DFK BIO LAB

iREJU rejucoll

Effective Skin Rejuvenation

Collagen in Human Body

At present, a total of 29 types of collagen have been found in different parts of our body, which play corresponding physiological functions.

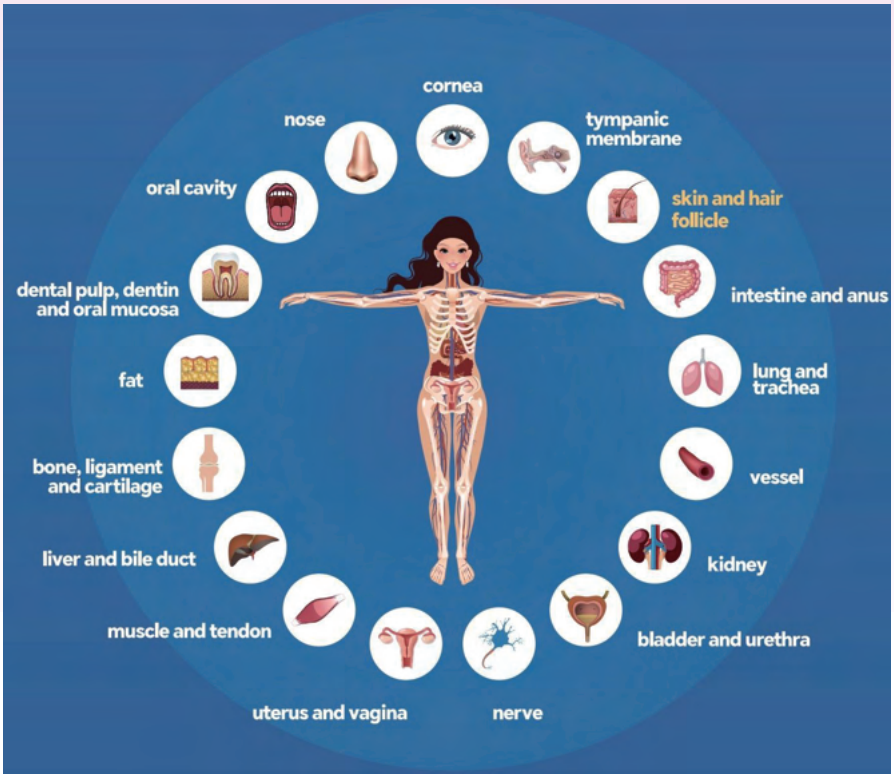
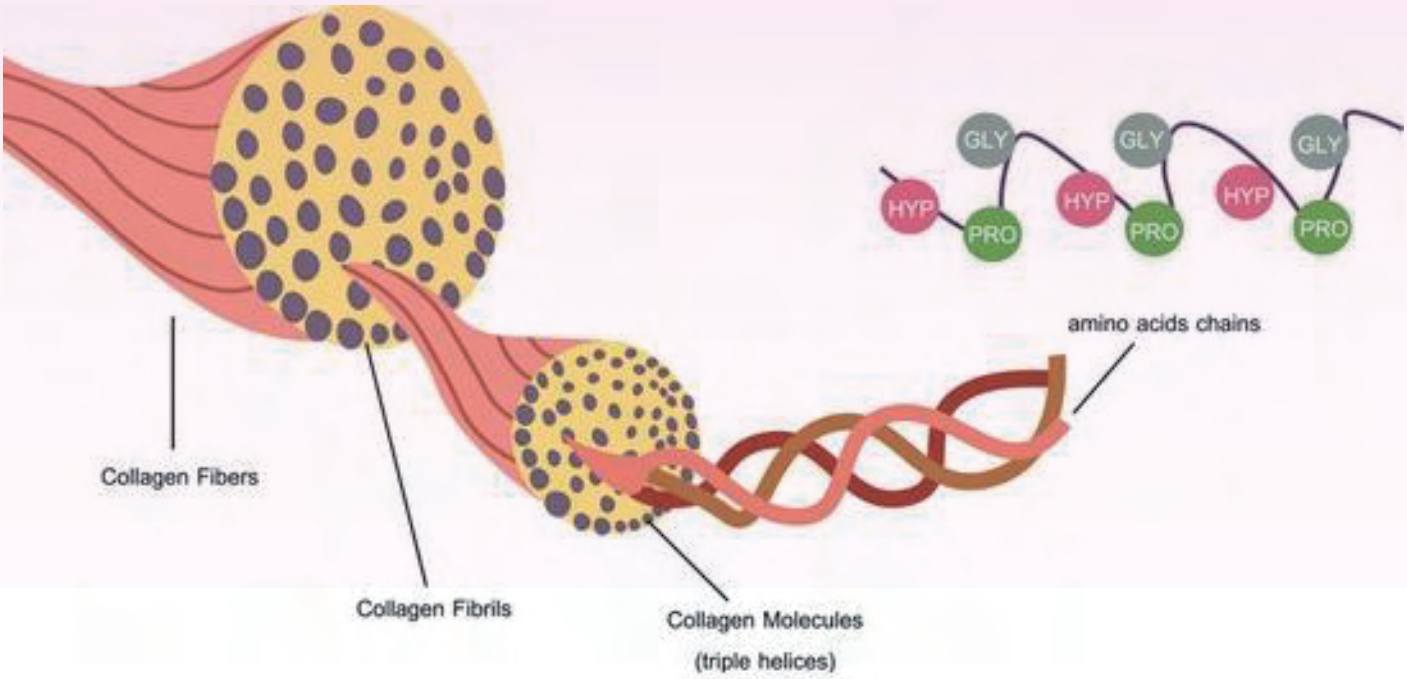


