

# Green algae as a platform for protein production: Food, Feed, and Nutritional Supplements

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*Chlamydomonas reinhardtii* is a model organism, but lacked a viable commercial production process and food safety record before Triton

- *Chlamydomonas reinhardtii* is a single-cell green alga.
- *Chlamydomonas* species are **distributed worldwide**.
- *Chlamydomonas reinhardtii* is a model organism, mostly due to its lab scale **synthetic biology**: an ideal host to produce mammalian/plant proteins, antibodies, vaccines, and hormones.
- But lack of an economic large scale production process.



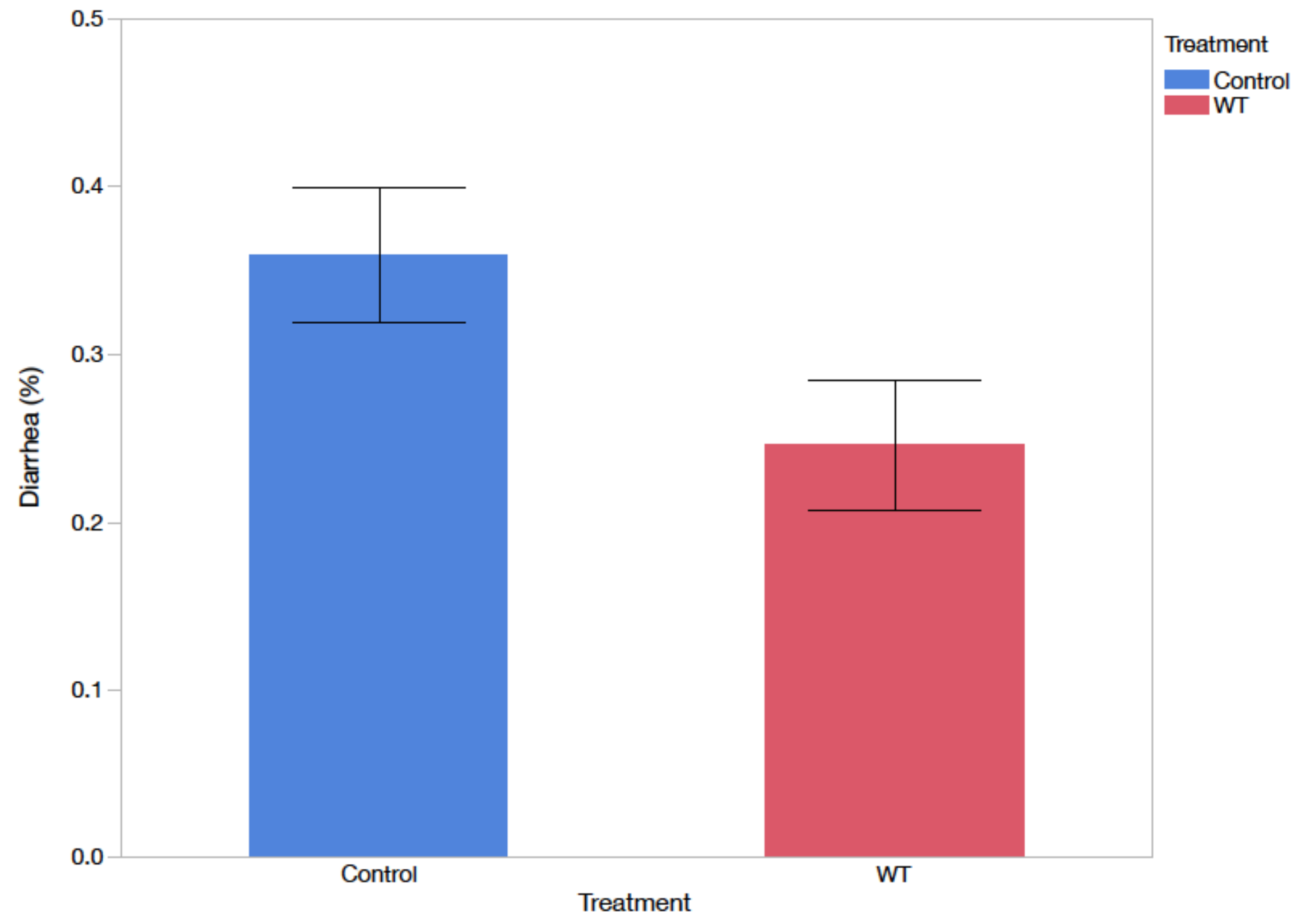
# Triton, founded in 2013, is a San Diego start-up company

- Triton has developed a cost effective, scalable, heterotrophic production process for *Chlamydomonas reinhardtii*.
- Triton discovered *Chlamydomonas reinhardtii* itself reduces diarrhea in pig trials.
- Triton has completed toxicity studies on *Chlamydomonas reinhardtii*.
- Triton has proprietary protein expression and production technology with 17 proteins in the pipeline.

