THE FORUM
For Collaborative Research℠

Hepatopathologist Survey and Histology slides

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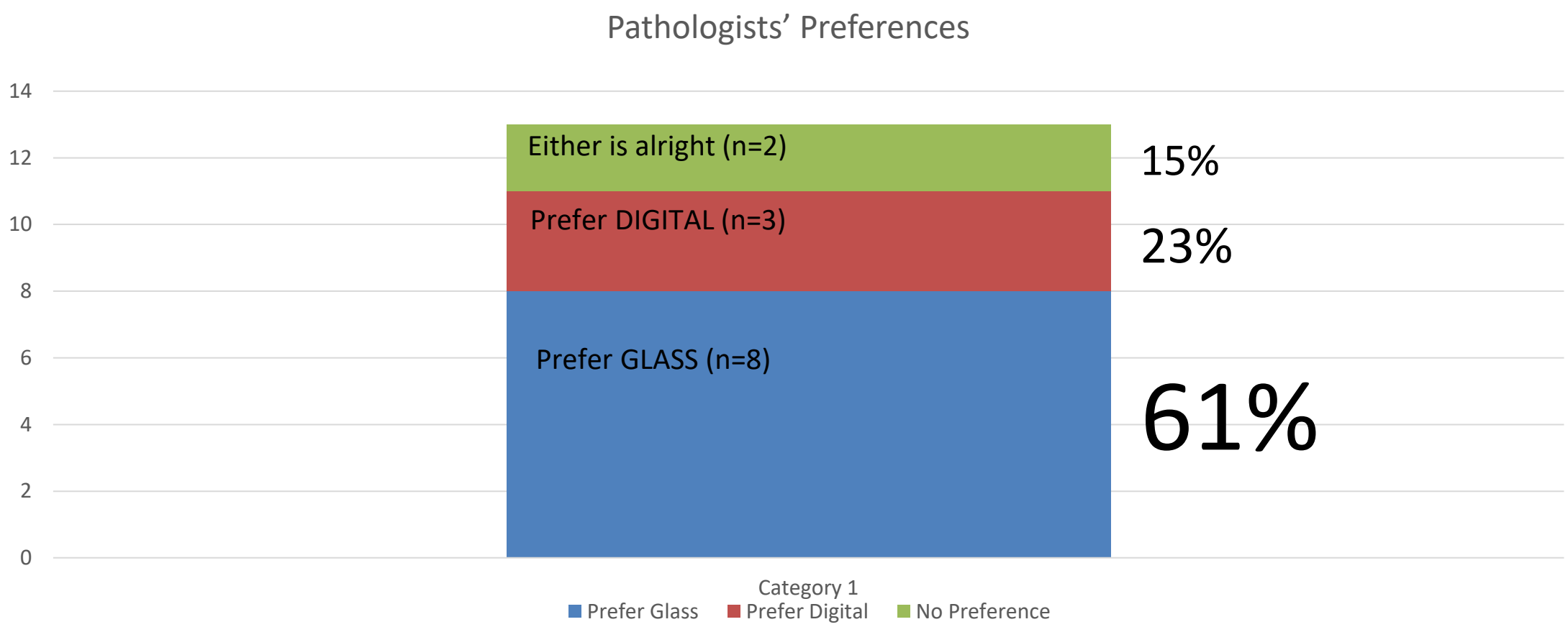
Pro's and Con's of Digital Slides in NASH Trials: Survey Results of Trial Pathologists



Pathologists' Comments Re: Digital Pathology v Glass

Depends on Quality of Original HE Slides	Depends on Quality of Scanning and Software	Other Comments
		Longer to load and examine; concern of missing "something"
	Qual of scanning; magnif "issues"; not all are user-friendly	Longer to score; cumbersome
"Real" issue is local preparation of slides		No differences "in my opinion"
		Need to be able to adjust focus "up and down"…can't do w/digitized images
"Garbage in, garbage out"	• Making annotations is nice on digit slides • Slide loading speed – potential problem	Some systems are easier than others; logging in to CRO's site can be difficult
	Improving; impractical to ship around glass	Need to standardize size of monitor used for scoring
	Can be tedious w slow cnxn speed	Glass: well-calibrated objectives; familiar speed; logistical issues w/glass for multiple viewers
		Glass: sharper images; navigation efficient
Old HE slides are hard to read on glass		
		Facilitates consensus reviews; software plug-ins allow other measurements (CPA); may replace glass in diagnostic work

