
STARFISH

A NEW OPPORTUNITY FOR MUSSEL
GROWERS AND A NEW SOURCE OF
INNOVATIVE MARINE BIOACTIVE MOLECULES

Alternative and Emerging Species Workshop
PEI Aquaculture Alliance
December 6-7 2017, Charlottetown

Patrice Dionne, CEO



STARFISH IS
A WELL-
KNOWN
PREDATOR
OF MUSSELS

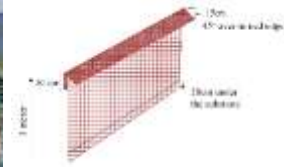


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PEST-CONTROL MEASURES

- Starfish mop
- Dredge
- Traps
- Fences
- Brine
- Lime

Barkhouse *et al.*, 2007. Can. Ind. Rep. Fish. Aquat. Sci. 279: vii + 38 p.



INEFFICIENT MEANS WITH NEGATIVE ENVIRONMENTAL IMPACTS

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UNSEEN OPPORTUNITY

Exploring how innoVactiv is turning this unseen opportunity into a value driver for the shellfish industry!



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A PECULIAR PROJECT TO START WITH...

Since 2004, innoVactiv has developed many specialty ingredients sourced from marine biomass for the cosmetic and dietary supplement industries.

Over the years, we evaluated different raw material sourcing such as seaweeds, microalgae, sea urchin, sea cucumber, etc.

Starfish caught our attention in 2008/2009:

- Starfish has a remarkable regeneration capacity
- Starfish can regrow a lost limb in a matter of time
- Some species are widely present in the North Atlantic ocean
- Regeneration = anti-aging opportunity for a cosmetic application

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Early phases

1. Sampling of various starfish species from North Atlantic Ocean
2. Generation of fractions and screening on specific cellular assays
3. Targeted *in vitro* activity found in the coelomic fluid of *Asteria vulgaris*

Can we “capture” starfish regenerative abilities and make it into a viable cosmetic ingredient?

1



2



3



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SIGNS OF SKIN AGING

- Dermo Epidermal Junction (DEJ) is a structure of major importance for skin cohesion and exchanges;
- Type III and IV collagens are structural fibres found in abundance in the upper dermis and at the DEJ;
- Type III and IV collagens decrease with age, causing the junction layer to lose its characteristic villosities and collapse.

- › Apparition of fines lines, wrinkles, deep wrinkles and skin sagging
- › Diminution of hydration, elasticity and firmness

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OUR CHALLENGE: OUTPERFORM RETINOL

+

- The gold standard anti-aging cosmetic molecule
- Reduces the signs of intrinsic aging and repairs photodamaged skin

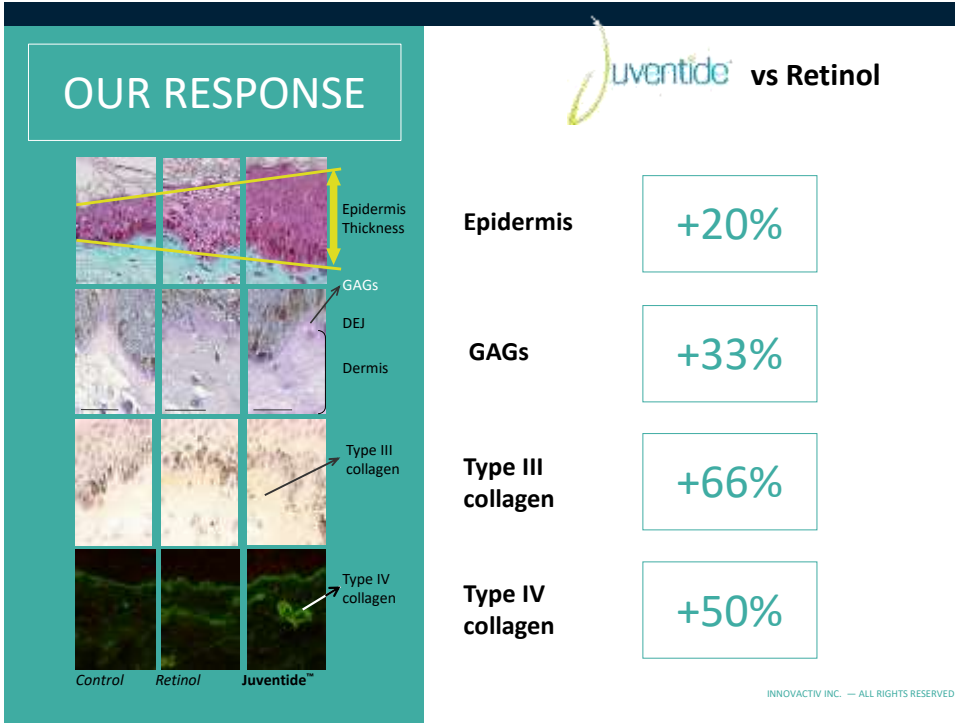
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Side effects with chronic use:

