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**Supplementary information**

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**Wearable materials with embedded  
synthetic biology sensors for biomolecule  
detection**

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## Supplementary Information

### Wearable Biosensors Enabled by Cell-Free Synthetic Biology

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**Table S1: List of tested fabrics for wFDCF synthetic biology reactions in this study**

| ID | Supplier                 | Supp. ID | Material        | Type                            | Name                            | Manufacturer Description                                                                                                                                         | Mode         | Price Per Bolt (\$/yd) |
|----|--------------------------|----------|-----------------|---------------------------------|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|------------------------|
| 0  | -                        | N/A      | -               | No substrate (control)          | No substrate (control)          | -                                                                                                                                                                | -            | -                      |
| 1  | Whatman GE               | 1442-042 | Cellulose Paper | 42.5mm filter papers            | 42.5mm filter papers            | Ashless filter papers with 0.2mm thickness and 42.5mm diameter.                                                                                                  | 100 Disk box | +\$300/yd              |
| 2  | Dharma Trading Co. (DTC) | SBC45    | Silk            | Spun Silk Broadcloth 45" wide   | Spun Silk Broadcloth 45" wide   | 100% spun silk 23mm, mid-weight flat woven fabric with a crisp hand and slight sheen, drapes nicely.                                                             | -            | \$13.39/yd             |
| 3  | DTC                      | SD       | Silk            | Silk Dupion 19mm 45" wide       | Silk Dupion 19mm 45" wide       | Picture shimmery silk with lots of texture - raised silk slubs - intermittent shiny threads - similar to Shantung. Makes outstanding jackets, suits, coats, etc. | 50 yd bolts  | \$10.75/yd.            |
| 4  | DTC                      | SG36     | Silk            | Silk Gauze 3mm                  | Silk Gauze 3mm 36" wide         | Wide weave. Very light, very sheer, very beautiful.                                                                                                              | 50 yd bolts  | \$2.32/yd.             |
|    |                          | SG45     | Silk            |                                 | Silk Gauze 3mm 45" wide         | Wide weave. Very light, very sheer, very beautiful.                                                                                                              |              | \$2.72/yd.             |
|    |                          | SG55     | Silk            |                                 | Silk Gauze 3mm 55" wide         | Wide weave. Very light, very sheer, very beautiful.                                                                                                              |              | \$3.79/yd              |
| 5  | DTC                      | SVEL45   | Silk            | Silk Velvet                     | Silk Velvet 45" wide            | Standard silk, 82% rayon. Dyes and paints super. The ultimate! Use for the Devore technique.                                                                     | 30 yd bolts. | \$11.09/yd.            |
|    |                          | SVEL55   | Silk            |                                 | Silk Velvet 55" wide            | Standard silk, 82% rayon. Dyes and paints super. The ultimate! Use for the Devore technique.                                                                     | 33 yd bolts  | \$13.69/yd.            |
| 6  | DTC                      | STCH ARM | Silk / Spandex  | Stretch Charmeuse 12mm 45" wide | Stretch Charmeuse 12mm 45" wide | All the softness and sheen of silk with the comfort of a Stretch fabric. 95% silk & 5% spandex. The low amount of spandex will not the dyeing process.           | 50 yd bolts  | \$13.15/yd.            |
| 7  | DTC                      | ST       | Silk            | Silk Twill 12mm 45" wide        | Silk Twill 12mm 45" wide        | A very utilitarian durable silk. Great for shirts, handkerchiefs, pillow cases, lamp shades, screens, etc.                                                       | 50 yd bolts  | \$8.48/yd.             |

|    |     |        |              |                                             |                                                   |                                                                                                                                                           |                |             |
|----|-----|--------|--------------|---------------------------------------------|---------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-------------|
| 8  | DTC | SRS45  | Silk         | Smooth Raw Silk 31.5mm                      | Smooth Raw Silk 31.5mm                            | 100% Silk 45" width                                                                                                                                       | -              | \$6.59/yd.  |
| 9  | DTC | SG4545 | Silk         | Silk Gauze 4.5MM 45" wide                   | Silk Gauze 4.5MM 45" wide                         | Some like it a bit heavier. Beautiful flowing fabric, great for sewing and gifts.                                                                         | 50 yd bolts    | \$4.09/yd.  |
| 10 | DTC | SK45   | Silk         | Silk Knit 45" wide                          | Silk Knit 45" wide                                | 100% Silk Jersey, 3oz/square yard approx. 100 g/m2, 22" wide tube (44" wide), soft hand with a nice drape, great for silk underwear garments and scarves. | -              | \$15.79/yd. |
| 11 | DTC | ORG45  | Silk         | Organza 5.5 mm                              | Organza 5.5 mm 45" wide                           | Very sheer, transparent, stiff, gauze-like fabric.                                                                                                        | 50 yd bolts    | \$4.59/yd.  |
|    |     | ORG55  | Silk         |                                             | Organza 5.5 mm 55" wide                           | Very sheer, transparent, stiff, gauze-like fabric.                                                                                                        |                | \$5.75/yd.  |
| 12 | DTC | CBSS36 | Silk         | Crepe Back Silk Satin (Charmeuse)           | Crepe Back Silk Satin (Charmeuse) 19.5mm 36" wide | It has a firm feel to the hand and a luxuriously heavy drape. Dyes and paints will show an intensity of color and richness on this fiber.                 | -              | \$10.29/yd  |
|    |     | CBSS45 | Silk         |                                             | Crepe Back Silk Satin (Charmeuse) 19.5mm 45" wide | It has a firm feel to the hand and a luxuriously heavy drape. Dyes and paints will show an intensity of color and richness on this fiber.                 |                | \$10.65/yd. |
|    |     | CBSS55 | Silk         |                                             | Crepe Back Silk Satin (Charmeuse) 19.5mm 55" wide | It has a firm feel to the hand and a luxuriously heavy drape. Dyes and paints will show an intensity of color and richness on this fiber.                 |                | \$13.95/yd. |
| 13 | DTC | VRS    | Rayon / Silk | Vicose Rayon / Silk Blend                   | Vicose Rayon / Silk Blend                         | 75% Rayon / 25% Silk blend. Weight equivalent to 18mm. Although fabric is semi-sheer when white. when dyed it is mostly opaque. 58"wide                   | -              | \$6.59/yd.  |
| 14 | DTC | TAF55  | Silk         | Silk Taffeta - 14.5mm                       | Silk Taffeta - 14.5mm                             | 100% Silk 55" width                                                                                                                                       | -              | \$20.37/yd. |
| 15 | DTC | SWSC   | Silk         | Sand Washed (Sueded) Charmeuse 19.5mm 15" w | Sand Washed (Sueded) Charmeuse 19.5mm 15" wide    | Beautiful & desirable! people here are taking up sewing because of it.                                                                                    | 11/50 yd bolts | \$19.01/yd. |

|    |     |             |                |                                                  |                                            |                                                                                                                                                                                                                     |                |             |
|----|-----|-------------|----------------|--------------------------------------------------|--------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-------------|
| 16 | DTC | SWCD<br>C   | Silk           | Stone wash<br>Crepe de<br>Chine                  | Stone wash<br>Crepe de Chine               | By stone (sand) washing this heavier weight of Crepe de Chine, one gets a matte silk with a soft, luxurious drape. This is a great weight for any almost article of clothing items like pillows, curtains and such. | -              | \$12.69/yd. |
| 17 | DTC | SWF         | Silk /<br>Wool | Silk /<br>Wool<br>blend 63%<br>silk, 37%<br>wool | Silk / Wool<br>blend 63% silk,<br>37% wool | Slightly sheer with a diagonal weave almost like a chiffon but sturdier. We also have scarves made out of this fabric. It's softer than wool warmer than silk 12.5mm 55" wide.                                      | -              | \$10.95/yd. |
| 18 | DTC | CHIF1<br>6  | Silk           | Silk<br>Double<br>Chiffon<br>16mm 45"            | Silk Double<br>Chiffon 16mm<br>45"         | With a crepey texture and a low subtle sheen, this is a perfect weight and drape for blouses. dressy slacks, or skirts. Takes dye beautifully                                                                       | -              | \$10.35/yd. |
| 19 | DTC | CHIF1<br>0  | Silk           | Silk<br>Chiffon 10<br>mm, 54"                    | Silk Chiffon 10<br>mm, 54"                 | An elegant, sheer fiber with a soft beautiful drape and a crepe like texture. Heavier and wider than the 8mm.                                                                                                       | -              | \$7.35/yd.  |
| 20 | DTC | CHIF4<br>4  | Silk           | Silk<br>Chiffon<br>8mm                           | Silk Chiffon<br>8mm 44"                    | An elegant. sheer fiber with a soft drape and a crepe like texture.                                                                                                                                                 | 50 yd<br>bolts | \$5.05/yd.  |
|    |     | CHIF5<br>5  | Silk           |                                                  | Silk Chiffon<br>8mm 55"                    | An elegant. sheer fiber with a soft drape and a crepe like texture.                                                                                                                                                 |                | \$6.89/yd.  |
| 21 | DTC | CDC12<br>36 | Silk           | Crepe de<br>Chine                                | Crepe de Chine<br>12mm 36" wide            | Soft luxurious crepe texture with great draping quality. Comes in 36"/45"/55" Width                                                                                                                                 | -              | \$7.29/yd.  |
|    |     | CDC12<br>45 | Silk           |                                                  | Crepe de Chine<br>12mm 45" wide            | Soft luxurious crepe texture with great draping quality. Comes in 36"/45"/55" Width                                                                                                                                 |                | \$7.49/yd.  |
|    |     | CDC12<br>55 | Silk           |                                                  | Crepe de Chine<br>12mm 55" wide            | Soft luxurious crepe texture with great draping quality. Comes in 36"/45"/55" Width                                                                                                                                 |                | \$9.55/yd.  |
| 22 | DTC | CDC45       | Silk           | Crepe de<br>Chine                                | Crepe de Chine<br>16mm 45"                 | Slightly crinkled texture with a gentle, graceful drape and very soft hand. Has a smooth surface that lends itself well to all types of painting styles. Ideal for all types of clothing and decorating.            | 50 yd<br>bolts | \$8.90/yd.  |
|    |     | CDC55       | Silk           |                                                  | Crepe de Chine<br>16mm 55"                 | Slightly crinkled texture with a gentle, graceful drape and very soft hand. Has a smooth surface that lends itself well to all types of painting styles. Ideal for all types of clothing and decorating.            |                | \$11.69/yd. |
| 23 | DTC | CCDC<br>45  | Silk           | Crepe de<br>Chine                                | Crepe de Chine                             | 100% Silk, Optically Whitened — 16mm, 45" width                                                                                                                                                                     | -              | \$8.90/yd.  |
| 24 | DTC | CBSSL<br>36 | Silk           | Crepe<br>Back Silk<br>Satin '                    | Crepe Back Silk<br>Satin 36"               | 100% Silk 12mm lightweight satin with a nice sheen on one side, matte texture on the other side, drapes nicely and feels fabulous.                                                                                  | -              | \$7.65/yd.  |

|    |     |             |                  |                        |                               |                                                                                                                                                                                                |                |             |
|----|-----|-------------|------------------|------------------------|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-------------|
|    |     | CBSSL<br>45 | Silk             |                        | Crepe Back Silk<br>Satin 45"  | 100% Silk 12mm lightweight satin with a nice sheen on one side, matte texture on the other side, drapes nicely and feels fabulous.                                                             |                | \$7.99/yd.  |
|    |     | CBSSL<br>55 | Silk             |                        | Crepe Back Silk<br>Satin 55"  | 100% Silk 12mm lightweight satin with a nice sheen on one side, matte texture on the other side, drapes nicely and feels fabulous.                                                             |                | \$10.29/yd. |
| 25 | DTC | HS16        | Silk             | Silk<br>Habotai        | Silk Habotai<br>16mm 45" wide | The basic "China Silk" but even heavier                                                                                                                                                        | -              | \$9.35/yd.  |
| 26 | DTC | HCJ         | Hemp /<br>Cotton | Hemp/Cott<br>on Jersey | Hemp/Cotton<br>Jersey         | 55% Hemp, 45% Cotton — 50z, 61" width                                                                                                                                                          | -              | \$7.22/yd.  |
| 27 | DTC | HS103<br>6  | Silk             | Habotai<br>Silk        | Habotai Silk<br>36"-103"      | Heavier weight. Great for pillows, jackets, banners.                                                                                                                                           | 50 yd<br>bolts | \$5.65/yd.  |
|    |     | HS104<br>5  | Silk             |                        | Habotai Silk<br>36"-103"      | Heavier weight. Great for pillows, jackets, banners.                                                                                                                                           |                | \$7.09/yd.  |
|    |     | HS105<br>5  | Silk             |                        | Habotai Silk<br>36"-103"      | Heavier weight. Great for pillows, jackets, banners.                                                                                                                                           |                | \$7.49/yd.  |
|    |     | HS107<br>0  | Silk             |                        | Habotai Silk<br>36"-103"      | Heavier weight. Great for pillows, jackets, banners.                                                                                                                                           |                | \$13.15/yd. |
| 28 | DTC | HS12        | Silk             | Silk<br>Habotai        | Silk Habotai<br>45" wide      | The basic China Silk, but heavier                                                                                                                                                              | -              | \$7.79/yd.  |
| 29 | DTC | HS836       | Silk             | Habotai<br>Silk        | Habotai Silk<br>8mm 36" wide  | When they say China Silk this is What they mean. Light Weight and sheer. The 8mm is the one most seen, and of which our Habotai scarves are made. Great for pillows, linings for jackets, etc. | 50 yd<br>bolts | \$4.75/yd.  |
|    |     | HS845       | Silk             |                        | Habotai Silk<br>8mm 45" wide  | When they say China Silk this is What they mean. Light Weight and sheer. The 8mm is the one most seen, and of which our Habotai scarves are made. Great for pillows, linings for jackets, etc. |                | \$5.05/yd.  |
|    |     | HS855       | Silk             |                        | Habotai Silk<br>8mm 55" wide  | When they say China Silk this is What they mean. Light Weight and sheer. The 8mm is the one most seen, and of which our Habotai scarves are made. Great for pillows, linings for jackets, etc. |                | \$6.35/yd.  |
| 30 | DTC | HS536       | Silk             | Habotai<br>Silk        | Habotai Silk<br>5mm 36" wide  | When they say China Silk this is What they mean. Light Weight and sheer.                                                                                                                       | 50 yd<br>bolts | \$2.77/yd.  |
|    |     | HS545       | Silk             |                        | Habotai Silk<br>5mm 45" wide  | When they say China Silk this is What they mean. Light Weight and sheer.                                                                                                                       |                | \$3.56/yd.  |
|    |     | HS555       | Silk             |                        | Habotai Silk<br>5mm 55" wide  | When they say China Silk this is What they mean. Light Weight and sheer.                                                                                                                       |                | \$3.65/yd.  |

|    |     |             |                 |                                                            |                                                         |                                                                                                                                                                                                                   |             |             |
|----|-----|-------------|-----------------|------------------------------------------------------------|---------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------|
| 31 | DTC | FCR4S       | Silk            | Flat Crepe                                                 | Flat Crepe 8mm<br>45" Wide                              | A fabric that looks like a combination of the texture and drape of crepe and luster of habotai. It is easy to dye and paint and accepts readily all types of painting techniques.                                 | 50 yd bolts | \$9.19/yd.  |
| 32 | DTC | DSAT4<br>5  | Rayon /<br>Silk | Devore<br>Satin (30%<br>Silk / 70%<br>Rayon)               | Devore Satin<br>(30% Silk / 70%<br>Rayon)               | 19 mm 45" wide. Silky, shiny beautiful fabric for "burn-out" (apply "Fiber-Etch" to remove the Rayon threads in a design leaving a lace of silk).                                                                 | -           | \$6.79/yd.  |
| 33 | DTC | HCDC        | Silk            | Heavy<br>Crepe de<br>Chine                                 | Heavy Crepe de<br>Chine 30mm<br>45"                     | Like our 16mm crepe de chine, only heavy enough to take dye with great depth and intensity. With a dull sheen and a soft drape it is perfect for pants, jackets, etc.                                             | -           | \$18.49/yd. |
| 34 | DTC | JAC97<br>02 | Silk            | Inkjet<br>Printable<br>Silk fabric                         | Inkjet Printable<br>Silk fabric                         | Inkjet silk fabric sheets 1.5"x11" comes with detachable paper support                                                                                                                                            | -           | \$17.12/yd. |
| 35 | DTC | JAC97<br>03 | Silk            | Semi-<br>transparent<br>Inkjet<br>Printable<br>Silk fabric | Semi-<br>transparent<br>Inkjet Printable<br>Silk fabric | Thin and semi-transparent inkjet silk fabric sheets 1.5"x11" comes with detachable paper support                                                                                                                  | -           | \$13.95/yd. |
| 36 | DTC | PWFC        | Wool            | Pure Wool<br>Gauze<br>Twill<br>Fabric                      | Pure Wool<br>Gauze Twill<br>Fabric 45"                  | 100% wool, lightweight with a subtle twill weave, 45" wide, 3.2 oz / linear yard                                                                                                                                  | -           | \$18.19/yd. |
| 37 | DTC | PWFA        | Wool            | Pure Wool<br>Gauze<br>Fabric                               | Pure Wool<br>Gauze Fabric<br>45"                        | 100% wool, lightweight and semi-sheer, 45" wide, 3.2 oz / linear yard                                                                                                                                             | -           | \$14.32/yd. |
| 38 | DTC | PHC         | Hemp            | Hemp<br>Canvas                                             | Hemp Canvas                                             | 100% Hemp - 11 oz, 53" width, optically whitened                                                                                                                                                                  | -           | \$14.17/yd. |
| 39 | DTC | HWM         | Hemp            | Hemp<br>Woven<br>Mid-<br>weight                            | Hemp Woven<br>Mid-weight                                | 100% Hemp - 5.4 oz, 53" width, optically whitened                                                                                                                                                                 | -           | \$8.99/yd.  |
| 40 | DTC | HSCH        | Hemp /<br>Silk  | Hemp Silk<br>Charmeuse                                     | Hemp Silk<br>Charmeuse                                  | 60% hemp, 40% silk. Silk lends a beautiful shine to one side, while the hemp lends strength to the body. 57" wide                                                                                                 | -           | \$22.38/yd. |
| 41 | DTC | HS          | Hemp /<br>Silk  | 60% Hemp<br>/ 40% Silk                                     | 60% Hemp /<br>40% Silk                                  | Natural. 57" wide. A spectacular fabric. Beautiful, soft and interesting. If this fabric was human you would want to marry it. The elegance of silk and the strength of hemp. Vertical textured grain., 2.6 oz/yd | 30 yd bolts | \$18.49/yd. |
| 42 | DTC | HR          | Hemp /<br>Rayon | 55% Hemp<br>/ 45%<br>Rayon                                 | 55% Hemp /<br>45% Rayon                                 | Natural, 59" wide. Soft and smooth, great for dresses and other clothing items. It washes well. 5.5 oz/yd                                                                                                         | -           | \$14.9/yd.  |