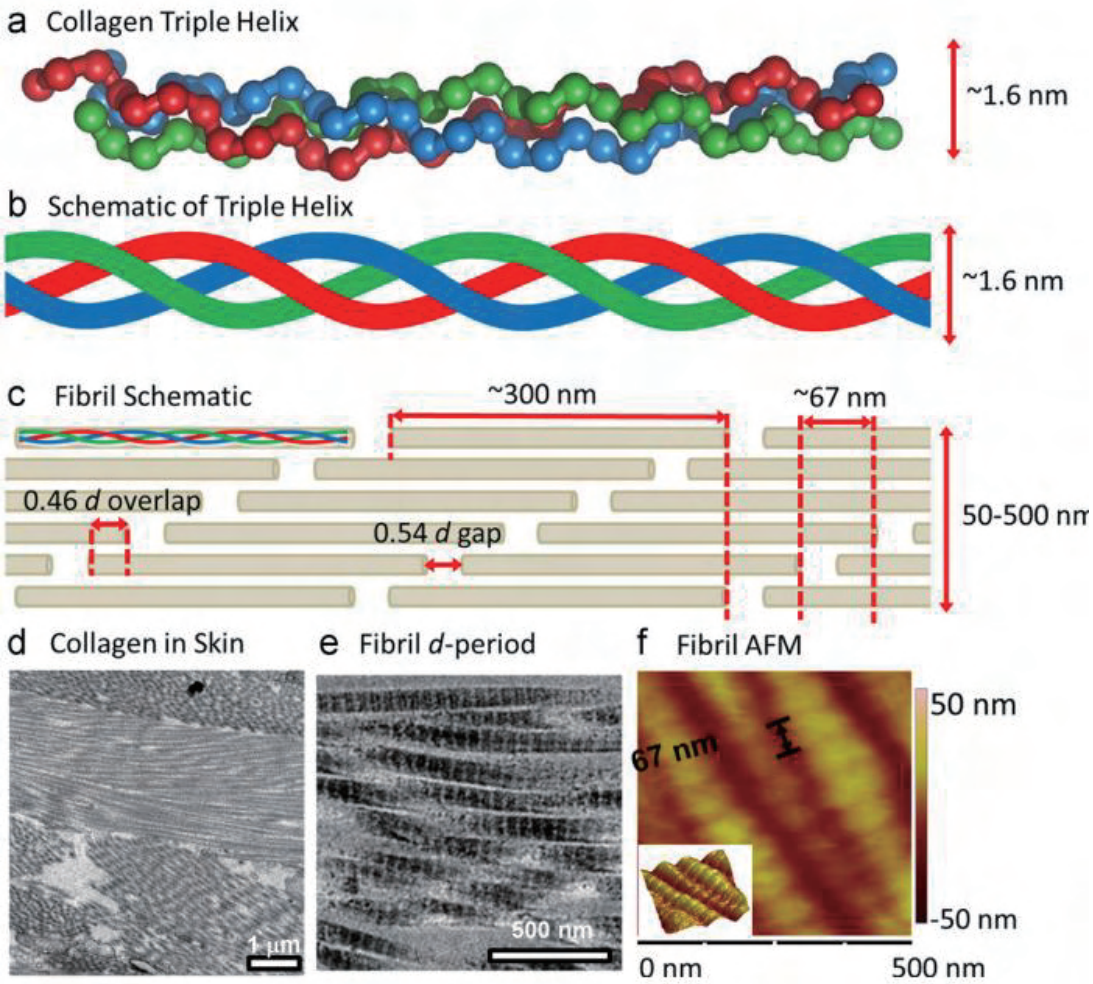
Table 1. The collagen family.

Collagen type	α Chains	Molecular species
Collagen I	α1(I), α2(I)	$[\alpha1(I)]_2$, α2(I) $[\alpha1(I)]_3$
Collagen II	α1(II)	$[\alpha1(II)]_3$
Collagen III	α1(III)	$[\alpha1(III)]_3$
Collagen IV	α1(IV), α2(IV), α3(IV), α4(IV), α5(IV), α6(IV)	$[\alpha1(IV)]_2$, α2(IV) α3(IV), α4(IV), α5(IV) $[\alpha5(IV)]_2$, α6(IV)
Collagen V	α1(V), α2(V), α3(V), α4(V)[a]	$[\alpha1(V)]_2$, α2(V) $[\alpha1(V)]_3$ $[\alpha1(V)]_2\alpha4(V)$ α1(XI)α1(V)α3(XI)
Collagen VI	α1(VI), α2(VI), α3(VI), α4(VI)[b], α5(VI)[c], α6(V)	
Collagen VII	α1(VII)	$[\alpha1(VII)]_3$
Collagen VIII	α1(VIII)	$[\alpha1(VIII)]_2$, α2(VIII) α1(VIII), $[\alpha2(VIII)]_2$ $[\alpha1(VIII)]_3$ $[\alpha2(VIII)]_3$
Collagen IX[e]	α1(IX), α2(IX), α3(IX)	[α1(IX), α2(IX), α3(IX)]
Collagen X	α1(X)	$[\alpha1(X)]_3$
Collagen XI	α1(XI), α2(XI), α3(XI)[d]	α1(XI)α2(XI)α3(XI) α1(XI)α1(V)α3(XI)
Collagen XII[e]	α1(XII)	$[\alpha1(XII)]_3$
Collagen XIII	α1(XIII)	$[\alpha1(XIII)]_3$
Collagen XIV[e]	α1(XIV)	$[\alpha1(XIV)]_3$
Collagen XV	α1(XV)	$[\alpha1(XV)]_3$
Collagen XVI[e]	α1(XVI)	$[\alpha1(XVI)]_3$
Collagen XVII	α1(XVII)	$[\alpha1(XVII)]_3$
Collagen XVIII	α1(XVIII)	$[\alpha1(XVIII)]_3$
Collagen XIX[e]	α1(XIX)	$[\alpha1(XIX)]_3$
Collagen XX[e]	α1(XX)	$[\alpha1(XX)]_3$
Collagen XXI[e]	α1(XXI)	$[\alpha1(XXI)]_3$
Collagen XXII[e]	α1(XXII)	$[\alpha1(XXII)]_3$
Collagen XXIII	α1(XXIII)	$[\alpha1(XXIII)]_3$
Collagen XXIV	α1(XXIV)	$[\alpha1(XXIV)]_3$
Collagen XXV	α1(XXV)	$[\alpha1(XXV)]_3$
Collagen XXVI	α1(XXVI)	$[\alpha1(XXVI)]_3$
Collagen XXVII	α1(XXVII)	$[\alpha1(XXVII)]_3$
Collagen XXVIII	α1(XXVIII)	$[\alpha1(XXVIII)]_3$