- Peeling
- Dryness
- Erythema
- Irritation

Could starfish coelomic fluid be a natural alternative to retinol with
SUPERIOR EFFICACY and NO ADVERSE EFFECTS?

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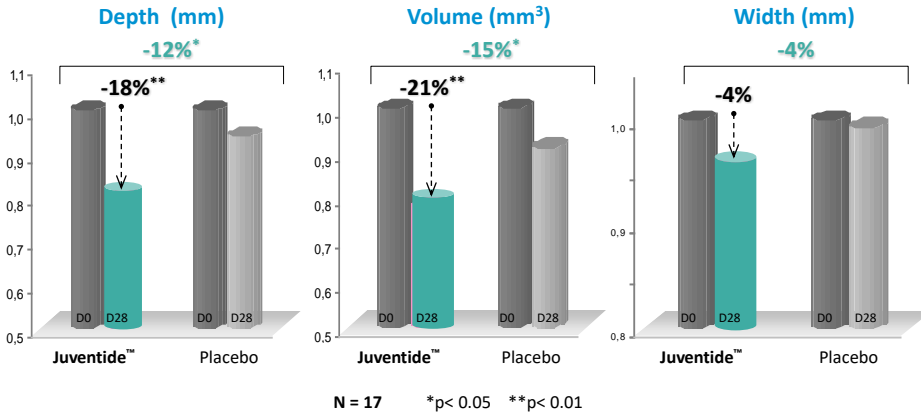
CLINICAL STUDY

Efficacy of Juventide™ on

- Wrinkle depth, volume & width
- Firmness & Elasticity
- Hydration

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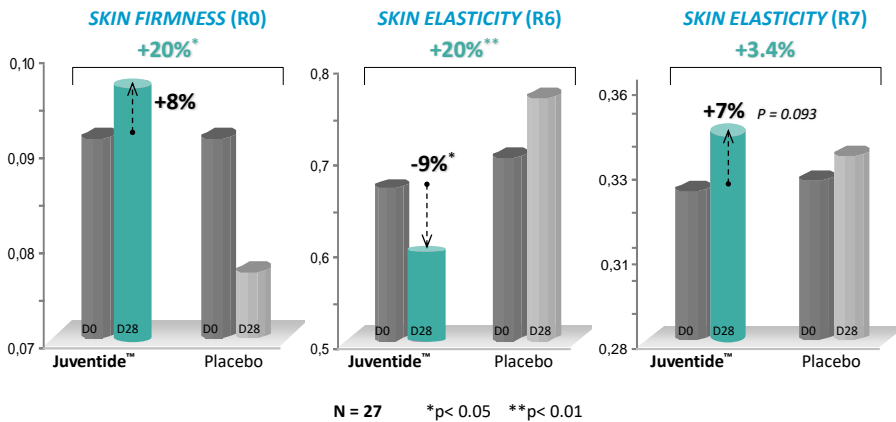
CLINICAL STUDY: ANTI WRINKLE



