Journey from a Small University Lab to Bringing New Therapy to the Patient's Bedside

David T. Woodley, M.D. & Mei Chen Ph.D

USC Department of Dermatology

Dermatology Innovation Forum

February 28th, 2019, Hilton Hotel, Washington D.C.

Longstanding Research

- **Type VII anchoring fibril collagen (C7): Relates to two human diseases:**
  - **1.) Epidermolysis Bullosa Acquisita (EBA)**
  - **2.) Genetic Dystrophic Epidermolysis Bullosa (DEB)**
- **NIH Grants: "Structure & Function of the EBA Antigen" for 30 years and Strategies Toward Therapies for DEB over 20 years: Mei Chen Ph.D. & David Woodley, M.D. have had a research partnership for 25 years.**
- **Developed:**
  - **A mouse model of EBA**
  - **A method for making large quantities of purified recombinant human C7**
  - **Dermal fibroblast lines that over-express C7**
  - **Purified domains and sub-domains of C7**
  - ***In vitro* and *in vivo* assays to determine functional potency of C7 and purified domains of C7**
  - **Various therapeutic approaches including cell therapy, protein therapy, and read-through drug therapy for DEB.**
  - **CHO cell-derived rhC7**

PATENTS: Chen/Woodley with the USC Stevens Institute on various aspects of human recombinant C7. Besides EBA and DEB, which are very rare diseases C7 plays a role in skin wound healing and inhibiting wound scarring

Shopping Around

- USC Stevens Institute “shopped” for people who might wish to license the patents.
- USC chose Dr. Mark de Souza and Mr. Jim Fordyce who had worked with Dyax Corp, which developed and commercialized protein therapy for hereditary angioedema
- Formed a new virtual company: Lotus Tissue Repair, Inc.
- After 18 months on our own resources Third Rock Ventures funded Lotus @ $26 million

Lotus Tissue Repair, Inc. With $$

- Lotus hired experts to collect data on the incidence and annual healthcare costs for DEB patients, attended multiple DEB patient meetings to understand the patients' perspective, held focus groups with experts from the C7 and DEB fields, hired an expert on FDA regulations, generated new IP & met all milestones ahead of schedule.
- 2013: Sale of Lotus to Shire Pharmaceuticals who developed significant CMC including the ability to synthesize grams of functional rhC7 from CHO Cells
- Leadership change at Shire & the program was halted and in limbo for 3 years
- With Mark DeSouza and Shire as a principle, a new company was formed called Phoenix Tissue Repair, Inc. with a new President & CEO Neil Kirby Ph.D; Vice President for Operations Ramsey Johnson; and Theresa Podrebarac, M.D. , M.SC, Chief Medical Officer and Le-Yi Wang, Vice President for Business Development

Phoenix Tissue Repair, Inc.

- **Spring of 2018:** Favorable animal toxicity studies in monkeys given intravenous rhC7
- **Fall of 2018:** Submitted IND to the FDA & a month later the FDA approved a Phase 1/2 clinical trial
- **Winter of 2019:** Phase 1/2 clinical trial has begun and 2 patients enrolled in February

- **CONCLUSION:** Keep your fingers crossed and say your prayers! By next year, you will know if we were successful or not!

What We Learned From This Experience

- If you have an idea or IP that has potential therapy for patients and commercial value, the research inventors need help bringing it “from the laboratory to the bedside”.
- The skill sets needed to run a successful university research lab are completely different than those to commercialize a drug.
- You need help from the right people.
- The inventors need to be part owners & remain involved in the project.
- The inventors must give up some autonomy.
- The inventors must consider if they have IP to protect it by a provisional patent prior to publishing a paper or presenting work at an academic meeting.

Do I Have Any Regrets?

- Yes, I wish I were younger!

- Thank You!

Phase ½ Study by Phoenix

- Screening Period – 4 weeks;
- Treatment Period - 10 weeks – IV infusions every 2 weeks
- Follow-up Period - 8 weeks

- **COHORT 1** (0.1 mg/kg of rhC7) = 2 patients
  - Group 1: - 3 doses q 2 weeks apart of rhC7 (0.1 mg/kg) & then 3 doses of saline
  - Group 2: - 3 doses of saline & then 3 doses of rhC7
- **COHORT 2** (0.3 mg/kg of rhC7) = 4 patients
  - Group I: 3 doses q 2 weeks apart of rhC7 (0.3 mg/kg) & then 3 doses of saline
  - Group 2: 3 doses of saline & then 3 doses of rhC7 (0.3 mg/kg)
- **COHORT 3:** (1.0 mg/kg) = 8 patients
  - Group I: 3 doses q 2 weeks apart of rhC7 (0.1 mg/kg) & then 3 doses of saline
  - Group 2: 3 doses of saline & then 3 doses of rhC7 (0.1 mg/kg)