The common structural feature of collagen:

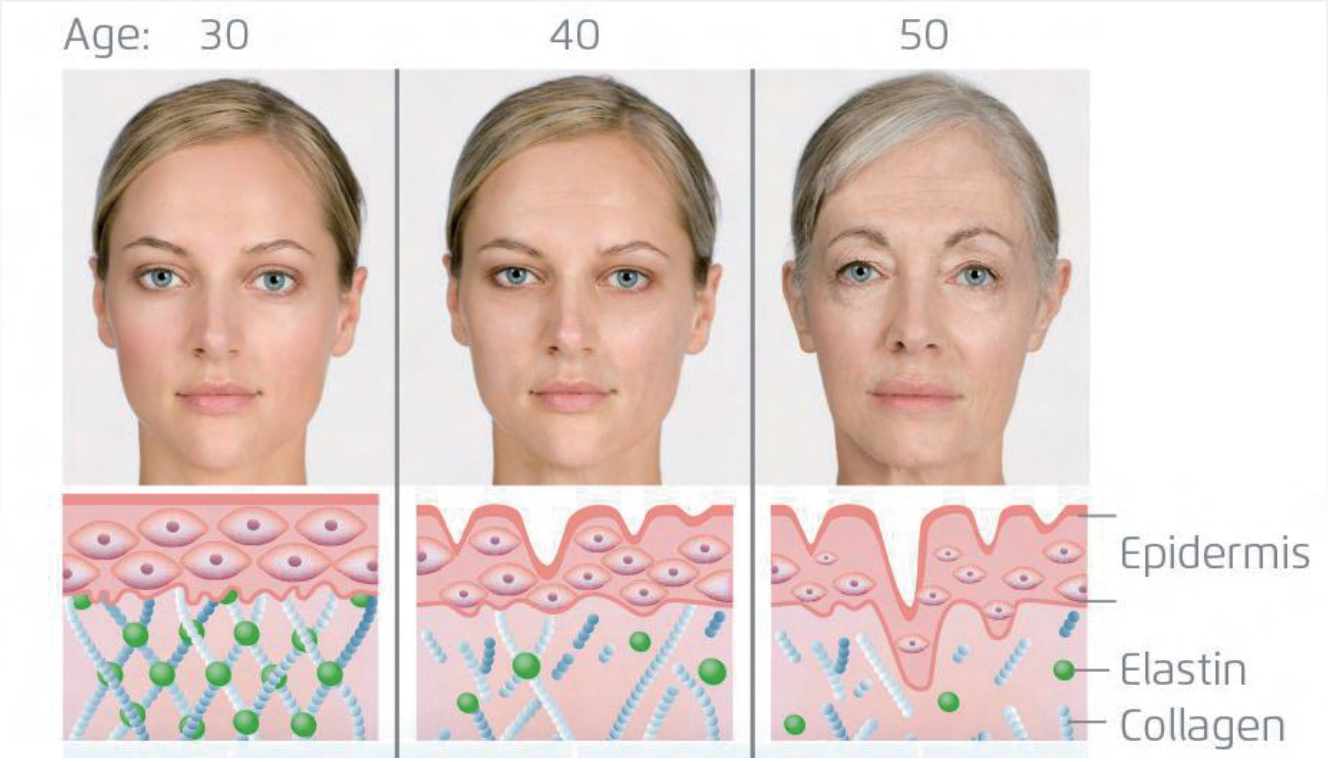
Triple helix structure





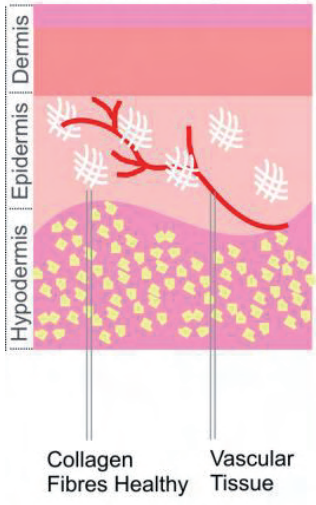
Cause of skin aging: Loss of collagen

Tender skin, healing without scars -> Tough skin, healing witth scars
Collagen loss: lack of elasticity, dryness, fragility, sensetivity, fine lines and a series of aging problems



20s

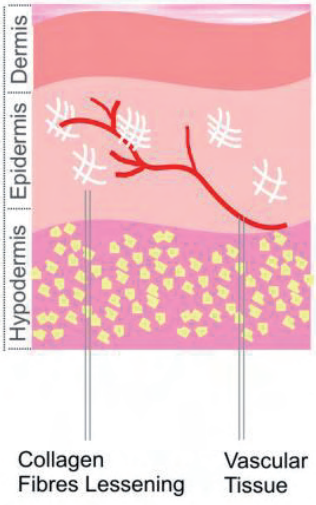
Free Radicals Attack Surface
Environmental Damage is High



Constant exposure to the sun & fast life style leads to skins premature aging.

