

Carol Liu<sup>1</sup>, Andreas Moritz<sup>2</sup>, Johannes Gahn<sup>2</sup>, Hermann Agis<sup>2\*</sup>

<sup>1</sup>Columbia University College of Dental Medicine, New York, NY

<sup>2</sup>Department of Conservative Dentistry and Periodontology, University Clinic of Dentistry, Medical University of Vienna, Vienna, Austria

Faculty Mentor\*

## INTRODUCTION AND OBJECTIVES

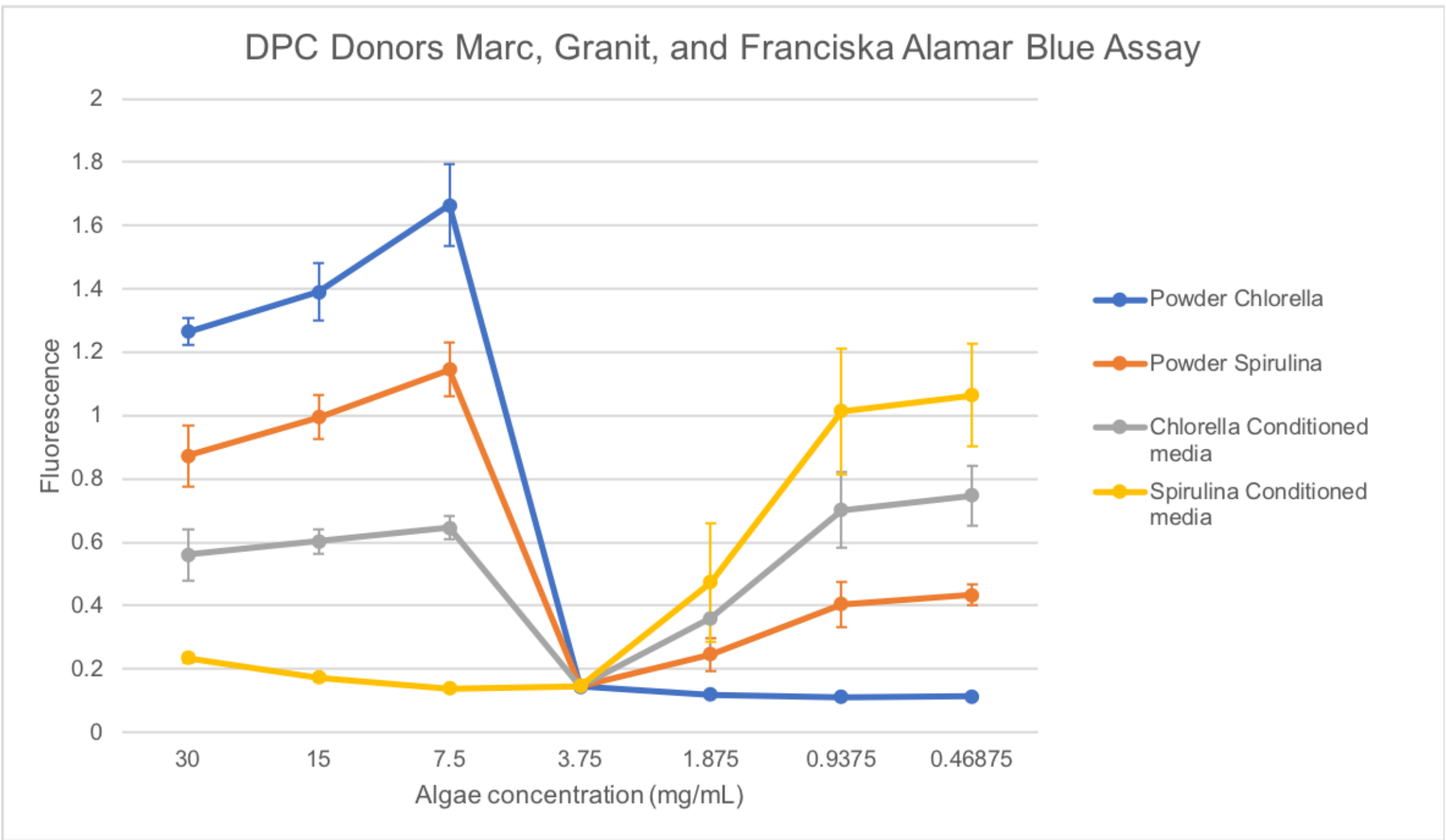
- The microalgae *Chlorella vulgaris* and cyanobacteria *Spirulina platensis* are marine algae superfoods that have risen in popularity due to their:
  - Nutritional quality (high vitamin and mineral content)
  - Potential role in wound healing, anti-viral properties, and antioxidant activities
- Previous studies have shown the efficacy of locally delivered spirulina gel as adjunct therapy in the treatment of chronic periodontitis
- Objective:** Observe the effects of Chlorella and Spirulina powder extract and conditioned media (CM) treatments on the viability, proliferation, and metabolism of human dental pulp cells (DPC), gingival fibroblast cells (GF), and periodontal ligament fibroblast (PDLF) cells.

