The growth and development of plants are closely related to the prevailing environmental conditions, so the correct reception of stimuli and signal transmission within the cell or between neighboring cells determines the survival of the plant organism. The ability of the cell to receive signals depends on the presence of appropriate receptors that are activated in response to a stimulus. This triggers a sequence of physico-chemical reactions of transmitting information to the effector and triggering a physiological response adequate to the stimulus. In this process, called signal transduction, a series of particles and signal elements are involved, forming a signal cascade. In the case of light stimuli, the receptors are, m.in, phytochromes (phys) and phototropins (PHOTs), which receive red and far red and blue wavelengths, respectively, critical in the process of photomorphogenesis, i.e. the non-trophic effect of light on plants. Their structure, types, and functions have generally been well documented. However, our recent research shows that there are elements in the structure of these proteins and in the transduction of the light signal which still need to be discovered and considered. We found that the phytochrome and phototropin genes contain characteristic sequences encoding adenylate and guanylate cyclases, i.e. enzymes responsible for the synthesis of cyclic nucleotides (cNMP), cAMP and cGMP, molecules referred to as secondary messengers, very well known from animals, transmitting information through the activation of many enzymes. This discovery is surprising, especially since the presence of cyclases in plants was discovered only a few years ago. As early as the 1980s, the participation of cyclic nucleotides in the light transduction pathway was indeed indicated, but so far no one has combined these facts into one whole. So, could phytochromes and phototropins be so-called "moonlight proteins," i.e., complex multidomain proteins that perform multiple functions? Do the small domains with adenylate cyclase properties located in them play a regulatory role? When do they become active, and what is the role of cyclic nucleotides, the products of their synthesis? We want to find answers to these questions by conducting research as part of this project. We planned to conduct several molecular and physiological studies to thoroughly understand these cyclases and cNMP regulation of photoreceptors themselves and in photomorphogenesis. By performing appropriate plant mutants, we will prove the critical role of cNMP in regulating the processes triggered by the absorption of light energy by photoreceptors. Our results will not only complement the existing knowledge about cyclases and the role of cNMPs in plants. Still, they will also allow us to define their participation as an indispensable and universal signaling element in cells, not only in response to light. The findings will be a breakthrough in this field of research, redefining the current view of light signal transduction in the cell.