|    |     |          |               |                                  |                                  |                                                                                                                                                                                                       |             |             |
|----|-----|----------|---------------|----------------------------------|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------|
| 43 | DTC | HM       | Hemp          | Hemp Summer Cloth                | Hemp Summer Cloth                | 100% Hemp - 70z, 53" width. Optically whitened                                                                                                                                                        | -           | \$8.98/yd.  |
| 44 | DTC | HCM      | Hemp / Cotton | Hemp Cotton Muslin               | Hemp Cotton Muslin               | 55% Hemp, 45% Cotton - 4.15z. 53" width. Optically whitened                                                                                                                                           | -           | \$5.51/yd.  |
| 45 | DTC | PTC45/58 | Cotton        | Pimatex Cotton - PFD             | Pimatex Cotton - PFD             | High quality, great for sewing fine clothing. For that special occasion blouse, dress shirt or heirloom item. Dyes as well or better than mercerized cotton 133x72 thread count, 45" wide, 3.7 oz/yd. | 30 yd bolts | \$5.75/yd.  |
| 46 | DTC | POP60    | Cotton        | Poplin                           | Poplin                           | 100% Cotton tightly woven, medium weight fabric 6 oz per yard Wide. Thread count is 108 threads per inch x 50 threads per inch.                                                                       | -           | \$5.8/yd.   |
| 47 | DTC | WJ242    | Rayon         | Rayon Satin, Heavyweight         | Rayon Satin, Heavyweight 58"     | Satin refers to a particular type of weave which results in a fabric with a very solid, tightly woven look. Optically whitened. 58" wide.                                                             | -           | \$9.65/yd.  |
| 48 | DTC | VRL      | Rayon         | Viscose Rayon Light              | Viscose Rayon Light              | 100% rayon, Optically whitened, 4 oz per sq yd, 45" wide threads per inch x 38 threads per inch.                                                                                                      | -           | \$3.36/yd.  |
| 49 | DTC | VCI      | Rayon         | Viscose (Rayon) Challis (Import) | Viscose (Rayon) Challis (Import) | Often seen in hawaiian shirts and ladies' wrap skirts. Because rayon is pure cellulose, it allows dyes to give very brilliant colors. 58" wide, 4 oz/yd, 90x60 threads.                               | 30 yd bolts | \$5.78/yd.  |
| 50 | DTC | SCVO     | Cotton        | Silky Cotton Voile               | Silky Cotton Voile               | Similar to our Cotton Voile, but with a tighter weave and a nice sheen this fabric has a very smooth silky 1.9 oz/yd sq. 52" wide                                                                     | -           | \$6.33/yd.  |
| 51 | DTC | SCN      | Cotton        | Slubby Cotton Knit               | Slubby Cotton Knit               | 100% cotton - 30z. 58"width                                                                                                                                                                           | -           | \$3.24/yd.  |
| 52 | DTC | BBF      | Bamboo Rayon  | Bamboo Rayon                     | Bamboo Rayon                     | 100% bamboo rayon. It's beautiful, soft and luxurious. 3.2 oz /sq yd, 60" wide. Thread count is 76x76 threads per inch.                                                                               | -           | \$7.15/yd.  |
| 53 | DTC | BAMF     | Bamboo Rayon  | 100% Bamboo Rayon Fleece         | 100% Bamboo Rayon Fleece         | This fabric is really soft. One side is a smooth knit while the flip side is a soft fleece. 14oz per square yd, 60" wide.                                                                             | -           | \$17.25/yd. |
| 54 | DTC | SOCJ     | Soy Cotton    | Soy Organic                      | Soy Organic Cotton Jersey        | 58% Soy, 37% Organic cotton, 5% Spandex. This is a lovely and extremely soft jersey with a wonderful drape. 6.3oz per square yd, 60"wide.                                                             | -           | \$12.99/yd. |



|    |     |        |               |                            |                             |                                                                                                                                              |             |             |
|----|-----|--------|---------------|----------------------------|-----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------|
|    |     |        |               | Cotton Jersey              |                             |                                                                                                                                              |             |             |
| 55 | DTC | RSAT45 | Rayon         | Rayon Satin                | Rayon Satin                 | Satin refers to a particular type of weave which results in a fabric with a very solid, tightly woven look. 45" wide. Optically Whitened.    | -           | \$8.95/yd.  |
| 56 | DTC | RV045  | Rayon         | Rayon Voile                | Rayon Voile                 | Gorgeous sheen and a soft smooth hand. Weave is loose, somewhat sheer, and drapes well. 45" wide Optically Whitened.                         | -           | \$6.65/yd.  |
| 57 | DTC | RT55   | Rayon         | Rayon Twill                | Rayon Twill                 | Has perhaps the nicest drape of any of our fabrics, including silks. Strong twill weave that will last. 55" Wide. Optically Whitened.        | -           | \$8.67/yd.  |
| 58 | DTC | RL55   | Rayon         | Rayon Lawn                 | Rayon Lawn                  | 100% rayon very smooth and has a fine weave. 2.5 oz per square yard, 54/55" wide. Thread count is 90 threads per inch x 88 threads per inch. | -           | \$4.47/yd.  |
| 59 | DTC | RCK    | Rayon         | Rayon Crinkle              | Rayon Crinkle               | Beautiful, light crinkled rayon - great fabric for all kinds of clothing. 86 x 44, 4.5 oz. / sq. yd. approx.                                 | 30 yd bolts | \$6.65/yd.  |
| 60 | DTC | QCS    | Cotton        | Cotton Sateen              | Cotton Sateen               | Sateen has a smooth finish on one side, kind of a sheen. This softer, finely woven fabric is used for lots more than quilts.                 | 20 yd bolts | \$7.65/yd.  |
| 61 | DTC | JER40  | Cotton        | Jersey Cotton              | Jersey Cotton               | 100% Cotton slightly stretchy fabric with a smooth flat face. It's what basic t-shirts are made of. 6.50z per linear yd 58/60" wide.         | -           | \$2.85/yd.  |
| 62 | DTC | MUS5B  | Cotton        | Premier Muslin Bleached    | Premier Muslin 60" Bleached | Bleached midweight muslin. 100% Cotton, 3.2 oz per square yard, 60" wide, Thread count is 68 threads per inch x 68 threads per inch          | -           | \$3.75/yd.  |
| 63 | DTC | NF     | Nylon         | Nylon                      | Nylon 58" wide              | Untreated dye able nylon. Prepared for printing. Perfect for banners or flags. Stronger outdoors than natural fibers.                        | -           | \$2.95/yd.  |
| 64 | DTC | NET48  | Cotton        | Cotton Net Fabric          | Cotton Net Fabric 48"       | 100% cotton, slight stiffness disappears when washed, 33yd bolt comes pre-folded in a bag, 48" wide.                                         | -           | \$3.75/yd.  |
| 65 | DTC | NPF    | Nylon         | Nylon 'Puppet Skin' Fleece | Nylon 'Puppet Skin' Fleece  | 100% Nylon - 120z, 54"/56" width.                                                                                                            | -           | \$17.89/yd. |
| 66 | DTC | NVEL   | Rayon / Nylon | Rayon/Nylon Velvet         | Rayon/Nylon Velvet          | 80% Rayon, 20% Nylon - 4.20z, 45" width.                                                                                                     | -           | \$8.55/yd.  |
| 67 | DTC | OCDT   | Cotton        | Organic Cotton Denim Twill | Organic Cotton Denim Twill  | This denim is strong and versatile. Anywhere you might use denim or twill. 70z per square yd, 56" wide.                                      | -           | \$12.38/yd. |

|    |     |         |               |                                     |                                              |                                                                                                                                                                                                                |             |             |
|----|-----|---------|---------------|-------------------------------------|----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------|
| 68 | DTC | MJ60    | Rayon         | Modal Rayon Jersey                  | Modal Rayon Jersey                           | 95% Rayon, Lycra. Rayon jersey is extremely popular in ready to wear at all the best retail stores. 100z / linear yard. 60" wide.                                                                              | -           | \$6.49/yd.  |
| 69 | DTC | MCCB 45 | Cotton        | Mercerized Combed Cotton Broadcloth | Mercerized Combed Cotton Broadcloth 45" wide | Very finely Woven, 133 x 72 threads per inch. Mercerized to take dyes and paints better. 60" Wide. For batik and fine painting. 3.5 oz/yd sq.                                                                  | 50 yd bolts | \$4.85/yd.  |
|    |     | MCCB 60 | Cotton        |                                     | Mercerized Combed Cotton Broadcloth 60" wide | Very finely Woven, 133 x 72 threads per inch. Mercerized to take dyes and paints better. 60" Wide. For batik and fine painting. 3.5 oz/yd sq.                                                                  |             | \$6.35/yd.  |
| 70 | DTC | LR      | Linen / Rayon | 55% Linen / 45% Rayon               | 55% Linen / 45% Rayon                        | Want the soft drape of rayon and cool comfort of linen? This is the one fabric for you. The linen look is heavy enough for pant, drapey enough for tops and dresses, 52" wide.                                 | 30 yd bolts | \$4.49/yd.  |
| 71 | DTC | LIN21   | Linen         | Linen-100% Bleached Linen           | Linen-100% Bleached Linen                    | Beautiful soft bleached fabric. We sell in three different weights. This one is 3.8 oz per square yard with 52x53 Thread Count, 54" wide.                                                                      | -           | \$6.59/yd.  |
| 72 | DTC | LIN6    | Linen         | Linen                               | Linen                                        | 100% Linen, Optically Whitened — 6,80z, 54" width.                                                                                                                                                             | -           | \$7.42/yd.  |
| 73 | DTC | LIN     | Linen         | Linen-100% Bleached Linen           | Linen-100% Bleached Linen                    | Beautiful soft bleached fabric. We sell in three different weights. This one is 4.70z per square yard with 50x54 Thread Count, 54" wide.                                                                       | -           | \$6.59/yd.  |
| 74 | DTC | KC118   | Cotton        | Kona Premium Muslin                 | Kona Premium Muslin 118"                     | Midweight cotton sheeting. 100% cotton, 4.2 oz per square yard, 118" wide, Thread count is 130 threads per inch x 70 threads per inch.                                                                         | -           | \$9.63/yd.  |
| 75 | DTC | mac     | Cotton        | Kona Cotton - PFD                   | Kona Cotton - PFD 45" wide                   | A quilter's dream fabric. also good for soft children's clothing, comfy shirts and dresses. The 60x60 thread count gives this even weave fabric a soft luscious feel and great durability. 45" wide. 44 oz/yd. | 30 yd bolts | \$5.39/yd.  |
|    |     | KC60    | Cotton        |                                     | Kona Cotton - PFD 60" wide                   | A quilter's dream fabric. also good for soft children's clothing, comfy shirts and dresses. The 60x60 thread count gives this even weave fabric a soft luscious feel and great durability. 45" wide. 44 oz/yd. |             | \$8.35/yd.  |
| 76 | DTC | CVEL    | Cotton        | Cotton Velveteen - PFD              | Cotton Velveteen - PFD                       | Our Velveteen is a woven 100% cotton with a short close weft pile in imitation Of velvet. Stronger and denser than our rayon Silk velvet and the pile is shorter. 220g/sq meter, 44" wide.                     | -           | \$11.28/yd. |

|    |     |        |        |                               |                               |                                                                                                                                                                                                  |              |            |
|----|-----|--------|--------|-------------------------------|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|------------|
| 77 | DTC | CVO55  | Cotton | Cotton Voile                  | Cotton Voile                  | Soft, gauzy cotton with a silky wonderful feel. Glides over your fingers and floats on air. Fantastic For all your Arabian night fantasies. 55" wide 1.9 oz/yd. 80x72 thread count, 30yd bolts.  | -            | \$5.82/yd. |
| 78 | DTC | CST57  | Cotton | Cotton Sateen                 | Cotton Sateen 57"             | 100% Cotton, mercerized, very soft sheen, 144x66 thread count, 60yd bolts, 57" wide.                                                                                                             | -            | \$5.99/yd. |
| 79 | DTC | CS     | Cotton | Cotton Sheeting               | Cotton Sheeting               | Good quality fabric soft and nice mid-weight. Suitable for all clothing types. 4.20z/sq yd. 55"-58" wide. 60x60 Thread count.                                                                    | -            | \$4.91/yd. |
| 80 | DTC | CPOP57 | Cotton | Cotton Poplin                 | Cotton Poplin 57"             | 100% cotton, mercerized, crisp fabric with a tight weave, 144x68 thread count, 57" wide, bolts are 60 yards.                                                                                     | -            | \$5.37/yd. |
| 81 | DTC | CPC    | Cotton | Cotton Print Cloth Mercerized | Cotton Print Cloth Mercerized | Our Best selling cotton fabric. For eyers, dyers, quilters and painters with great quality for finished items (80x80 thread count). Takes dyes and paints particularly well. 45" wide. 3.1 oz/yd | 100 yd bolts | \$3.85/yd. |
| 82 | DTC | CLF    | Cotton | Cotton Lycra PFD              | Cotton Lycra PFD              | Cotton, Lycra. This is the fabric We use to make our cotton/lycra bike shorts and tights. It's PFD (prepared for dyeing) so it dyes up brilliantly. 60" before shrinkage, 6.3 oz/yd.             | 50 yd bolts  | \$5.76/yd. |
| 83 | DTC | CL55   | Cotton | Cotton Lawn                   | Cotton Lawn                   | 100% Cotton, Optically Whitened, 2.0 oz per Square yard. 56/57" wide, thread count 90 threads per inch x 88 threads per inch.                                                                    | -            | \$4.36/yd. |
| 84 | DTC | MUS2B  | Cotton | Cotton Muslin Bleached        | Cotton Muslin 36" - Bleached  | Bleached lightweight muslin, with tiny slubs throughout the weave. 100% cotton, oz per square yard, wide. Thread count 68"x68".                                                                  | -            | \$1.98/yd. |
| 85 | DTC | 7CDB60 | Cotton | 7 oz Duck, Bleached           | 7 oz Duck, Bleached 60"       | Grade "A" Duck. 84 x 29 threads. A little lighter weight. Drapes better than the 10 oz. All dye well. but the natural dyes darker.                                                               | -            | \$4.98/yd. |
|    |     | 7CDN63 | Cotton |                               | 7 oz'Duck,Natural 60"         | Grade "A" Duck. 84 x 29 threads. A little lighter weight. Drapes better than the 10 oz. All dye well. but the natural dyes darker.                                                               |              | \$4.72/yd. |
| 86 | DTC | BD-N   | Cotton | Bull Denim Natural            | Bull Denim Natural            | Soft feel and tough as nails. Dyes great. Hats, pants, shorts, bags anywhere you use denim. 60" wide. 10 oz/yd. 50 yard bolts.                                                                   | -            | \$4.39/yd. |
|    |     | BD-B   | Cotton |                               | Bull Denim bleached           | Soft feel and tough as nails. Dyes great. Hats, pants, shorts, bags anywhere you use denim. 60" wide. 10 oz/yd. 50 yard bolts.                                                                   |              | \$4.68/yd. |
| 87 | DTC | CCL    | Cotton | Combed Cotton Lawn            | Combed Cotton Lawn            | This is a soft, high quality semi-sheer lawn suitable for blouses. christening gowns, lingerie, and all your fine sewing needs.                                                                  | 20 yd bolts  | \$6.95/yd. |

|    |                                   |          |        |                          |                                      |                                                                                                                                                                                                 |             |             |
|----|-----------------------------------|----------|--------|--------------------------|--------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------|
| 88 | DTC                               | CC110    | Cotton | Combed Cotton            | Combed Cotton 110"                   | 100% Mercerized Soft Cotton, oz per square yard, 110-112" wide. Thread count is 92 threads per inch x 88 threads per inch.                                                                      | -           | \$6.69/yd.  |
| 89 | DTC                               | HCG      | Cotton | Heavier Cotton Gauze     | Heavier Cotton Gauze                 | Optically whitened, Soft lightly textured. A heavier weight than our cotton bubble gauze. 3.7 oz per square yd, 50" wide, 48 x48 Thread Count.                                                  | -           | \$5.26/yd.  |
| 90 | DTC                               | FT60     | Cotton | French Twill             | French Twill 60"                     | Midweight cotton with a tight diagonal weave, 100% cotton, 4.5 oz per square yard. 60" wide, thread count is 132x61                                                                             | -           | \$5.99/yd.  |
| 91 | DTC                               | ESS      | Cotton | Essex Linen-PFD          | Essex Linen-PFD                      | Linen 145% Cotton Blend. Slightly textured with a linen look. Optically whitened. 5.5 oz per square yd, 52" wide. 51x49 Thread Count.                                                           | -           | \$4.75/yd.  |
| 92 | DTC                               | CVS55    | Cotton | Cotton Voile             | Cotton Voile                         | 100% Fully Combed Cotton, Optically whitened, 1.4oz per square yard, 57-58" wide, Thread count is 70 x 70 threads per inch.                                                                     | -           | \$4.19/yd.  |
| 93 | DTC                               | CJ60     | Cotton | Cotton Jersey PFD        | Cotton Jersey 60" PFD                | 100% cotton jersey. PFD ready to dye. 9.5 oz per linear yd. 6 oz./yd. That is a little heavier than the average T-shirt. We use it for skirts, dresses, tops and kids' clothing. 60" wide.      | 30 yd bolts | \$3.55/yd.  |
| 94 | DTC                               | CIL      | Cotton | Cotton Interlock         | Cotton Interlock                     | Very warm and soft a little stretchy. Perfect for baby wear. Double knit construction makes it thicker & heavier than single knit. 60z/sq. yd, 62" wide.                                        | -           | \$5.19/yd.  |
| 95 | DTC                               | CG       | Cotton | Cotton Bubble Gauze      | Cotton Bubble Gauze                  | Beautiful white all cotton fabric. like a crinkle gauze. Very neat for skirts, tops, anywhere you want it light and airy. We have a heavier gauze. 50" wide, 22oz/sq yd.                        | 50yd bolts  | \$4.98/yd.  |
| 96 | DTC                               | CF60     | Cotton | Combed Cotton Fleece     | Combed Cotton Fleece                 | 100% Cotton - 8.70z, 60" width                                                                                                                                                                  | -           | \$11.79/yd. |
| 97 | DTC                               | 10CDB 60 | Cotton | Cotton Duck, Bleached    | Cotton Duck, Bleached. 10 oz. 45/60" | Grade "A" duck. 76 x 28 threads. Almost has the weight and texture of canvas but the flex and drape of a heavy jacket weight cotton. For strong use. It dyes well, but the natural dyes darker. | -           | \$5.69/yd.  |
|    |                                   | 10CDB 63 | Cotton |                          | Cotton Duck, Natural. 10 oz. 63"     | Grade "A" duck. 76 x 28 threads. Almost has the weight and texture of canvas but the flex and drape of a heavy jacket weight cotton. For strong use. It dyes well, but the natural dyes darker. | -           | \$5.55/yd.  |
| 98 | Jacquard, Rupert, Gibbon & Spider | JAC97 01 | Cotton | Jackard Inkjet Printable | Inkjet Printable Cotton fabric       | Inkjet fabric sheets 1.5"x11" comes with detachable paper support                                                                                                                               | -           | \$100/yd    |

|      |                            |            |                    |                                                     |                                                     |                                                                                                                                                                                                                                                                                                                                                        |   |           |
|------|----------------------------|------------|--------------------|-----------------------------------------------------|-----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|-----------|
|      | Inc.<br>(JRGSi)            |            |                    | Cotton<br>fabric                                    |                                                     |                                                                                                                                                                                                                                                                                                                                                        |   |           |
| 99   | Silhouette of America Inc. | CTNF AB    | Cotton             | Silhouette Inkjet Printable Cotton fabric           | Inkjet Printable Cotton fabric                      | Inkjet fabric sheets 1.5"x11" comes with detachable paper support                                                                                                                                                                                                                                                                                      | - | \$150/yd  |
| 100  | LumiGram SARL              | LUMW 01    | Polyester          | Lumigram optic fiber fabric (white)                 | Lumigram optic fiber fabric (white)                 | Lumigram optic fiber fabric (white). Optic fiber diameter is 0.25mm, with a spacing pitch of 1.2mm, horizontally oriented in a matrix of polyester based synthetic fabric (85% PL,15% PA6)                                                                                                                                                             | - | \$35/yd   |
| 5101 | Wilton Industries Inc.     | 500523 240 | Sucralose/Dextrose | Inkjet Printable Sugar sheets                       | Inkjet Printable Sugar sheets                       | Dried inkjet sheets made of food starch-modified (corn), maltodextrin, glycerin, sugar, water, food starch-modified (potato), dextrose, cellulose gum, gum arabic, titanium dioxide (color), polysorbate 60, mono and diglycerides of fatty acids, sorbitan monostearate, potassium sorbate (preservative), artificial flavor, citric acid, sucralose. | - | +\$300/yd |
| 102  | JRGSi                      | JAC97 02   | Silk               | Dirty Inkjet Printable Silk fabric                  | Dirty Inkjet Printable Silk fabric                  | Inkjet silk fabric sheets 1.5"x11" comes with detachable paper support                                                                                                                                                                                                                                                                                 | - | +\$300/yd |
| 103  | JRGSi                      | JAC97 03   | Silk               | Dirty Semi-transparent Inkjet Printable Silk fabric | Dirty Semi-transparent Inkjet Printable Silk fabric | Thin and semi-transparent inkjet silk fabric sheets 1.5"x11" comes with detachable paper support                                                                                                                                                                                                                                                       | - | +\$300/yd |
| 104  | JRGSi                      | JAC97 01   | Cotton             | Dirty Inkjet Printable Cotton fabric                | Dirty Inkjet Printable Cotton fabric                | Inkjet fabric sheets 1.5"x11" comes with detachable paper support                                                                                                                                                                                                                                                                                      | - | +\$300/yd |
| 105  | Silhouette of America Inc. | CTNF AB    | Cotton             | Dirty Inkjet Printable Cotton fabric                | Dirty Inkjet Printable Cotton fabric                | Inkjet fabric sheets 1.5"x11" comes with detachable paper support                                                                                                                                                                                                                                                                                      | - | +\$300/yd |