## METHODS

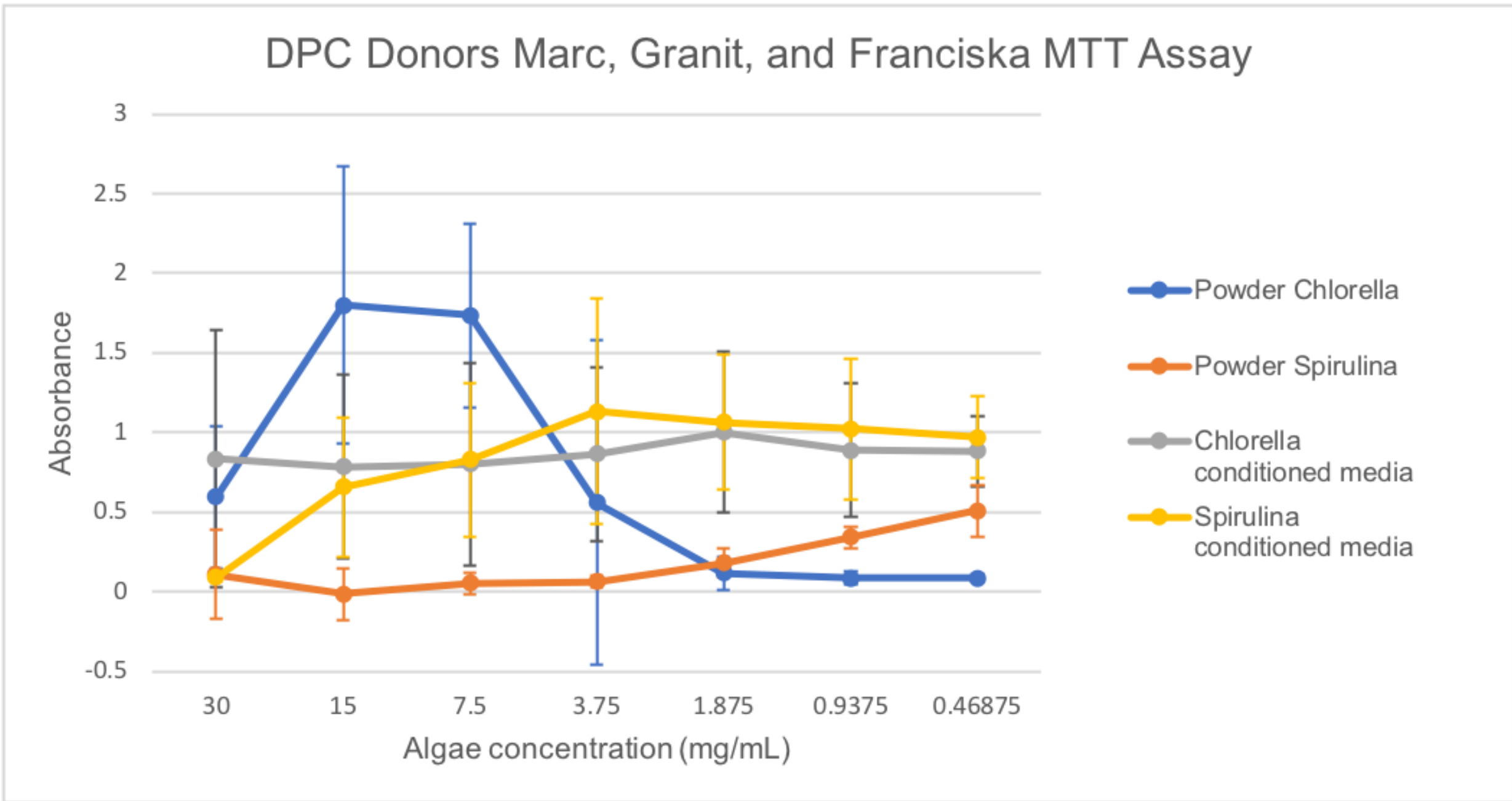
- 30 mg/ml *Chlorella vulgaris* or *Spirulina platensis* was dissolved in αMEM supplemented with 1% Penicillin/Streptomycin (overnight at 37°C, gentle shaking)
- Powder extracts** were aliquoted, or filtered through a 0.22µm sterile filter to create **conditioned media**
- Desired cells (DPC, GF, PDLF) were stimulated with desired algae concentrations and allowed to incubate at 37°C for 24 hours; changed media prior to assay
- MTT and AlamarBlue assays** measured cell viability of cultures stimulated with different concentrations of algae powder extract or CM
- Highest algae concentration (3.75 mg/ml) that demonstrated cell viability was selected for **LIVE/DEAD assay and MTT staining**
- Cell culture media was collected and **ELISA** was performed to measure **VEGF, IL-6, and IL-8 levels**

## RESULTS

**Figure 1. AlamarBlue Assay results from dental pulp cells stimulated with various concentrations of Chlorella or Spirulina powder extract and conditioned media.\***



**Figure 2. MTT Assay results from dental pulp cells stimulated with various concentrations of Chlorella or Spirulina powder extract and conditioned media.\***



\*Due to the pigmented nature of algae biomass, highly concentrated algae preparations may have caused interference with colorimetric assays and produced artificially high measurements.

