Unicellular photosynthetic organisms forming the phytoplankton are the basis of primary production. Because these organisms cannot regulate their inner temperature, the medium temperature strongly constrains their growth. Understanding the impact of this factor is topical in a global change context. In this PhD thesis we have investigated how phytoplankton adapts to temperature. By analyzing the growth rate as a function of temperature for hundreds of species we highlighted the characteristics that can be accurately described by a mathematical model. We have identified the links between the cardinal temperatures as well as their thermodynamical fundament using the mechanistic Hinshelwood model. We then challenged the Eppley hypothesis ‘hotter is faster’ for 5 phylogenetic phytoplankton groups and determined the evolutionary limits for each of them. We have also studied the adaptation mechanisms associated to long term temperature variations by developing an evolutionary model using the adaptive dynamics theory allowing to predict the evolutionary outcome of species adaptation to a simple temperature cycle. Our results have been compared to a selection experiment carried out in a controlled device on Tisochrysis lutea. Our method has been extended to predict the adaptation of a strain to periodic temperature profiles and study phytoplankton adaptation at the global ocean scale. In situ data of sea surface temperature have been used as a forcing variable and have permitted to show that the elevation of temperature will be critical for several species in particular for those living in areas where the annual temperature fluctuation is high such as the Mediterranean sea.