**Table S2: DNA and RNA sensor sequences used in this study.**

| Name                                                           | Sequence (5' to 3')                                                                                                                                                                                                                                            | Fig.             | Notes                                                                                                                                                                    |
|----------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>tetO</i>                                                    | TCCCTATCAGTGATAGAGATTGACATCCCTATCAGTGATAGAG<br>ATCTAGAAATAATTTTGTTAACTTTAAGAAGGAGATATACAT                                                                                                                                                                      | 1                | TetR operator region. sfGFP coding region immediately follows.                                                                                                           |
| Zaire Ebola Virus Toehold Switch Sensor (ZD) <sup>1</sup>      | AAGCTGTTGGATATTTGTATCAGTCCTTGCTCTGCATGTTATAG<br>TTATGAACAGAGGAGACATAACATGAACATGCAGAACCATGTT<br>AACCTGGCGGCAGCGCAAAAGACCATGATTACGGATTCA...                                                                                                                      | 1, S3            | Zaire Strain Ebola Toehold Sensor. DNA template is shown. The start of the LacZ coding sequence is shown in italics.                                                     |
| Zaire Ebola Virus RNA trigger (ZD) <sup>1</sup>                | AUGCAGAGCAAGGACUGAUACAAUCCAACAGCUU                                                                                                                                                                                                                             | 1, S3            | RNA gene fragment trigger of the VP30 gene of Zaire ebolavirus                                                                                                           |
| Theophylline Riboswitch Sensor E (Sensor E) <sup>2</sup>       | GGTGATACCAGCATCGTCTTGATGCCCTTGCGCAGCACCTGCT<br>AAGGAGGTAACAACAAGatgagcaaaaggtgaagaaATGACCAT<br>GATTACGGATTCA...                                                                                                                                                | 1,2              | Theophylline riboswitch E sequence. DNA template is shown. Coding sequence begins with a 6-aa sfGFP fragment. The start of the LacZ coding sequence is shown in italics. |
| F30-2xdBroccoli Aptamer <sup>3</sup>                           | TTGCCATGTGTATGTGGGAGACGGTCGGGTCCATCTGAGACGG<br>TCGGGTCCAGATATTCGTATCTGTCGAGTAGAGTGTGGGCTCA<br>GATGTCGAGTAGAGTGTGGGCTCCACATACTCTGATGATCCA<br>GACGGTCGGGTCCATCTGAGACGGTCGGGTCCAGATATTCGTA<br>TCTGTCGAGTAGAGTGTGGGCTCAGATGTCGAGTAGAGTGTGG<br>GCTGGATCATTCATGGCAAG | 2, S9            | F30-dimeric RNA broccoli aptamer sequence. DNA template is shown. Subcloned from Addgene plasmid #66843 (pET28c-F30-2xdBroccoli).                                        |
| HIV RNA Toehold switch Sensor (#8)                             | CCCUUUUCUUUUAAAAUUGUGAAUUAUCUGCAUGGACUUU<br>AGAACAGAGGAGAUAAAGAUGAUGGCAGUAUUAAACCUUGCGG<br>CAGCGCAAAAG                                                                                                                                                         | 2, Ext.-3        | RNA HIV Toehold Sensor                                                                                                                                                   |
| HIV Virus RNA trigger                                          | AUGGCAGUAUUCAUUCACAAUUUUAAAAGAAAAGGG                                                                                                                                                                                                                           | 2, Ext.-3        | RNA gene fragment trigger of the HIV retrovirus                                                                                                                          |
| Lyme Disease RNA Toehold switch Sensor                         | GUUGCAGAUUAUCCCAUCUUUCCCGAAUUUAUACGGACUU<br>UAGAACAGAGGAGAUAAAGAUGGUAUUAUUCAGAACCGGCG<br>GCAGCGCAAAAG                                                                                                                                                          | Ext.-3           | RNA Lyme Toehold Sensor                                                                                                                                                  |
| Lyme Disease ( <i>B. burgdorferi</i> ) <i>ospC</i> RNA trigger | GGCAUAUUAUGACUUUAUUUUUAUUUAUUCUUGUAUUAU<br>UCAGGGAAAGAUGGGAUACAUCUGCAAAUUCUGCUGAUGAGU<br>CUGUUAAGGGCCUAUUCUACAGAAUAAGUAAAAAAUUAUAC<br>GGAUUCUAA                                                                                                                | Ext.-3           | RNA gene fragment trigger from <i>B. burgdorferi</i> bacterium (Lyme's Disease)                                                                                          |
| CRISPR-Cas12a <i>mecA</i> gRNA                                 | GGGUAUUUCUACUAAGUGUGAGAUUUAAAGAAGAUGGUAUGUG<br>G                                                                                                                                                                                                               | 3, Ext.-4 and -6 | Cas12a guide RNA targeting single <i>mecA</i> gene fragment, was synthesized by in vitro T7 transcription.                                                               |
| CRISPR-Cas12a <i>mecA</i> dsDNA trigger                        | TTTAATTTTGTTAAAGAAGATGGTATGTGGAAGTTAGATT                                                                                                                                                                                                                       | 3, Ext.-4 and -6 | Double stranded trigger sequence for Cas12a using <i>mecA</i> gRNA.                                                                                                      |
| <i>mecA</i> RPA primer1 (F)                                    | CATTGATCGCAACGTTCAATTTAATTTTGTTAAAG                                                                                                                                                                                                                            | 3, Ext.-4 and -6 | Forward primer for RPA reaction for Cas12a <i>mecA</i> experiments                                                                                                       |
| <i>mecA</i> RPA primer2 (R)                                    | TACGATCAATATGTATGCTTTGGTCTTTCTGCATTCCTG                                                                                                                                                                                                                        | 3, Ext.-4 and -6 | Reverse primer for RPA reaction for Cas12a <i>mecA</i> experiments                                                                                                       |
| CRISPR-Cas12a <i>ermA</i> gRNA                                 | GGGUAUUUCUACUAAGUGUGAGAUUUAAUGGUGGAGAUGG<br>A                                                                                                                                                                                                                  | 3, Ext.-6        | Cas12a guide RNA targeting single <i>ermA</i> gene fragment, was synthesized by in vitro T7 transcription.                                                               |
| CRISPR-Cas12a <i>ermA</i> -dsDNA trigger                       | GCTTTGGGTTTACTATTAAATGGTGGAGATGGATATAAAAA                                                                                                                                                                                                                      | 3, Ext.-6        | Double stranded trigger sequence for Cas12a using <i>ermA</i> gRNA.                                                                                                      |
| <i>ermA</i> RPA primer1 (F)                                    | TCGTTGAGAAGGGATTTCGCAAAAGATTGC                                                                                                                                                                                                                                 | 3, Ext.-6        | Forward primer for RPA reaction for Cas12a <i>ermA</i> experiments                                                                                                       |
| <i>ermA</i> RPA primer2 (R)                                    | GGATGAAAAATAGTGGTGGTACTTTTGTGAGC                                                                                                                                                                                                                               | 3, Ext.-6        | Reverse primer for RPA reaction for Cas12a <i>ermA</i> experiments                                                                                                       |
| CRISPR-Cas12a <i>spa</i> gRNA                                  | GGGUAUUUCUACUAAGUGUGAGAUUGGUAUGCUUGAGCUUUG<br>U                                                                                                                                                                                                                | 3, Ext.-6        | Cas12a guide RNA targeting single <i>spa</i> gene fragment, was synthesized by in vitro T7 transcription.                                                                |
| CRISPR-Cas12a <i>spa</i> dsDNA trigger                         | TTCACCAGTTTCTGGTAATGCTTGAGCTTTGTTAGCATCT                                                                                                                                                                                                                       | 3, Ext.-6        | Double stranded trigger sequence for Cas12a using <i>spa</i> gRNA.                                                                                                       |
| <i>spa</i> RPA primer1 (F)                                     | AAGAAGCAACCAGCAAACCATGCAGATGC                                                                                                                                                                                                                                  | 3, Ext.-6        | Forward primer for RPA reaction for Cas12a <i>spa</i> experiments                                                                                                        |
| <i>spa</i> RPA primer2 (R)                                     | ACCTAACGCTAATGATAATCCACCAAATAC                                                                                                                                                                                                                                 | 3, Ext.-6        | Reverse primer for RPA reaction for Cas12a <i>spa</i> experiments                                                                                                        |
| CRISPR-Cas13a MRSA crRNA                                       | GAUUUAGACUACCCCAAAAACGAAGGGGACUAAAACACTCATG<br>CCATACATAAATGGATAGACG                                                                                                                                                                                           | Ext.-5           | Cas13a guide RNA (crRNA) targeting single MRSA gene                                                                                                                      |

|                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                            |                                                                                                                                    |
|------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|------------------------------------------------------------------------------------------------------------------------------------|
|                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                            | fragment, was synthesized by in vitro T7 transcription.                                                                            |
| CRISPR-Cas13a<br>MRSA Trigger                  | CGUCUAUCCAUUUAUGUAUGGCAUGAGU                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Ext.-5                     | Single stranded RNA trigger sequence for Cas13a using MRSA crRNA.                                                                  |
| Fluorophore-quencher<br>(FQ) reporter          | 5'-6FAM/TTATT/IowaBlackFQ                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 3, 4,<br>Ext.-4, 6,<br>S10 | Substrate for Cas12a CRISPR-based sensors. When trans-cleaved by cis-activated Cas12a it generates a fluorescent signal.           |
| Zika Toehold switch<br>27B sensor <sup>4</sup> | TTTCGCTCTATTCTCATCAGTTTCATGTCTGTGTCGGACTTT<br>AGAACAGAGGAGATAAAGATGGACACAGGACACAACCTGGCGG<br>CAGCGCAAAAGCTGCGTAAACTGagc...                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | S7                         | RNA Zika Toehold Sensor. The start of the sfGFP coding sequence is shown in italics.                                               |
| Zika Virus RNA<br>trigger <sup>4</sup>         | GGGCCAGCACAGUGGGAUGAUCGUUAAUGACACAGGACAUGAA<br>ACUGAUGAGAAUAGAGCGAAAGUUGAGAUAAACGCCCAAUUCAC<br>CAAGAGCCGAAGCCACCCUGGGGGGGUUUGGAAGCCUAGGACU<br>UGAUUGUGAACCAGGACAGG                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | S7                         | RNA gene fragment trigger of the Zika single-stranded RNA flavivirus                                                               |
| SARS-CoV-2 S-gene<br>Cas12a gRNA Sensor        | GGGUAUUUUCUACUAAGUGUAGAUCAGGCUGCGUUAUAGCUUG<br>GAAUU                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 4                          | gRNA targeting region in SARS-CoV-2 Spike gene                                                                                     |
| RT-RPA-F4                                      | gcaaactggaaagattgctgattataattataaattacc                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 4                          | Primer for SARS-CoV-2 RT-RPA                                                                                                       |
| RT-RPA-R4                                      | cctgatagattttcagttgaaatatctc                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 4                          | Primer for SARS-CoV-2 RT-RPA                                                                                                       |
| RT-RPA-R3                                      | ccttcaacaccattacaaggtgtgctacc                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 4                          | Primer for SARS-CoV-2 RT-RPA                                                                                                       |
| SARS-Cov-2 IVT<br>RNA Target                   | GGUGAUGAAGUCAGACAAAUCGCUCCAGGGCAAACUGGAAAGA<br>UUGCUGAUUUAUAAUUAUUUUUACCAGAUUUUUACAGGCUG<br>CGUUUAUAGCUUGGAAUUCUAAACUUCUAGUUCUAAAGGUUGGU<br>GGUAAUUUAUUUACCUGUAUAGAUUUUUAGGAAGUCUAAUC<br>UCAAAACCUUUUGAGAGAGAUUUUCAAACUGAAAUCUACAGGC<br>CGGUAGCACACCUUGUAAUGGUGUUGAAGGUUUUAAUUGUUAC<br>UUUCCUUUACAAUCAUAUGGUUUCCAACCCACUAAUGGUGUUG<br>GUUACCAACCA                                                                                                                                                                                                                                                                                                      | 4                          | S gene RNA fragment trigger for SARS-CoV-2 generated by in vitro transcription from a DNA template                                 |
| HCoV-229E IVT<br>RNA Target                    | GGGUUAAUGUGUCACAAACCUUAUUGCUAAUUAUAAUUUAUU<br>GCAACUCUGUUAUUUACAGACUGAGAUGGACCAGUUGUCCUU<br>UGAUGUACCAGAUUGGUUUUUUAUUCUACAGGCCUAAUUCAAUCC<br>GUUGAGCUACCUGUGUCUAAUUGUGUCGCUACCUGUUUAUCAUA<br>AACAUACGUUUUAUUGUGUUGUACGUUCAAACCUACAGAG<br>UGGCGGUGGCAAGUGCUUUUACUGUUAUCCUGUGGUGUUAUU<br>AUUACACUGGCCAAUUUUUAUGAAACUAAAGGGCCUUUGUGUG<br>UUGACACAUACACUUCACUACCAAUACGUUGCUGUUUAUUGC<br>CAAUGUUGGUAGGUGGAGUGCUAGUAUUUACAGGGAUUUGC<br>CCUUUUUCUUUUGGCAAAGUUAUAAACUUUGUUAAUUUUGGCA<br>GUGUAUGUUUUUCGCUAAAGGAUUAUACCGGUGGUGGCGCAAU<br>GCCUAUAGUGGCUAAUUGGGCUUAUAGUAAGUACUUAUACUUA<br>GGCUCAUUGUAUGUUUCUUGGAGUGAUGGUGAUGGAAUUAUG<br>GCGUCCCAACA                | 4                          | Homologous S gene RNA fragment trigger from human coronavirus strain 229E, generated by in vitro transcription from a DNA template |
| HCoV-HKU1 IVT<br>RNA Target                    | GGGUUACUAAUUAUAAUUAUAAUCCUUCUUCUUGGAAUAGAA<br>GGUAUGGUUUUAAUAAUUUUUAAUUGAGCUCUCAUAGUGUUGU<br>UUACUCACGUUAUUGUUUUUCUGUUAUAAUACUUUUUUGUCCU<br>UGUGCUAAACCUUCUUUUUGCUUCAAGUUGCAAGAGUCAUAAAC<br>CACCUUCUGCUUCCUGUCCUAUUGGUACUAAUUAUCGUUCUUG<br>UGAGAGUACUACUGUACUGACCACACUGACUGGUGUAGGUGU<br>UCUUGUUUACCUGAUCCUAUACUGCUUAUGACCCUAGGUCUU<br>GUUCUCAAAAAAGUCUCUGGUUGGUGUUGGUAACAUAUUGUGC<br>AGGGUUCGGUGUUGAUGAAGAAAGUGUGGUGUAUUGGAUGGA<br>UCAUAUAAUGUUUCUUGUCUUUGUAGUACUGAUGCCUUUCUAG<br>GUUGGUCUUAUGACACUUGCGUCAGUAACAACCGUUGUAAUUAU<br>UUUUUCUAAUUUUUAAUUUAAUUGGUUAUAAUAGUGGUACCACU<br>UGUUCUAAUGAUUUUUAUUGCAGCCUAAUACUGAAGUUUUUACUG<br>AUGUUUGUGUUGAUUACG | 4                          | Homologous S gene RNA fragment trigger from human coronavirus strain HKU1, generated by in vitro transcription from a DNA template |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |   |                                                                                                                                                                                                                         |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| HCoV-NL63 IVT RNA Target                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | GGGGUAAUGUUAGUGCAACUAACAUAUCAAACUUACUUUAUUGCAUUCUCCAUUUGAAAAGUUGCAGUGUGAGCACUUGCAGUUUGGAUUGCAGGAUGGUUUUUUAUUCUGCAAAUUUUUCUUGAUGAUAAUGUUUUUGCCUGAGACUUAUGUUGCACUCCCCAUUUUAUUAUC AACACACGGACAUAAAUUUUACUGCAACUGCAUCUUUUUGGUGGUUCUUGUUUAUGUUUGUAAACCACACCAGGUAAUAUAUCUCUUAAUGGUAAACAUUCAGUGUGUGUAGAACAUCUCAUUUUUCAAUUAGGUAAUUUAUAACCGCGUUAAGAGUGGUUACACAGGUGA CUCUUAUGGCACAUUUUUUAAAGAGUGGCACUUGUCCAUUUUCUUUUUCUAAGUUAAAUAUUUUCAAAGUUCAAAGACUAUUU GUUUUCUAACCGUCGAAGUGCCUGGUAGUUGUAAUUUUUCCGCUUGAAGCCACCUGGCAUACACUUCUUAUACUAUUGUUGGUGCUUUGUAUGUUACUUGGUCUGAAGGUAAUUCUAUUCUGGUGUACCUUA                       | 4 | Homologous S gene RNA fragment trigger from human coronavirus strain NL63, generated by in vitro transcription from a DNA template                                                                                      |
| HCoV-OC43 IVT RNA Target                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | GGGGCAGGUUUAAUCCUUCUACUUGGAAUAGGAGAUUUGGUUUUACAGAACAACUCUGUUUUUAAGCCUCAACCUGUAGGUGUUUUACUCAUGAUGUUGUUUAUGCACAACAUUGUUUUAAAGCUC CCACAAAUUCUGUCCGUGUAAAUUGGAUGGGUCUUUGUGUGUAGGUAAUGGUCCUGGUUAUGAUGCUGGUUAUAAAAUAGUGGUUAAGGCACUUGUCCUGCAGGUACUAAUUAUUUAACUUGCCAUA AUGCUGCCCAAUGUGAUUGUUUGUGCACUCCCGACCCCAUUAC AUCUAAAUCUACAGGGCCUUAACAAGUGCCCCCAACUAAAUAUACUUAGUUGGCAUAGGUGAGCACUGUUCGGGUCUUGCUAUUUAAA GUGAUUAUUGUGGAGGUAAUCCUUGUACUUGCCAACCAAGCAAGC AUUUUUGGGUUGGUCUGUUGACUCUUGUUUACAAGGGGAUAGG UGUAAUAUUUUUGCUAAUUUUUAUUUGCAUGUGUAAUAGUG GUACUACUUGUUCUACUGAUUUACAAAAUCAACACAGACAUAAUUCUUGGUGUUUGUGUAAUUAU | 4 | Homologous S gene RNA fragment trigger from human coronavirus strain OC43, generated by in vitro transcription from a DNA template                                                                                      |
| Fluorophore-Biotin (FB) reporter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 5'-6FAM/TTATTTTATT/Biotin                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 4 | Reporter molecule used for the SARS-CoV-2 face mask sensor SHERLOCK Reaction. Upon cis-activation, Cas12a collateral activity will cleave the ssDNA linker, separating the 6-carboxyfluorescein from the biotin moiety. |
| Notes: <ol style="list-style-type: none"> <li>1. All toehold sensors and corresponding trigger RNAs for were in vitro transcribed from DNA templates containing the T7 RNA polymerase promoter: TAATACGACTCACTATA</li> <li>2. The sequence GGG was added to the 5' end of all toehold sensor RNA and target RNA fragment sequences for efficient expression by T7 RNA polymerase. The Ebola ZD toehold sensor only contains a GG after the T7 promoter. If the RNA sequence began with G or GG, only GG or G, respectively, was added to the 5' end of the sequence.</li> <li>3. The GGG prefix is not shown in the sensor sequences so that the target RNA binding site can be readily identified, but GGG was always added to the start of each RNA to encourage efficient transcription by the polymerase.</li> <li>4. The coding sequences of the reporter protein LacZ in the colorimetric sensors were added immediately after the 21-nt linker in the toehold switch RNA sequences starting with the second codon (Threonine) of the wild-type beta-Galactosidase enzyme.</li> <li>5. Considered Zika virus strains (KU312312, AY632535) have sufficient sequence homology to be detected using the same toehold switch sensors (27B).</li> </ol> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |   |                                                                                                                                                                                                                         |



