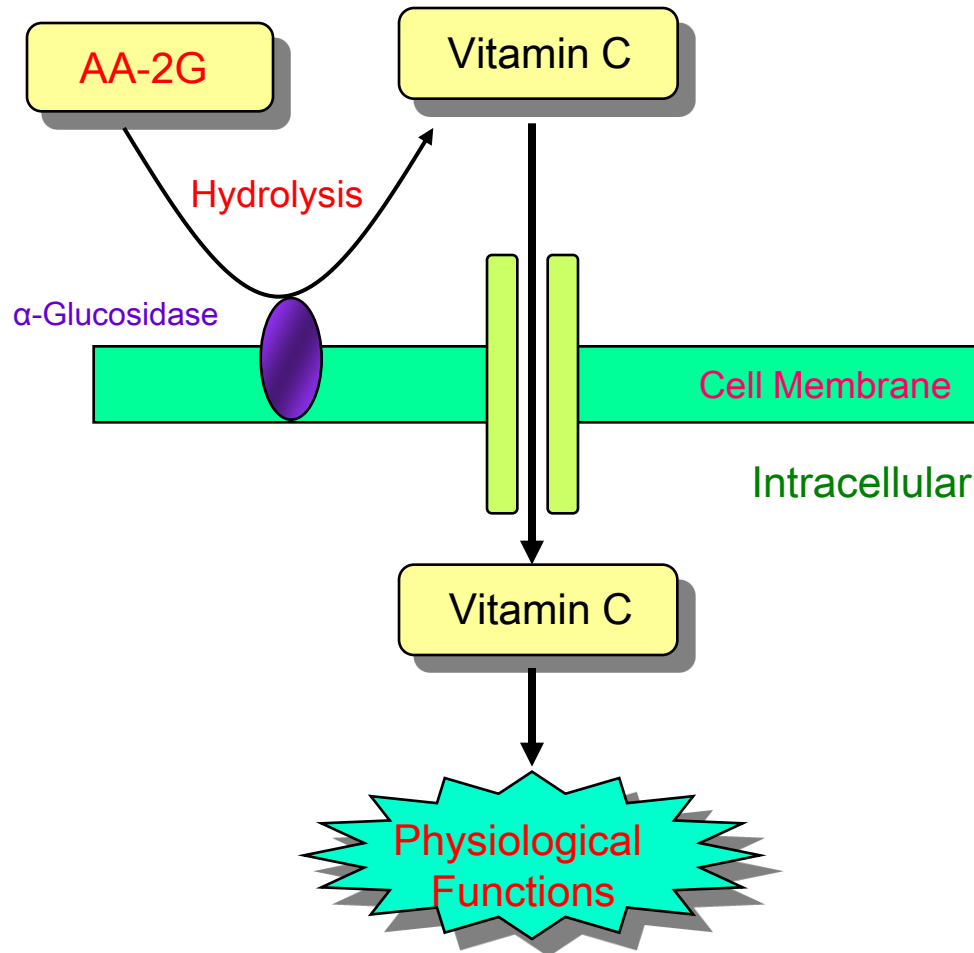


Cells were treated with 1mmol/L of AA-2G or vitamin C, respectively.

★ Vitamin C is continuously taken up by cells after AA-2G is cleaved into Vitamin C by a cellular enzyme.

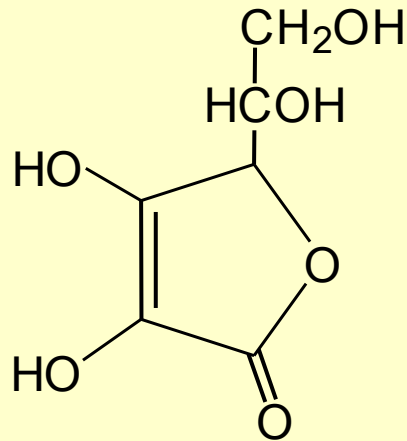
# Bioavailability of AA-2G

AA-2G releases vitamin C through the action of  $\alpha$ -glucosidase



# Vitamin C - Functions in the Body -

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Vitamin C

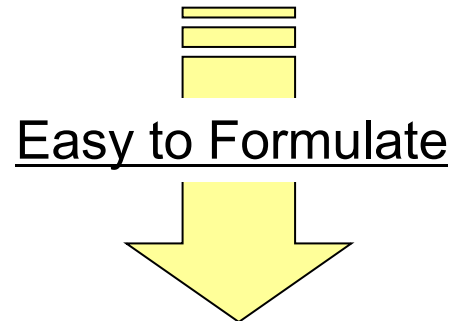
## Physiological Activities

- Prevents Scurvy  
(by enhancement of collagen synthesis)
- Antioxidant Activities
- Inhibition of Melanin Synthesis
- Antiviral Activities
- Enhancement of the Immune System

# Formulation of AA2G™

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- ★ Less caking and dusting, which means easier handling
- ★ Soluble in water
- ★ Highly stable in final products