Pathologists' Comments Re: Digital Pathology v Glass

Depends on Quality of Original HE Slides	Depends on Quality of Scanning and Software	Other Comments
		• Scores on Digit appear to be lower than on glass • Harder to ddx balloon v mimic • Early fibrosis more difficult • Inflammation tends to be underscored • Steatosis is the same • Artefacts harder to deal with in Digit slides • Hard for software to find good focus • Color may not be same • May be diff to ddx plasma cells from lymphocytes • Focusing "issues"
Answers based on premise that dig slides are as good and software are as easy as glass		No need to mail glass; saves time
Original slide staining is main issue		Glass is quicker (happy to do either)

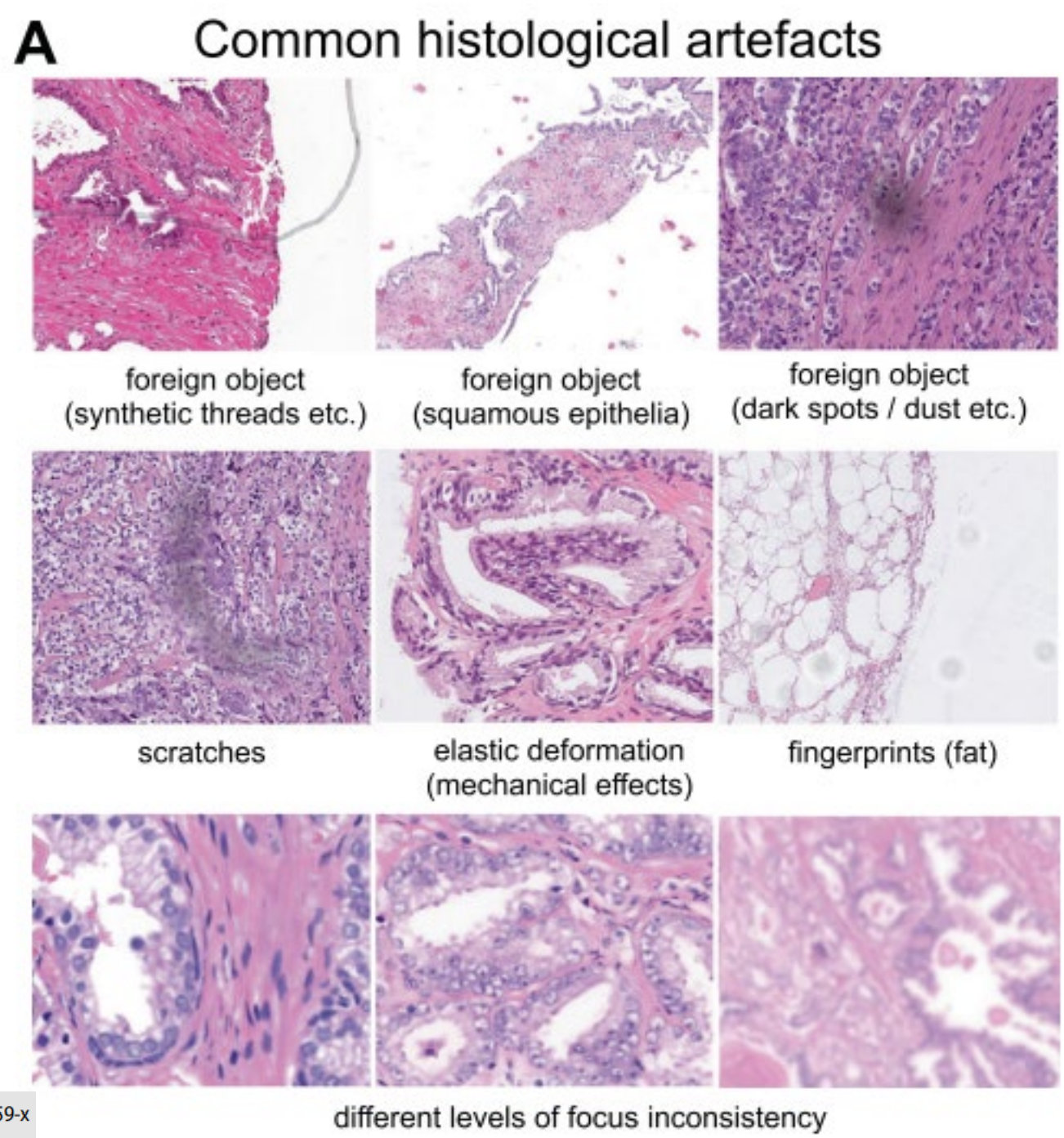
Quality control stress test for deep learning-based diagnostic model in digital pathology

