Introduction
The corneal stroma is a highly organised extra-cellular matrix (ECM) comprised of collagen. The collagen fibrils have a uniform size and lamella sheet arrangement, which gives transparency and structural integrity to the tissue\(^1\). Disruption to this organised structure can lead to blindness even if the rest of the eye functions normally. The best treatment option is usually the transplantation of a cadaver cornea. This is subject to the availability of suitable donor tissue, which is in short supply. Hence an alternative is desperately required. Biomaterials and tissue engineering are promising areas for producing a replacement to donor tissue. The most challenging aspect of such work is reproducing the organised stromal structure with its cellular component\(^2\).

An in vitro produced corneal replacement will need to be comparable with suitable ex vivo tissue. Rabbit corneal tissue is a well established model for human tissue; however it lacks a Bowman’s layer and has less lamella inter-lacing than that seen in human tissue\(^3\). This may restrict a comparison of the novel stromal substitute produced in this work. The pig has previously been over-looked as a model for human corneal tissue, although it is commonly used for other models, e.g. skin. Our preliminary studies suggest its stromal structure is close to that reported for human tissue.

Materials and Methods
Primary human corneal fibroblasts (HCFs) [keratocytes] were cultured on tissue culture plastic or novel aligned collagen sheets and stimulated to produce a de novo ECM.

The aligned collagen sheets were produced by stimulation of dermal collagen fibrillogenesis under controlled pH conditions. After 4-weeks the cellular alignment within the ECMs, were analysed with transmission electron microscopy (TEM) and compared with the rabbit and porcine corneal tissue models.

Results
Collagen sheets were built up from the initiating aligned bundles (Figure 1). Orthogonally arranged collagen sheets were produced, and when put into culture with HCFs the cells were able to align along these bundles. The cells also produced additional ECM components, stabilizing the structure and could be compared with the porcine stroma seen by TEM (Fig 2).

Discussion and Conclusions
This work has demonstrated the suitability of the porcine eye as a viable alternative model for the human stromal structure. The ECM produced by the HCF cells within the orientated collagen fibres is shown to provide a stable structure potentially suitable for the production of an artificial corneal stroma.

References
List references cited in text as

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