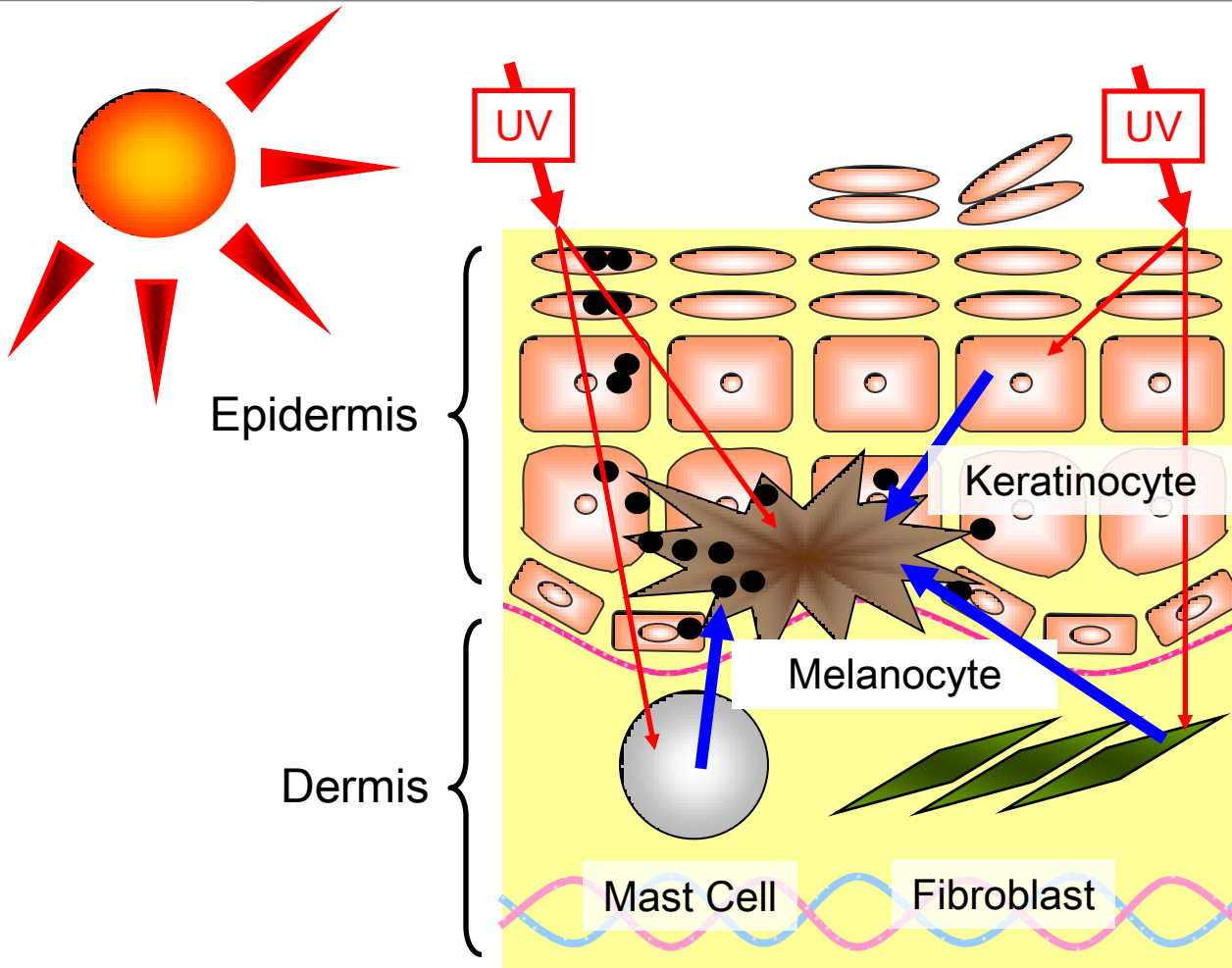


AA2G™ can be formulated into a wide range of skin products, such as toners, milky lotions and creams.



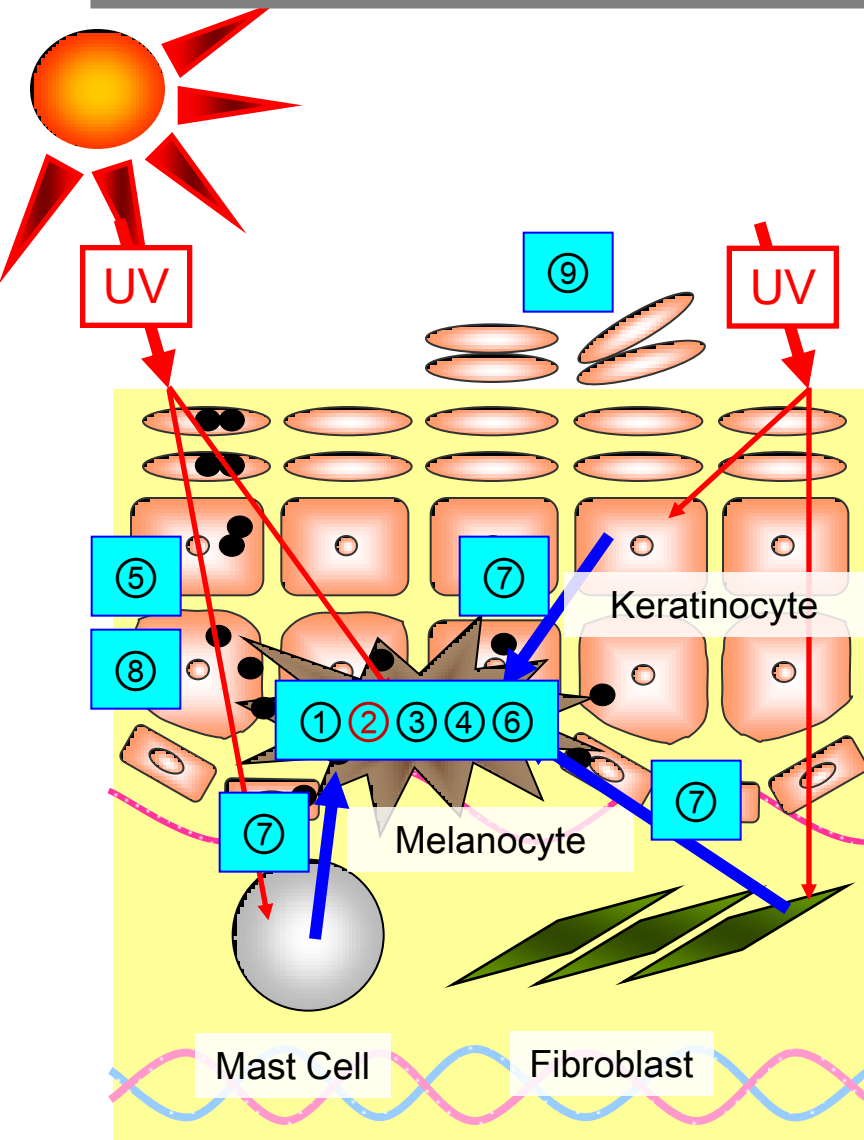
	AA2G <sup>TM</sup> as a Whitening Agent	
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# Melanin Production in Skin Tissue