Birgid Schömig-Markiefka[1], Alexey Pryalukhin[2], Wolfgang Hulla[2], Andrey Bychkov[3,4], Junya Fukuoka[3,4], Anant Madabhushi[5,6], Viktor Achter[7], Lech Nieroda[7], Reinhard Büttner[1], Alexander Quaas[1] and Yuri Tolkach[1]

Modern Pathology; https://doi.org/10.1038/s41379-021-00859-x

Digital pathology provides a possibility for computational analysis of histological slides and automatization of routine pathological tasks. Histological slides are very heterogeneous concerning staining, sections' thickness, and artifacts arising during tissue processing, cutting, staining, and digitization. In this study, we digitally reproduce major types of artifacts. Using six datasets from four different institutions digitized by different scanner systems, we systematically explore artifacts' influence on the accuracy of the pre-trained, validated, deep learning-based model for prostate cancer detection in histological slides. We provide evidence that any histological artifact dependent on severity can lead to a substantial loss in model performance. Strategies for the prevention of diagnostic model accuracy losses in the context of artifacts are warranted. Stress-testing of diagnostic models using synthetically generated artifacts might be an essential step during clinical validation of deep learning-based algorithms.

" Garbage in….garbage out"….



Modern Pathology; https://doi.org/10.1038/s41379-021-00859-x

1 Our results show that substantial losses of accuracy can occur when the focus quality levels are still visually perceptible as adequate by pathologists (Fig. 3).

2 Image compression effects were investigated by several groups showing accuracy deterioration of models for metastatic cancer detection and segmentation, nuclei segmentation, and lymphocyte detection [17, 19]. Image compression is a fully controllable parameter set up manually during scanning (usually at a level of 80% or more). It normally does not undergo any changes after complete and successful validation of digital pathology system. However, lower levels of JPEG compression can be manually set up by WSI operator to reduce needs for a storage space or in research setting. Interestingly, the human eye does not recognize image alteration within a wide range of compression levels (30–90%). The results of the current study and other published studies [17, 33] show that this might have potential consequences for accuracy of analytical models trained on datasets with lower compression levels, should they be applied to such images. Our findings show that any compression levels under 80% can result in accuracy deterioration and should be avoided.

