COMPARISON OF BSA FLUORESCENCE IN SALINE AND PHOSPHATE BUFFER SOLUTIONS UNDER GAMMA-IRRADIATION

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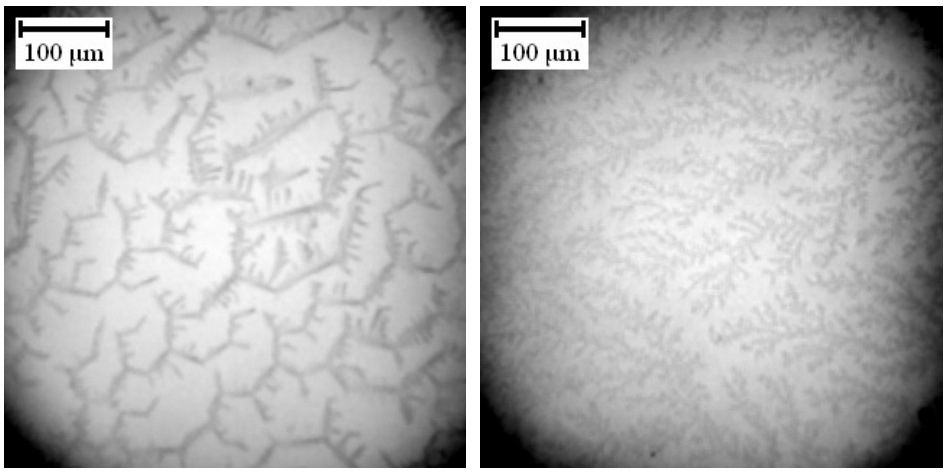
Introduction

• Previous work [1]: films formed by desiccation of saline solutions of bovine serum albumin (0.5 mg/ml BSA in 20 mM NaCl).
  ◦ Patterns on films and solution spectra change after irradiation.
• In the literature: buffers are typically used.
• Question: does buffer absence affect fluorescence under irradiation?



A B

Fig. 1. Example micrographs of films obtained from (A) 0.5 mg/ml BSA + 20 mM NaCl solution, and (B) the same solution irradiated with 2000 Gy.

Comparison with BSA irradiation in literature

• Gaber [2]: similar experiments with phosphate buffer (PBS), but different BSA concentration (4 mg/ml BSA).

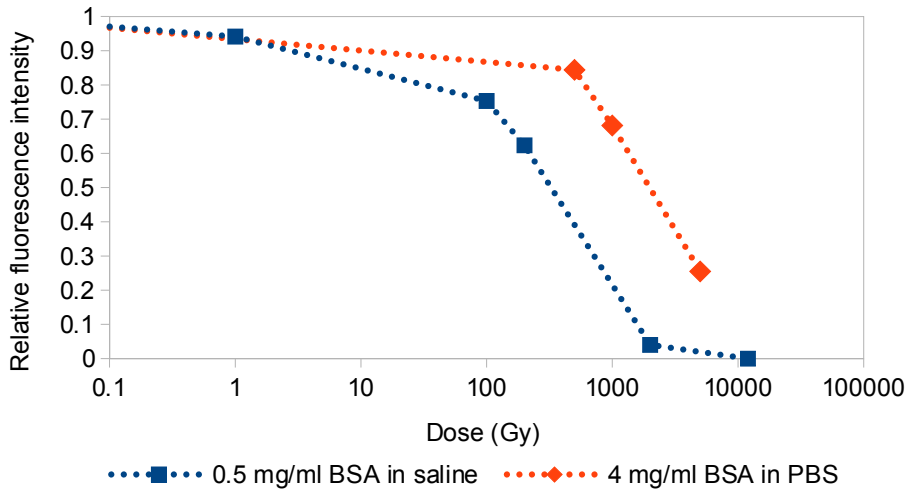


Fig. 2. Comparison of relative fluorescence from our experiments [1] (■) and adapted from Gaber [2] (◆).

• After adjusting for concentration, saline and phosphate data show nearly collinear trends in the logarithmic dose scale.

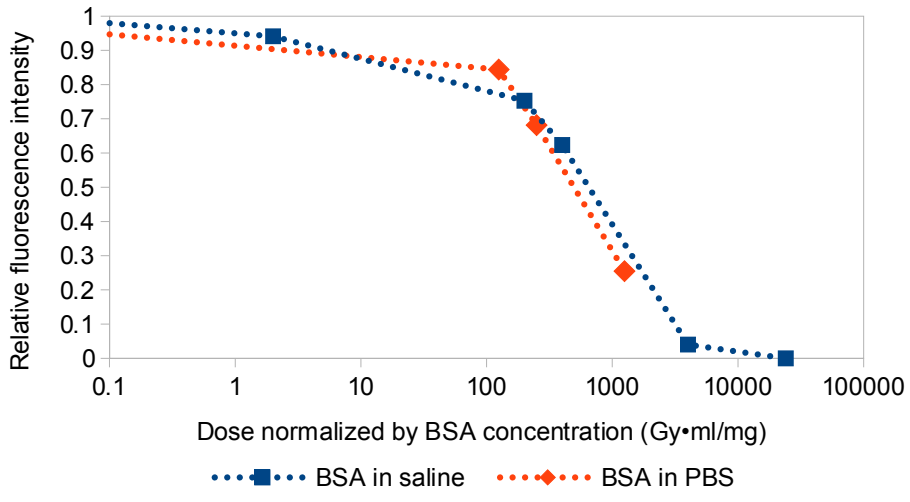


Fig. 3. Comparison of relative fluorescence from our experiments [1] (■) and adapted from Gaber [2] (◆) after adjusting for concentration.