30s

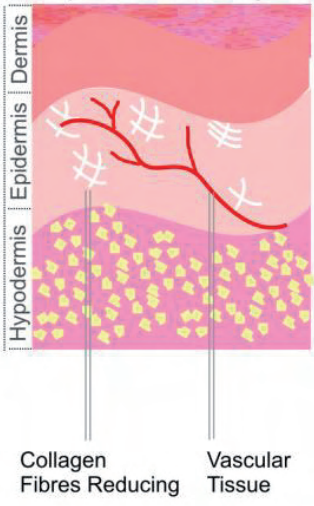
First Signs of Aging Appear
Dull, Lackless, Lifeless Skin



Skin regeneration is reducing leading to dull complexion & uneven skin tone. Use of harsh skin care can become apparent. Elastin degradation can show first signs of aging.

40s

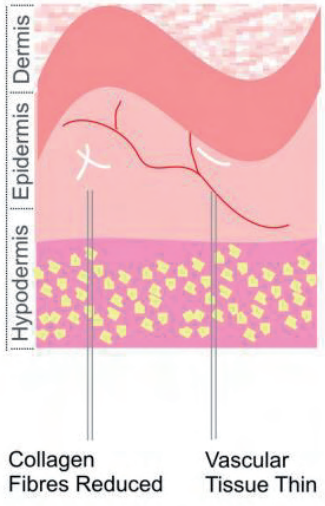
Significant dullness, aging & dark spots. Skin sensitivity.



Skin thinning can cause sensitivity, redness, dry, oily, sudden redness. Photo aging appears - dark spots - more prominent signs of aging appear.

50+

Significant tension decrease.
Moisture retension slowing.



Decrease in surface tension impairs skin structure and ability to defend itself. Barrier lessens leading to less efficiency in retaining moisture. Combined with excessive dryness sometimes accompanied by adult acne.

Development history of collagen material

1

Vegetable collagen
From White Fungus, Peach glue etc

2

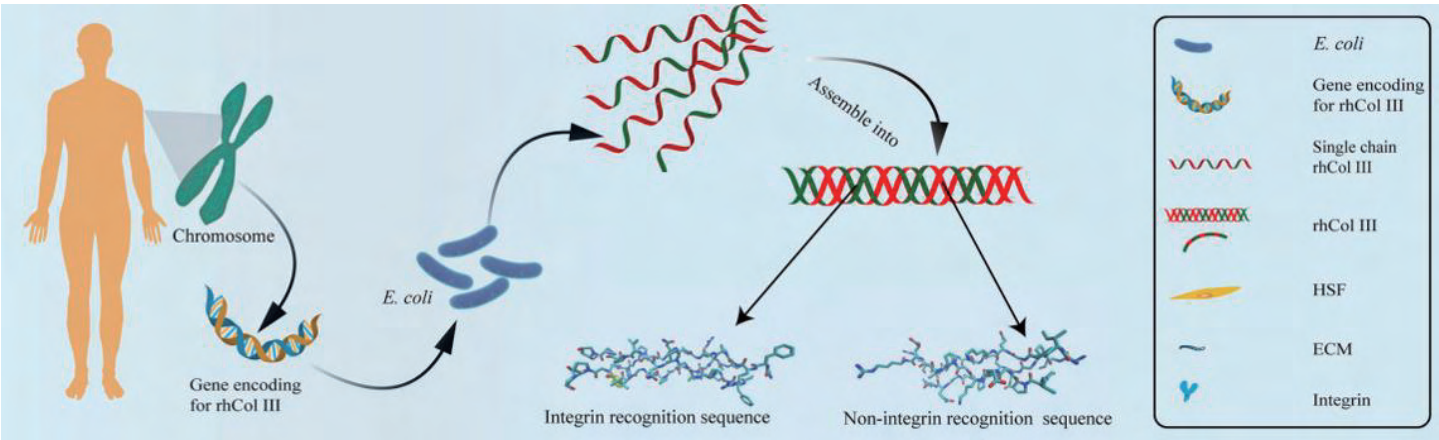
Animal collagen
From Pigs, Cows, Fish

3

Recombinant collagen
Biotechnology, Fermentation sources

What is iREJU REJUCOLL?

Recombinant collagen iREJU REJUCOLL is recombinant humanized collagen based on yeast fermantation process and is bio-designed to mimic natural human collagen. It is obtained by fermentation and has 100% consistency with the collagen sequence in human body.



- Medical grade: Injectable medical grade, safe ingredient
- Animal-Free: No animal source, no transmission concerns and low Immunogenicity
- Safe: Endotoxin level <0.05 EU/mg
- High purity: Purity up to 95%, high biological activity, no chemical residues, low risk of allergies

Comparison of collagen extraction methods

Conventional method

Actual tissue acquisition -> Various pretreatment and chemical treatments -> Separation and purification

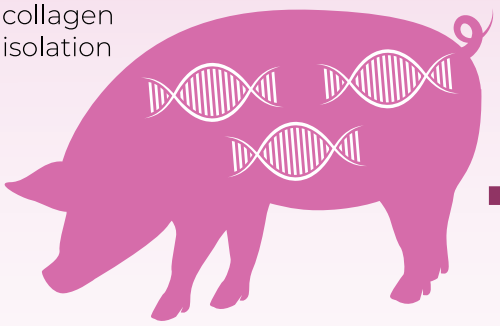
VS

Genetic recombination method

Extract only specific genetic information within the organization -> Isolation and purification through genetic recombination technology

Conventional production method

ex) Pig collagen isolation



Obtain connective tissue such as skin, bones, tendons etc.

