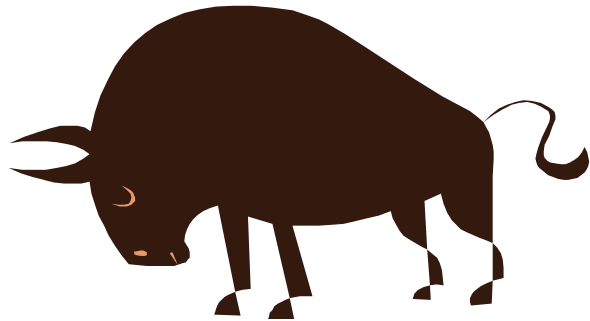


Collagen for cosmetics



Bovine collagen was used in the past.

- Risk of contamination by pathogens such as BSE
- Risk of causing allergic reactions



Currently fish collagen is used.

- No risk of the contamination
- Problem of allergic reaction remains. (Problem might be worse than it was.)



In medical areas, many proteins are produced as recombinant human proteins for safe use.

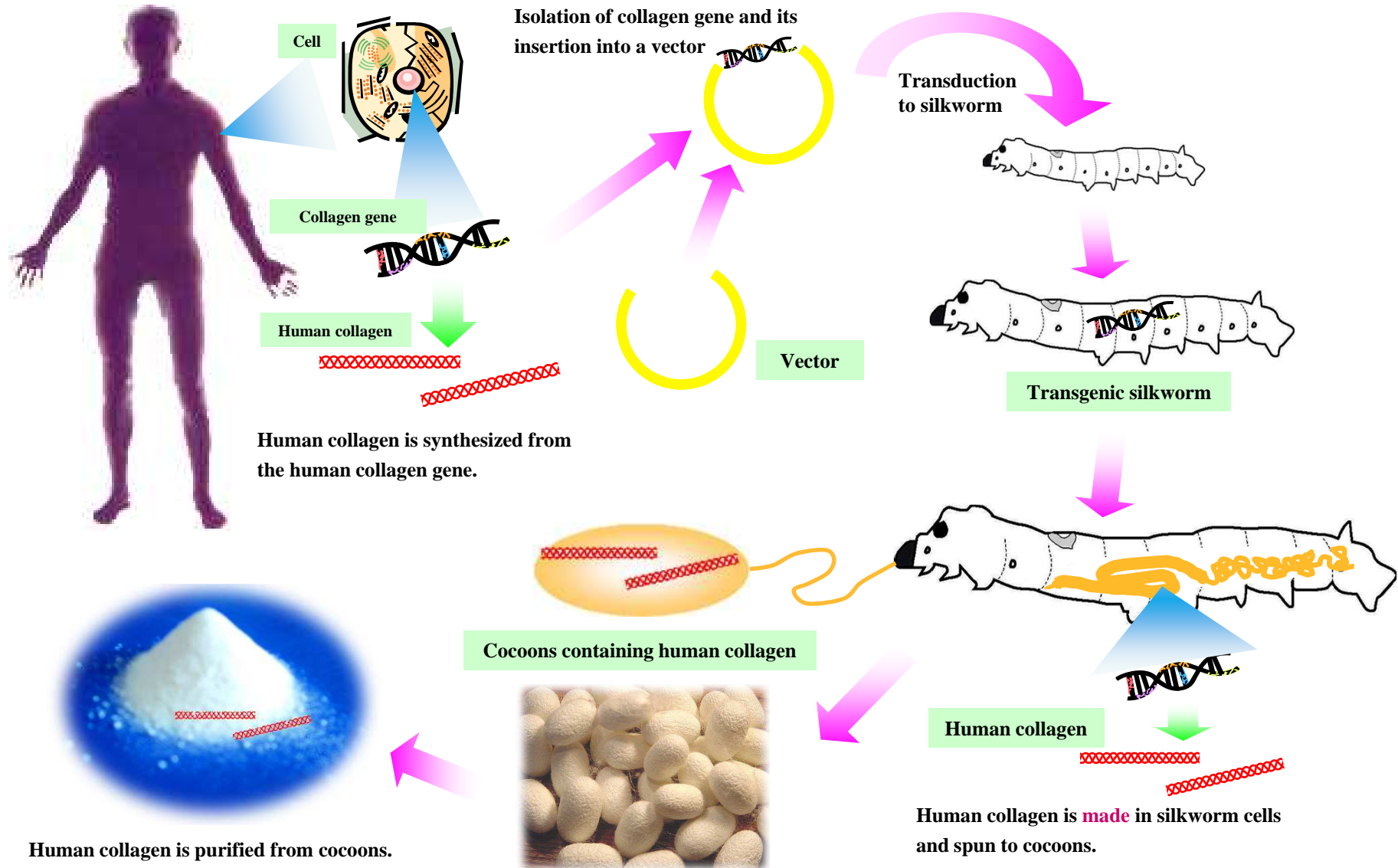
Why is human collagen not used in cosmetic areas?