1. Melanin is produced upon UV stimulation(→).
2. In addition, melanocyte activation factors (→), which are produced by adjacent cells, induce melanocytes to produce melanin.

# Various Sites of Action for Whitening Agents



## ① Inhibition of Tyrosinase

Kojic Acid, Arbutin, Elagic Acid, Rusinor, 4MSK  
Tranexamic Acid, Rhododenol

## ② Reduction of Dopa-Quinone or Existing Melanin

AA-2G, AA-2P, VC-IP

## ③ Suppression of Tyrosinase Maturation

Magnolignan

## ④ Cleavage of Tyrosinase

Linoleic Acid, Rhododenol

## ⑤ Suppression of Melanin Polymerization

VC-Ethyl, Kojic Acid

## ⑥ Suppression of Melanocyte Proliferation

Chamomilla ET

## ⑦ Suppression of Melanocyte Activation Factor

ChamomillaET, Tranexamic Acid

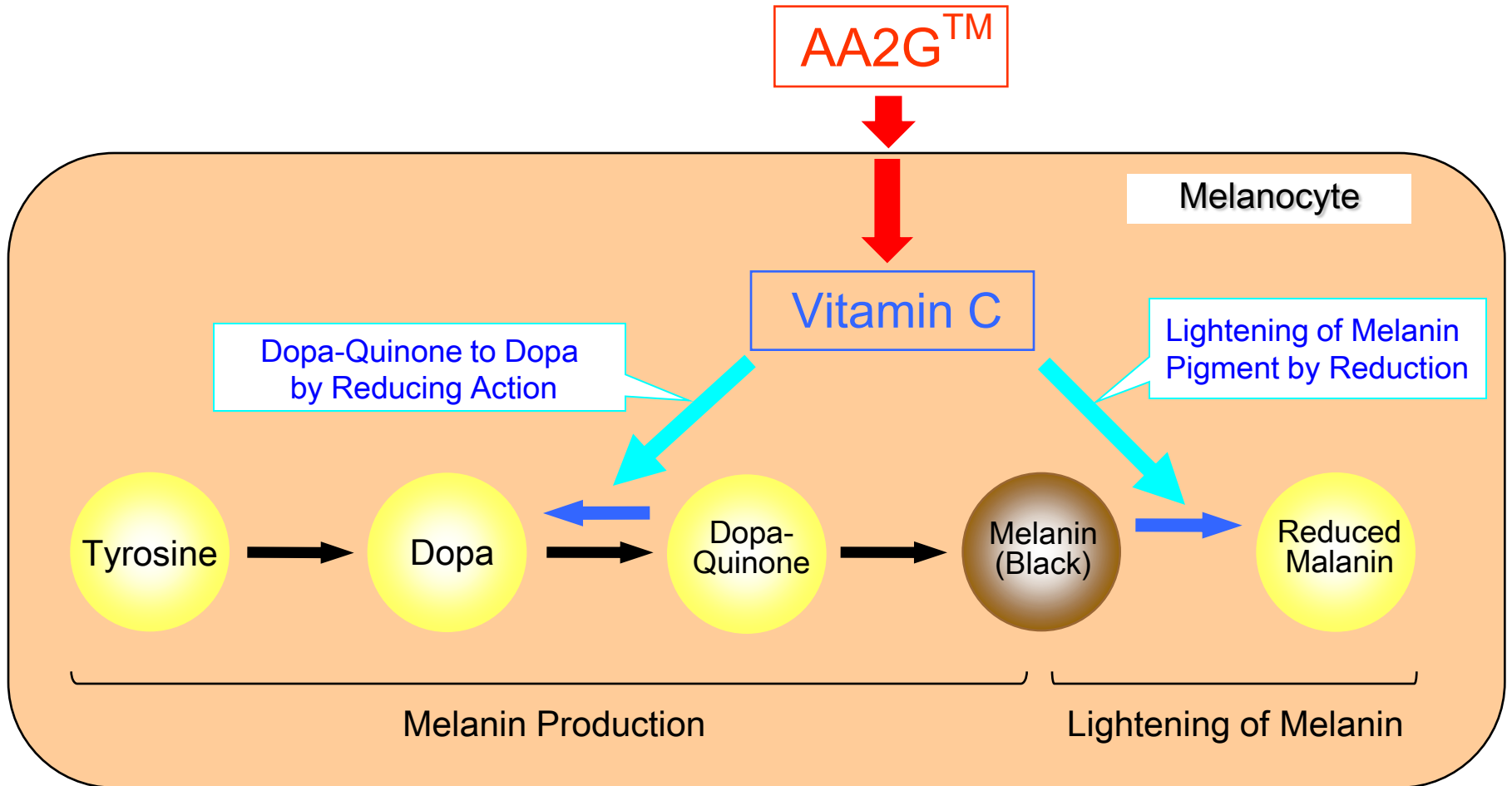
## ⑧ Inhibition of Melanin Transport

Niacinamide

## ⑨ Enhancement of Epidermal Cell Turn Over

4MSK, AMP

# Whitening Mechanism of AA-2G

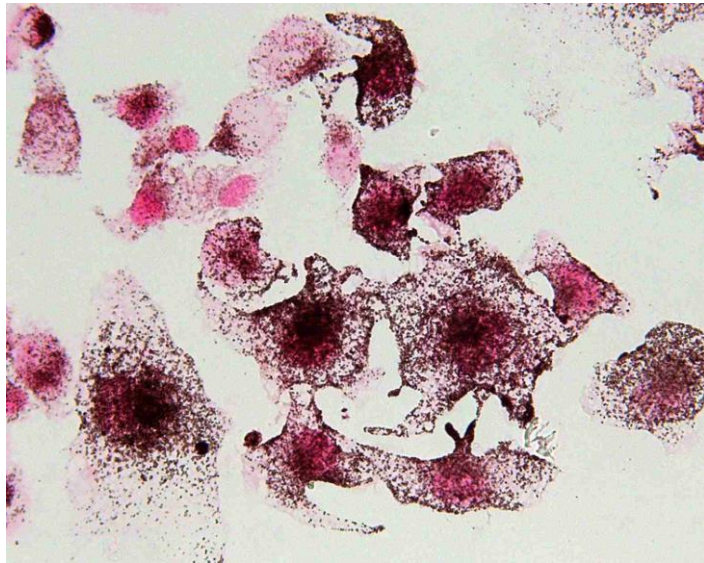


AA2G<sup>TM</sup> affects both melanin and its precursor.

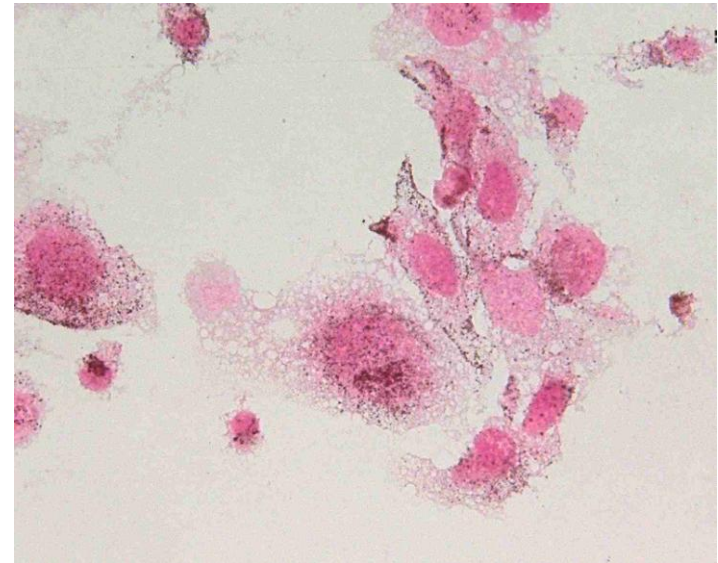
# Inhibition of Melanin Production

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Experiment using melanocytes (B16 melanoma)