Removal of impurities through cleaning and pre-treatment

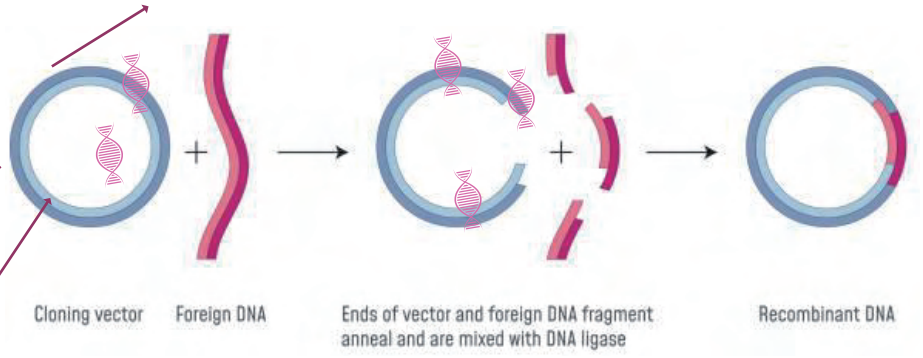
Tissue softening and collagen separation through chemical treatment such as acid/base

Collagen elution through heat or enzyme treatment

Acquisition of pure collagen through refining and drying

Genetic recombination method

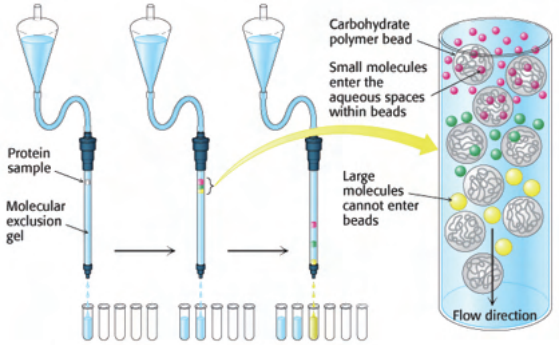
Determining the type of targeted collagen
ex) Human collagen



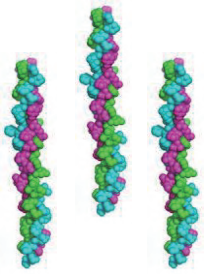
Tool for recombination, **"vector"**: A means of actual actuation

Select an expression system capable of production, induce mass production after gene insertion
ex) Insert the human collagen gene into the system of bacteria (E.coli): Mass production of collagen protein through microbial culture

Protein isolation/Refining



Pure collagen



What is different?

Animal derived collagen VS recombinant humanized Collagen

Animal derived collagen and recombinant collagen each have their own advantages and disadvantages. The advantages and disadvantages can vary depending on which characteristics are more important when choosing because these two collagen types differ in their source and manufacturing method.

Animal derived collagen

Advantages

- Cost-effective: It has economic advantages because it has a relatively low manufacturing cost and is widely used raw material.
- Rich Amino Acids: Animal collagen has an amino acid structure that is very similar to human skin, which can be beneficial for skin regeneration and moisturizing effects.
- Efficient absorption: Pig collagen is relatively well absorbed by the body due to its small molecular weight.

Disadvantages

- Allergic Reaction Possible: Some people may develop an allergic reactionto animal collagen.
- Religious and Cultural Constraints: Since pig collagen is extracted from pigs, some people do not use it for religious or cultural reasons.
- Source of Raw Ingredients: Collagen comes from animals, so it can be inconvenient for consumers who are sensitive to animal welfare or ethical issues.

Recombinant humanized collagen

Advantages

- Ethical Problem Solving: SInce recombinant collagen is synthesized in microorganisms or cells through genetic recombination technology, it is suitable for consumers who are sensetive to animal welfare because it does not use animal raw materials.
- Accurate ingredient control: Collagen produced in a recombinant manner can selectively produce certain types of collagen, enabling more accurate implementation of the desired properties.
- Less allergic reaction: The risk of allergic reactions is relatively low because animal sources are not used.

Disadvantages

- More expensive: Because the method of production using genetic recombination technology costs a lot of technology and money, recombinant collagen is more expensive tha animal sourse collagen.
- Complexity of the production process: Recombinant collagen has to undergo microbial culture and gene recombination, so the production process can be complex and time consuming.

Recombinant Humanized Collagen VS Animal Collagen

	Animal collagen	Recombinant humanized collagen
Homology	Differences in amino acids sequence from human collagen	100% human collagen sequence identity
Biological Activity	Structural damage caused by the extraction process, reduced biological activity	Selected high-activity core functional areas with correct triple helix structure
Stability	Uneven batch of raw materials	E. coli or yeast fermentation technology with high stability
Immuno genicity	Prone to human immune response	N/A
Pathoge nicity	Contain certain immunogenic components, carry viruses such as mad cow disease	N/A
Crosslinking Agent	Often added to slow down degradation time and increase strength	N/A
Religiosity	Religious issue	N/A

Collagen VS Collagen Booster (Regenerator)

		Pure collagen	Collagen regenerator/booster (HA, CMC, PLLA, PCL etc.)
Material Properties	Allergenicity	NO Risk	Risk
	Degradability	V	V
Duration		Direct Replenishment	Stimulates regeneration
Effect	Filling Effect	Higher elasticity, less displacement and swelling, more natural effect	Relatively easy to displace and swelling
	Adaptation site	Suitable for filling tear troughs, fine lines around the eyes, lips and other fine areas Effectively improve the dark circles under the eyes	Adaptable to all of the face, but cause tyndall effect appear when used in delicate areas such as tear troughs
Cost		Fewer approved products, higher prices	Many approved products, wide price range

Why it should be iREJU REJUCOLL?

