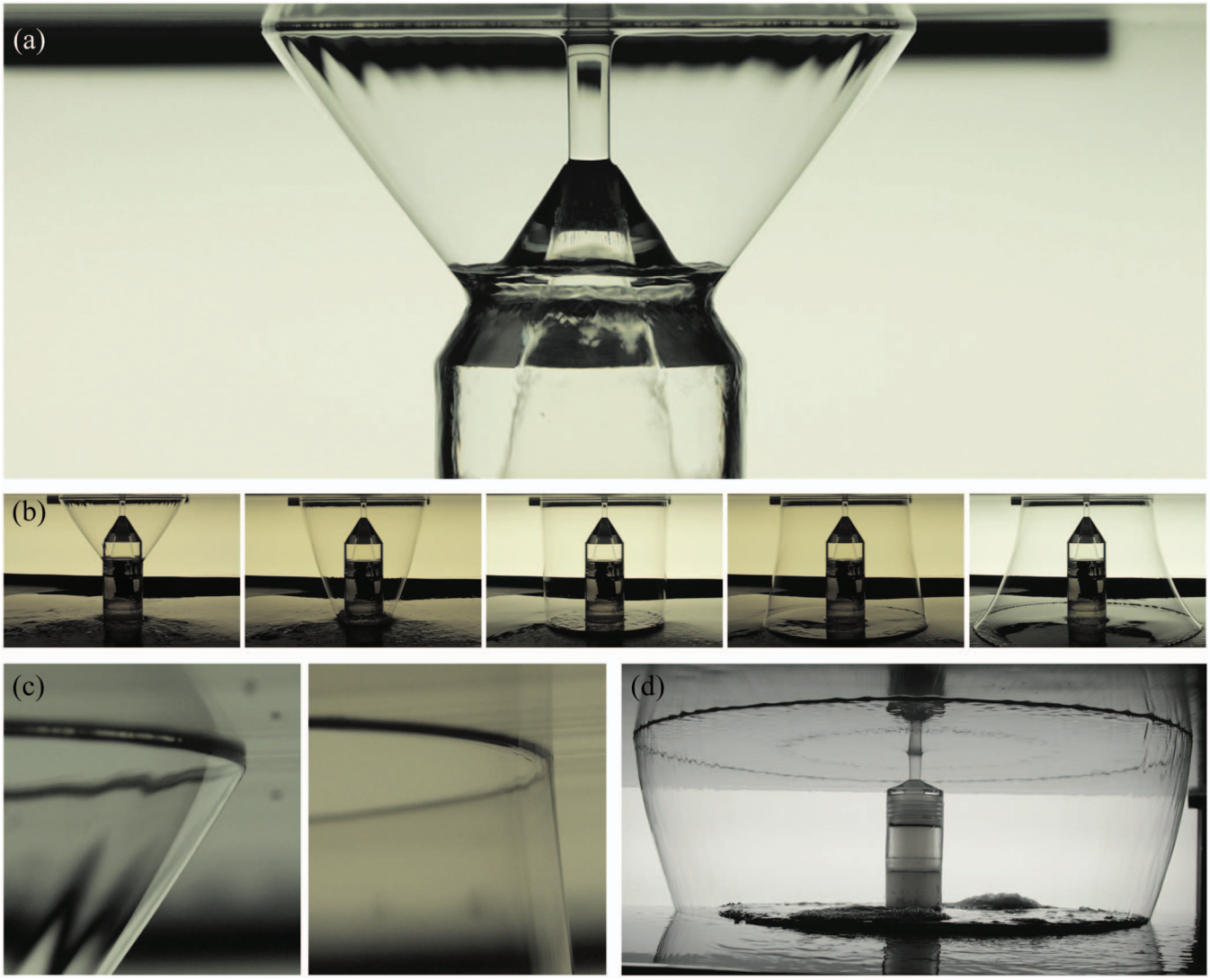

FIG. 1. (Color)

Water bells created from below

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We investigate the flows generated when a vertical liquid jet impinges on a large horizontal plate from below. Following impact, the liquid spreads radially as a thin film on the underside of the plate, and at a critical radius, it leaves the plate and descends as a continuous sheet. The sheet closes to form a water bell as shown in Fig. 1(a). The radius of departure from the horizontal plate is determined by dynamical considerations alone—the plate is quite smooth; there are no corners, edges, or asperities.

The shape of the water bell can be altered once it has been formed. Pumping additional air to the inside of the bell causes the surface to change dramatically. A series of bells created using this process is shown in Fig. 1(b). The bell expands radially at the base, and may form a perfect cylinder. Similar shapes can be obtained by changing the flow rate of the impinging jet after a water bell has been formed.

Figure 1(c) shows the sharp departure from the plate in two cases; the angle of departure varies widely. Finally, a large water bell is shown from below in Fig. 1(d). The diameter of this bell is approximately 50 cm.

For this study, water with surfactant and glycerol-water mixtures were used. This allowed for viscosities ranging from 1–120 cP. The fluid was pumped at flow rates of 3–20 L/min through a nozzle of radius 4 mm.