Control

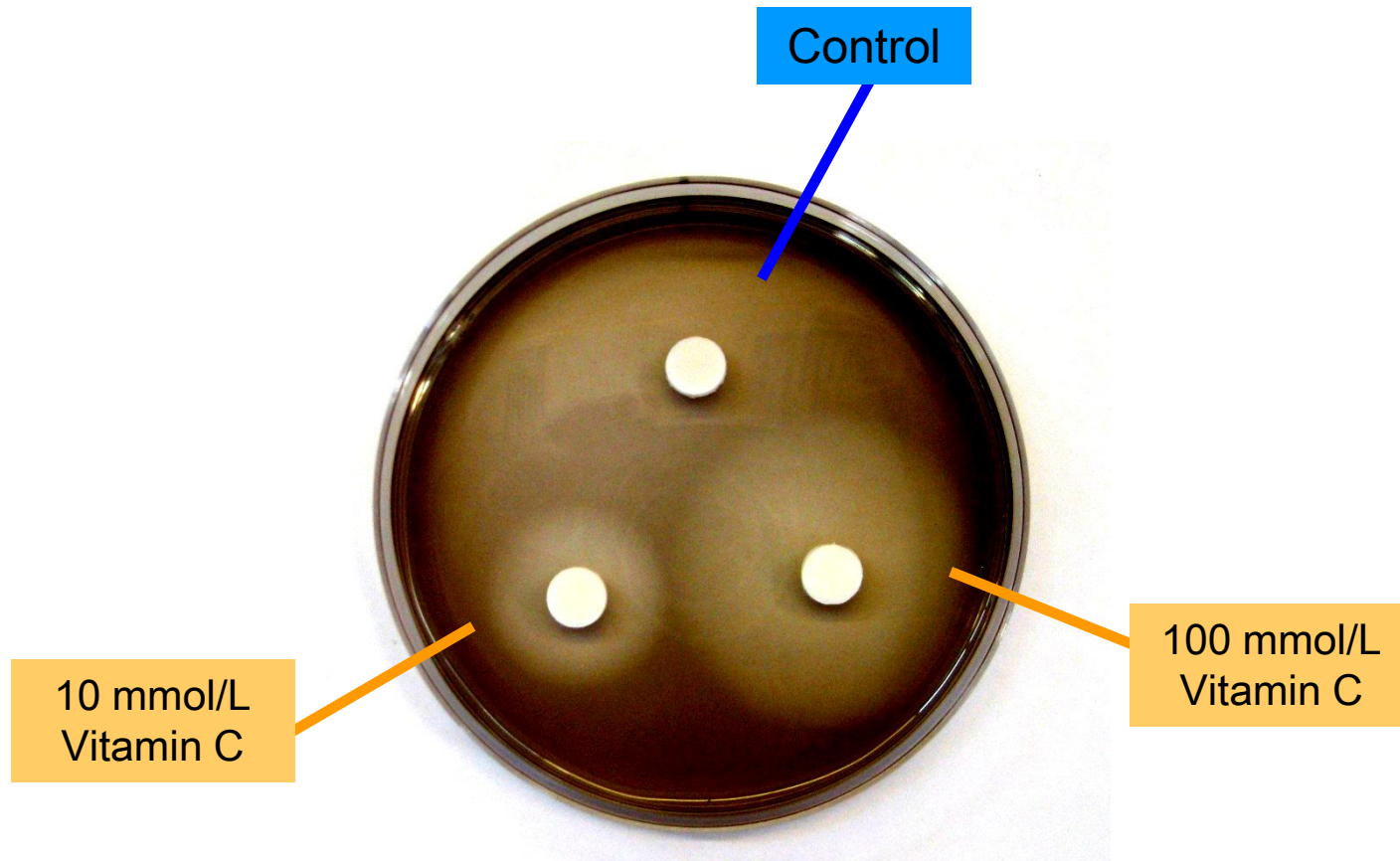


10 mmol/L AA-2G

★ AA-2G inhibits melanin production.

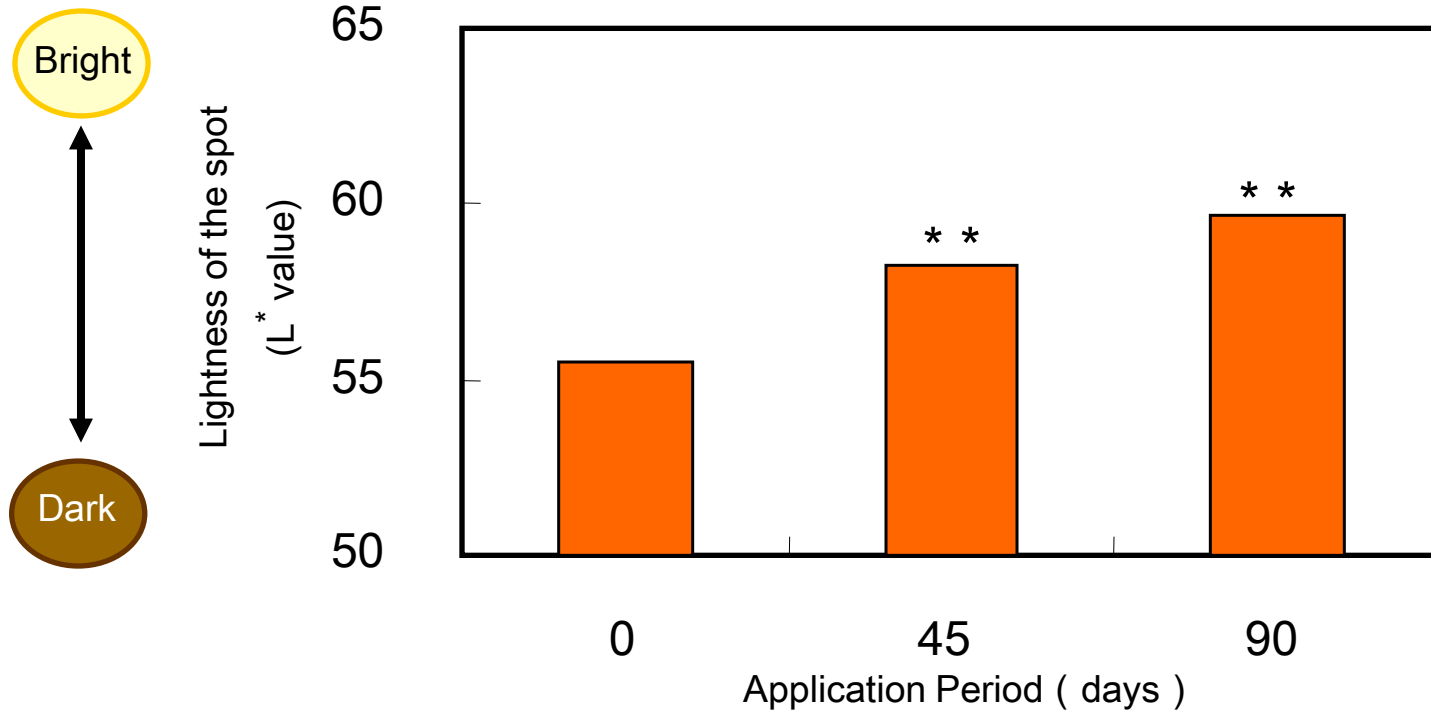
# Lightening of Melanin Pigment by Vitamin C

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★ Vitamin C lightens the pigmented melanin by reduction reaction.

# Clinical Trial : Effect of AA2G<sup>TM</sup> Cream on Sun Spots



N=16 (Females, ages 37-55)

\*\* Statistically significant vs day 0 ( $p < 0.01$ )

★ With 2% AA2G<sup>TM</sup> cream application, significant lightening of sun spots was observed.

**AA2G™**

**L-Ascorbic Acid 2-Glucoside**

- Comparison with other Vitamin C Derivatives -

**HAYASHIBARA CO.,LTD.**





	<h1>Formulation Characteristics</h1>	
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# Stability in Skin Toner

2% AA2G™    3% AA-2P ( Na )    3% AA-2P ( Mg )

Day 0



AA2G™ : pH6.5

AA-2P ( Na ) : pH6.7, coloration

AA-2P ( Mg ) : pH6.6

Day 30, 40°C



AA2G™ : no change

AA-2P ( Na ) : discoloration

AA-2P ( Mg ) : precipitation

Day 30, 50°C



AA2G™ : no change

AA-2P ( Na ) : discoloration

AA-2P ( Mg ) : coloration, precipitation

★AA2G™ causes less coloration and/or precipitation than AA-2P.