“Allergy diseases start from the skin.”

Current theory holds that allergens penetrating the skin can cause sensitization that triggers allergic diseases such as food allergies, atopic dermatitis, asthma, and allergic rhinitis.

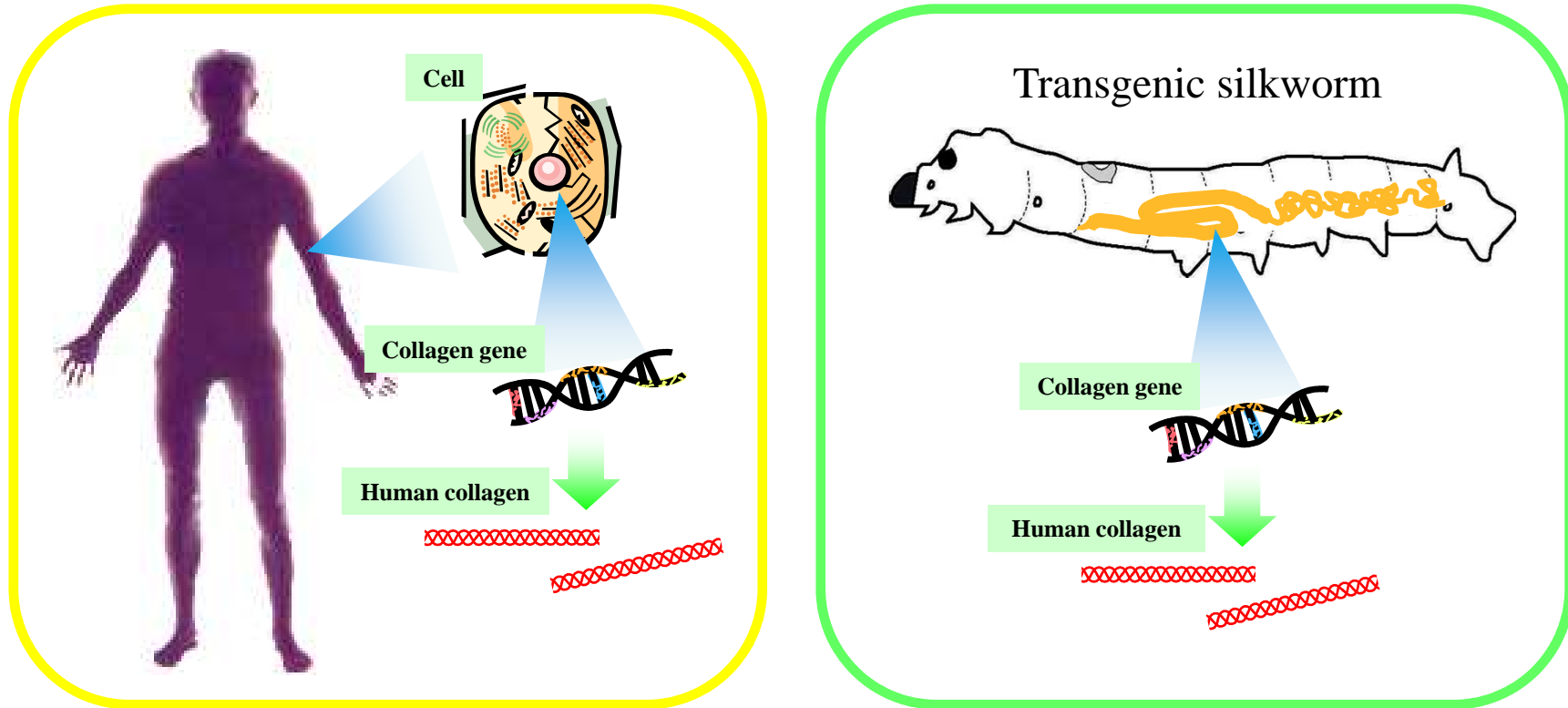


Outline of human collagen production using TG silkworm



*Human collagen does not have a triple-helix configuration
(Fish collagen also non-triple helix configuration at human body temperature)

Merit of silkworm-produced human collagen 1: Safety of human collagen



Human collagen is made from the human collagen gene in TG silkworm cells.

