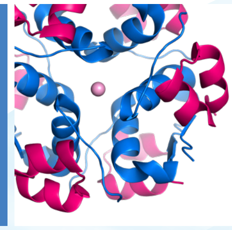
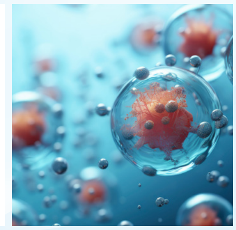
Fluorescence

# Overcoming Sensitivity and Resolution Challenges in Optical Characterization of Proteins with the HORIBA Fluorolog®-QM Spectrofluorometer





Application Note
Life Sciences
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## Introduction

Characterization of protein-based samples utilizing fluorescence spectroscopy is fundamental to advancing our understanding of biomolecular structure, interactions, and dynamics, which are crucial for drug discovery, biophysics, and cellular biology. Yet, researchers face persistent challenges: many samples are inherently low in concentration, labeling can alter protein structure and function, and biological media often introduce significant scattering. Conventional spectrofluorometers, limited by low sensitivity and poor stray light rejection, struggle to deliver high-resolution spectra under these conditions.

The **HORIBA Fluorolog®-QM Spectrofluorometer** addresses these challenges head-on. Engineered for peak sensitivity and precision, it empowers researchers to detect even the faintest protein signals with confidence, regardless of sample complexity.


Figure. 1 Photograph of the highly modular Fluorolog-QM

## Optical Characterization of Proteins

Accurate measurement of intrinsic protein fluorescence—such as from tryptophan residues—is essential, but technically demanding. Low-abundance samples require instruments capable of detecting extremely weak signals. Furthermore, the need to avoid labeling (to preserve native protein function) places additional demands on instrumentation sensitivity. Scattering from cell suspensions or other turbid media distorts fluorescence signal, introduces background noise and other artifacts, further confounding traditional fluorescence detection.

## The Fluorolog-QM Advantage

The Fluorolog-QM is the world's most sensitive spectrofluorometer, combining cutting-edge hardware and robust optical design to overcome the limitations of conventional systems.

## Key Benefits

- **Unmatched Sensitivity:** Capture subtle fluorescence from low-concentration proteins without resorting to labeling, while preserving sample integrity and biological relevance.

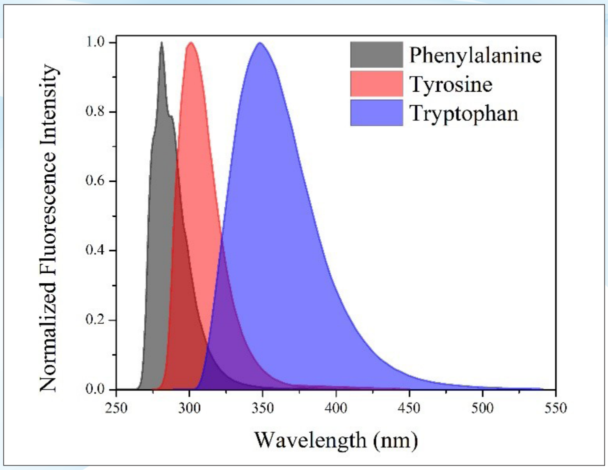


Figure 2. Intrinsic label-free fluorescence emission spectra acquired using the Fluorolog-QM

- **Superior Stray Light Rejection:** Thanks to a true double monochromator optical design with an intermediate slit, the Fluorolog-QM excels in rejecting stray light, thus conserving any vibronic structure and delivering spectra with high spatial resolution, even in highly scattering environments such as cell suspensions or turbid solutions.