Juventide™ provides a real decrease of the wrinkles depth, volume and width for a younger looking skin

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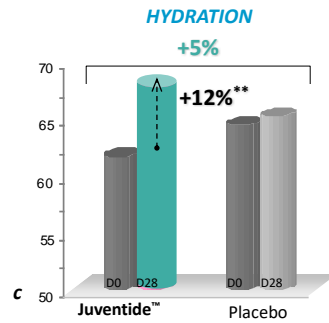
CLINICAL STUDY: FIRMNESS / ELASTICITY



Juventide™ provides a strong improvement of the skin firmness and elasticity compared to the placebo

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CLINICAL STUDY: HYDRATION



N = 27 **p < 0.01

Juventide™ increases skin hydration significantly after 28 days providing healthy looking skin

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COMPOSITION OF JUVENTIDE™

Four different
sulfated
saponins

Small peptides
and free
amino acids
Minerals

Asterosaponin
general structure

JUVENTIDE™ OFFERS THE UNIQUE EQUILIBRIUM GIVEN BY NATURE TO
STARFISH ENSURING ITS REGENERATIVE POTENTIAL

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PREMIUM COSMETIC INGREDIENTS

- Strength of research (published articles, patents, clinical studies, etc.)
- Strong safety profile (Non-GMO, no pesticides, no contaminants, no acute or chronic effects, etc.)
- Good manufacturing practices (ISO 22716)
- Chain of custody, clear documentation, traceability
- Supply reliability (good inventory management, supported shelf life, C-TPAT, etc.)

But what about sourcing of coelomic fluid?

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SOURCING CONSIDERATIONS

- No starfish commercial fishing in Canada.
- Starfish is a mussel “eaters” → go where the mussels are!
- PEI mussels industry is #1 in North America.
- Initial partnerships in 2008/2009 to establish a preliminary supply chain structure mainly to support our R&D efforts and pre-commercial operations:
 - Stephen Stewart (Confederation Cove) – Sourcing of starfish
 - Nova Scotia Agricultural – Development of an extraction line
- Slower commercial ramp-up than expected:
 - Starfish is an “animal”
 - Cosmetic companies (especially big “players”) are “sensible” toward animal-derived specialty ingredient

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RECENT COMMERCIAL DEVELOPMENTS

- Commercial breakthrough in Asia (China)
- Strong demand growth increasing our needs for coelomic fluid and structuration of supply chain

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SOURCING CONSIDERATIONS

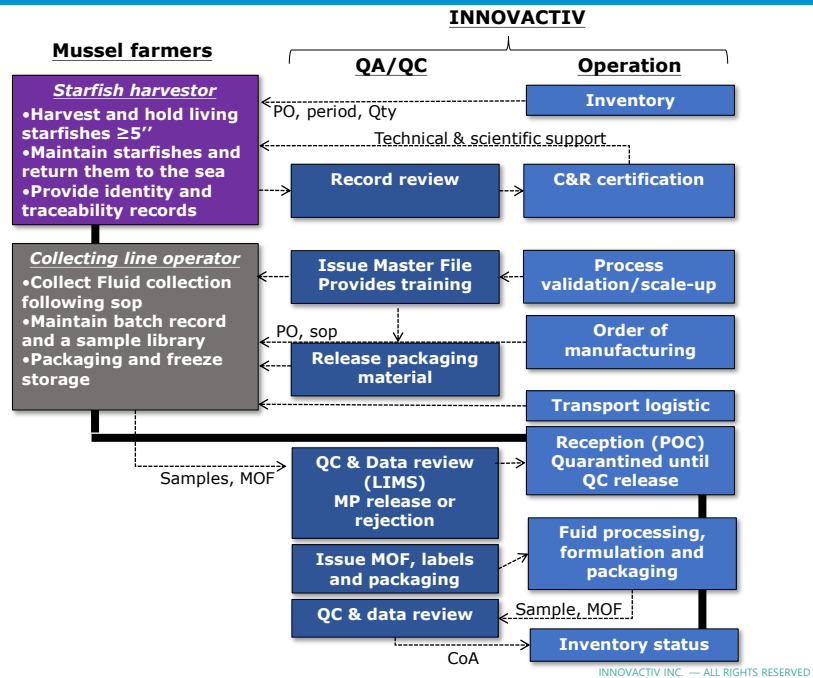
Sustainable and gentle process in full respect of marine ecosystem.