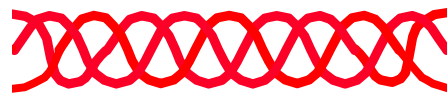


The collagen made consists of human collagen sequences.

→ Low risk of allergic reactions

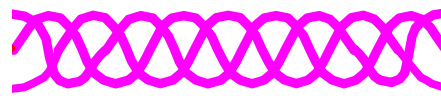
* Many proteins for medical use are produced as human proteins through the use of recombinant technologies.

Amino acid similarity of human, bovine, and fish collagens



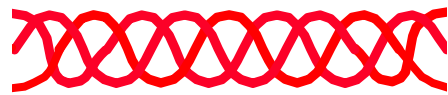
Human collagen

VS



Bovine collagen

Similarity of $\alpha 2(I)$ chain:
93.3%



Human collagen

VS



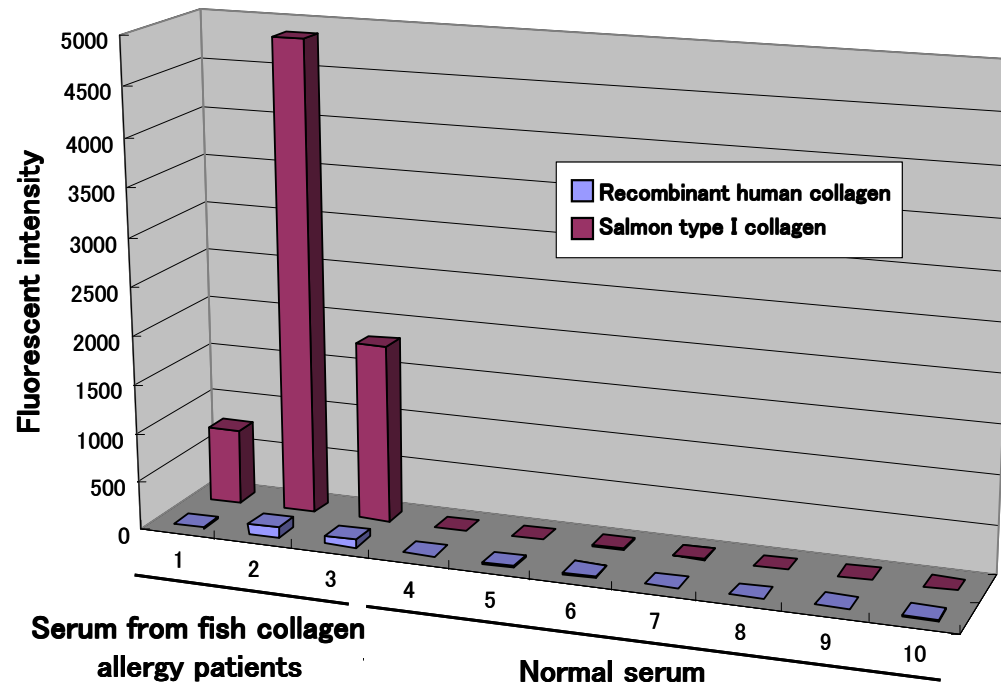
Salmon collagen

Similarity of $\alpha 2(I)$ chain:
67.3%

Fish collagen might be recognized as an antigen in the human body because its amino acid similarity to human collagen is not high enough. In fact, 30% of fish food allergies are reported to be caused by fish collagen.

Because the silkworm-produced human collagen consists of amino acid sequences that are identical to human collagen (similarity: 100%), the collagen is almost never recognized as an antigen.

Reactivity of IgE from patients with fish collagen food allergy to recombinant human collagen