**Table S3: Reporter sequences used in this study.**

| Name (Fig.#)                                                                  | Sequence (5' to 3')                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| LacZ<br>Colorimetric<br>Reporter DNA<br>Sequence<br>(Fig.1, Ext.-1,<br>S2-S5) | <b>ATG</b> ACCATGATTACGGATTCACTGGCCGTCGTTTTACAACTGCTGACTGGGAAACCTGGCGTTACCCAACTTAATCGCCTTGACGACATCCCCCTTTCCGCCAGCTGG<br>CGTAATTAGCGAAGAGGCCCGCACCGATCGCCCTTCCCAACAGTTGCGCAGCTGAATGGCGAATGGCGCTTTGCCCTGGTTTCCGGCAACCAAGCGGTCGCGAAAGCTGG<br>CTGGAGTGCATCTTCTGAGGCCGATACTGTCGTCGTCCTCCCTCAAACCTGGCAGATGCACGGTTACGATGCGCCCATCTACACCAACCTGACCTATCCCATACCGTCAAT<br>CCGCGCTTTGTTCCACCGGAGAAATCGACGGGTTGTTACTCGCTCAGATTTAATGTTGATGAAAGCTGGCTACAGGAAGGCCAGACCGCAATATTTTGTATGGCGTTAAC<br>TCGGCGTTTTATCTGTGGTGCAACGGGCGCTGGTGGTTACGGCCAGGACAGTCGTTTGGCGTCTGAATTTGACCTGAGCGCATTTTACGCGCCGGAGAAAAACCGCTC<br>GCGGTGATGGTGCCTGGAGTGACGGCAGTTATCTGGAAGATCAGGATATGTGGCGGATGAGCGGCATTTTCCGTGACGCTCTCGTTGCTGCATAAACCGACTACACAA<br>ATCAGCGATTTCCATGTTGCCACTCGCTTTAATGATGATTTTACGCCGCGCTGACTGGAGGCTGAAGTTACAGATGTGCGCGAGTTGCGTGACTACCTACGGGTAACAGTT<br>TCTTTATGGCAGGTTGAAACGACAGTTCGCCAGCGGCCACCGCGCTTTTCGGCGGTGAAATATATGATGAGCGTGGTGGTTATGCCGATCGCGTACACTACGTCTGAACGTC<br>GAAACCCGAACTGTGGAGCGCCGAAATCCGAAATCTCTATCGTGGGTGGTTGAAGTGCACACCGCCGACGGCAGCTGATTGAAGCAGAAGCGCTGCGATGTGCGGTTTC<br>CGCGAGGTGCGGATTGAAATGGTCTGCTGCTGCTGAACGGCAAGCCGTGCTGATTTCGAGCGCTTAACCGTCAACGAGCATCATCTCTGATGGTCAGGTCATGATGAG<br>CAGACGATGGTGAGGATATCCTGCTGATGAAGCAGAACTTTAACCGCGTGGCGTGTTCGCATTATCCGAACCATCCGCTGTGGTACACGCTGTGCGACCGCTACCGG<br>CTGTATGTGGTGGATGAAGCAATATTGAAACCCAGCGCATGGTGCCAAATGAATCGTCTGACCGGATGATCCGCGCTGGCTACCGGCGATGAGCGAACGCTAACGCGAATG<br>GTGACGCGCGATCGTAATCAACCGGATGTGATCATCTGGTGGTGGGAATGAATCAGGCCACGGCGCTAATCAGCAGCGCTGTATCGCTGGATCAATCTGTGATCCT<br>TCCCGCCCGGTGCAGTATGAAGCGCGGAGCCGACACACCGGCCACGATATTTATTTGCCCGATGTACGCGCGCGTGGATGAAGACCAAGCCCTTCCCGGCTGTGCGGAA<br>TGGTCCATCAAAAAATGGCTTTCGCTACCTGGAGAGACGCGCCGCTGATCCTTTGCGAATACGCCACGCGATGGGTAAACAGTCTTGGCGGTTTCGCTAAATCTAGCGAG<br>GCGTTTCGTGATATCCCCGTTTACAGGCGGCTTCGCTGGGACTGGGTGGATGCTGCTGATTAAATATGATGAAACAGGCCAACCCGTTGGTGGCTTACGCGGTTGAT<br>TTTGGCGATACGCCGAACGATCGCCAGTTCTGTATGAACGCTGTGCTTTTGGCCACGCGACGCCGATCCAGCGCTGACCGGAAGCAAAACACACGACGAGTTTTCAG<br>TTCGCTTTATCCGGGCAAAACATCGAAGTGACCGCGAATACCTGTTCCGTCATAGCGATAACGAGCTCCTGCAGTGGTGGCGCTGGATGGTAAGCCGCTGGCAAGC<br>GGTGAAGTGCCTCTGGATGTGCTCCACAAGTTAAACAGTTGATTGAACCTGCTGAATACCCGACCGGAGAGCGCCGGGCAACTCTGGCTCAGATACCGGTAGTGCA<br>CCGAACCGGACCGCATGTTGAGAAGCCGGGCATCAGCGCTGGCAGCAGTGGCGTCTGGCGGAAACCTCAGTGTACGCTCCCCCGCGCTCCACCGCATCCCGCAT<br>CTGACACCCAGCGAAATGGATTTTGCATCGAGCTGGTAATAAGCGTTTGGCAATTAACCGCCAGTCAGGCTTTCTTTCACAGATGTGGATTGGCGATAAAAAACAATG<br>CTGACGCGCTGCGCGATCAGTTACCCGCTGCACCGCTGGATAACGACATTTGGCGTAAGTGAAGCGACCCGATTAACCTCAACGCTGGGTGGAACGCTGGAAGCGCGG<br>GGCGATTACCGAGCGGAAGCAGCGTTGTTGCAAGTGCAAGCGCAGATACACTTGTGATGCGGTGCTGATTACGACCGCTCAGCGGTGGCAGCATCAGGGGAAAAACCTTATTT<br>ATCAGCGGAAACCTACCGGATGTGATGATGAGTGGTCAATAGCGGATTAACCGTGTATGTTGAAGTGGCGAGCGATACACCGCATCCGCGCGGATTTGGCGTGAATCGGCAG<br>CTGCGCGAGTACGACAGCGGTAAACTGCTCGGATTAGGGCCCAAGCAAACTCCGACCGCTTACTGCGCCGCTTTTTCAGCGGCTGGGATCTGCCATTGTACAGC<br>ATGTATATCCCGTACGCTTTCGCGAGCGAAACCGGTGTGCGCTGCGGGACGCGCAATTTGAATATGCGCCACACCAAGTGGCGCGGCACTTCCAGTTCAACATCAGCGCG<br>TACAGTCAACAGCACTGATGAAACCGACCATCGCCATCTGCTGACCGGGAAGAGGCATATGGTGAATATCAGCGGTTTCCATATGGGGATTGGTGGCGACGACTCC<br>TGGAGCCGTCAGTATCCGCGGAATTCCAGCTGAGCGCGCGTGCAGTACCATTCACAGTTGGTCTGGTGTCAAAAA <b>TAA</b> |
| GFPmut3B<br>Fluorescent<br>Reporter DNA<br>Sequence<br>(Fig. S7)              | <b>ATG</b> CGTAAGGAGAAGAACTTTTCACTGGAGTTGCCCAATTTCTGTTGAATTAGATGGTGATGTTAATGGGCACAAATTTTCTGTCAGTGGAGAGGTGAAGGTGATGCA<br>ACATACGGAACCTTACCTTTAAATTTATTTGCACTACTGGAACCTACCTGTTCCGTGGCCAACTTGTCACTACTTTTCGTTATGGTGTCAATGCTTTGCGAGATAC<br>CCAGATCACATGAACAGCATGACTTTTCAAGAGTGGCATGCCCGAAGGTACGTACAGGAAGAACTATATTTTCAAGATGACGGGAATACAGACAGCTGCTGAA<br>GTCAAGTTTGAAGGTGATACCTTTTAAATAGAAATCGAGTTAAAGGTTATGATTTTAAAGAGATGGAAACATTTCTGGACACAAATTTGAATACAACTATAACTCACAC<br>AATGTATACATCATGCGAGACAAACAAAGAAATGGAATCAAAGTTAACTTCAAATTTAGACACAACTTGAAGATGGAAGCGTTCAATAGCAGACCATATCAACAAAT<br>ATCCCGATTGGCGATGGCCCTGTCCTTTTACCAGACAACCATTTACCTGTCCACACAACTCTGCCCTTTTCGAAAGATCCCAACGAAAGAGACCATGATGCTCTTGAG<br>TTTGTAAACCGTCTGGGATTACATATGCGATGGATGAATATACAAAAGGCTGACGACAAACGACGAAACTACGCTTTAGTAGCT <b>TAA</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| sfGFP<br>Fluorescent<br>Reporter DNA<br>Sequence<br>(Fig. 2, 3)               | <b>ATG</b> AGCAAAAGGTGAAGAACTGTTTACCGCGTTGTGCCGATTCTGGTGAACCTGGATGGCGATGTGAACGGTCACAAATTCAGCGTGCCTGGTGAAGGTGAAGCGGATGCC<br>ACGATTGGCAAACTGACGCTGAAATTTATCTGCACCAACCGGCAAACTGCCGGTGGCGTGCCGCGACGCTGGTGACCACTGACCTATGGCGTTTCACTGTTTGTAGTGCAT<br>CCGGATCACATGAACAGCTCAGATTTCTTTAAATCTGCAATGCCGGAAGGCTATGTGAGGAAGCTACGATTAGCTTTAAAGATGATGGCAAAATATAAAGCGCGCGCTG<br>GTGAATTTGAAGGCGATACCTGGTGAACCGCATTTGAATGAAAGGACCGGATTTTAAAGAGATGGCAATATCTCGGGCCATAAATCTGGATACAACTTTAATAGCCAT<br>AATGTTTATATTACGCGGATAAACAAGAAAAATGGCATCAAAGCGAATTTTACCGTTCGCCATAACGTTGAAGATGGCAGTGTGCAGCTGGCAGATCATTATCAGCAGAAT<br>ACCCGATTTGGTGATGGTCCGCTGCTGCTCGCGGATAATCATTTATCTGAGCAGCAGACCGCTTCTGTCTAAAGATCCGAACGAAAGGACGCGGGACCATATGTTCTG<br>CATGAATATGTAATGCGCGAGGTATTACGTGGAGCGCATCGCGAGTTGCAAAAA <b>TAA</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| eforRed<br>Fluorescent<br>Reporter DNA<br>Sequence<br>(Ext.-7)                | <b>ATG</b> AGCGTGATTAACAGGTGATGAAACCAAACTGCATCTGGAAGGCACCGCTTAATGGTCTATGATTACCATTTGAAGGTAAAGGTGAAGGCAAAACCGTATGAAGGTCTG<br>CAGCATATGAAATGACCGTTACCAAGGTGCACCGCTGCCGTTTACGCTTCATATTTGACCCCGAGCGCATATGTATGGTAGCAAAACCGTTTAAACAAATATCCGCGAGAT<br>ATCCCGGATTATCACAAACAGAGCTTTCCGGAAGGTATGAGCTGGGAACGTAGCATGATTTTGAAGATGGTGGTGTGTGACCGCAAGCAATCATAGCAGCATTTAATCTG<br>CAAGAAAACTGCTTCACTACGACGTGAAATTCATGGTGTAACTCTGCCCTCCGATGGTCCGTTATGCAAGAAAACCATTCAGGTTGGGAACCGAGCGTTGAAACCGCTG<br>TATGTTCTGATGGTATGCTGAAAAGCGATACCGCATGGTTTTTAAACTGAAAGGTGGTGGTCATCATCTGTGGATTTCAAAACCCACTACAAGCAAAAAAACCGGTT<br>AAACTGCCGGAATTCATTTGTGTGAACATCGTCTGGAAGTGAACAAACGATAAAGATTTTACCACCTGGGATCAGCAAGAAGCAGCAGAAGGTCTTTTAGTCCGCTG<br>CCGAAGCACTGCCG <b>TAA</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| dTomato<br>Fluorescent<br>Reporter DNA<br>Sequence<br>(Ext.-7)                | <b>ATG</b> GTGAGCAAGGGCGAGGAGGTCAACAAAGTTTCATGCGCTTCAAGTGCGCATGGAGGGCTCCATGAACGGCCACGAGTTCGAGATCGAGGGCGAGGGCGAGGGCCG<br>CCCTACGAGGGCACCCAGACCGCAAGCTGAAGGTGACCAAGGCGGCCCTTCCCTTCGCTGGGACATCTGTCCCCCAGTTTATGATAGGCTCCCAAGCGCTACGCTG<br>AAGCACCCCGCCGATCCCGATTACAAGAGCTGCTCTTCCCGAGGGCTTCAAGTGGGAGCGCTGATGAACCTTCGAGGACGCGGCTGCTGACCTGACCCGAGGAC<br>TCCTCCCTGACGAGGCGCAGCTGATCTACAAGGTGAAGTGCAGGCGCAACCACTTCCCCCGGAGCGCCCGTAAATGCAGAAAGAACCATGGGCTGGGAGGCCCTCCACC<br>GAGCGCTGTACCCCGCGACGCGGTGCTGAAGGGCGAGATCCACAGGCGCTGAAGTGAAGGACGCGCGCACTACTGTTGGAGTTTCAAGACCATCTACATGGCAAG<br>AAGCCGTCGCACTGCCCGCTACTACTACGTGGACACCAAGCTGACATCACTCCACAAAGGAGACTACACCATCTGGAACAGTACGAGCGCTCCGAGGCGCCGAC<br>CACCTGTCTCTGACGGCATGGACGAGCTGTACAAG <b>TAA</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Nanoluciferase<br>Luminescent<br>Reporter DNA<br>Sequence<br>(Fig. 2, Ext.-7) | <b>ATG</b> GGTCATCACCAACCATCACCGTGGCGTAGCGTGTTCACATTGGAGGACTTTGTAGGGGACTGGCGCCAGACAGCGGGCTACAACCTTGATCAGGTTCTGGAGCAG<br>GGAGGTGAAGTTTCACTTTCCAGAAATTTGGGTGTGAGTGTCAACCCGATCCAACTGATCGTCTTCCGGAGAAAATGGGCTGAAGATCGACATCCATGTTATTTCTCT<br>TATGAAGGCTTAGCGGAGATCAAATGGGCCAAATCGAAAAGATTTTCAAAGTGGTATATCTGTTGACGACCATCATTTAAGGTCATTTGATACGGAACCTTTAGT<br>ATCGAGCGCTCACACCTAACATGATGACTATTTTGGCCGTCGATGAGGGCATCGCAGTGTGTGACGAAAATAAATCACCCTGACAGGAGCACTGGGAACGGCAAT<br>AAGATTATCGACGAGCGCTTATTAACCCAGATGGTGCCTTTTATTCGCTGCTACTATTAATGGTGTCACTGGCTGGCGTTTGTGCAACGCGATCCTGGCAT <b>TAA</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

**Table S4: Technology Comparison****Table S4a. Comparison to other related technology categories.**

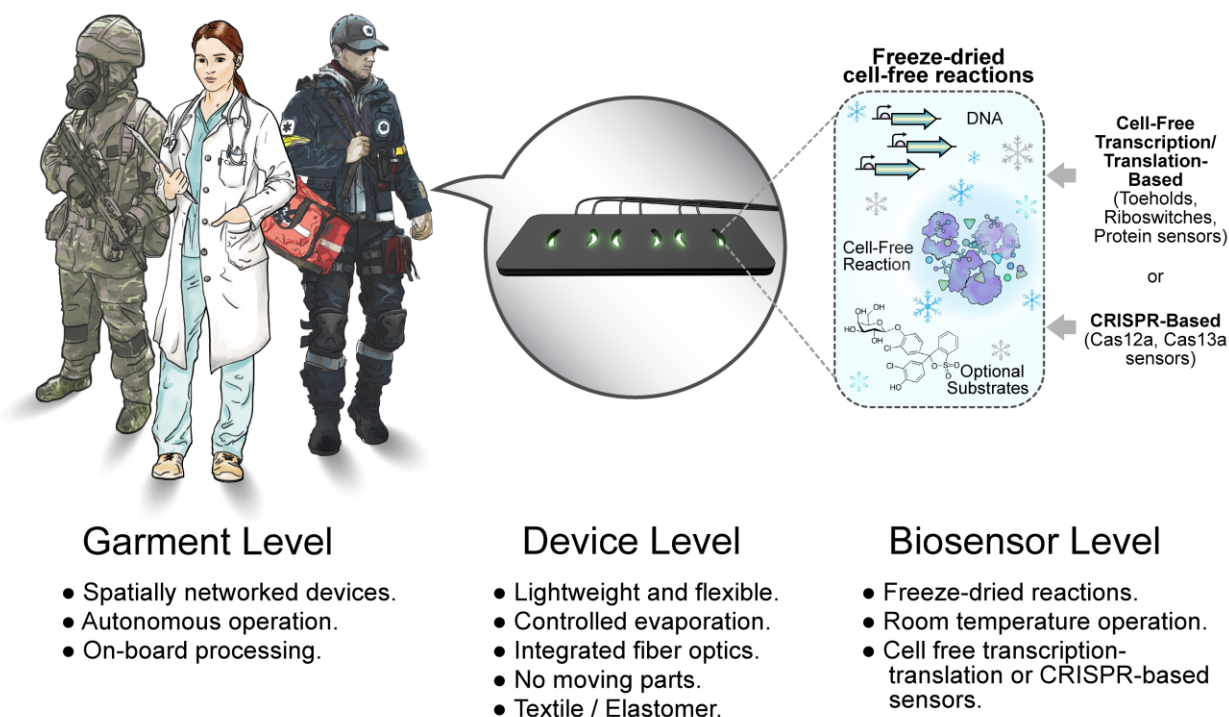
|                                                | Wearable Synthetic Biology<br>(This work) | Current Wearable Devices | Point-of-Care<br>Diagnostics |
|------------------------------------------------|-------------------------------------------|--------------------------|------------------------------|
| Wearable Form Factor                           | YES                                       | YES                      | NO                           |
| Autonomously Functioning                       | YES                                       | YES                      | NO                           |
| Synthetic Biology Reactions                    | YES                                       | NO                       | YES                          |
| Molecular Sensing                              | YES                                       | NO                       | YES                          |
| Pathogen Sensing                               | YES                                       | NO                       | YES                          |
| Rapid Modular Programmability of<br>Components | YES                                       | NO                       | YES                          |
| Portable Instrumentation                       | YES                                       | YES                      | YES                          |