# Stability in Skin Cream

2% AA2G™    3% AA-2P ( Na )    3% AA-2P ( Mg )    3% Oil-soluble Vitamin C

Day 14, 4°C



pH 6.6    6.8    6.6    6.6

AA2G™ : no change

AA-2P(Na) : slight coloration

AA-2P(Mg) : no change

Oil-soluble vitamin C : slight coloration

Day 14, 40°C



pH 6.6    7.0    6.5    6.3

AA2G™ : no change

AA-2P(Na) : coloration

AA-2P(Mg) : no change

Oil-soluble Vitamin C : coloration

Day 14, 50°C



pH 6.6    6.8    6.3    5.5

AA2G™ : no change

AA-2P(Na) : discoloration

AA-2P(Mg) : no change

Oil-soluble vitamin C : discoloration and separation

● AA2G™ causes less coloration.

# Stability in Skin Gel with a Synthetic Polymer

2% AA2G™    3% AA-2P ( Na )    3% AA-2P ( Mg )

Day 0



AA2G™ : pH6.6 , gel formed

AA-2P(Na) : pH6.7, no gel form, coloration, turbidity

AA-2P(Mg) : pH6.7, no gel form, precipitation

Day 30, 40°C



AA2G™ : clear gel

AA-2P(Na) : no gel form, discoloration, separation

AA-2P(Mg) : no gel form, discoloration, precipitation

Day 30, 50°C



AA2G™ : clear gel

AA-2P(Na) : no gel form, discoloration, separation

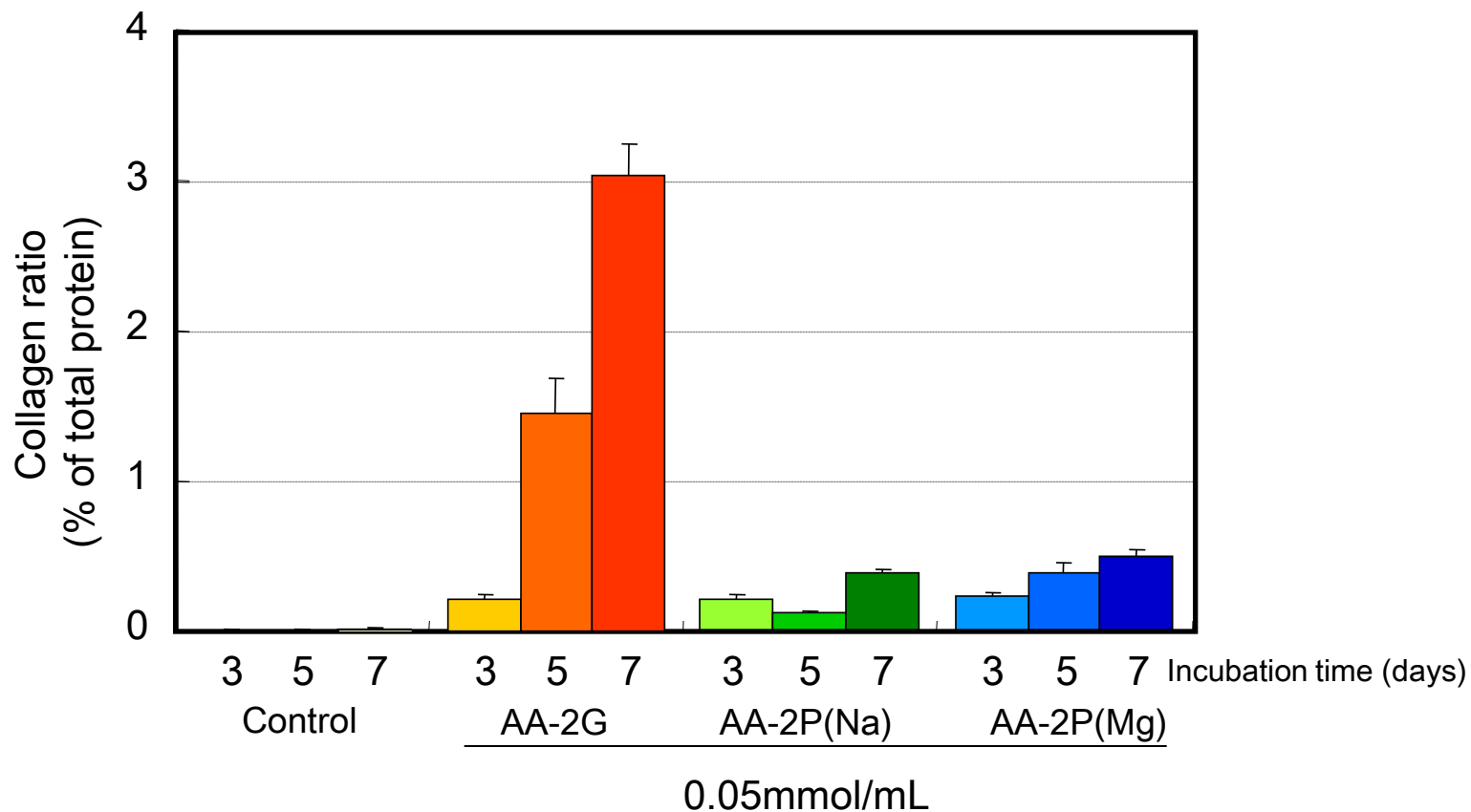
AA-2P(Mg) : no gel form, discoloration, precipitation

- AA2G™ forms gels easily without coloration, discoloration, separation or precipitation.