Comparison with HSA irradiation in literature

• Hu et al. [3]: changes in human serum albumin's fluorescence and bityrosine content (indicating aggregation) were observed after 200 Gy (1–50 µM HSA, phosphate buffer).
• Our DLS measurements of BSA size show similar behavior after 200 Gy, also pointing to aggregation (7.5 µM BSA, 20 mM NaCl) [1].

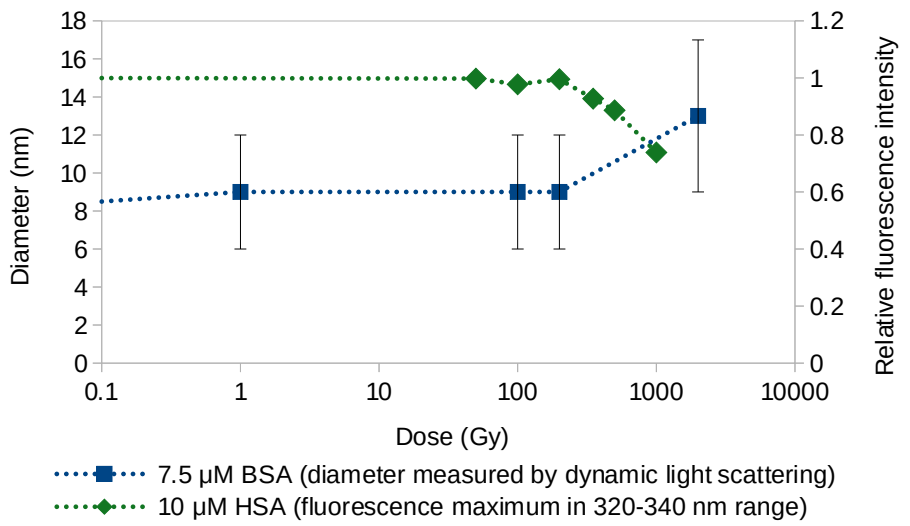


Fig. 4. Comparison of our DLS measurements of BSA size [1] (■) and relative fluorescence of HSA adapted from Hu et al. [3] (◆).

• Why is BSA fluorescence affected at smaller doses than HSA, but BSA aggregation affected at the same doses as HSA aggregation and fluorescence?
• Hypothesis: external tryptophan residues affected at low doses, internal tryptophan at higher doses.

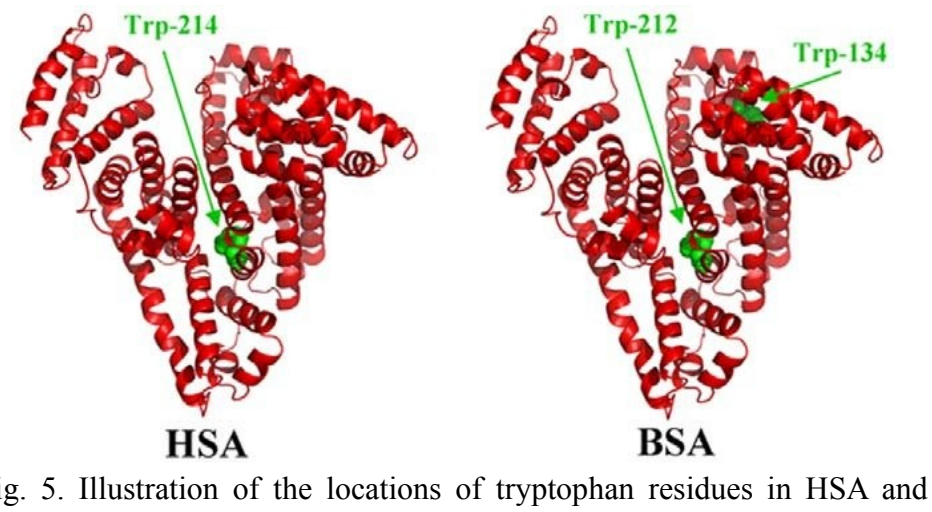


Fig. 5. Illustration of the locations of tryptophan residues in HSA and BSA. Adapted from Zhang et al. [4], licensed under CC BY 4.0.

Conclusions

• Saline is a viable medium for fluorescence studies in BSA irradiation experiments.
• In both BSA and HSA, significant structural disruption begins after ~200 Gy.
• Their fluorescence response to γ-irradiation after that point may be similar, but BSA is more sensitive to low doses.

References

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