**Table S4b. Detailed comparison with other synthetic biology sensor-embedded materials.**

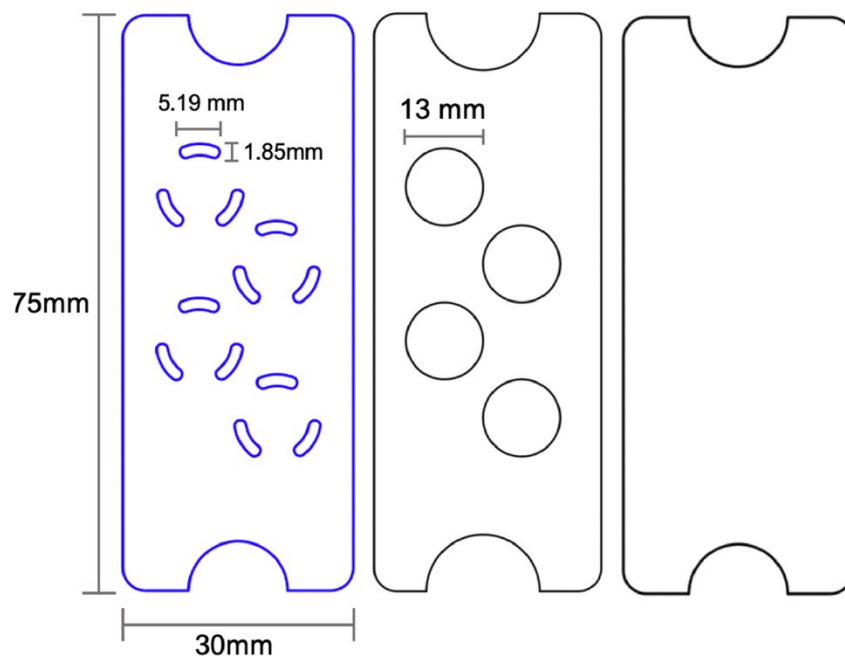
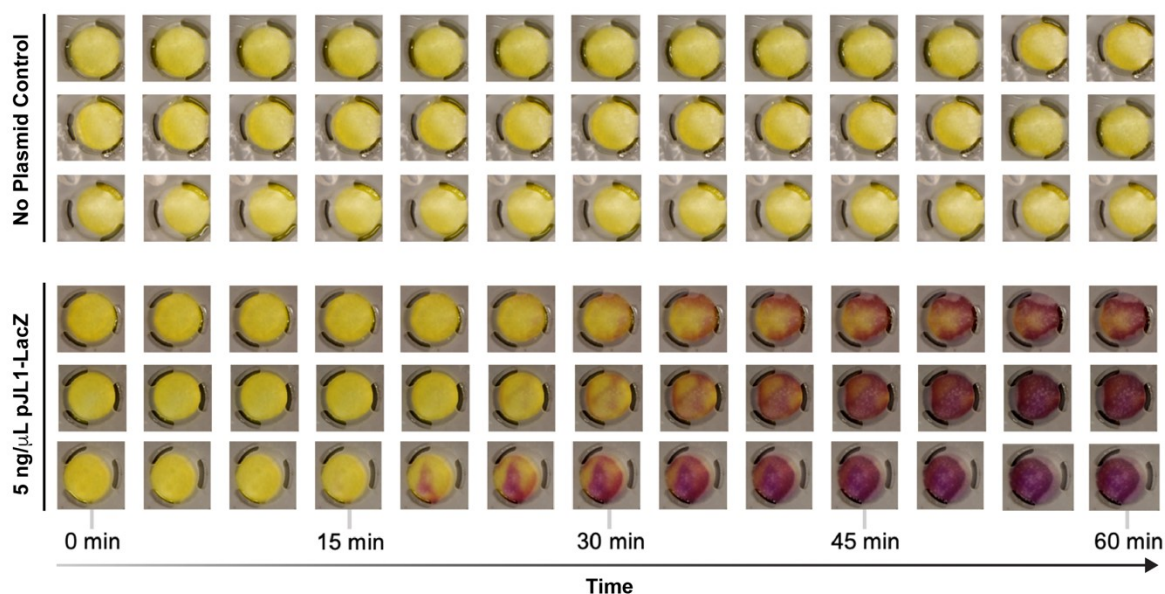
|                      | Stretchable<br>Hydrogel-<br>Elastomer<br>Devices with<br>Encapsulated<br>Programmed<br>Cells (Liu, X.<br>et al 2017) <sup>4</sup> | 3D Printing<br>of Living<br>Responsive<br>Materials<br>and Devices<br>(Liu, X. et<br>al 2017) <sup>5</sup> | Engineered<br>Bacteria<br>Deposited onto<br>Textiles,<br>Ceramics, and<br>Plastic (Moser, F.<br>et al 2019) <sup>6</sup> | Harnessing the<br>Hygroscopic and<br>Biofluorescent<br>Behaviors of<br>Genetically Tractable<br>Microbial Cells to<br>Design Biohybrid<br>Wearables (Wang,<br>W. et al. 2017) <sup>7</sup> | Programmable<br>CRISPR-<br>Responsive<br>Smart Materials<br>(English, et al.<br>2020) <sup>13</sup> | wFDCF<br>(This Work)                                           |
|----------------------|-----------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|----------------------------------------------------------------|
| LOD                  | 100 nM                                                                                                                            | 100 nM                                                                                                     | 25 $\mu$ M                                                                                                               | n/a                                                                                                                                                                                        | 11 aM                                                                                               | 17 aM                                                          |
| Sensor<br>Format     | Living Cells                                                                                                                      | Living Cells                                                                                               | Living Cells                                                                                                             | Living Cells                                                                                                                                                                               | Cell-free<br>Freeze-dried<br>Reactions                                                              | Cell-free<br>Freeze-dried<br>Reactions                         |
| Matrix<br>Material   | Hydrogel                                                                                                                          | Hydrogel                                                                                                   | Textiles,<br>Ceramics,<br>Polymer                                                                                        | Polymer                                                                                                                                                                                    | Hydrogel, paper                                                                                     | Textiles,<br>polymer,<br>paper                                 |
| Shelf-stable         | NO                                                                                                                                | NO                                                                                                         | NO                                                                                                                       | NO                                                                                                                                                                                         | YES                                                                                                 | YES                                                            |
| Detection<br>target  | Small<br>Molecules                                                                                                                | Small<br>Molecules                                                                                         | Small Molecules,<br>Light                                                                                                | Atmospheric<br>Humidity                                                                                                                                                                    | dsDNA                                                                                               | Hydration,<br>Small<br>Molecules,<br>Proteins, RNA<br>and DNA. |
| Output               | Fluorescent                                                                                                                       | Fluorescent                                                                                                | Fluorescent                                                                                                              | Fluorescent                                                                                                                                                                                | Fluorescent,<br>Colorimetric,<br>Conductivity                                                       | Fluorescent,<br>Colorimetric,<br>Luminescent                   |
| Detection<br>time    | 2 hrs                                                                                                                             | 2-4 hrs                                                                                                    | 3-18 hrs                                                                                                                 | minutes                                                                                                                                                                                    | 45 min – 24 hrs                                                                                     | 6 min – 2 hrs                                                  |
| System<br>Complexity | Simple                                                                                                                            | Moderate                                                                                                   | Moderate                                                                                                                 | Moderate (Additional<br>Wash Steps)                                                                                                                                                        | Moderate                                                                                            | Moderate                                                       |
| Wearable<br>Format   | NO                                                                                                                                | NO                                                                                                         | YES                                                                                                                      | YES                                                                                                                                                                                        | NO                                                                                                  | YES                                                            |

**Table S4c. Detailed comparison with point-of-care diagnostic technologies.**

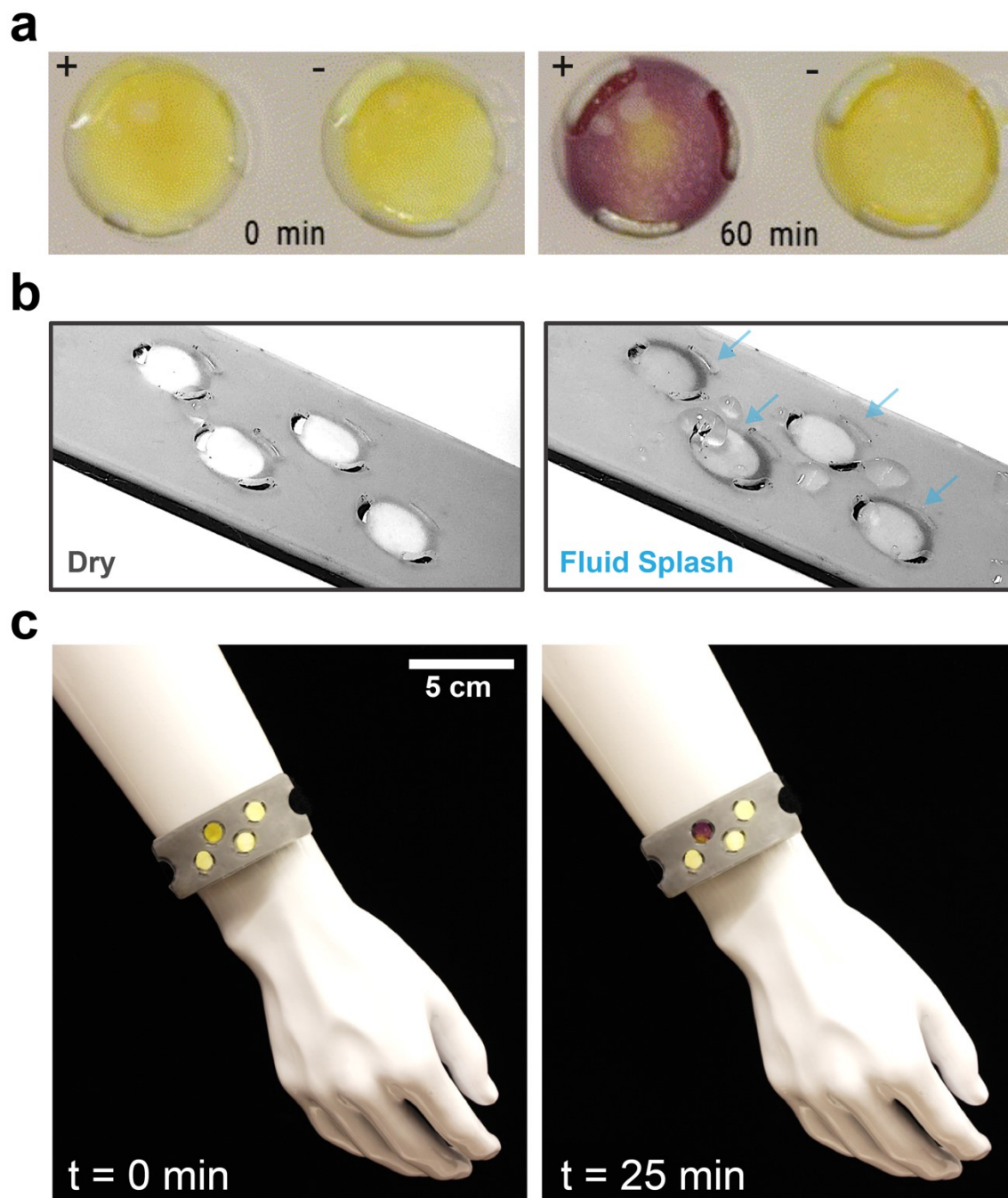
| Variable                   | qPCR                  | Microarrays/<br>Fluorescent<br>barcodes | Next<br>Generation<br>Sequencing<br>(NGS) | Fluorescence<br>In Situ<br>Hybridization<br>(FISH) | Toehold<br>switches     | SHERLOCK<br>/<br>DETECTR | wFDCF<br>(This work)                                                                                      |
|----------------------------|-----------------------|-----------------------------------------|-------------------------------------------|----------------------------------------------------|-------------------------|--------------------------|-----------------------------------------------------------------------------------------------------------|
| <b>Cost<br/>(USD)</b>      | \$0.85                | \$250.00                                | \$23.00                                   | Expensive                                          | Low-Cost                | Low-Cost                 | Low-Cost<br>(~\$100 USD<br>for reusable<br>portable<br>spectrophotom<br>eter + ~\$1<br>USD per<br>sensor) |
| <b>Ease of<br/>Use</b>     | Trained<br>Specialist | Trained<br>Specialist                   | Trained<br>Specialist                     | Trained<br>Specialist                              | Trained<br>Specialist   | Trained<br>Specialist    | Autonomous<br>Functioning                                                                                 |
| <b>Readout</b>             | Fluorescence          | Fluorescence                            | Fluorescence                              | Fluorescence                                       | Visual/<br>Fluorescence | Visual/<br>Fluorescence  | Visual,<br>Fluorescence,<br>Luminescence<br>and Digital                                                   |
| <b>Sensitivity</b>         | aM                    | aM                                      | aM                                        | aM                                                 | fM                      | aM                       | aM                                                                                                        |
| <b>Time</b>                | ~3 Hour               | 1 Day                                   | >1 Day                                    | 4-16 Hour                                          | 1-4 Hour                | ~1-3 Hour                | 6 min - 2 Hour                                                                                            |
| <b>Multiplex</b>           | YES                   | YES                                     | YES                                       | YES                                                | YES                     | YES                      | YES                                                                                                       |
| <b>Wearable<br/>Format</b> | NO                    | NO                                      | NO                                        | NO                                                 | NO                      | NO                       | YES                                                                                                       |



**Figure S1. Wearable biosensors using freeze-dried synthetic biology circuits.** Wearable freeze-dried cell-free implementation shown at different scales. Key operating parameters are listed for each level. Freeze-dried cell-free reactions can be embedded in reaction sachets at the device level that are distributed throughout garments for use by warfighters, clinicians, and first responders. Upon exposure to an external splash, the reactions are rehydrated, activating dormant synthetic gene circuits that detect pathogens, metabolites, and toxins. The biosensor circuits are driven by lyophilization-compatible cell-free transcription and translation machinery or CRISPR ribonucleoproteins.

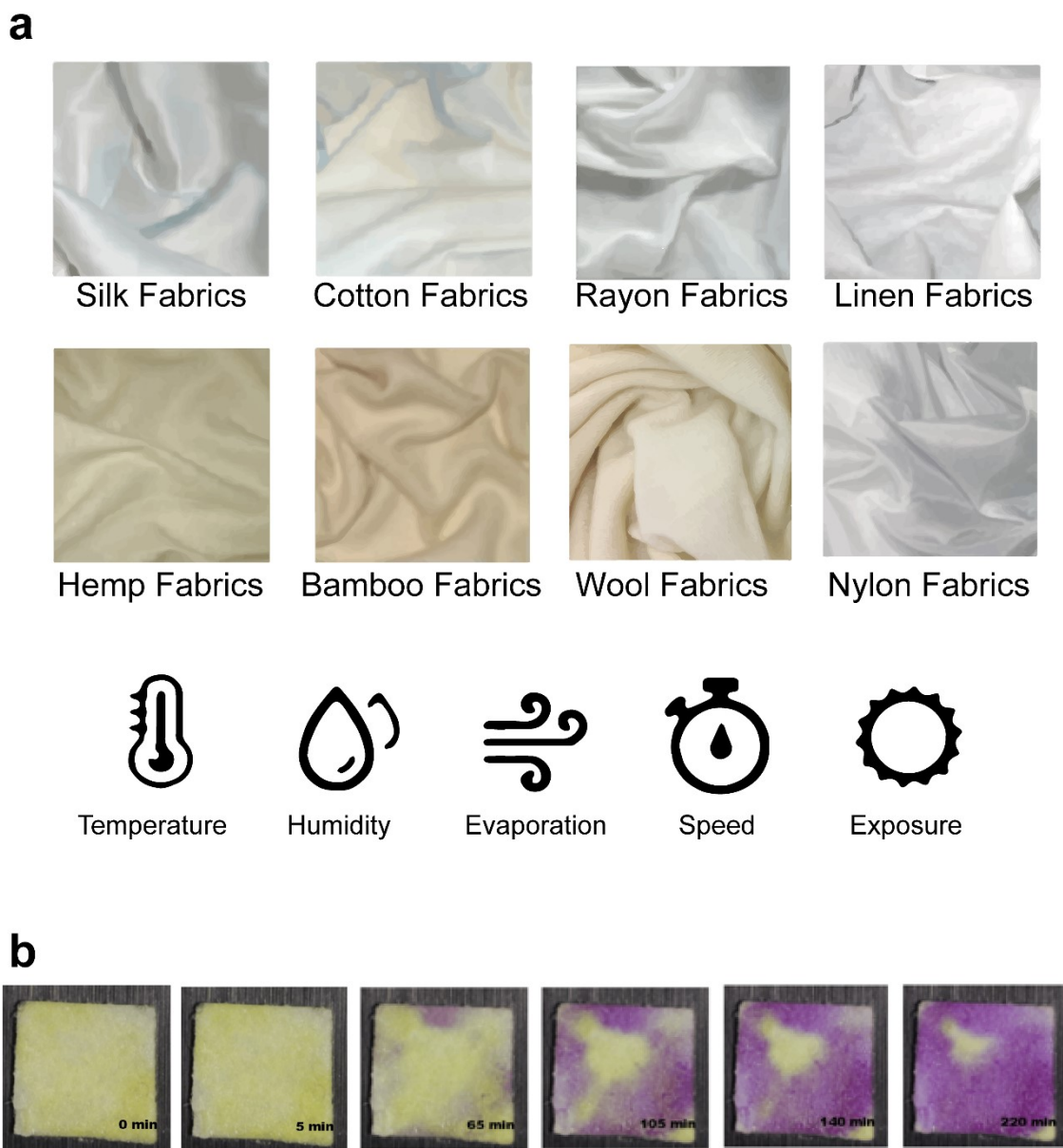
**a****b**

**Figure S2. Assembly layers and sample activation of colorimetric wFDCF reactions with constitutive  $P_{T7}::LacZ$  module.** **a**, The layout of elastomer layers in the colorimetric wFDCF device. **b**, Activation of colorimetric prototype wells using 40 ng/ $\mu$ L constitutive LacZ-T7 plasmid in a 50  $\mu$ L rehydration splash as compared to rehydration with no plasmid. After complete rehydration, PURExpress reactions were conducted at 1.5x concentration. All the reactions were incubated at 30°C and were exposed to the ambient environment. Images were taken every 5 minutes. Each row shows a representative single-well reaction.

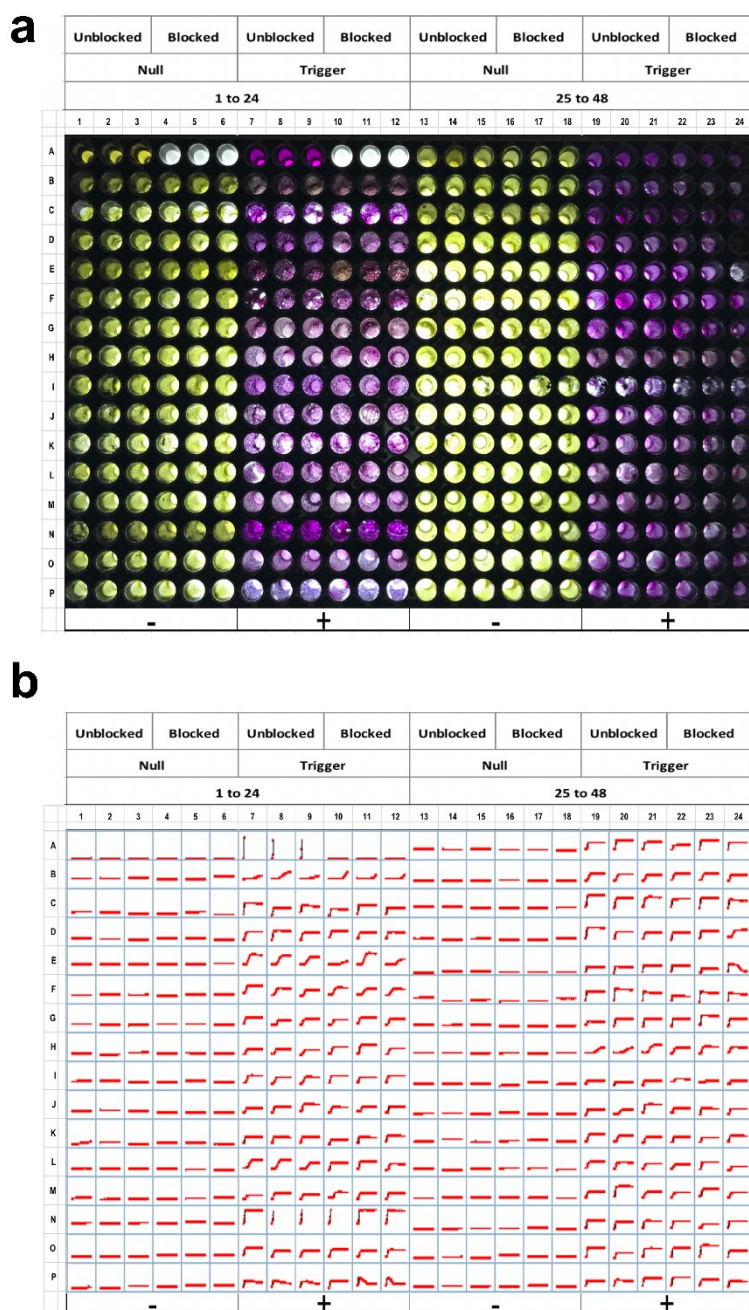


**Figure S3. Sample activation of wFDCF colorimetric devices and bracelet for detection of Ebola virus RNA.** **a**, Activation of colorimetric Ebola virus DNA toehold wFDCF sensor using a 50  $\mu$ L splash of dd-H<sub>2</sub>O sample containing 300 nM Ebola RNA trigger as compared to control (t = 60 min). **b**, Port wicking into sachets containing reaction disks using dd-H<sub>2</sub>O fluid splash. Rehydrated paper disks are visibly darker after fluid entry and wicking into the substrate (t = 1 sec after splash). **c**, Activation of the wearable colorimetric bracelet with four independent Ebola virus DNA toehold sensors (t = 25 min). Color change in activated sensor disk is distinguishable within 25-60 min after rehydration, as compared to surrounding controls.





**Figure S4. Textile substrate compatibility testing using synthetic biology reactions and sample colorimetric reaction. a,** Samples of eight fabric types selected as part of the textile screening for wFDCF compatibility. Bottom icons indicate the environmental and hydration conditions that were monitored over time for analysis. **b,** A sample wFDCF colorimetric activation in a 1 x 1 cm cellulose matrix square containing 75  $\mu$ L of NEB cell-free PURExpress® in vitro protein synthesis solution (New England Biolabs, Inc., Ipswich, MA) with 40 ng/ $\mu$ L constitutive pJL1-LacZ plasmid.



