A rapid development of information processing techniques and advancing digitalization of our everyday life lead directly to the growing demands towards electronic components and computing systems. As the result, the conventional paradigms of circuits design and construction and the classical, theoretical approach become obsolete. Therefore, the continuous growth of interest in alternative – compared to silicon-based classical devices – fields of electronics is observed. These could be utilized in the construction of fundamental components (diodes, transistors, binary logic gates, etc.), as well as qualitatively new devices, which would initiate more general changes in worn patterns existing from the very beginning of digital technology – biosensors, thin-film displays, molecular-based memories, smart materials, etc.

On the one hand, several successful attempts of harnessing the smallest elements of our reality to work for the benefit of data transmission have been observed – vide quantum computing and molecular electronics – on the other, a lot of research effort is focused on the change in transferring medium, namely from electrical current/potential (found in conventional systems) to light, which could be applied according to its dual nature, as the carrier of both energy and information. That is how the dawn of molecular optoelectronics looks like – the concept which connect both aforementioned ideas.

One of the most promising branches of these studies concerns the use of carbon nanostructures and organic modifiers in new hybrid materials, which would possess the ability to communicate through the interchange of electrical, chemical and optical signals. In terms of this approach, a controlled modification of photoelectrochemical properties within this systems could catalyze the construction of basic electronic components – logic gates, transistors, diodes, etc. – but also devices that could realize more complex functions – e.g. artificial synapses, photomemristors. This field, which is just waiting for the exploration, can bring substantial benefits for the information Society in next few years.