# Pig trial results - *E. coli* challenge

After inoculating pigs with *E.coli*, and feeding them with wildtype algae, over the course of this experiment, the following statistically significant result was observed:

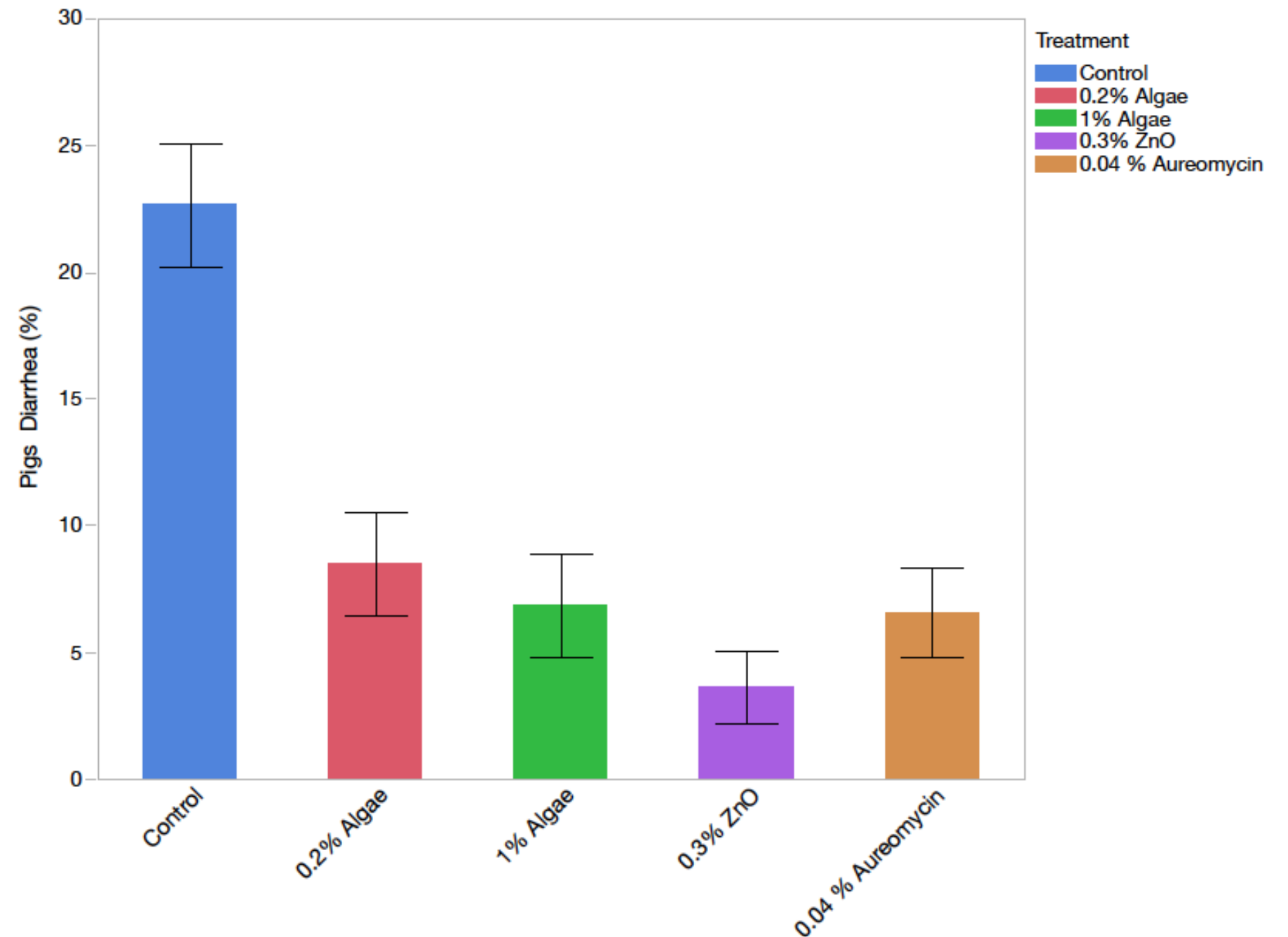
1. Diarrhea incidence dropped from 35% to 24%, a reduction in the incidence of diarrhea by 31%



# Pig trial results - Exposure to natural disease

After exposing pigs to natural disease conditions in pens, and comparing a diet augmented with algae to both a control diet and diets augmented with traditional diarrhea controls, the following results were observed:

1. Algae performed as well as Zinc and Aureomycin in significantly reducing incidence of diarrhea
2. Algae reduced the incidence of diarrhea over a control diet by a statistically significant 63%



# For the first time, Triton has developed a viable commercial viable production process for *Chlamydomonas reinhardtii* in fermenters

- **Productivity:** Increased from  $< 0.4$  to  $> 20$  grams/liter/day,
- **Titers:** Increased from  $< 2$  grams/liter to  $> 80$  grams/liter.
- **Validation:** Process validation by two independent contract manufactures in 200 liter tanks, and one in 3,000 liter tanks.
- **Scale:** It can be scaled up for  $>500,000$  liter tank for commercial production.
- **Costs:** would be between \$2 to \$10 per kg (dried powder)





Triton's media is made of "fertilizers" and acetate. At harvesting, greater than 90% of the Nitrogen, Phosphate, Potassium and Carbon are utilized by the algae

- Petrochemicals can be converted into nutritious green algae powder with nutritional value better than vegetables
- *C. reinhardtii* has a high efficiency of utilizing fertilizers and fresh water
- *C. reinhardtii* does not require crop protection chemicals
- *C. reinhardtii* has a high protein content, unsaturated fatty acids, and minerals
- *C. reinhardtii* is provided in a dried powder like flours, easy for transportation and storage

### Utilization at harvesting

