

# Design, Characterization, and Usage of Fluorescent-DHFR as a Visual Biochemistry Lab Teaching Tool to Enhance Learning

**Dana Morrone, Junyun Park, Jeri Obeng, Peter Spezia and Jonathan Huang**

University of Health Sciences and Pharmacy in St. Louis, 1 Pharmacy Place, St. Louis, Missouri, 63110, USA

([dana.Morrone@uhsp.edu](mailto:dana.Morrone@uhsp.edu))

Student feedback from an undergraduate biochemistry lab course suggested that usage of visibly traceable proteins may assist their learning. Based on this feedback, students developed and characterized a suite of fluorescent protein-dihydrofolate reductase (DHFR) fusions as tools for a biochemistry teaching lab. Unlike the wt versions, members of this suite are well-expressed, soluble, visible, highly stable, and easily characterized. The color of mCherry and EGFP fluorescent fusions with microbial DHFR allows students to visibly track their target protein from expression through purification, while fusions with BFP are visible under UV-light. Importantly, we found that fluorescent protein fusions with DHFR did not kinetically interfere as the  $K_M$  and  $k_{cat}$  values were not remarkably altered from the unfused variant. We observed potential learning gains on a course assessment when students used these visible variants, suggesting that the often overlooked element of visual cues in a biochemistry lab may be an exploitable component of learning.

**Keywords:** visible proteins, biochemistry

## Mission, Review Process & Disclaimer

The Association for Biology Laboratory Education (ABLE) was founded in 1979 to promote information exchange among university and college educators actively concerned with teaching biology in a laboratory setting. The focus of ABLE is to improve the undergraduate biology laboratory experience by promoting the development and dissemination of interesting, innovative, and reliable laboratory exercises. For more information about ABLE, please visit <http://www.ableweb.org/>.

Papers published in *Advances in Biology Laboratory Education: Peer-Reviewed Publication of the Conference of the Association for Biology Laboratory Education* are evaluated and selected by a committee prior to presentation at the conference, peer-reviewed by participants at the conference, and edited by members of the ABLE Editorial Board.

### Citing This Article

Morrone D, Park J, Obeng J, Spezia P, and Huang J. 2022. Design, Characterization, and Usage of Fluorescent-DHFR as a Visual Biochemistry Lab Teaching Tool to Enhance Learning. Article 65 In: Boone E and Thuecks S, eds. *Advances in biology laboratory education*. Volume 42. Publication of the 42nd Conference of the Association for Biology Laboratory Education (ABLE). <https://doi.org/10.37590/able.v42.abs65>

Compilation © 2022 by the Association for Biology Laboratory Education, ISBN 1-890444-17-0. All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of the copyright owner. ABLE strongly encourages individuals to use the exercises in this volume in their teaching program. If this exercise is used solely at one's own institution with no intent for profit, it is excluded from the preceding copyright restriction, unless otherwise noted on the copyright notice of the individual chapter in this volume. Proper credit to this publication must be included in your laboratory outline for each use; a sample citation is given above.