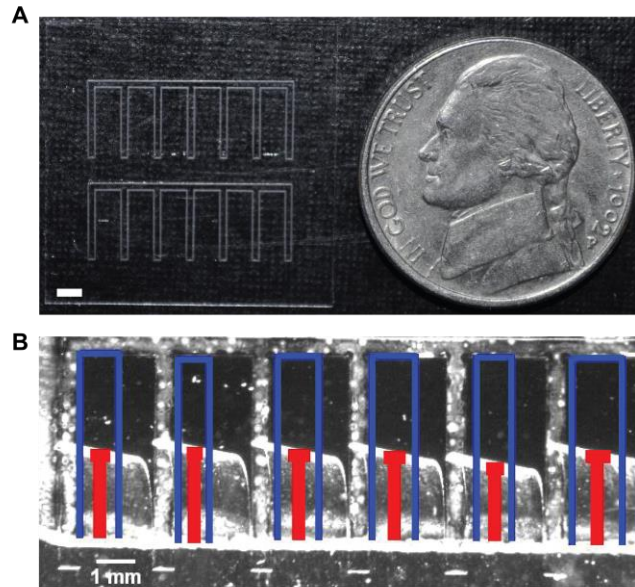**Supplementary Figures**

Fig. S1. Representative airway chip. (A) Example airway on a chip substrate prior to cell

seeding. The glass cover slip is 22 X 22 mm. The films are 5 mm long and 2 mm wide. Scale bar

represents 2 mm. **(B)** Representative contractile stress experiment. The blue region enables

thresholding for tracking of the film edge and is equal in length to the unpeeled film. The red line

tracks the projection of the film and is used for calculating the radius of curvature of the film.
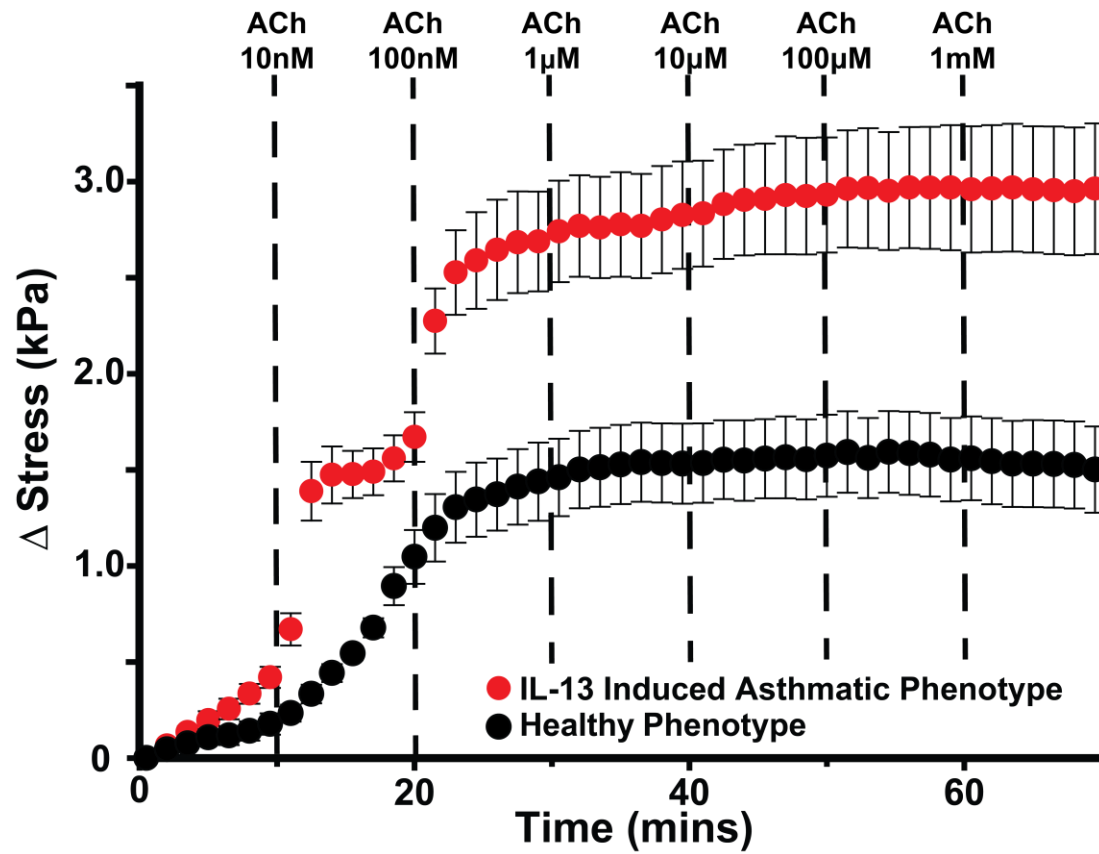
Scale bar represents 1 mm.