**Figure S5. Textile screening using model constitutive  $P_{T7}::LacZ$  assay.** **a**, A sample 384-well plate containing triplicates of BSA blocked and unblocked 2 mm discs of 30 different textile types after constitutive  $P_{T7}::LacZ$  expression following a 12-hour run for reactions containing 1.8  $\mu\text{L}$  of NEB cell-free PURExpress® in vitro protein synthesis solution (New England Biolabs, Inc., Ipswich, MA) with 40 ng/ $\mu\text{L}$  constitutive pJL1-pLacZ plasmid (+) or without plasmid as controls (-). **b**, Examples of qualitative traces of colorimetric signals for these different fabric disks using a plate spectrophotometer (420 nm absorbance). While the traces shown here are not normalized across all samples, the increase in signal per cell indicates a color change from yellow to purple. Normalized absorbance values were calculated and used for subsequent analyses.



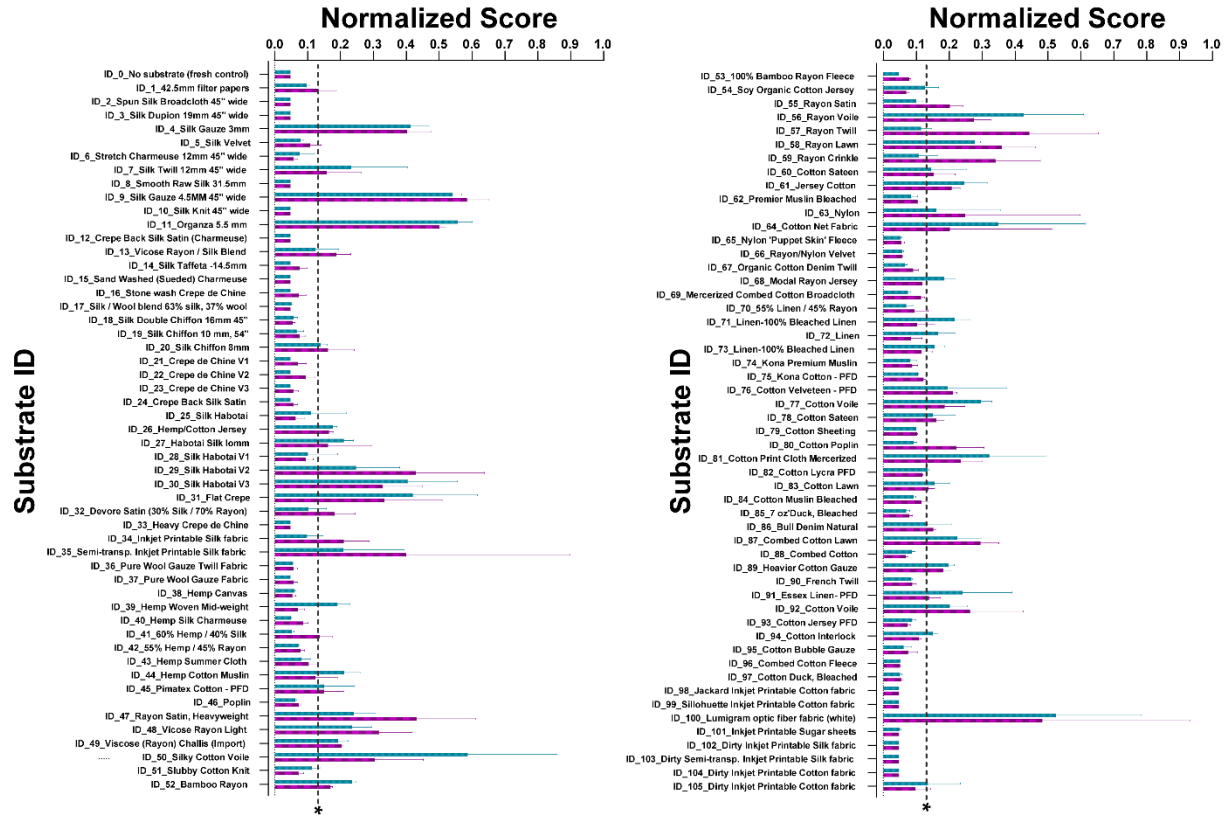
## Normalized FDCF Fabric Aggregated Functionality Scoring

Score = Average (A, B, C, D, E, F)

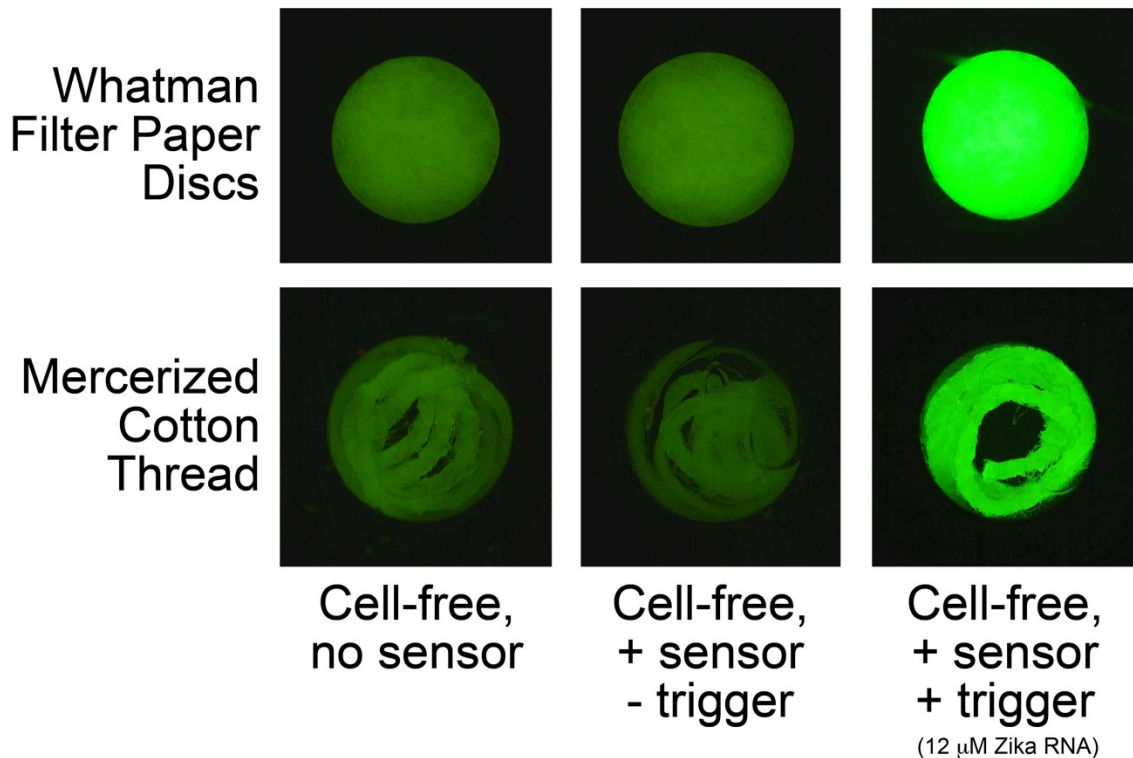
A = Normalized FDCF LacZ Colorimetric Intensity in Fabric  
B = Normalized Max FDCF LacZ Reaction Rate in Fabric  
C = Normalized Time to Max FDCF LacZ Reaction Rate in Fabric  
D = Normalized Lag Time of FDCF LacZ Reaction Rate in Fabric  
E = Normalized In-Fabric Fiber Density  
F = Normalized In-Fabric Autofluorescence Intensity

--- \* Grade 4 Whatman Filter Paper Disc Score

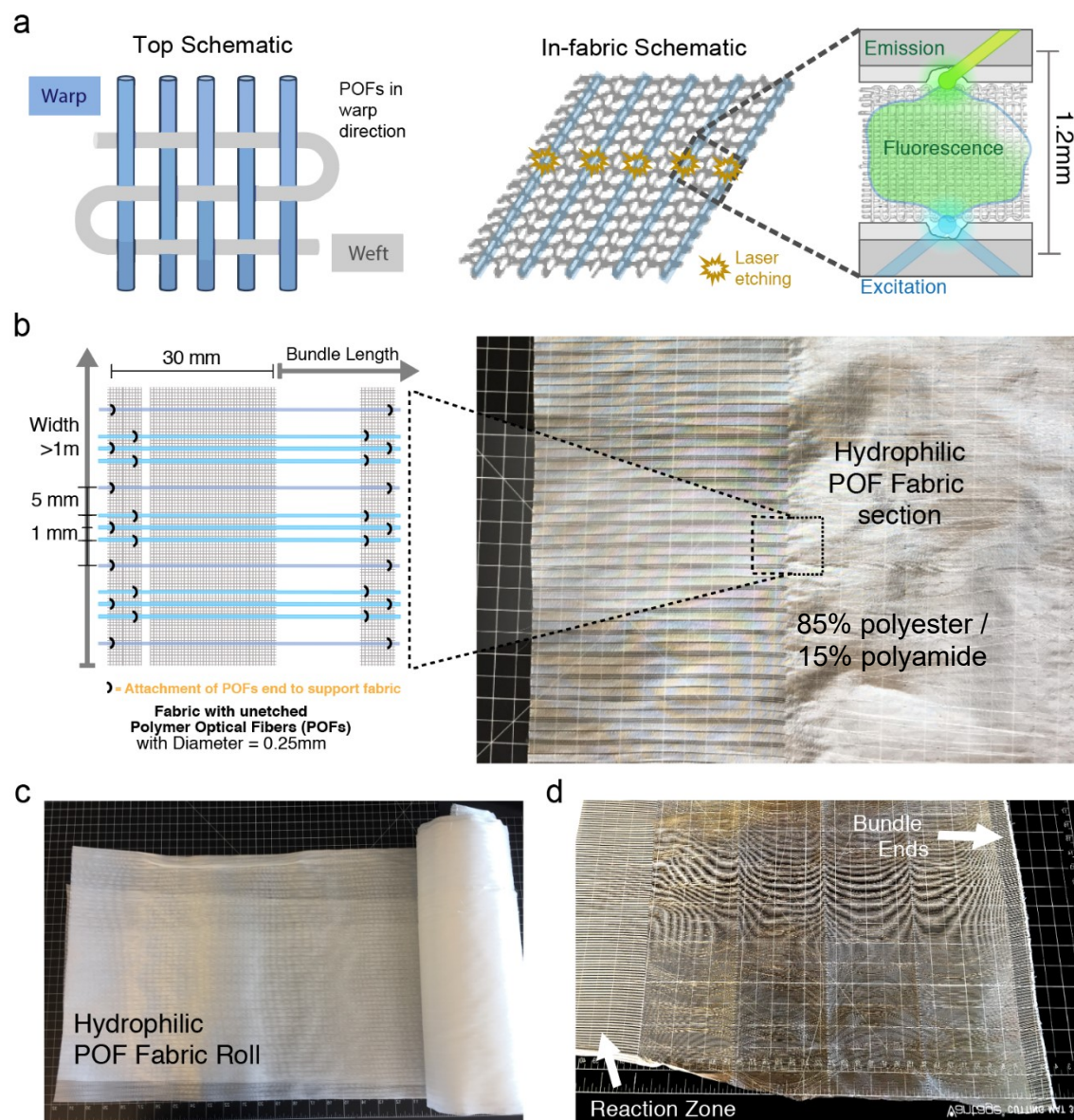
Unlocked  
5% BSA Blocked



**Figure S6. Compilation of normalized functional scoring for colorimetric wFDCF textile screening.** A normalized functionality score was calculated for each of the 103 evaluated fabrics tested for compatibility with freeze-dried PURExpress reaction generating a LacZ output. This score was generated by measuring six key parameters: peak absorbance intensity at 420 nm, reaction rate, time to maximum signal, lag-time, fabric fiber density and in-fabric autofluorescence, and then multiplying normalized scores for each of these measurements, penalizing longer times to maximum signal, long lag-times and high autofluorescence. Dotted line indicates aggregated score value for Whatman No. 4 filter paper. The highest average score was observed in fabric ID#:100 containing 85% Polyester / 15% Polyamide fibers.

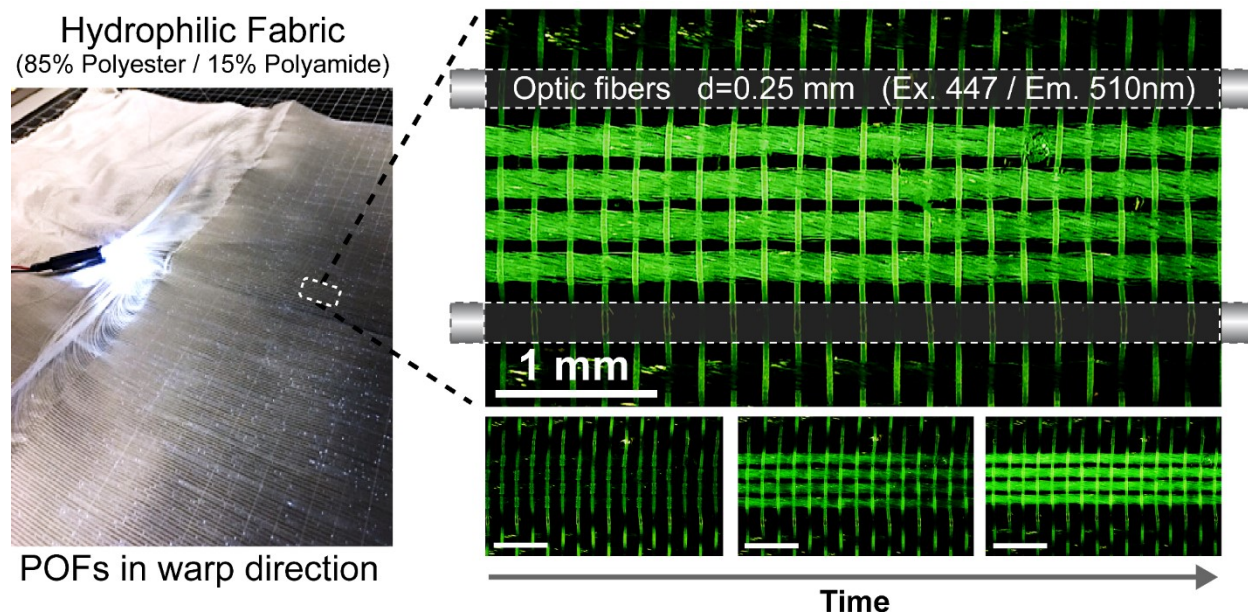


**Figure S7. Zika DNA toehold sensor activation in single mercerized cotton thread.** **a**, Sterile mercerized cotton threads ( $d = 0.2$  mm,  $L = 1$  cm) taken from a Dukal<sup>TM</sup> Gauze pad (Dukal Corp., Ronkonkoma, NY) were coiled and deposited into single wells of a flat 384-well black polystyrene plate with a clear glass bottom (Corning Inc., Kennebunk ME). Thread samples were wicked with 2  $\mu$ L of a solution containing 1x Cell-free PURExpress<sup>®</sup> in vitro protein synthesis solution (New England Biolabs, Inc., Ipswich, MA), adding 33 nM Zika DNA toehold sensor 27B (sfGFP) for sensing. Samples were frozen using liquid nitrogen and lyophilized for 4 hours. For testing, 2  $\mu$ L of dd-H<sub>2</sub>O with 1.2  $\mu$ M of freshly made Zika RNA trigger was added to each of the freeze-dried samples, and fluorescence was assessed after 60 minutes under a fluorescence digital microscope Dino-Lite Edge AM4115T-GFBW (Dunwell Tech, Inc., Torrance, CA). These reactions were compared to those occurring in 2 mm disks of Whatman<sup>TM</sup> No. 4 filter paper (GE Healthcare Lifesciences Inc., Chicago, IL). Zika RNA trigger appears to produce a higher fluorescent signal as compared to PURExpress reactions containing no template and reactions with sensor template but with no trigger.

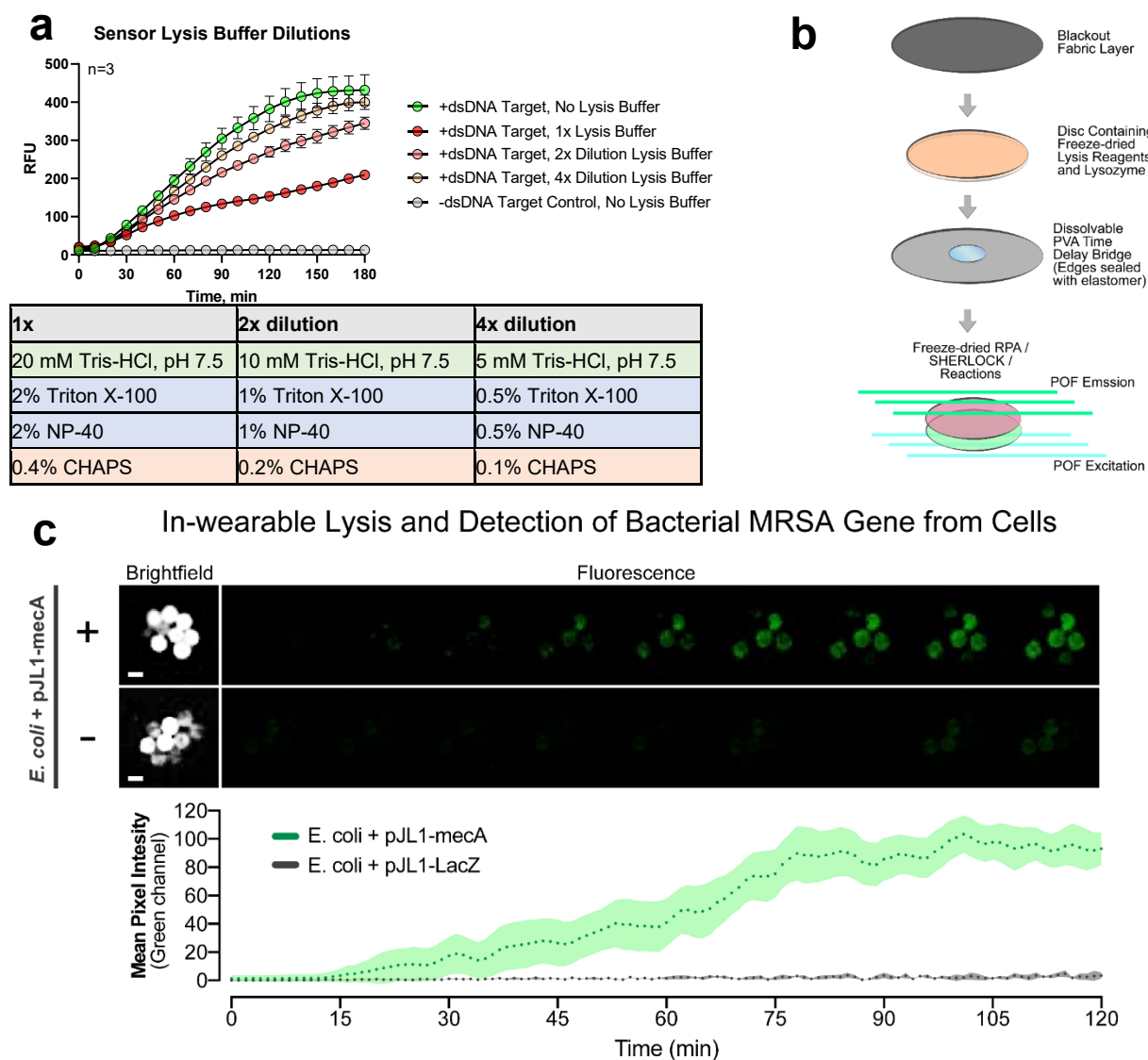


**Figure S8. Fabrication of polymeric optical fiber (POF) fabric for wFDCF.** **a**, Clean 0.2 mm hydrophilic yarns made of 85% polyester and 15% polyamide were weaved in VELO style along the weft in combination with 0.25 mm un-etched poly(methyl methacrylate) POFs as warp using a standard industrial loom via Dreamlux's process (Samsara S.R.L., Milan, IT). When etched in specific regions, the cladding of POFs can be disrupted to allow for efficient excitation and emission signal collection from fluorescent or luminescent samples rehydrated within the hydrophilic fibers of the fabric. **b**, A three-fiber multi-strip design was achieved with a POF pitch of ~1 mm and intermediate POFs at 5 mm from the strip center for easy cutting. The reaction zone was cut to be ~30 mm in length. The width of the fabric roll was arbitrary, usually above 1 m depending on the used loom. Free POFs can then be detached from the un-weaved side to be bundled together. **c**, A roll of the hydrophilic POF fabric after weaving. **d**, A cut section of the hydrophilic POF fabric with indications in reaction zone and bundle ends.

