Enhancing Single-Cell Workflows with In Vivo Optical Imaging: A Focus on BLI & FLI

In vivo optical imaging techniques like bioluminescence imaging (BLI) and fluorescence imaging (FLI) can be valuable tools in certain aspects of single-cell workflows, particularly in the context of live animal or tissue studies. These techniques allow researchers to visualize and track specific cells or cell populations within a living organism, which can provide complementary information to single-cell RNA sequencing (scRNA-seq) or other in vitro single-cell analyses. Here's how BLI and FLI can help in single-cell workflows:

1. **Visualization of Specific Cells or Marked Populations:**
   BLI and FLI techniques rely on the use of genetically encoded or exogenous fluorescent or bioluminescent markers. These markers can be used to label and visualize specific cells or cell populations within an organism, enabling researchers to track their behavior and localization in real-time.

2. **Cell Fate and Migration Studies:**
   BLI and FLI are particularly useful for tracking the migration and distribution of cells within a live animal model. Researchers can use these techniques to study cell trafficking, immune cell responses, stem cell engraftment, and other dynamic processes in vivo.

3. **Gene Expression Analysis:**
   While BLI and FLI primarily provide information about cell location and behavior, they can be used in combination with additional techniques to monitor gene expression in live animals. For instance, researchers may use genetically encoded reporters like green fluorescent protein (GFP) or luciferase as indicators of specific gene expression within single cells.

4. **Disease Models:**
   In vivo optical imaging is commonly used in the study of disease models. Researchers can monitor the progression of diseases, assess disease-related cellular changes, and evaluate the effects of therapeutic interventions at the cellular level.

5. **Functional Studies:**
   BLI and FLI can also be used to study cellular functions or activities within a live organism. For example, calcium imaging can be achieved using fluorescent calcium indicators to study neural or muscle cell activity.

6. **Non-Invasive Imaging:**
   One of the advantages of BLI and FLI is that they can provide non-invasive imaging, reducing the need for invasive procedures that could affect the biological system under study.

In summary, BLI and FLI can be valuable tools for visualizing and tracking specific cells or cell populations in vivo, which can complement the information obtained from single-cell RNA sequencing and other in vitro single-cell analyses. Researchers should choose the most appropriate combination of techniques based on the specific research questions and the strengths and limitations of each method.