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**Figure 3. a)** ViewMaster inspiration toy, **b)** Design concept sketch, **c)** Final design concept presented in class, **d)** Look-like prototype made out of cardboard, **e)** First CAD 4x6x5” model, **f)** Scaling by 1.7 of the model to conform to design inputs size requirements, **g)** The final ParaViewer design representation in Fusion 360.

The ParaViewer comprises several components: a lid, slide disk, inner wheel, and housing unit. Several iterations were made and are summarized in **Figures 7-10** below.

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**Figure 7. ParaViewer Lid.** **a) Original lid design with thicker width and larger diameter hole.** The phone is placed on top of this hole to capture images. An issue with this design is that the lid would not stay in place, **b) Lid with fthe prongs that would insert into the back housing to hold the lid in place.** An issue with this design was that the fthe prongs were too difficult to lift from the base. Another issue with this design is the height of the lid. It prevented the reverse phone lens from being close to the sample. This prevented the images from being clear, **c) Thinner lid height for the reverse lens to be close to the sample**. This design also incorporated only two prongs. The primary issue with this design is that the phone would not stay in place. Easily bumping into the phone would cause it to come off the lid and produce unreliable images, **d) Lid with reverse lens slot and cell phone guides on the lid surface to keep the phone in place.** The imaging hole evolved to a small square to incase the reverse lens. However, the square lens slit was too small. This design was not implemented as it was determined the location of the reverse lens should be exact, prior to implementing the cell phone guides, **e)** **Removed guides and added a center hole for a turning key to enable manual rotation**. This manual rotation was added because the housing spring mechanism was not functioning. This rotation is simpler and involves a key turning the slide in the center hole. Although the reverse lens fit in the slot on this lid, the primary issue with this design was that the reverse lens would not focus as it was too far from the sample, **f) Lid with adjusted imaging hole**. This lid allowed the phone lens more freedom to capture the correct images on the slide disk. The main issue with this lid prototype was that the imaging hole was too large for added supports to hold the phone on the lid, **g) Decrease imaging hole diameter**, **h) Final lid** with one guide to hold the cell-phone in place.

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**Figure 8. ParaViewer Slide Disc. a) Slide disc sketched on cardboard** with 6 samples taken from Kato-Katz slide template, **b)** **Laser cut wooden slide** with hemocytometer chambers for loading of samples, **c) Added rectangular notch punctures** to test rotation mechanism, **d) Final single-use slide design** with 8 hemocytometer chambers incorporated (2 samples per donor). Note: This disc only displayed 5 out of 8 samples.

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**Figure 9. ParaViewer Inner Wheel.** **a) Original inner wheel design copied from the ViewMaster**, **b) Added small holes** on the surface to insert spring for the rotation mechanism, **c) Increased length of the hollow shaft** in the back for better stability once mounted on the back housing. Additionally, a thin slide guide was added at the bottom to ensure the slide would not slip out of place, **d) Removed the handle for rotation** clicking to allow manual rotation key.

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**Figure 10. ParaViewer Housing. a)** Original LED back housing large enough to encase a rechargeable LED light, slide disk, and the possibility of future hardware for the automation of rotating the slide disk. **b)** Added hollow shafts at the bottom to bring the lid into place and hold inner components together.