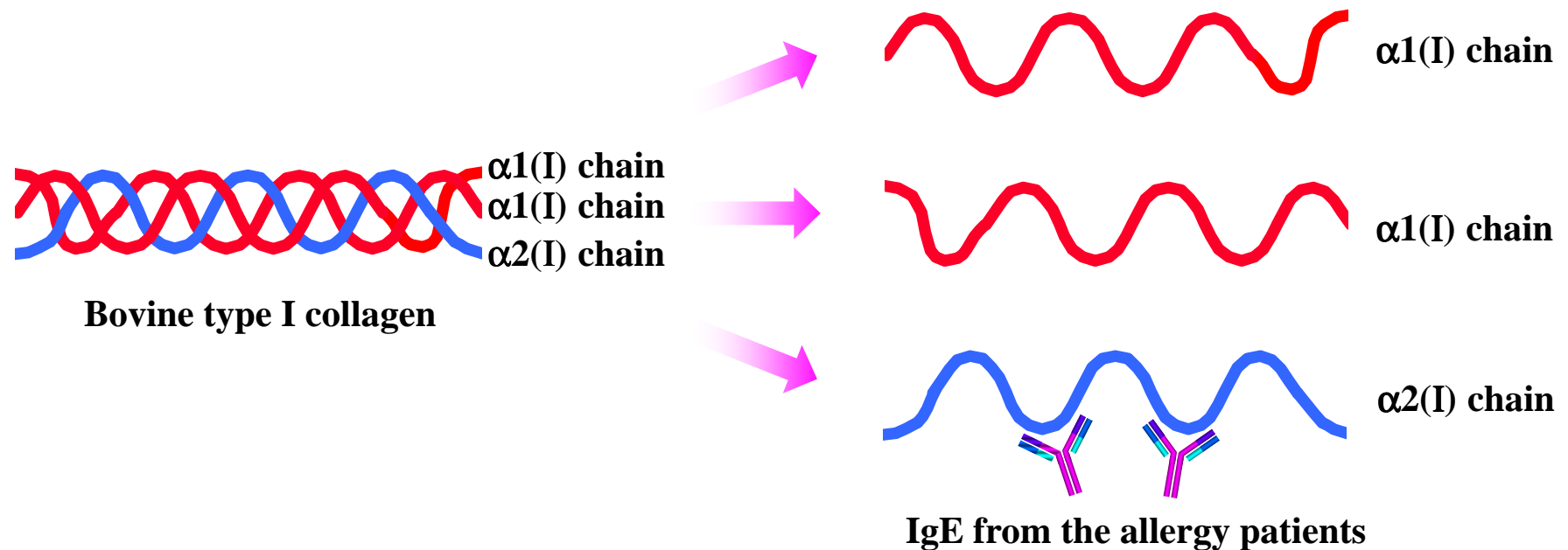
Result from contract research
by Prof. Masahiro Sakaguchi
of Azabu University

We analyzed the reactivity of recombinant human collagen to IgE from patients with a food allergy to fish collagen.

The IgE reacted strongly to salmon collagen, but exhibited little reaction to the human collagen.



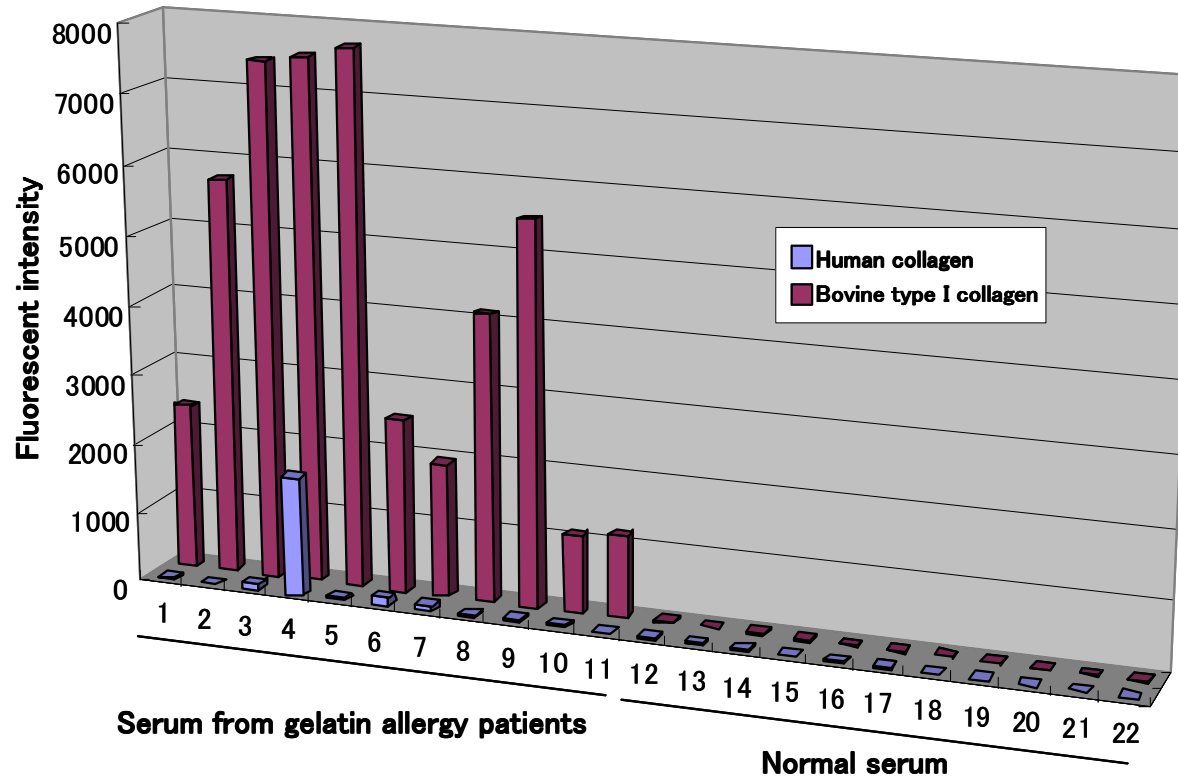
Antigenic epitope of bovine type I collagen