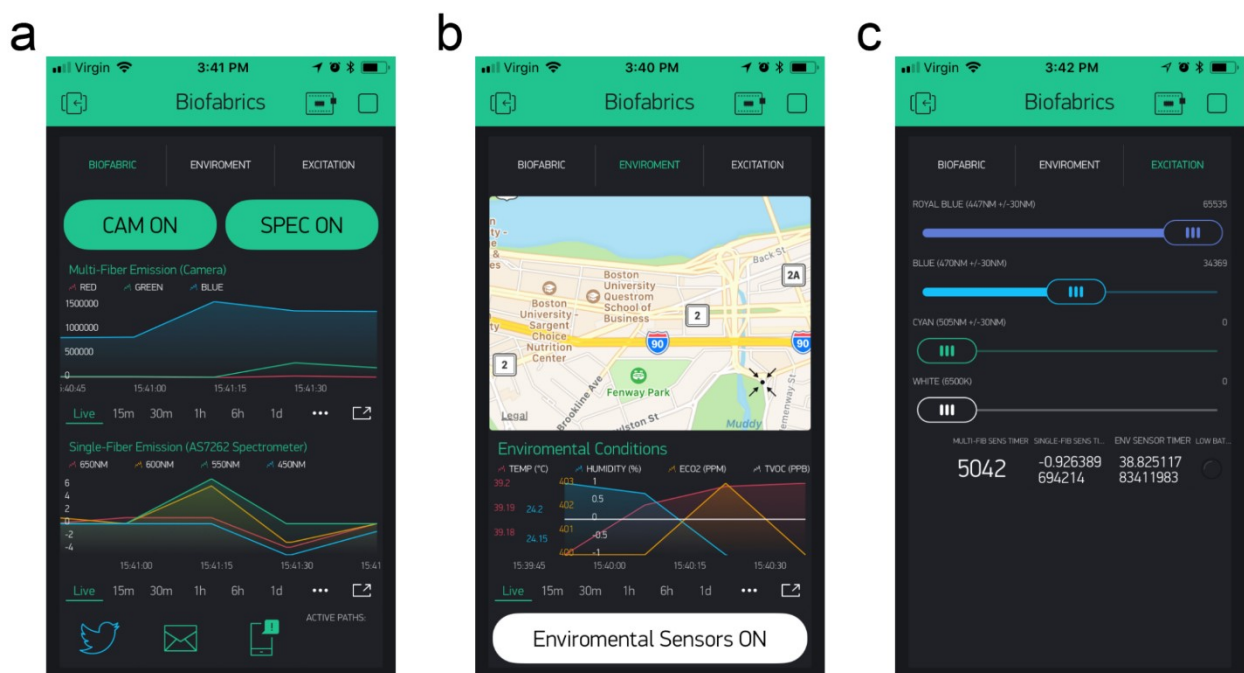




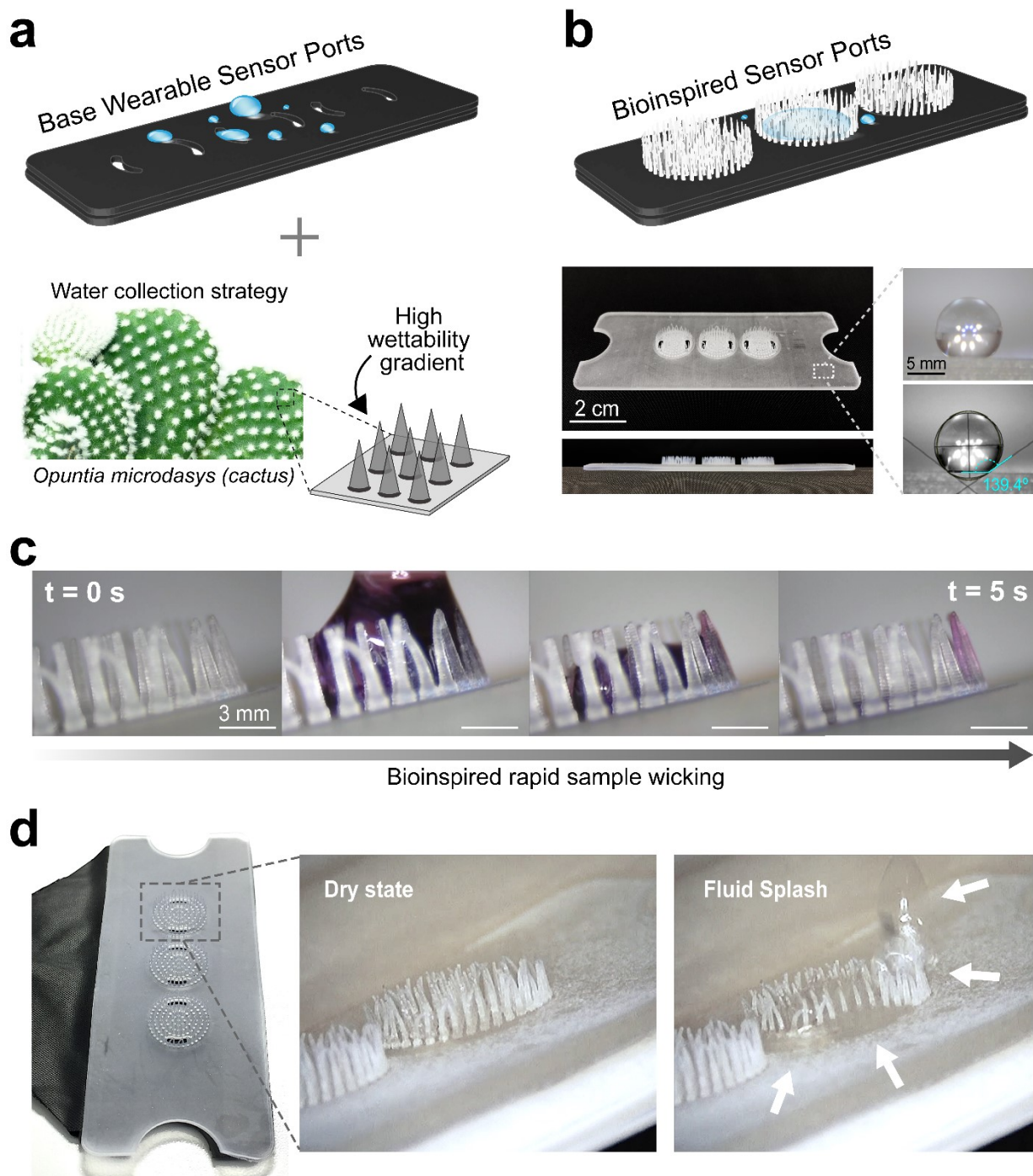
**Figure S9. POF fabric compatibility with lyophilized transcription-only fluorescent aptamer reactions.** POF fabric treated to eliminate RNases was lyophilized with a fluorescent aptamer reaction containing pJL1-F30-2xd-Broccoli aptamer template and an in vitro transcription reaction (HiScribe™ T7 Quick High Yield RNA Synthesis Kit; NEB, Ipswich, MA). The lyophilized in-fabric sensors were activated by rehydration with a fluid splash of dd-H<sub>2</sub>O spiked with 50  $\mu\text{M}$  of the substrate (5Z)-5-((3,5-Difluoro-4-hydroxyphenyl)methylene)-3,5-dihydro-2-methyl-3-(2,2,2-trifluoroethyl)-4H-imidazol-4-one (DFHBI-1T; Tocris Bioscience, Minneapolis, MN). Upon rehydration, the in vitro transcription reaction generates an RNA aptamer that binds to the DFHBI-1T substrate, generating fluorescence.



**Figure S10. Integrated wFDCF sample lysis.** **a**, Detergent combinations for cellular lysis were tested against CRISPR-Cas12a SHERLOCK reactions. Shown are reactions for the SARS-CoV-2 SHERLOCK sensor tested in various detergent dilutions. Based on these results, the 2x dilution was chosen as the optimal lysis buffer. For bacterial samples, the lysis buffer was supplemented with 100  $\mu\text{g/mL}$  of lysozyme for dissolving peptidoglycan and 5% sucrose to create a hyperosmotic environment. Plot values are mean  $\pm$  s.d. from  $n=3$  independent SHERLOCK reactions for 5 different conditions performed in a microplate assay. **b**, For testing of in-device lysis, two elements were added to the fluorescent wFDCF devices - an additional substrate insert containing lyophilized optimized lysis reagents and a PVA time delay to enable sufficient lysis incubation. **c**, In-wearable wFDCF *mecA* sensors containing the lyophilized lysis buffer and PVA time delay were challenged with intact *E. coli* cells either containing the target *mecA* gene (+, top images) or a negative control plasmid (-, bottom images). The plot shows mean pixel intensity calculated as described in the methods for  $n=9$  optical fibers for three independently fabricated wFDCF devices. The data is shown as mean (dark dotted line)  $\pm$  s.d. (light colored region). Scale bars for images of fiber optic ends is 250  $\mu\text{m}$ .



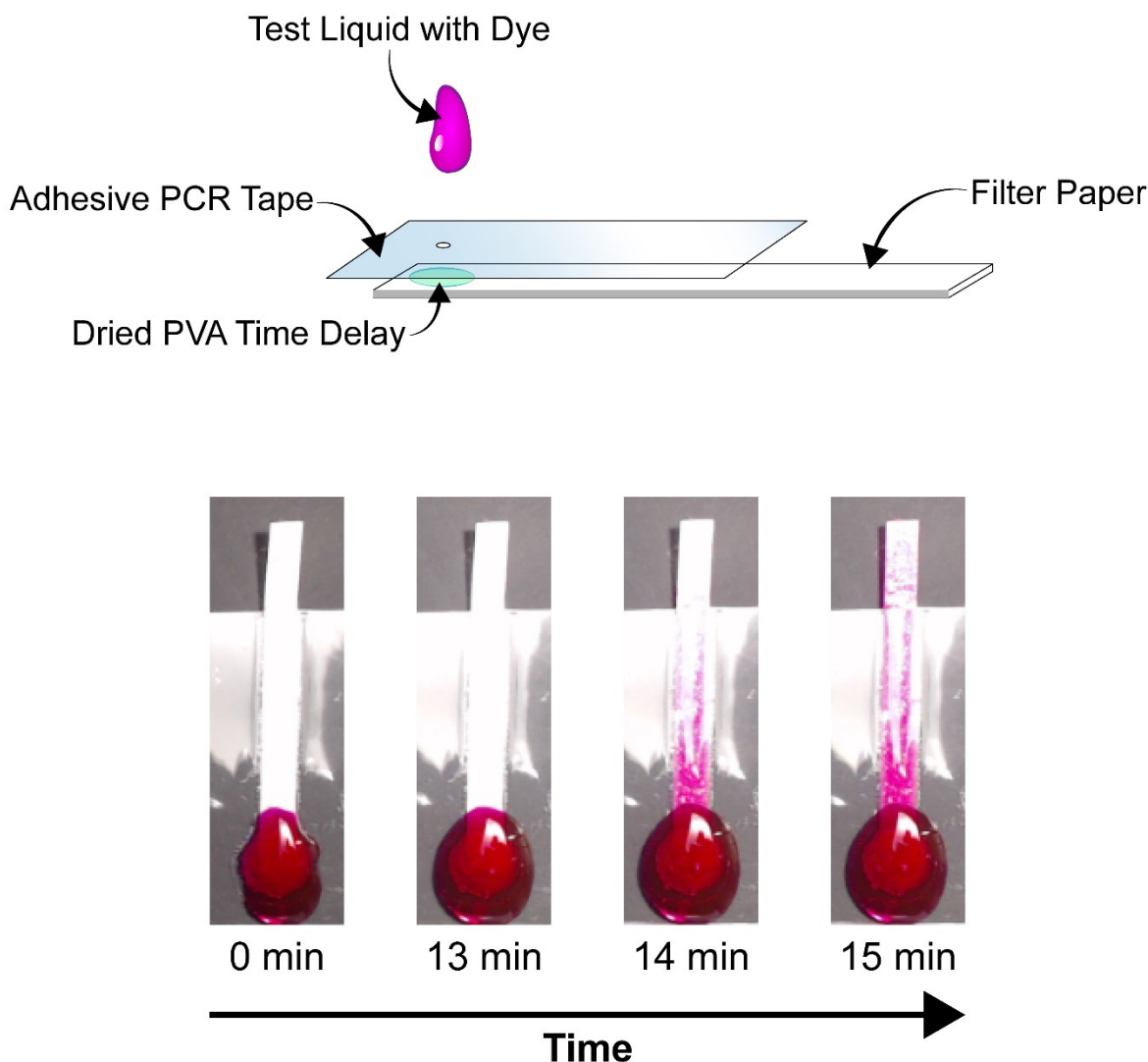
**Figure S11. Custom mobile application software.** **a**, Main window of the developed wFDCD sensor mobile application "Biofabrics" where spectrographic measurements are continuously recorded. Display graphs show independent color channels and bottom icons alert features such as Twitter, email, or messaging as a method of alarm in case of sensor activation. **b**, Environmental window of the mobile application shows geolocation information as well as recorded measurements of temperature (°C), humidity (%) and CO<sub>2</sub> (PPM). **c**, Excitation window of the application allows on-the-fly user adjustment of the LED illumination parameters of the four Luxeon Star LEDs installed in the wFDCF device using a Saber Z4 Color Mixing Array (Quadica Developments Inc., Lethbridge, Alberta). LEDs included in the current device were: 447nm, 470nm, 505nm, and 6500K white. This mobile application was developed using blynk.io (Blynk Inc., New York, NY) and the Raspberry Pi communication module. All generated data were recorded in the internal local memory of the wearable device and this application for analysis.



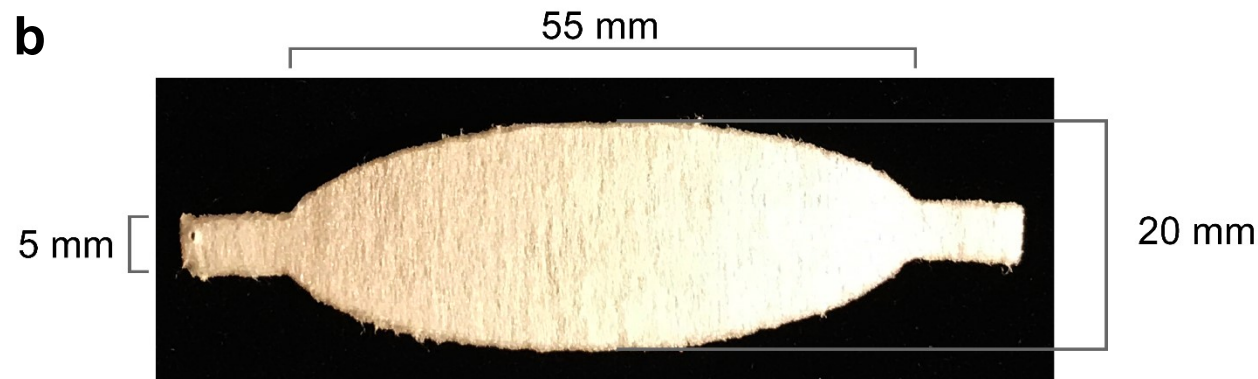
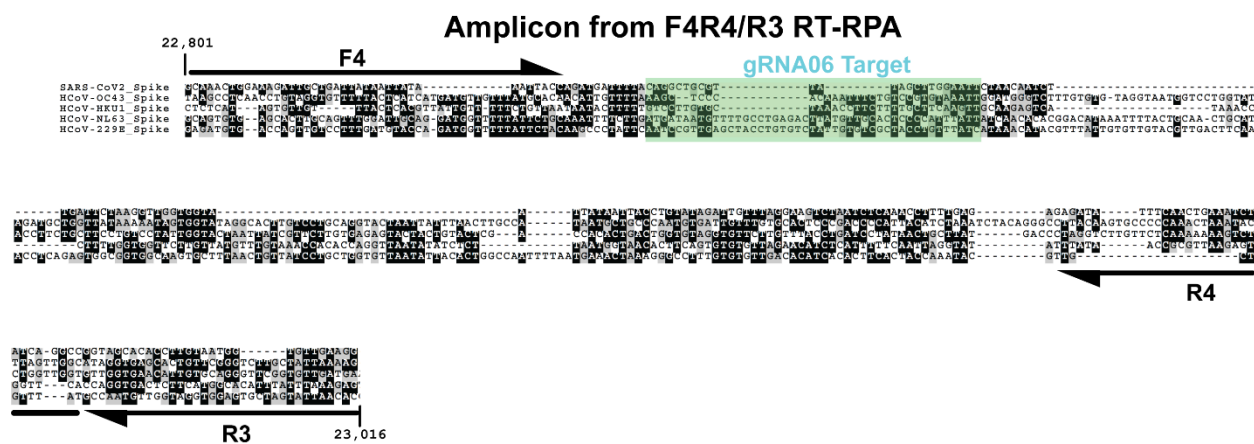
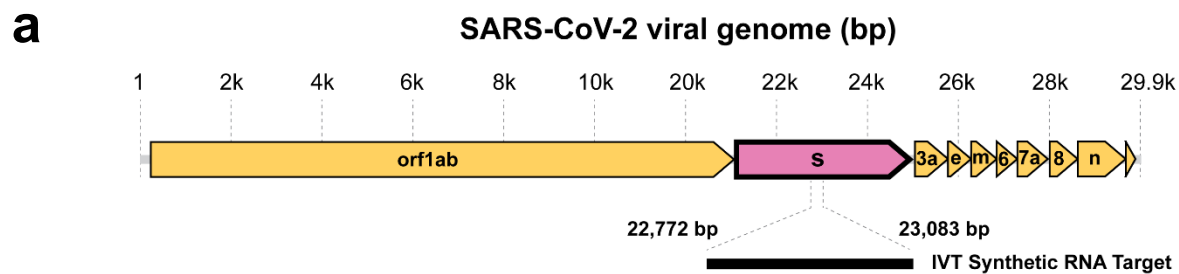
**Figure S12. Bioinspired sample-wicking for textile-based wFDCF synthetic biology devices.** **a**, Schematic of the base cover presented for the textile-based wFDCF synthetic biology devices, as well as the underlying biomechanical mechanism of water collection at the areoles of the bunny ears cactus, *Opuntia microdasys*<sup>5,6</sup>. The high aspect ratio and agglomeration of spikes in these areoles, known as glochids, provide a high wettability gradient, which pins fluid for rapid

absorption. **b**, Modified cover for our textile-based wFDCF synthetic biology devices with *Opuntia*-inspired wicking ports. The cover features 3D-printed conical spikes (1 mm base diameter) with an aspect ratio of 1:5 arranged concentrically with 1 mm spacing. The cover was fabricated using an elastic photoreactive resin and a stereolithography 3D-printing method using a Form 2 printer (Formlabs Inc., Sommerville, MA), coated with NeverWet© superhydrophobic coating (NeverWet LLC., Lancaster, PA). Contact angle measurements to confirm hydrophobicity of cover surfaces is also shown. **c**, Five-second time-lapse of the fluid pinning and port wicking exhibited by the device. This demonstration shows that upon fluid splash over the device, fluid rolls through superhydrophobic regions until they encounter the bioinspired ports, which readily pin the fluid, drawing it down into the underlying absorbent fabric layers inside the reaction chamber. **d**, A photograph of an assembled textile-based wFDCF synthetic biology device including the bioinspired port. Images before and after fluid splash are also shown to evince behavior.



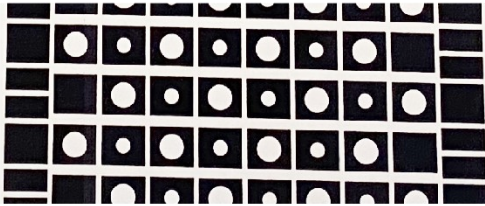


**Figure S13. Polyvinyl Alcohol (PVA) time delays for optimized multi-stage wFDCF Reactions.** PVA fluidic time delays allow for wearable multi-stage reactions to occur rather than one-pot lyophilized reactions. Testing of the PVA time delays was performed by applying various PVA mixtures to filter paper, allowing to fully dry overnight, covering with impenetrable PCR tape where a 6 mm hole was punched through and aligned directly on top of the dried PVA region. A test aqueous dyed liquid was applied and PVA dissolution and wicking into the filter paper was monitored over time. A representative experiment is shown using a 50  $\mu\text{L}$  dried time delay consisting of  $\sim 67,000$  MW PVA (Millipore-Sigma, St. Louis, MO) that allows for a time delay of  $\sim 15$  minutes. For the A-version sensors, 20% (w/v) PVA was used. For the B-version sensors, this was reduced to 18% (w/v) to allow more facile pipetting. No substantial change in delay time was noticed between the 18% and 20% delays.