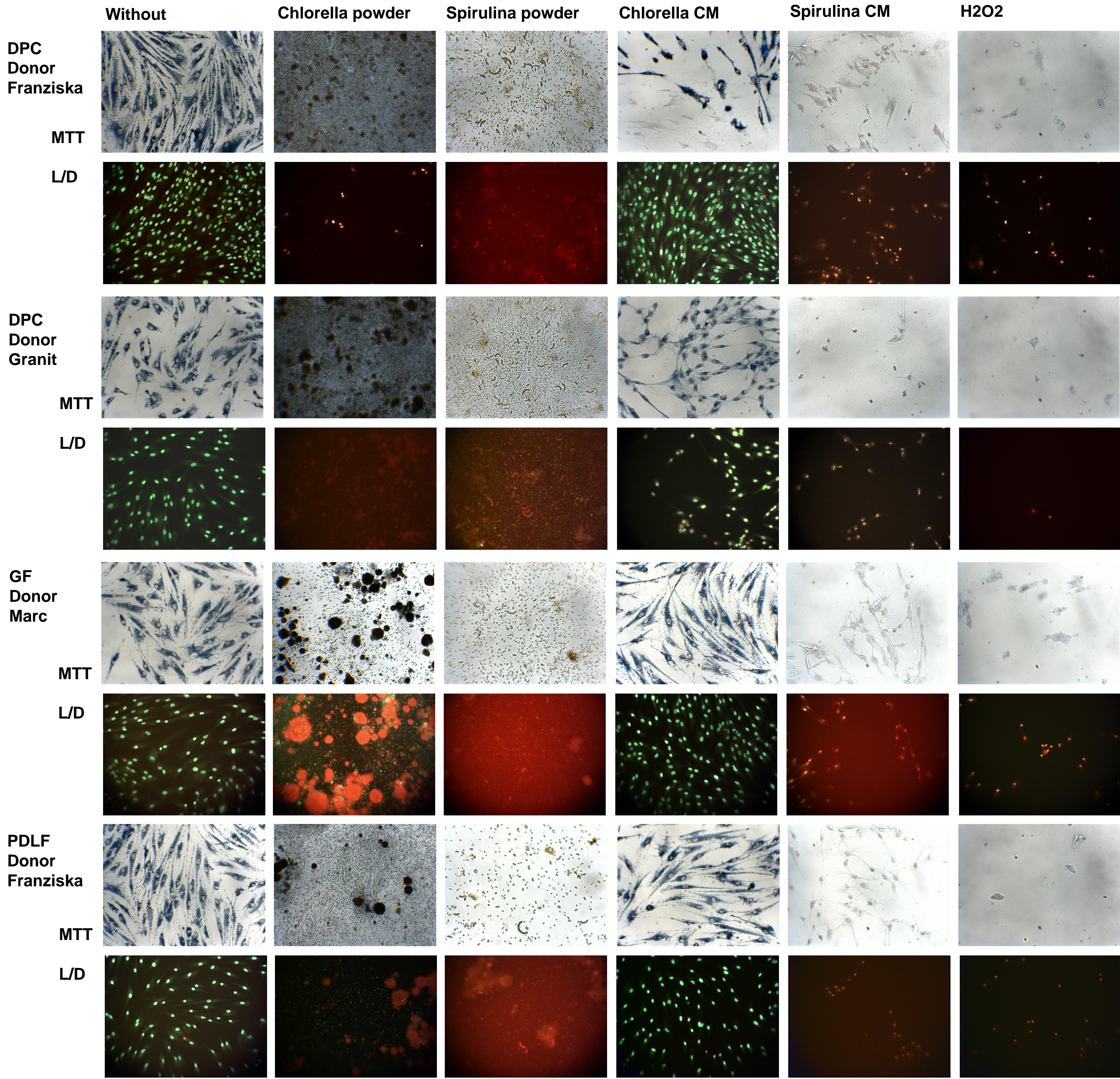
## CONCLUSIONS

- Treatment with conditioned media exhibited less cytotoxicity to DPC, GF, and PDLF cells compared to powder extract formulations (Figure 1 and 2)
  - Chlorella conditioned media was the only algae preparation that produced viable cells at a concentration of 3.75 mg/ml (Figure 3)
- Chlorella CM may increase the expression of certain chemokines, such as IL-6 and IL-8 (Figure 4)
- These results have implications for the formulation and effects of algae with regards to its potential use as a therapeutic agent in treating oral disease
- Further research is required to better understand the impacts of Chlorella and Spirulina on inflammation in oral tissues

## ACKNOWLEDGEMENTS

◆ This research was funded by the College of Dental Medicine 2019 Dental ICE Summer Research Fellowship

**Figure 3. MTT staining and LIVE/DEAD assay results for dental pulp cells, gingival fibroblast cells, and periodontal ligament fibroblast cells stimulated with 3.75 mg/ml Chlorella or Spirulina powder extract and conditioned media.**



**Figure 4. ELISA was performed to measure levels of IL-6 (A), IL-8 (B), and VEGF (C) in cell culture media collected following MTT staining and LIVE/DEAD assay.**

