Iron, the fourth most abundant element in the Earth's crust, faces limited bioavailability in our oxygenated world, impacting the growth of all organisms. Notably, not all organisms are equally skilled at acquiring iron. Extremophiles, like the microalgae Dunaliella, present alternative iron acquisition mechanisms. Dunaliella, known for its exceptional iron acquisition abilities and thriving in harsh conditions, holds potential applications in biotechnology.

My research focused on employing a systems biology approach to unravel iron homeostasis mechanisms in two halotolerant Dunaliella species. To support this analysis, high-quality genome assemblies were crucial and were achieved using a hybrid strategy combining next-generation and long-read sequencing. These assemblies served as the foundation for a comparative multi-omics analysis, revealing diverse strategies employed by Dunaliella for iron acquisition and management. These strategies included an expansion of transferrins and a unique family of siderophore proteins, constituting a "mix-and-match" iron uptake strategy. Additionally, ferredoxin acted as a significant iron reservoir, released by triggering flavodoxin production, reducing the algae's iron requirement by 6%. These unique iron mechanisms make Dunaliella stand out among organisms.

Looking ahead, my goal is to further explore these distinctive iron strategies and potentially integrate them into other systems.