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at the Permian Basin

LB-063 - X-Ray Micro-Computed Tomography-Virtual Reality Tool - Novel Collaborative Platform to Accelerate Placental Research

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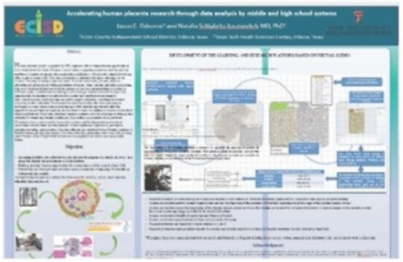
INTRODUCTION

Applications of novel technologies for evaluation and understanding complex structure of a biological system in collaborative manner and in real time has been a rapidly developing field in the traditionally conservative area of placental pathology. Citizen-scientists proved to be a great resource for large-scale NIH projects. We previously reported creation of learning and research platform, based on placental virtual slides bank (*Human placental project*, NIH, Bethesda, July 19th 2017).



Here, we leverage a novel platform, combining microCT and visualization software package, syGlass in virtual reality (VR).

MATERIAL AND METHODS

Placentas were obtained from a planned cesarean section at 165 dGA (full term 163-186 dGA) from pregnant baboons (Papio spp), micro CT scan was performed, using methodology for visualizing the fetal vascular network by applying a long-acting aqueous colloidal polydisperse iodinated blood-pool contrast agent, eXIA 160XL, with optimized image acquisition parameters and volume-rendering techniques(Prajapati and Keller 2011, Prajapati, Rodriguez et al. 2014) . Images were visualized, using micro-photonic platform (Micro-photonic Inc, Allentown, PA). Micro-CT images were loaded into the syGlass (Morgantown, WV) software and the villi were traced in stereoscopic Virtual Reality (VR) with 3D controllers. Three longest traceable villi were traced and their length and radius we measured.

CASE PRESENTATION

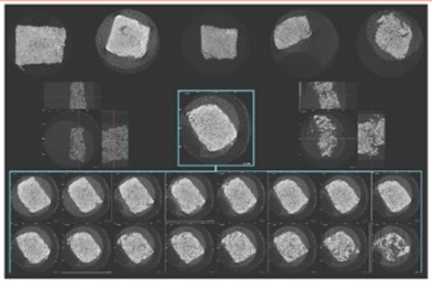


Figure 1. Representative images of five placentas (upper panel), their representation from Y, X and Z axis (middle panel) and serial images, demonstrating variations in vascular density within placenta.

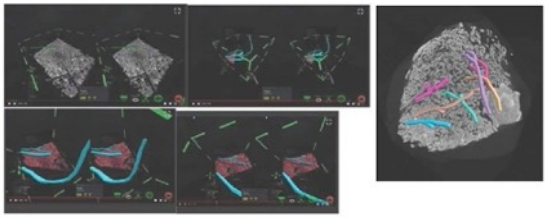


Figure 2. Tracing of intervillous space, using VR technologies.

Placenta Data	Time (for all structures)	Largest 3	Avg Radius 1	Avg Radius 2	Avg Radius 3
29275	9:43	1:31	37.60	26.05	23.39
29285	6:04	1:40	35.62	19.81	20.45
29302	7:38	1:06	56.79	23.66	17.70
29310	-	1:13	72.52	33.42	35.09
29311	-	2:02	33.46	27.94	27.55
29330	-	2:31	30.33	25.07	24.80

Table 1: Tracing annotations performed in syGlass. For some datasets, most structures could be traced. For others, only the largest could be traced. To illustrate tracing times, the three largest structures were traced and tracing times and average radii (in relative voxels) are reported.

DISCUSSION

Figure 3. Quantification of microCT scans vilous diameter and packing density using Imaris 9 (Bitplane, USA) software.

Quantification of 3D images is an important tool in understanding organ structure and function in norm and pathology. Variability in placental villous and intervillous spaces within organ and within representative specimen requires novel tools for images and their analyses. Such tools have been developed by companies (Fig.3) and research groups (Aughwane, Schaaf et al. 2019).

CONCLUSION

The novel platform, which combines micro-CT scans with VR visualization is well suited as an effective and unique collaborative tool for modeling, evaluating, and analyzing data of placental structure. Based upon the successful outcomes of this platform there are opportunities for this methodology to be used in other areas of research. In addition there is an opportunity to implement a citizen science model with high school students to maximize data annotation and expose students to potential career pathways and advanced scientific method in evaluation of placental structure and function.

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