Fig. S2. The acetylcholine dose response in healthy and asthmatic tissues plotted versus time. Statistical significance at each dose is shown in Fig. 1E. n=15 films, 3 chips for healthy tissue; n=23 films, 4 chips for IL-13 exposed tissue. Data points represent mean ± standard error.
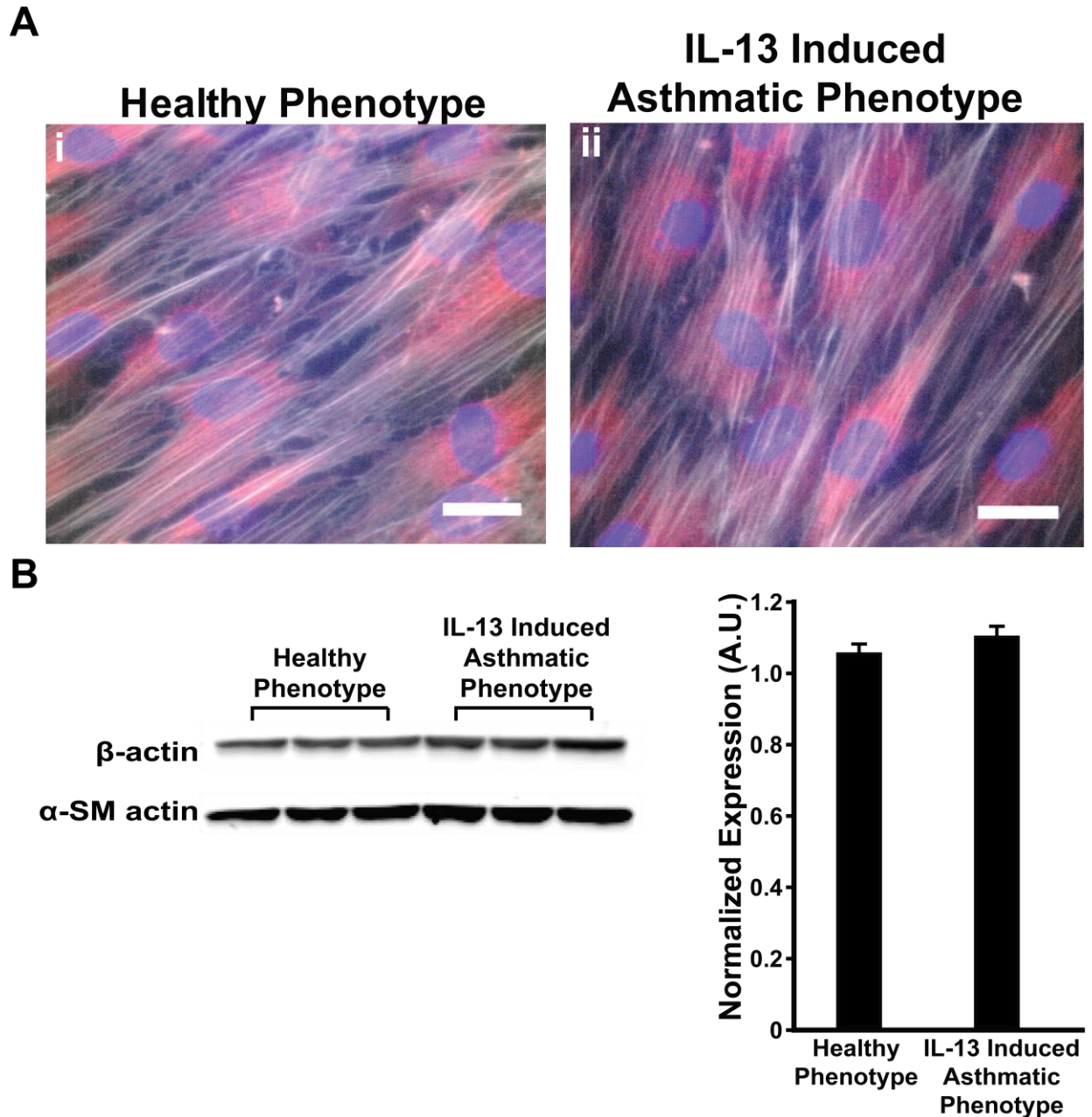
A

