

Highly fluorescent 2-amino-6-cyanopurines as new bioimaging tools for studying yeast vacuoles

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Fluorescent nucleobase analogues (FNAs) have been extensively used for scientific and biomedical purposes owing to their relevant photophysical properties. In this study, five newly synthesized 2-amino-6-cyanopurines were evaluated for their fluorescent probing and imaging capabilities using *Saccharomyces cerevisiae* as model organism. The new compounds, which were synthesized using highly efficient cost-effective methods, show unique photophysical properties compared to other FNA, such as longer absorption and emission wavelengths, environment-sensitive emission, and unprecedented brightness [1]. The new 2-amino-6-cyanopurines specifically accumulate in vacuoles of living yeast cells. Vacuole staining requires active cell metabolism (glucose/energy dependency), since it was not evident in ethanol-fixed (dead) cells, as well as when cells energy metabolism was challenged through (i) starvation or by (ii) inhibiting glycolysis and ATP production with the glucose analogue, 2-deoxyglucose, or with the metabolic uncouplers, NaN₃ and NaF [2,3].

The new purine derivatives stand as auspicious vacuole fluorescent probes for advanced microscopy cell imaging, as they are non-toxic toward the model organism, are easy-to-obtain, and may be a cost-effective alternative to commercially available fluorescent dyes. To our knowledge, these are the first FNAs capable to stain intracellular structures (e.g. vacuoles) in living cells. Their photophysical properties makes them suitable for monitoring vacuolar function, dynamics, and stress responses. Their applications range from basic research about autophagy, aging, and stress tolerance, to practical uses in industrial fermentation, environmental sensing, and disease modelling. In a research field mostly populated by green- and red-emitting fluorophores, the blue-emitting purines herein presented allow for new fluorophore combinations in multiplex imaging, while paving the way for new nucleobase-inspired probes emitting in the visible light spectrum.

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References

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