# JELLYFISH-SOURCED COLLAGEN
## DEVELOPING A PROTOCOL AND BUSINESS MODEL

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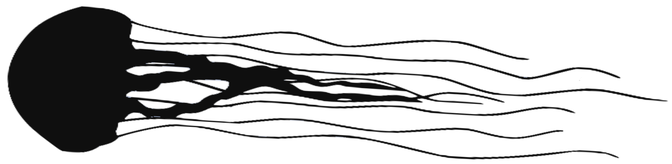

**The Jellyfish Issue** Jellyfish blooms, which are a high occurrence of jellyfish in one particular area, have been increasing worldwide. There are multiple factors that contribute to the rise of blooms, including, but not limited to: nutrients, sunshine, temperature, and oxygen concentration. Jellyfish blooms threaten to harm the balance of our marine ecosystems- acting as an invasive species. In addition to its negative effects on our oceans, jellyfish also have a negative impact to humans. Jellyfish foul up nuclear power plant engines, they kill off species that are fished for food, and harm beach-goers. Although the root of the problem has not been pinpointed, many solutions to the problem of blooms have been presented. One effective way of decreasing the effects of blooms is to fish for them. Once the jellies are fished, a use for the creatures is not immediately clear. The culture of consuming jellyfish is limited to a few nations in East Asia, so this could not be a means to use the creatures. Jellyfish are made up of very little solid matter- they are 95% water, however, the other 5% is connective tissue made up largely of proteins. The most valuable of those proteins is collagen, which currently has a $5 billion market. Thus, a sustainable way to solve the growing jellyfish issue is to use it as a source of collagen. The most collagen dense areas of the jellyfish are the epidermis, endoderm, and tentacles, which help shape and propel the creature [Figure 1].

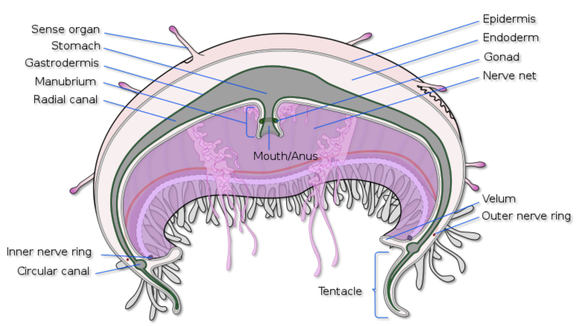


**Figure 1** [http://exotic-aquariums.com/JF/JA/Cross_section_jellyfish_en_(edit).svg.png]

**Experiments** The method of extracting collagen from jellyfish has to be sustainable and eco-friendly, in order to keep with the intention of solving an environmental issue. Thus, the most cost-effective and green method of extracting collagen- with the least waste products- is to spray dry the collagen into a powder. Spray-drying is the process of taking a solution and evaporating all liquids, leaving a dry powder that has a long shelf-life, due to its lack of water content. The solvents used were also low-eco impact. Initially, solely acid-based solutions were tested. However, various literature were conclusive that the ability of acids to quickly denature the collagen was not optimal for the purposes of this project. Another well researched method of extracting collagen is using enzymes. The most common enzyme used in collagen extraction is pepsin- which is usually porcine-sourced. Since the industry surrounding porcine and bovine-sourced materials is not sustainable, and creates a great deal of waste, this method was not adopted for the project. Instead, papain (sourced from papayas and pineapples) was used to break down the 5% of the solid matter in the jellyfish and was suspended in ethanol, which is easily spray-dried, following the protocol developed below [Figure 2].

## Protocol

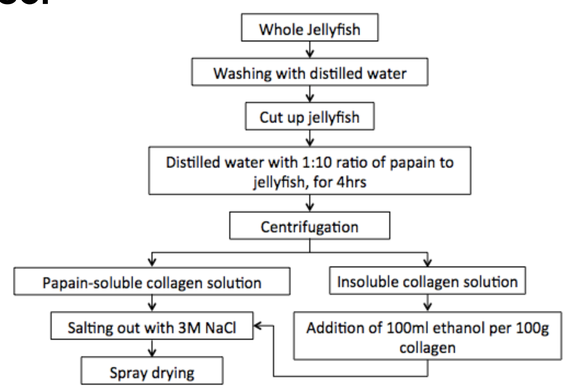


**Figure 2**

**Business Model** Due to the location of easily harvested jellyfish near coastal nations, our business model aims to organize a local market in these areas for jellyfish-extracted collagen. Since the water weight of jellyfish is high, transporting it long distances is not optimal to the process. Thus, jellyfish caught near coastal areas would be processed at plants nearby. The collagen produced at the site would then be distributed to nearby pharmaceutical and medical facilities. The collagen would then be utilized in various ways, depending on the area. Figure 3 shows areas that are continually impacted by jellyfish.

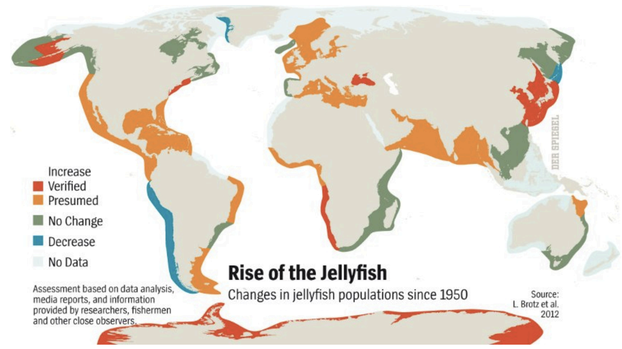


**Figure 3** [https://dabrownstein.files.wordpress.com/2013/10/jellification.jpg]

**Global Health Application** The lack of improvement in the health of populations across the world has a great deal to do with access to resources and facilities. Our business plan aims to jump start an economy for collagen, which has extensive uses in tissue and bone damage repairs- in addition to uses in pharmaceuticals. Providing a method to extract collagen allows developing coastal nations to improve medical supply, as well as to encourage local production of materials.

**References**
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**Acknowledgements** I would like to thank my entire team based in Cape Town and Paris this summer: Charlotte Lee, Eliza Hale, Patrick Coats, and Matthew Martindale. I would also like to thank Professor David E. Edwards, Andrea Sachdeva, and the entire teaching staff of ES20, who helped develop our idea over the course of the semester. I would also like to thank Deen Bhatta for his contribution and commitment to making this project come to life.

This research was supported by the Harvard Global Health Institute.

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