Animal Welfare Problem Solved

Since recombinant collagen is not derived from animals, it is synthesised by microorganisms or cells through genetic recombination technology, it avoids ethical issues related to animal welfare. While collagen from animals is something to consider during slaughter or stress on animals, recombinant collagen can complately eliminate these problems.

Minimize Allergic Response and Safety

Minimize Allergic Response: For those who have allergic reactions to animal collagen, recombinant collagen may be safe. It may be more suitable, especially for those who are highly sensitive to collagen isolated from pigs or cattle.
Safety: Recombinant collagen is produced through thorough quality control and safety checks, making it more reliable for users.

Technological advances and customized collagen

Precise ingredient control: Genetic recombination tachnology allows recombinant collagen to selectively produce certain types of collagen. For example, by accurately synthesizing collagen types that are helpful for the skin, the effect can be further maximized. This is difficult to implement with traditional animal collagen.

Technological Advances

Technology to produce recombinant collagen continues to advance, thereby improving quality. It is also possible that production methods will improve more and more efficiently, reducing the price difference.

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Smart consumtion trends

Consumer Choice: As consumers are becoming more interested in ethical and sustainable consumption, there is a growing demand for animal-free products. Recombinant collagen is a product that can meet the needs of these consumers.
Eco-Friendly Brand Image: Brands' use of recombinant collagen id advantageous as a marketing strategy that emphasizes environmental protection and ethical consumption. As consumers favor ethical and sustainable products, demand for recombinant collagen will increase.

The development of health and well-being

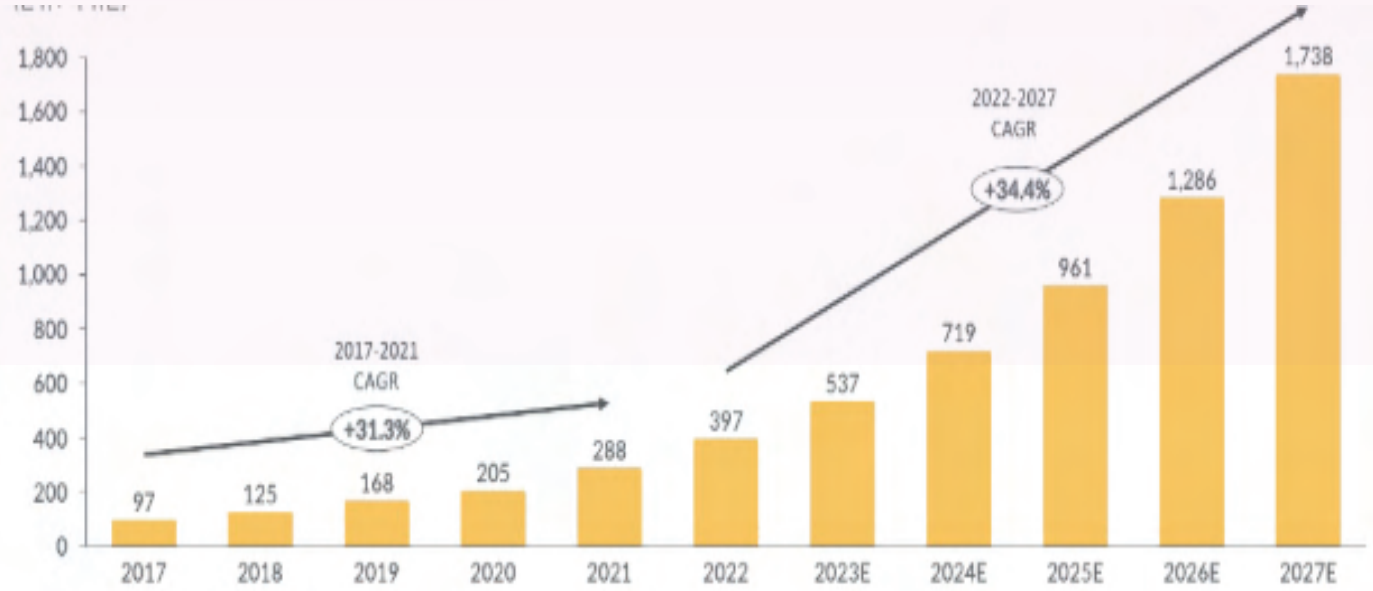
Human-like Structure: Because recombinant collagen may have a more similar structure to the human body, it has a higher absorption rate and can have better skin regeneration and moisturising effects. This can benefit not only skin health, but also joint and muscle health.
Personalized Health Care: Recombinant collagen can be produced to suit specific amino acid composition, providing customized collagen products tailored to individual health conditions and needs.

Legal regulations and international demands

Tightening Regulations: There are tightening regulations around the world of animal products, and recombinant collagen may be an alternative to the change. For example, some countries have strict regulations on products usding animal sources, so recombinant collagen may be in the spotlight.
Trends in Global Markets: Global consumption trends are changing in line with sustainability and ethical consumption, and the use of recombinant collagen will expand in line with these trends.

iREJU REJUCOLL: The next trend in Medical Aesthetics

The reason for future use of recombinant collagen is due to ethical and environmental reasons, personal safety, personalized health care, and change in global trends. With sustainable consumption and advances in technology, recombinant collagen will become an increasingly important option.