- Harvesting of starfish;
- Transportation in sea water tanks to collecting facility ;
- Harmless and soft coelomic fluid collecting;
- Micro-filtration and formulation of Juventide™;
- Reintroduction of starfish to ocean... for future harvest!



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COELOMIC FLUID OPERATIONAL FLOW CHART



STARFISH HARVESTING

- Partnership with mussel growers for starfish harvesting.
- Starfish specie (only *Asteria vulgaris*) of the right size are collected directly from mussels soaks and put in seawater tanks on boat.
- Seawater tanks are then brought to harbor for coelomic fluid extraction.



COLLECTION OF FLUID

- Mobile autonomous extraction line directly located on harbor;
- Gently collect coelomic fluid from starfish by gravity;
- Unique proprietary mobile collection line solely developed for starfish.



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SUSTAINABLE and CIRCULAR « FARMING »

Starfish are returned to
the ocean after
coelomic fluid
collection



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FUTURE

- Juventide is still at an early phase in its product life cycle
- Most recent starfish harvest
 - October 2017 (3 days)
 - 5 338 starfish harvested
 - 65¢ / starfish paid to mussel growers
- Next harvests planned:
 - Spring 2018: ≥ 15 000 starfish
 - Fall 2018: ≥ 30 000 starfish
- “Comparable” ingredients (e.g. snail slime) indicate a huge potential
 - Estimated market for snail slime: 45-60 T per year
 - Juventide has everything to compete against this ingredient
 - 10T > 325K starfish!

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FUTURE

- Win/win partnership with shellfish industry:
 - Opportunity to generate a “revenue stream” from a specie considered as a pest with a smooth integration in daily operations.
- Huge potential but:
 - Need to comply with the concept of “Sustainability and Circular Farming”
 - In other words: Starfish must returned alive to the ocean.
- Need to comply to strict SOP’s for harvesting and also to the regulatory environment of the cosmetic industry

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OUR UNIQUE PASSION

Provide, to our clients of the dietary supplement and cosmetic industries, science-based specialty ingredients that will make their products stand out from the competition and make a difference in improving and maintaining people's wellbeing.



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OVER A DECADE AT THE FOREFRONT OF INNOVATION

2014 and up

- Increase commercial presence with growing sales team
- Integration of new ingredients as distributor/commercial agent
- Established credibility and leadership position on the market
- 12 employees

2012-2014

- Divesting of most cosmetic ingredients (15 ingredients)
- Full integration of commercial activities with internal sales force

2008-2012

- Transition from R&D to commercial company
- First commercial presence at tradeshows
- Commercial representation through an external agent
- Completion of first nutraceutical human clinical trials
- Filing of first nutraceutical patent

2006-2008

- Filing of 4 new patents and launch of 11 new cosmetic ingredients
- Initiation of nutraceutical R&D work

2005

- Filing of first patent and launch of a first cosmetic active ingredient.

2004

- Starting in March 2004
- 2 employees



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Our products portfolio

InSea²

Dual action **glucose-optimizer** for optimal metabolism

Juventide

Topical **anti-wrinkle** with unique replenishing effect

VivenSea

Topical **skin cell activator** to tackle aging process

myoceram

Gluten-free vegetable ceramides for **optimal skin hydration**

Myoceram™ is a trademark of Nippon Flour Mills Co., Ltd.

Specialty ingredients offering clinically-demonstrated benefits for nutraceutical and cosmetic applications

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inno**activ**

Thank you !

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