Using bio-functionalized gold nanorods to observe the plasmonic photothermal effect on individual BaF3 cells

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The exploitation of the plasmonic photothermal effect of gold structures, such as gold nanorods, for photothermal therapy in cancerous tissue is of great interest for the scientific community\(^1\). While a wide array of medical applications for targeted and non-targeted gold nanorods has been developed in the past, further understanding of the plasmonic photothermal effect and the parameters involved at the cellular level is of utmost importance.

We investigate the photothermal effect of gold nanorods in detail on the single-cell level. We have developed a method to selectively irradiate individual cells that were incubated with bio-functionalized gold nanorods and to monitor the induced plasmonic photothermal effect on these cells over time by measuring trypan-blue induced color changes of the cell. Figure 1 (a) exemplarily shows micrographs of a BaF3 cell before and at specific moments in time after light irradiation. In panel (b), the observed color changes, which indicate the dying of the cell, are quantified in terms of an absorbance value. We compare the efficiency of the plasmonic photothermal effect on BaF3 cells that were incubated either with non-targeted PEG-coated nanorods or with PEG-coated nanorods targeted with the aptamer AIR-3A that specifically binds to the Interleukin-6 receptor of the cells. We find that targeted gold nanorods lead to color changes twice as fast as non-targeted ones. Based on our observations we discuss the mechanism and specificity of the plasmonic photothermal effect on the single-cell level.

Figure 1: (a) Micrographs of one individual cell before (0s) and at specific moments after laser irradiation. (b) Absorbance transient of the same cell.

References

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