* Data Source: Frost & Sullivan, CIMB Research

Permability of recombinant collagen in medical aesthetic injection market

Efficacy of iREJU REJUCOLL

Stimulates fibroblast proliferation

Repairs the skin barrier

Increases epidermal moisturizing

Promotes deep burn wounds healing

Enhances skin elasticity & nourishes it

Delays skin aging

Improves skin lesions

Promotes cell infiltration

Recombinant collagen applications

There are some institution have done some studies related to Recombinant collagen, papers thesis published in domestic and foreign scientific journals. This type of collagen has potential applications in many areas including those below:

Wound Care

Collagen dressings and powder
Flowable Scaffolds
Skin substitutes
Wound and burn grafts

Orthopaedic & Sports Medicine

Bone graft substitutes
Cartilage repair
Tendon repair

Aesthetic Medicine

Dermal fillers
Suture line reinforcement
Skin booster

Dental Sphere

Bone graft substitutes
Dental membranes
Dental plugs

Cell Culture

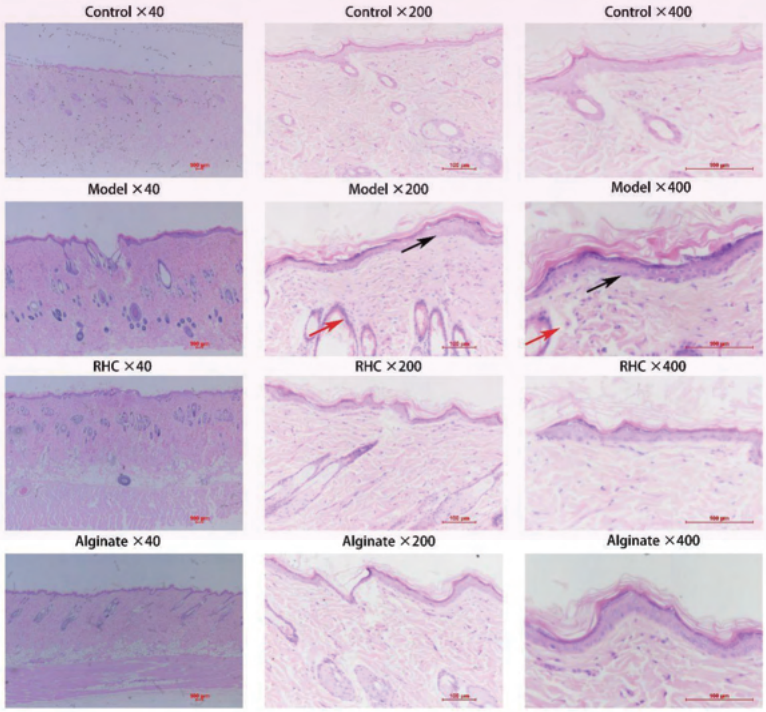
Collagen-based Cell culture kit
Cell culture media

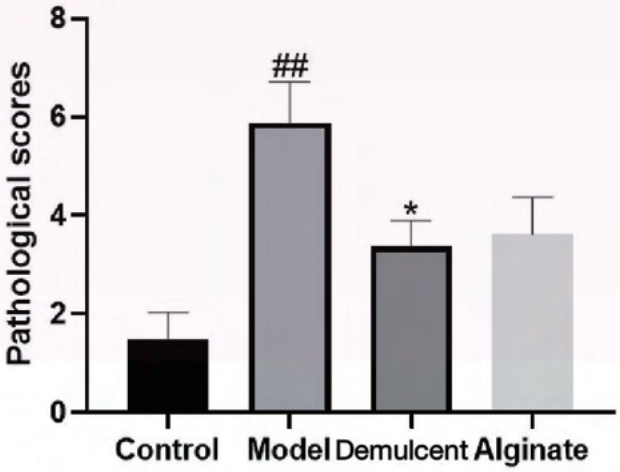
Others

Oral tissue regeneration
Eyes, Dural Repair
Nerve Repair

Healing effect of recombinant collagen

Recombinant collagen can significantly improve the microcirculation of deep second-degree burned wounds, reduce the infiltration of inflammatory cells and promote the healing of burn wounds.