It was reported that the inoculation of vaccines containing gelatin (denatured bovine type I collagen) caused a serious anaphylaxis reaction. The IgE from patients with anaphylaxis to the vaccines was proven to mainly react to bovine collagen $\alpha 2(I)$ chains.

TG silkworm-produced human collagen carries a low risk of causing allergic reactions because the collagen does not contain any high antigenic $\alpha 2(I)$ chains.

Reactivity of IgE from patients with gelatin allergy to human collagen

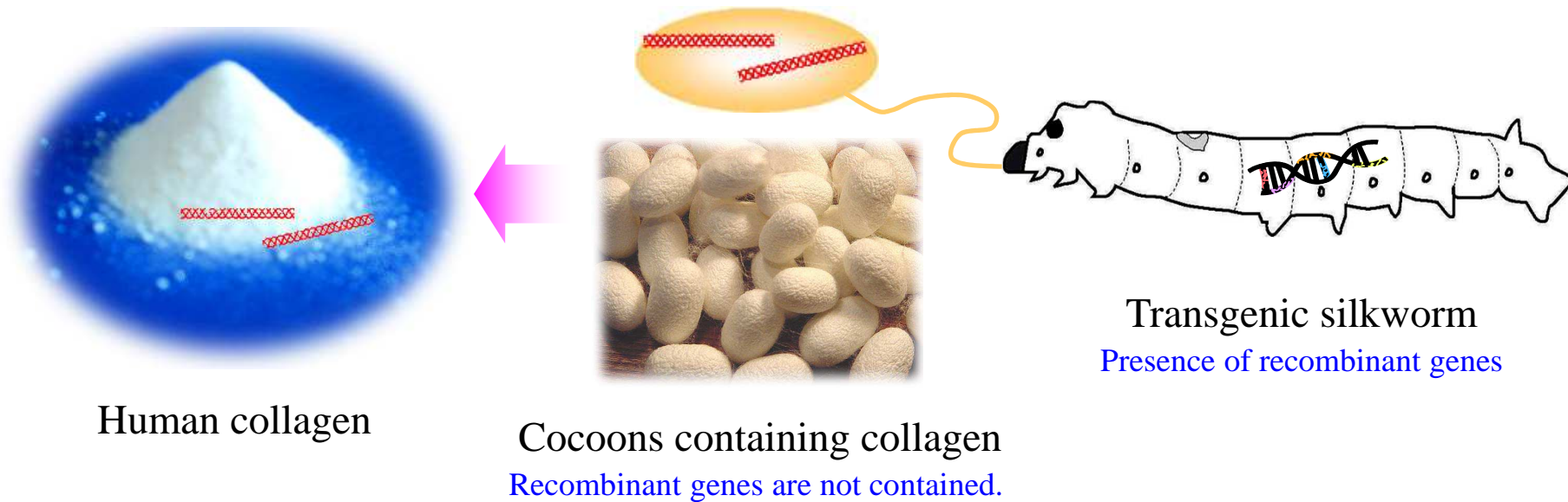


Result from contract research
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We analyzed the reactivity of human collagen to IgE from patients with anaphylaxis to vaccines containing gelatin (denatured bovine type I collagen).

The IgE reacted strongly to bovine collagen, but exhibited little reaction to human collagen.

Merit of silkworm-produced human collagen 2: Absence of recombinant genes in cocoons



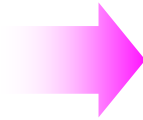
Human collagen is spun to cocoons, but recombinant genes remain in the silkworm cells.

Human collagen isolated from cocoons does not contain recombinant genes.

* Generally, GM foods contain recombinant genes in their edible parts.



Merit of silkworm-produced human collagen 3: Safety of silk



Human collagen

Silk is a safety material that is often used as a suture.



Human collagen purified from cocoons is also a safe material.



Neosilk[®]-Human Collagen I

● Features of Neosilk[®]-Human Collagen I

- ◆ Collagen with human sequences
- ◆ No contamination of animal-derived materials
- ◆ High solubility in various solutions



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