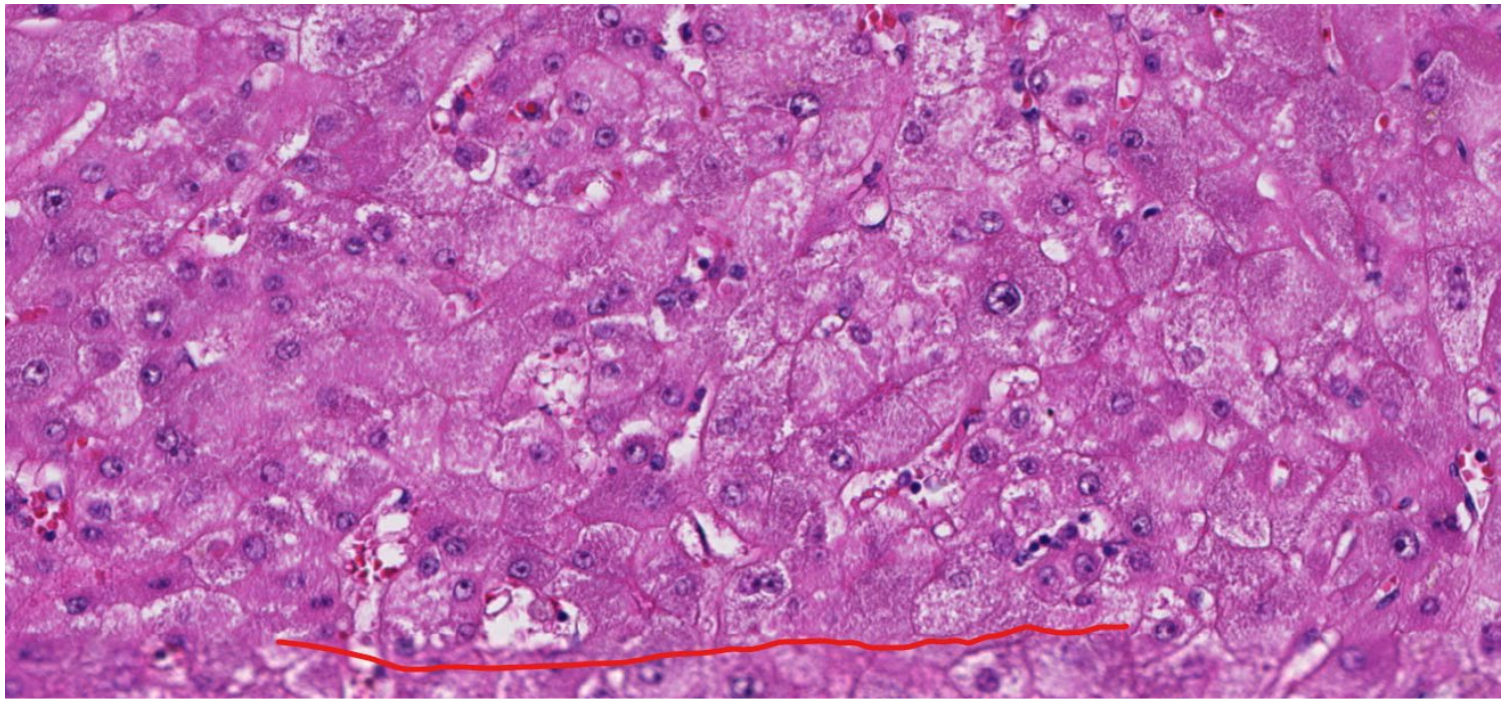
3 Hematoxylin-eosin staining is a factor which is extremely difficult (or even impossible) to standardize at pre-analytical stage. WSIs from the single laboratory and, especially, from different institutions have very different HE-staining schemes due to multitude of factors, such as variation of stains, reagents and manufacturers, protocols, room conditions, and many more [34] (Supplementary Fig. 1). Additional layer of heterogeneity are color schemes of WSI scanners from different manufactures which imprint every scanned slide [35, 36]

Recommendations

- Pre-analytic QC: HE slide staining…?central lab; ?pathologist review prior to scanning
  - And trichromes
- "Knowing own models": understand the system being used
- Improve "model accuracy: augmentation of training dataset using "synthetic artefacts"
- "And lastly, more standardization is warranted for digital pathology systems, particularly in terms of color calibration and image compression levels."