	Comparison of Functional Activity	
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# Enhancement of Collagen Production

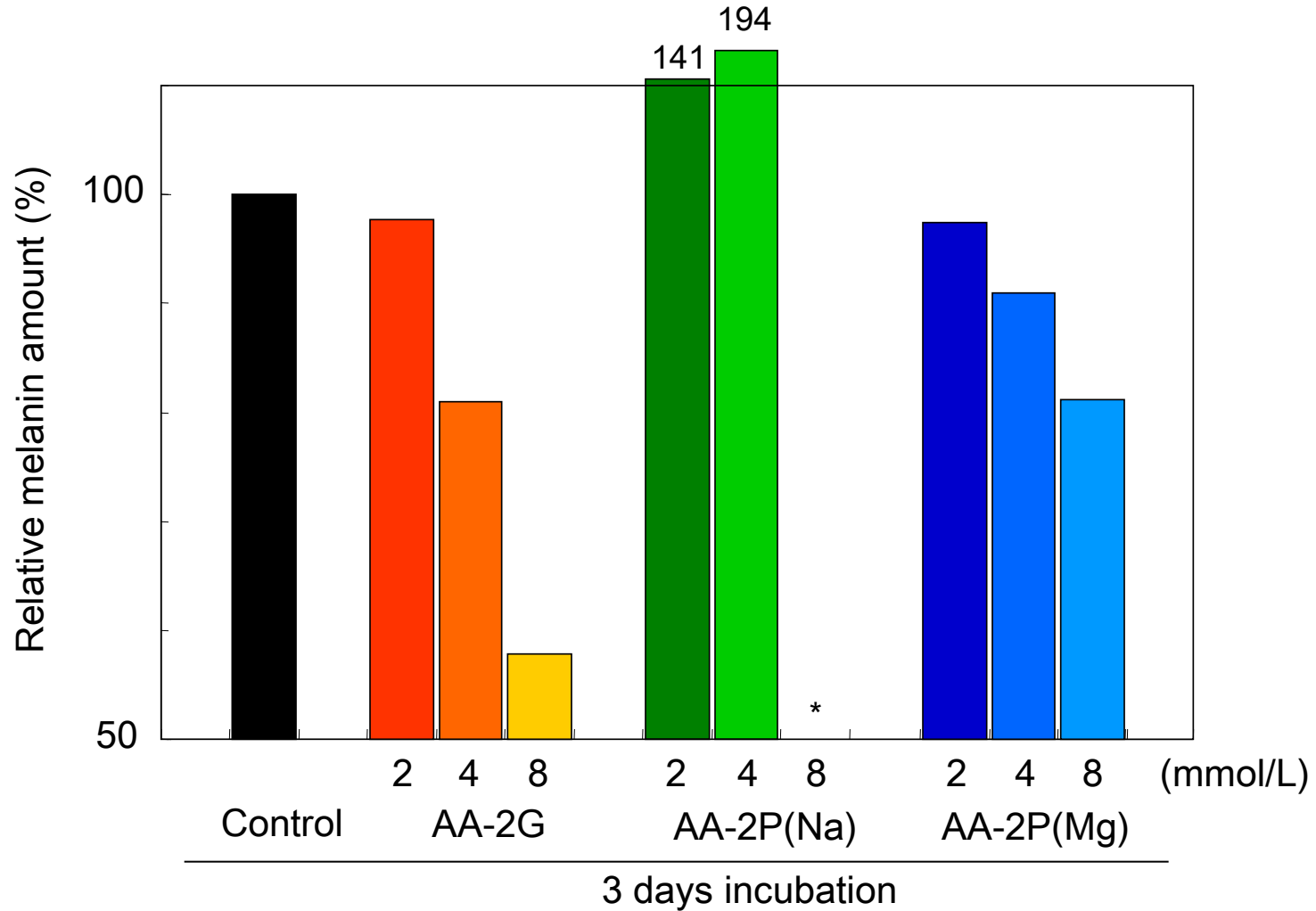
Experiment using human dermal fibroblasts



★ AA-2G shows strong and continuous stimulation of collagen production as compared to AA-2P.

# Inhibition of Melanin Production by Vitamin C Derivatives

Experiment using melanocytes (B16 melanoma)