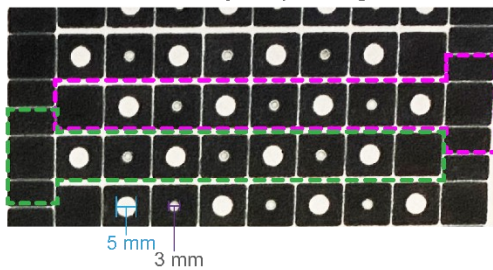


**C**

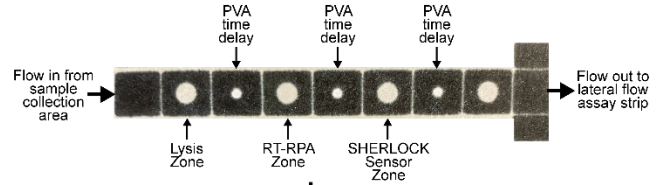
1. Wax printed patterns for multiple  $\mu$ PADs.



2. After wax reflow by hot pressing.



3. Individual  $\mu$ PADs arrays are cut from each sheet.



4. PVA time delays are applied and dried overnight.



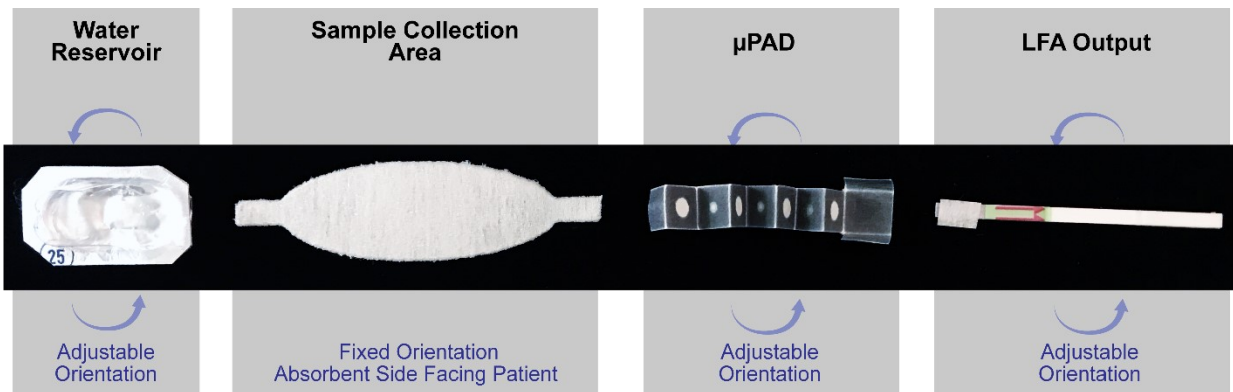
5. Lysis, RT-RPA, and SHERLOCK reactions are pipetted onto zones, snap-frozen, and lyophilized.

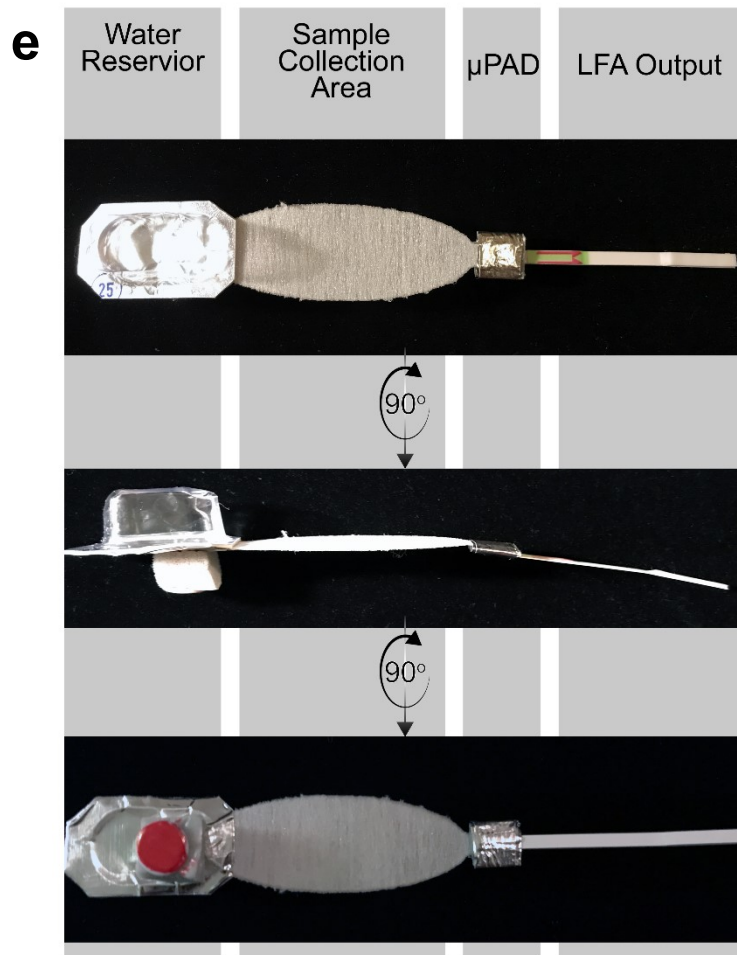


6.  $\mu$ PADs are folded to overlap all zones on one axis..



**d**





**f**



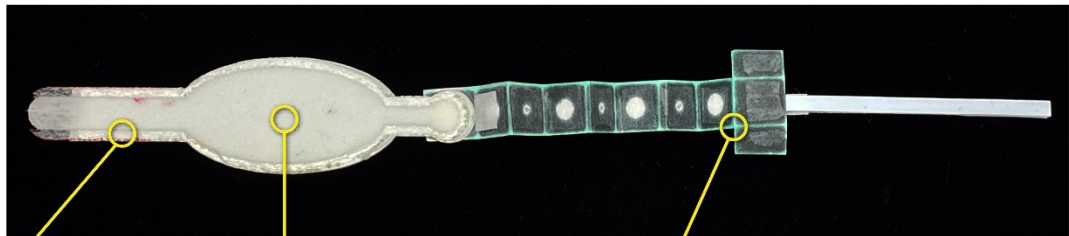
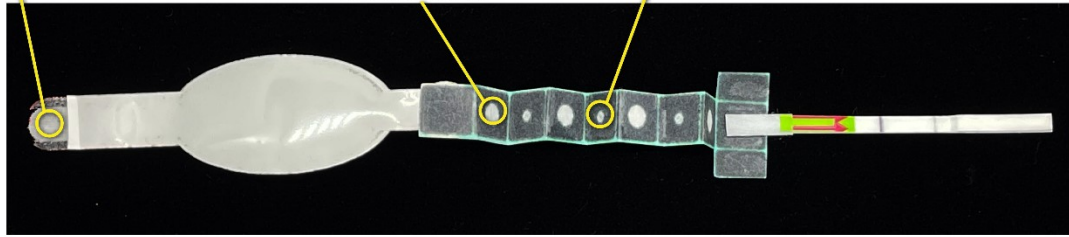
**Figure S14. SARS-CoV-2 face-mask diagnostic A-version sensor design and construction.**

**a**, SARS-CoV-2 genomic region targeted by the RT-RPA and SHERLOCK sensor utilized in the face-mask diagnostic of our A-version sensors, used for the experiments shown in Figure 4d-g. Our Cas12a gRNA sensor targets a region (highlighted in green in the multiple sequence alignment) in the Spike protein gene between 22-23k of the SARS-CoV-2 region. An *in vitro* transcribed RNA portion of the SARS-CoV-2 genome corresponding to 22,772:23,083 was generated from a synthesized DNA fragment and used in testing. The multiple sequence alignment shows the aligned homologous regions from SARS-CoV-2 and the three circulating human coronavirus strains (OC43, HKU1, NL83, and 229E). The sequence alignment was generated using Clustal Omega (EMBL-EBI) and BoxShade (SIB Swiss Institute of Bioinformatics). The shown region corresponds to the amplicon generated from RT-RPA with the F4/R4/R3 primer mix. The sequences for the gRNA, *in vitro* transcribed RNA targets, and RT-RPA primers are presented in Supplementary Table S2. **b**, Laser-cut sample collection pad from capillary wicking material. A polymeric wicking material was laser-cut with a large sample collection area (55 x 20 mm) that will be positioned inside of the mask to collect respiratory droplets and aerosols for virus detection. **c**, Images of the  $\mu$ PAD construction. Steps for construction the  $\mu$ PAD device portion of the sensor: (1) A solid wax printer is used to print an array of  $\mu$ PADs on filter paper. (2) The printed wax pattern is refluxed by application of a hot press, to fully allow the wax to penetrate the filter paper. (3) The individual  $\mu$ PADs are cut from each sheet. (4) Then, polyvinyl alcohol is added to the time delay zones and allowed to dry at room temperature overnight. (5) Fresh lysis reagents, RT-RPA reactions, and Cas12a SHERLOCK reactions are applied to their respective reaction zones; the  $\mu$ PAD is lyophilized for a minimum of 4 hours. (6) After lyophilization, the  $\mu$ PAD is folded using RNase-free tweezers to overlap the reaction zones. **d**, Components of the face-mask sensor before assembly. From left to right, the water blister allows for user-activation of the rehydration reaction. The sample collection area absorbs viral particles from the patient. The  $\mu$ PAD contains the freeze-dried nucleic acid test sensor reactions, separated by PVA time delays. Finally, a lateral flow assay generates a visual output based on Cas12a-based cleavage of a FAM-Biotin probe. The orientation of the water blister reservoir,  $\mu$ PAD, and LFA components can be adjusted provided the fluidic contacts are properly maintained. These components can also be either placed on the outside or the inside of the face mask. Due to operational requirements, the sample collection pad requires an orientation with the Porex surface facing the patient, and can only be positioned on the inside of the mask. **e**, Fully assembled sensor. **f**, Demonstration of sample flow through face-mask sensor. Bromophenol blue dye was spotted at random locations throughout the sample collection zone. Upon hydration from the reservoir, a sample front can be clearly seen sweeping across the sample zone and into the  $\mu$ PAD. **g**, In order to preserve patient confidentiality, the LFA strip for A-version sensors are oriented with the LFA indicator surface facing the mask to hide the output from external view. The clinician must pull the strip back to observe / record the results.



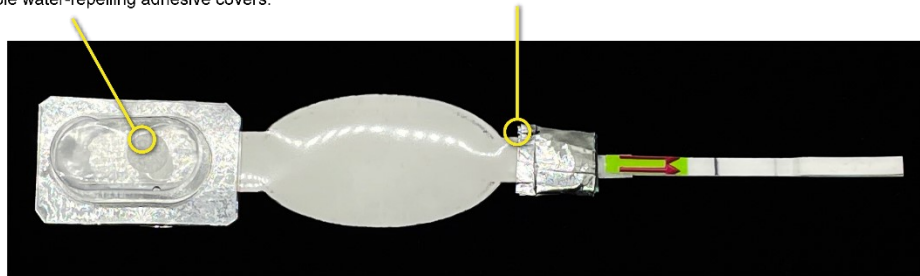
**a**

- 1 Reservoir connection area enlarged to ensure adequate flow to collection zone.
- 2 Borders of sample collection pad is rastered to fuse the Porex HRM fiber media with the PET backing material, eliminating delamination.
- 3 Porex HRM fiber media is cut with fibers parallel to the longitudinal axis of the sample collection pad. This increases flow speed.
- 4 Lysis buffer composition altered from A-version. Elimination of Triton X100 and lowering of NP-40 percentage prevents erosion of  $\mu$ PAD wax layers. CHAPS increased.
- 5 PVA time delays were adjusted to 18% (w/v), decreasing viscosity for more consistent application.
- 6 Border areas not containing wax are blocked using hydrophobic ink to prevent fluidic short-circuits during operation.



**b**

- 7 Venting holes were punched into the water blister reservoir to eliminate buildup of vacuum. The holes were overlaid with breathable water-repelling adhesive covers.
- 8  $\mu$ PAD area interfacing with the sample collection pad was tightly sealed to prevent unwanted fluidic short circuits.



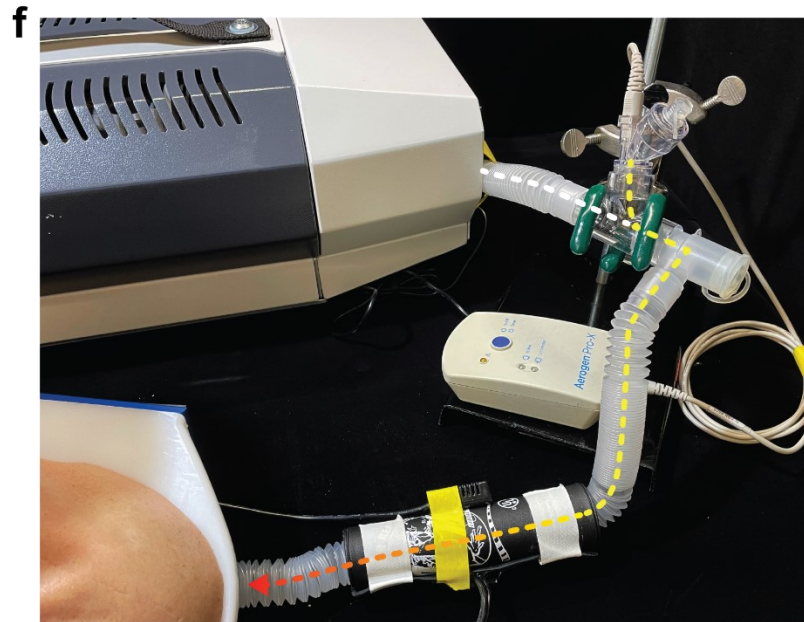
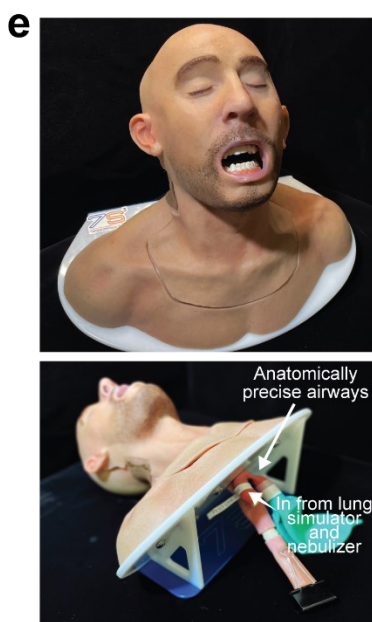
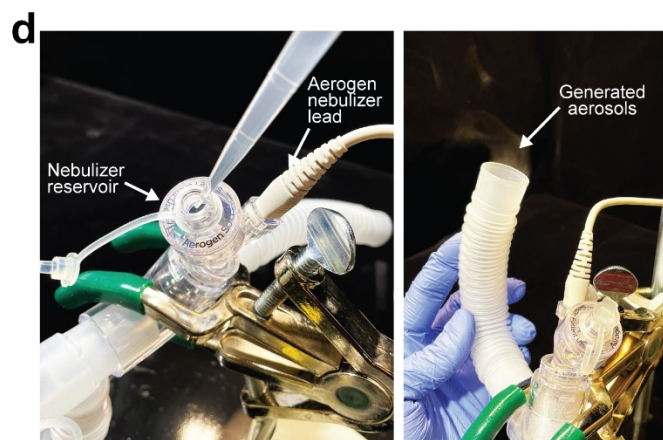
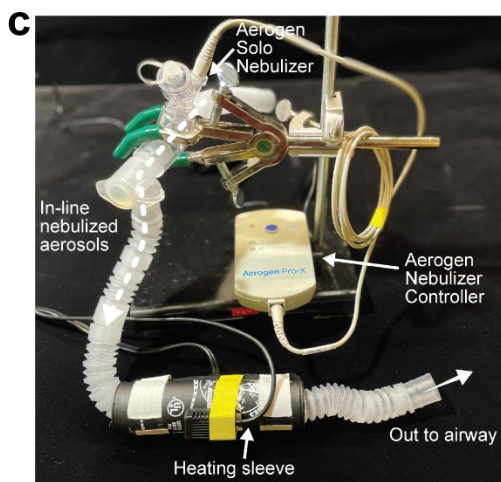
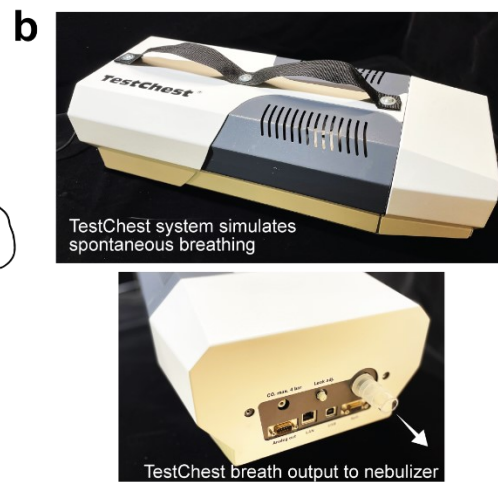
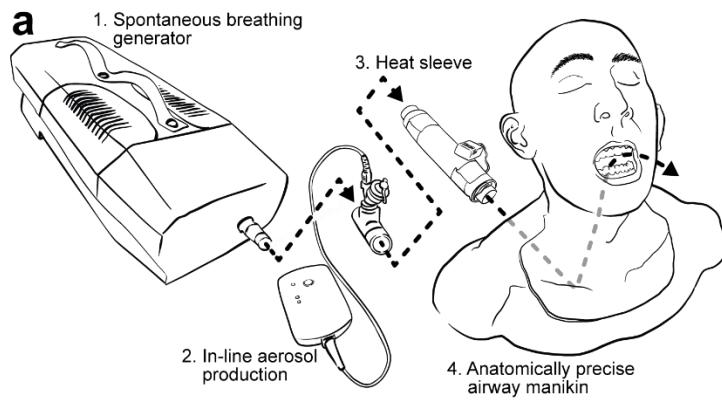
**c**



**Figure S15. SARS-CoV-2 face-mask diagnostic B-version sensor design and construction.**

The B-version of the SARS-CoV-2 face-mask sensors contain a number of improvements over the A-version sensors that optimize robustness and consistency. These sensors were used for the on-simulator mask experiments shown in Figure 4i-j. **a**, Sub-assembly consisting of the sample collection pad,  $\mu$ PAD (unfolded), and the LFA output strip, highlighting key differences between the B-version and A-version sensor components. **b**, Fully assembled B-version face-mask sensors with indicated changes from A-version sensors. **c**, A B-version sensor fully integrated into a face mask. The water blister reservoir is positioned as a flap on the outside of the mask, to prevent potential crushing of the blister while the mask is being worn.





**Figure S16. A breathing simulator for exhaled emission testing of the SARS-CoV-2 face-mask wearable diagnostic.** **a**, A schematic of the key modules used in the breathing simulator. Dotted lines indicate connecting airflow through the different modules via ventilation tubing connectors. **b**, To generate spontaneous breathing rhythms, the TestChest® (Organis GmbH, Switzerland) is a full physiologic artificial lung system that can accurately replicate pulmonary mechanics such as lung vital capacity and functional residual capacity. It allows the user to control the respiration rate and tidal volume to simulate complex breathing mechanics. **c**, The nebulizer and heating assembly. To simulate SARS-CoV-2 laden exhalation breath plumes, the Aerogen® Solo nebulizer system (Aerogen, Inc., Ireland) was used to generate aerosols in the simulated breath stream. The Aerogen® platform is a medical-grade inhalation medicine device that uses vibrating mesh technology. The Aerogen®-produced aerosols have a measured size distribution<sup>7</sup> (0.4 - 4.4 microns) that matches the size range of naturally occurring lung aerosols and droplets<sup>8</sup>. A self-regulating thermal pad sleeve was used to heat the simulated breath to maintain a face mask microclimate of 35°C. **d**, Photos of the nebulizer reservoir being filled (left) and the nebulized aerosols exiting the tubing (right). **e**, A high-fidelity anatomically precise airway manikin (7-SIGMA Simulation Systems, Minneapolis, MN), can simulate exhaled breath as it would exit physiologic airway structures and provides realistic fitment of the mask on a patient's face. **f**, A photograph showing the full air flow path from the TestChest® to the Aerogen® Solo nebulizer, through the heating sleeve, and connecting to the 7-SIGMA manikin.

## Supplemental References

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