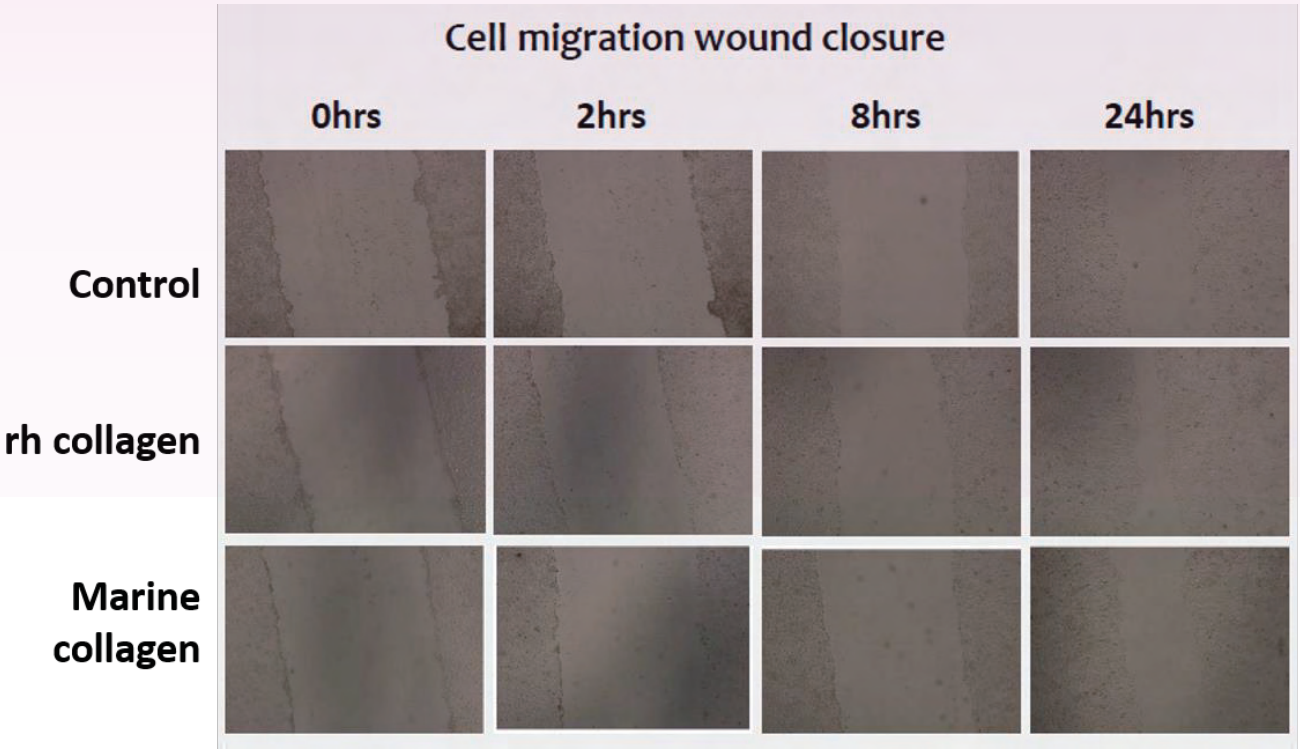
Advantage over animal-derived collagen

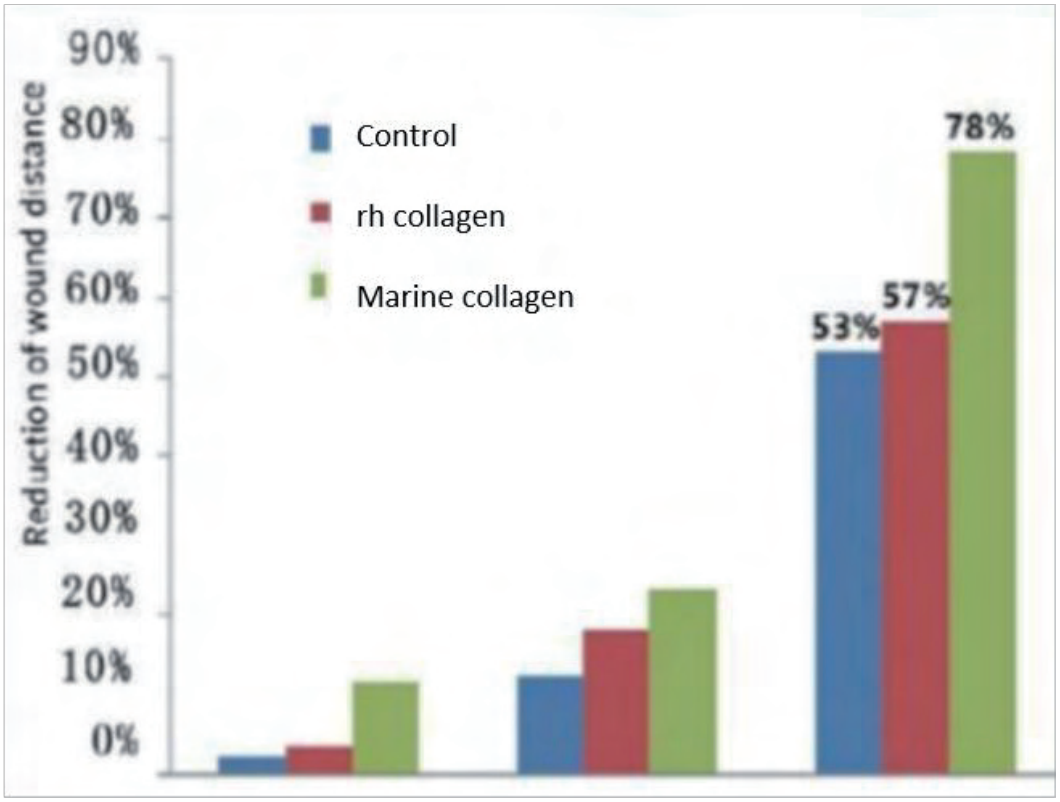
Bio collagen has 200 times the performance of animal collagen in cell proliferation. Bio collagen is proven to promote cell growth when the concentracion ranges from 0.005% to 1%.

	1%	0.50%	0.10%	0.05%	0.01%	0.005%
Biollagen	133.98%	129.38%	127.42%	124.73%	121.82%	115.63%
Marine collagen	116.90%	111.15%	110.17%	105.40%	103.29%	101.19%

Advantage over animal-derived collagen

Experiment uses cell scratching to determine cell migration and repair ability. Recombinant collagen has 6 times the reparing ability compared to marine collagen.





Safety test lists of iREJU REJUCOLL

1. Immunotoxisity Test
2. Cytotoxicity Test
3. Skin/Eye Irritation Test
4. Delayed-type Hypersensitivity Test
5. Intradermal Reaction Test
6. Oral Mucosa Irritation Test
7. Rectal Irritation Test
8. Penile Irritation Test
9. Vaginal Irritation Test
10. Ames Test
11. In vitro Mouse Lymphosa TK Assay Test
12. Acute Systemic Toxisity Test
13. Pyrogen Test

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