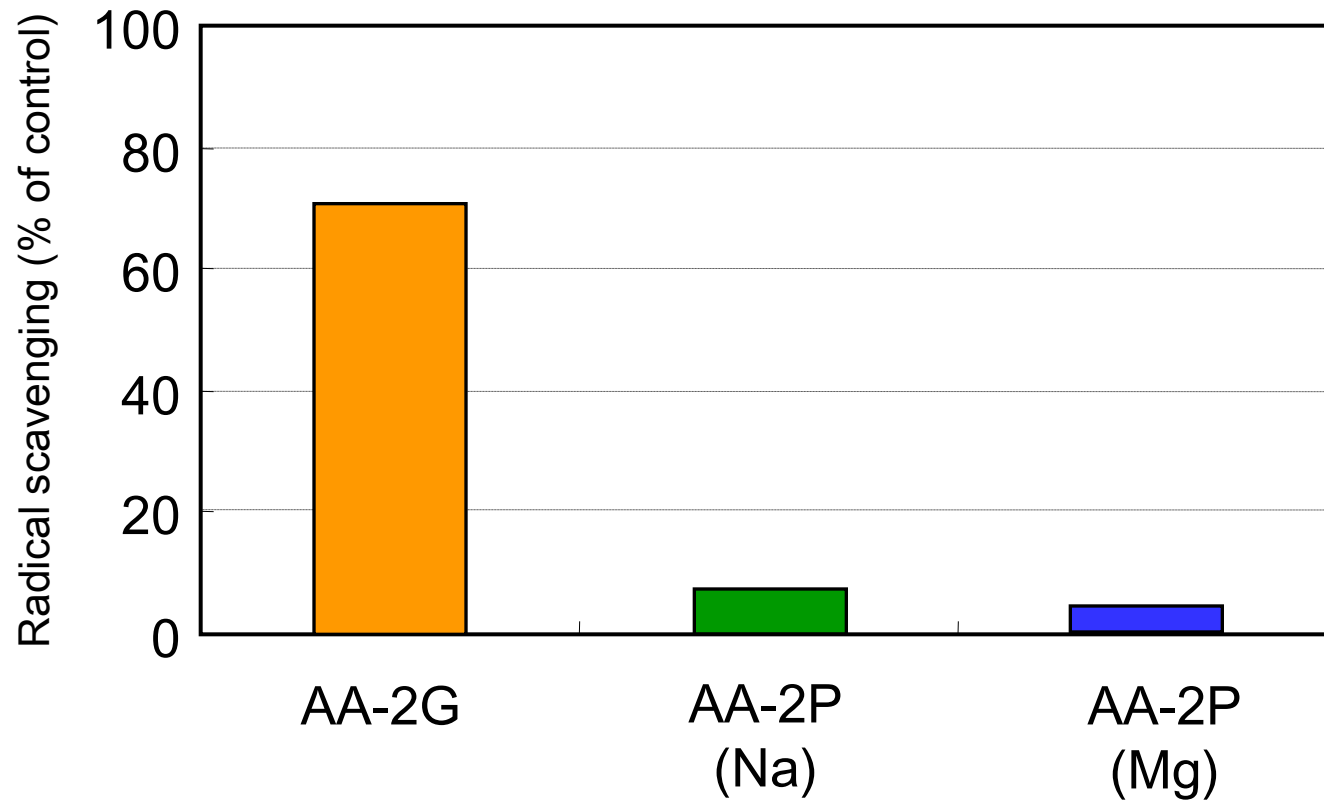


\* not detectable due to cellular damage

★ AA-2G strongly inhibited melanin production by B16 melanoma.

# Antioxidant Activity of Vitamin C Derivatives

Scavenging effect of DPPH radicals



★ AA-2G has greater radical scavenging capacity as compared to AA-2P.



# Advantages of AA2G™ over AA-2P

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## ① Formulation Characteristics

- Less coloration
- Good compatibility with polymers
- High solubility
- High stability (pH and heat)



Easy to handle

## ② Biological Functions

- Enhancement of collagen production
- Inhibition of melanin synthesis
- Enhanced radical scavenging



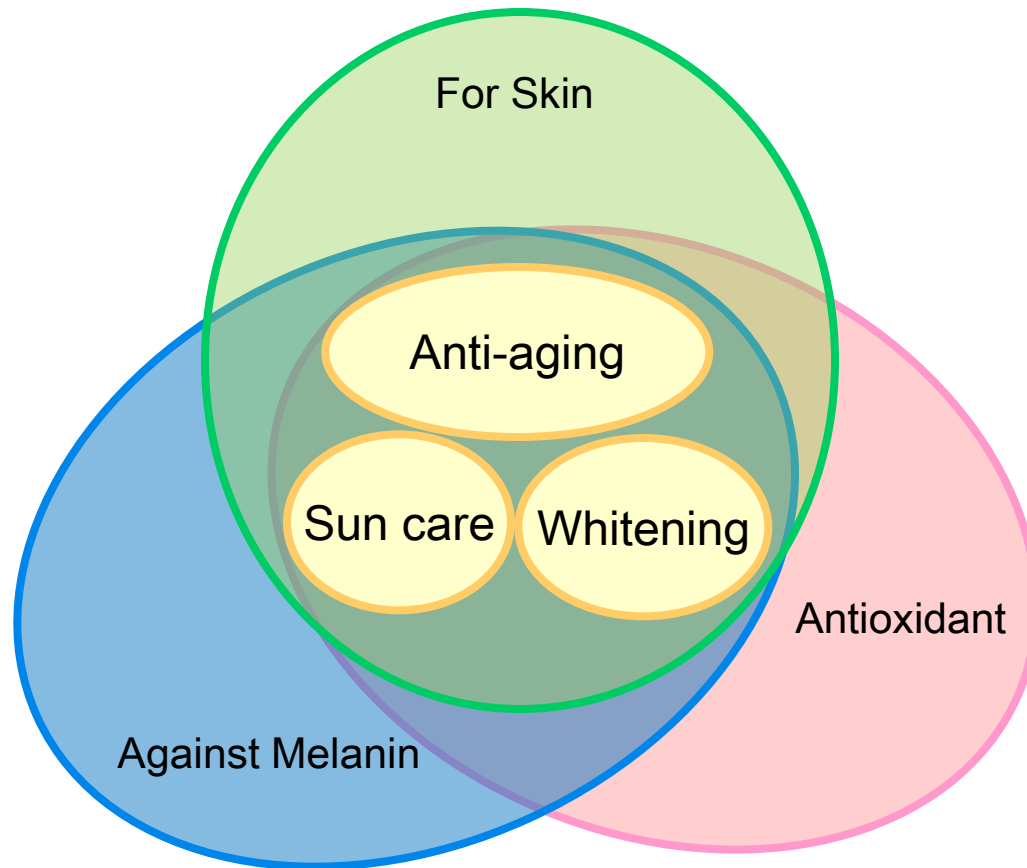
Long-lasting effects



Greater activity

# Potential of AA2G™

AA2G™ ⇒ Superior Vitamin C



AA2G™ should be a base ingredient of all your skin care products !