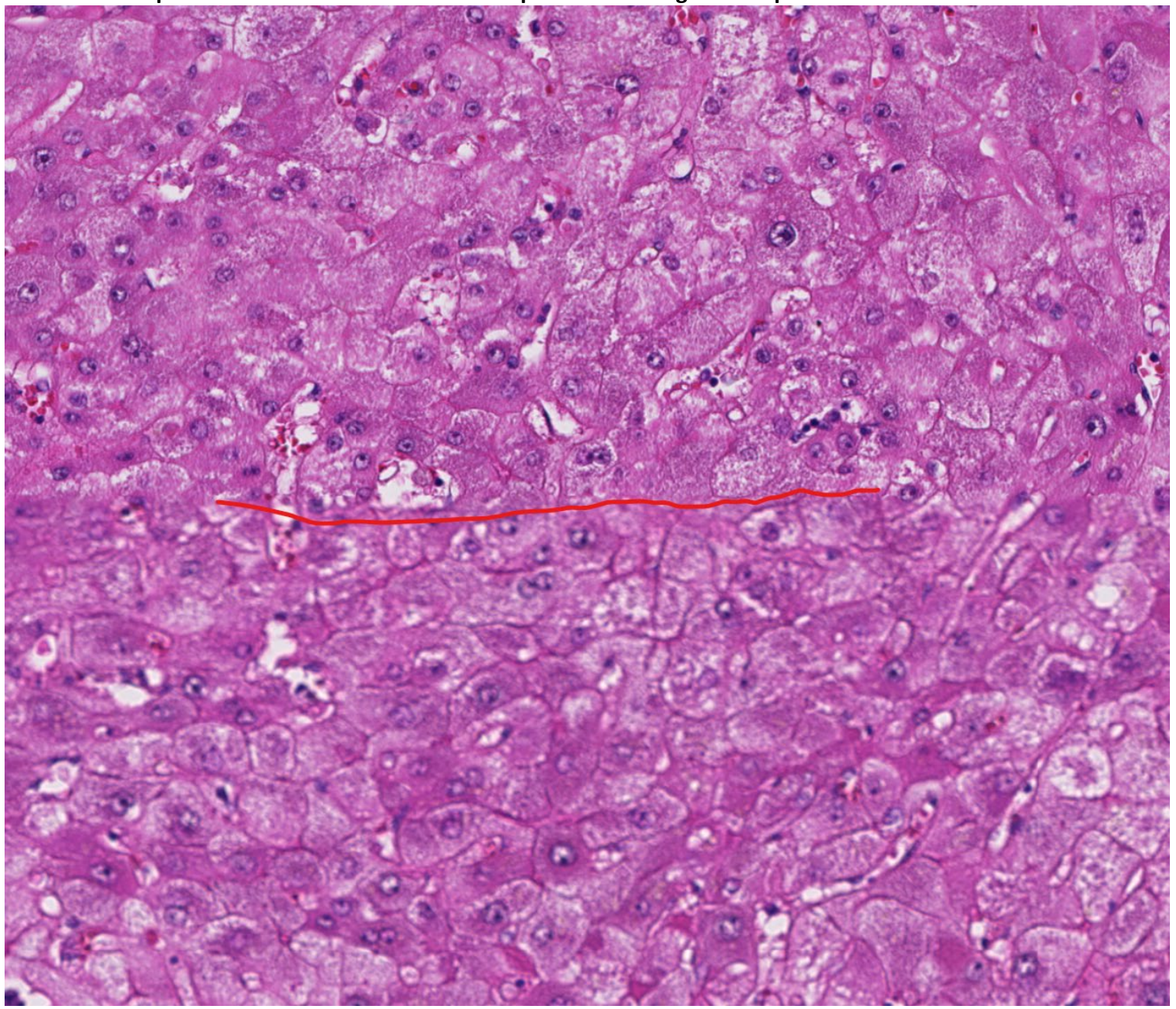
Modern Pathology; https://doi.org/10.1038/s41379-021-00859-x

…an example of an artefact that would create problems for digital interpretation



In focus

…an example of an artefact that would create problems for digital interpretation



In focus

NOT in focus…but no way to change field view with digital field; this is likely a histo lab sectioning/cutting problem

Slide courtesy of David Kleiner

…now, to real life!