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3D-printing Mask filters inspired by animal nasal cavity[1] JISOO YUK, ANUJ BASKOTA, BENJAMIN COOKE, KARL FROHLICH, DANIEL MORTON, Cornell University, CHUN-I CHUNG, University of Illinois at Urbana-Champaign, ASHLEY JORGENSEN, SAIKAT BASU, South Dakota State University, LEONARDO CHAMORRO, University of Illinois at Urbana-Champaign, SUNGHWAN JUNG, Cornell University — Since the outbreak of COVID-19, wearing a face mask has become essential all over the world. However, unfortunately the N95 respirator, which has an antiviral effect, is suffering from a supply shortage, and cloth face coverings are vulnerable to virus blocking, so the supply of next-generation masks is highly demanded. In this study, we investigated the nasal structure of animals with high olfactory capabilities (dog, pig, rodents, etc.), and proposed the design of new respiratory filters. First, we characterized the geometric properties of animal's nasal structures using CT scanned images. Animal's olfactory chambers have a complicated maze-like structure for air to sharply turn around and bifurcate. The gap width and the radius of curvature are on the order of a millimeter or slightly less. Based on the geometric dimensions in animals, filters with various tortuous air pathways were constructed using a 3D printer, and then the inhalation/exhalation resistance and filtration performance were evaluated under human breathing conditions (5˜100 LPM). We found that these bio-inspired mask cartridges work well to collect micron-sized particles and lower the pressure drop across the cartridges.

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