B

Fig. S3. Bronchial smooth muscle phenotype. **(A)** Example tissues immunostained for f-actin (white) to detect the actin cytoskeleton, α-smooth muscle actin (red) to identify muscular phenotype, and nuclei (blue). Scale bar is 25 μm. **(B)** Western blot gel using β-actin as a control for total protein expression. Normalized protein expression, measured by Western blot, for α-smooth muscle actin. Mean ± standard error, n=3 tissues for each condition, no statistical significance.
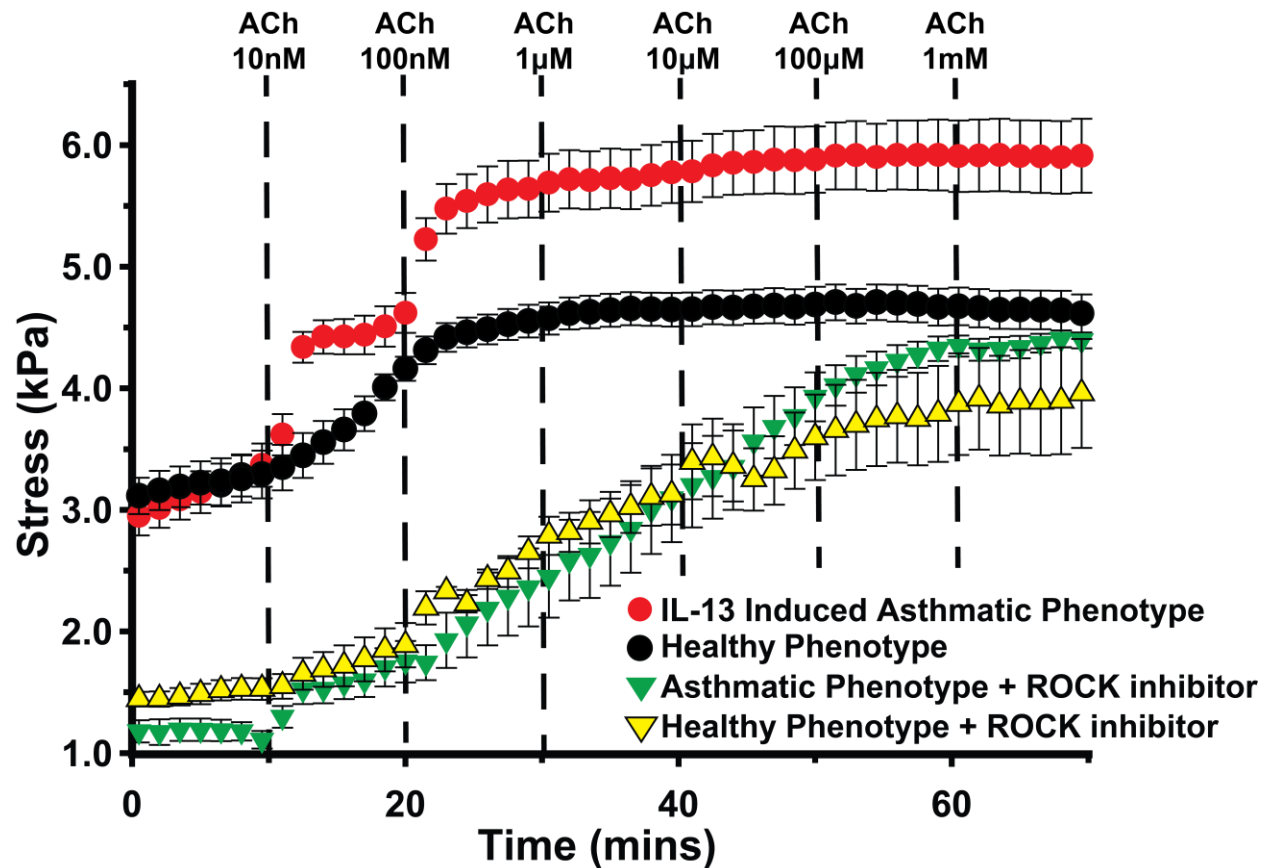
Fig. S4. The acetylcholine dose response plotted versus time. The contractile response of healthy and asthmatic tissues treated with 10 μM HA1077 was compared to healthy and asthmatic tissues. The acetylcholine dose response was plotted versus time denoting statistical significance at each dose in Fig. 4A. Data points represent mean +/- standard error. There was no statistical difference between the healthy and asthmatic tissues pretreated with HA1077 at any dose. n=15 films, 3 chips for healthy tissue; n=23 films, 4 chips for IL-13 exposed tissue; n=12 films, 2 chips for IL-13 exposed tissues pretreated with HA1077; n=4 films, 1 chip for healthy tissue pretreated with HA1077. Data points represent mean +/- standard error.