Be-(a)-ware of the Red Flags: Common Flaws of Nonreproducible Preclinical Research Studies
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The shocking discovery that the majority (75%–89%) of preclinical research studies, predominantly oncology related and published in top-tier journals, could not be reproduced was recently reported for 2 independent retrospective observational studies (1, 2). The findings of nonreproducibility in these studies were interestingly consistent.

What can help determine whether research results will stand the test of time? In a recent article in Nature, Begley noted that whether you are an author, editor, reviewer, or reader, you should ask 6 key questions when assessing study validity (3). The 6 questions are:
1. Were experiments performed blinded?
2. Were basic experiments repeated?
3. Were there positive and negative controls?
4. Were reagents validated?
5. Were all the results presented?
6. Were statistical tests appropriate?

Nonreproducible studies may veil experimental missteps, such as absence of validation for off-label use of reagents, failure to perform basic QC measures or to repeat experiments, and a suboptimal experimental approach with nonblinded investigators. Inappropriate statistical analyses of data sets can be misleading and should also be checked. In-depth evaluation of the methods section and figure legends of reports can help identify these limitations or, conversely, highlight strengths of well-performed studies. An additional common feature of nonreproducible studies is the display of errors of omission, including the mention of “data not shown,” reporting of “a typical result,” or selective presentation of images of experimental results.

These common caveats are not novel. “What is also remarkable is that many of these flaws were identified and expunged from clinical studies decades ago,” noted Begley. The current system-based practice of basic science research and publishing, however, allows the generation of research reports with poor validity. Thus, it is essential that every author, editor, reviewer, and reader rigorously review research studies and be-(a)-ware of the red flags in suspect work.

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References

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