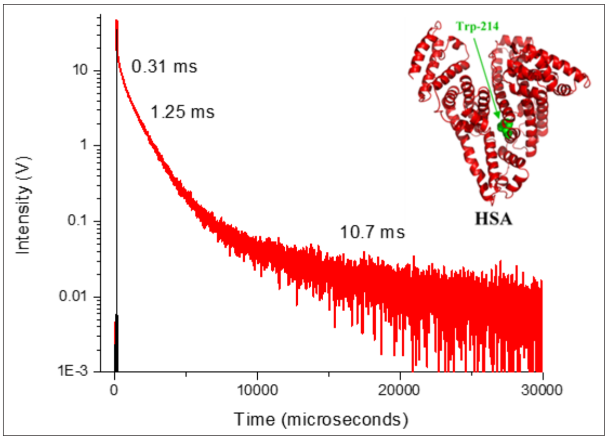


Figure 3. Time-resolved room-temperature phosphorescence decay of label-free HSA protein. Inset figure adapted from Ref 1.

## Innovation Under the Hood

The Fluorolog-QM's advanced optical architecture is the foundation of its performance. The true double monochromator optical design minimizes stray light, while the intermediate slit further sharpens spectral resolution. High-quantum-efficiency detectors maximize signal capture.

By leveraging the Fluorolog-QM in conjunction with our cutting-edge Time-Correlated Single Photon Counting (TCSPC) modality, researchers can generate a wealth of information regarding the excited-state dynamics in protein samples. The data yielded by these investigations enables the development of a comprehensive and nuanced understanding of proteins.

Whether measuring intrinsic protein fluorescence, tracking conformational changes, or monitoring protein-ligand interactions in complex media, researchers can now achieve results previously considered unattainable.

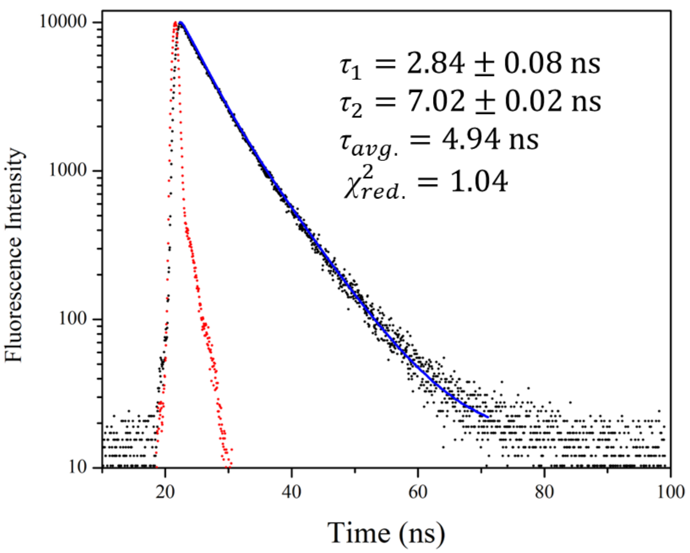


Figure 4. TCSPC decay, fit, and instrument response function of label-free HSA

## Applications

The Fluorolog-QM is ideally suited for:

- Label-free protein detection and conformational analysis
- Protein-ligand and protein-protein interaction studies
- Kinetic and equilibrium binding assays in turbid or scattering media
- Biomolecular crowding and cellular fluorescence studies

## Conclusion

When sensitivity, precision, and spectral resolution are non-negotiable, the **HORIBA Fluorolog-QM Spectrofluorometer** sets the new standard. It enables researchers to overcome the inherent challenges of protein fluorescence studies, delivering reliable, high-quality data from even the most complex samples.

For a closer look at how the Fluorolog-QM redefines fluorescence measurements in protein-based samples, watch: The Fluorolog-QM: Spectrofluorometer with peak sensitivity and versatility.

**Experience the difference—where the most demanding fluorescence challenges meet a new benchmark in instrumentation.**

## For more information

Contact your HORIBA representative or visit HORIBA.com to learn how the Fluorolog-QM can empower your research.

## References


[1] Belatik, Ahmed, et al. "Locating the binding sites of Pb (II) ion with human and bovine serum albumins." PloS one 7.5 (2012): e36723.



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