Table S1: Comparison of power requirements for selected implantable devices. Data source: Medtronic Inc.

Model	Description	Voltage	Current	Battery Capacity	Estimated Life
Reveal DX	Insertable Cardiac Monitor	3.6 V	-	0.25 Ah	3 Yrs
Maximo	Single Chamber ICD	3.2 V	9.1 µA (pacing)	0.9 Ah	9 Yrs
Vitatron	Pacemaker	2.8 V	14.8 – 24.2 µA (pacing)	1.4 Ah	7-8 Yrs

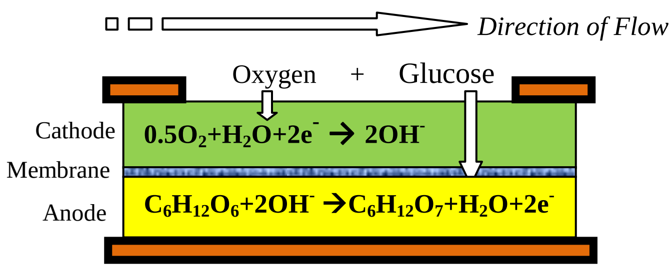

Figure S1: Schematic of iBFC

Anode: $C_6H_{12}O_6 + 2\ OH^- \rightarrow C_6H_{12}O_7 + H_2O + 2\ e^-$

Cathode: $0.5\ O_2 + H_2O + 2e^- \rightarrow 2OH^-$

Overall reaction: $C_6H_{12}O_6 + 0.5\ O_2 \rightarrow C_6H_{12}O_7$

$\Delta G^\circ = -2.51 \times 10^5\ J/mol;\ V^\circ = 1.30\ V$ [19]

Where ΔG° is the standard Gibbs Free Energy and V° stands for standard potential.

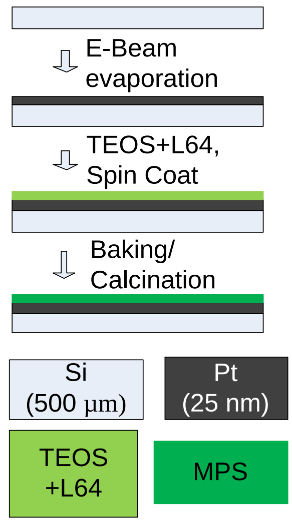

Figure S2: Fabrication procedure for preparation of Mesoporous Silica (MPS)

Table S2: Comparison of iBFC performance results with their components and operational conditions

Anode (µm)	Membrane (µm)	Cathode (µm)	Glucose concentration (% w/v)	Oxygen concentration (% w/v)	Max. Power Density (µW/cm^2)	Ref
Activated Carbon + 10% Pt	3% PVA-PAA (30 µm)	Activated Carbon	0.1%	Air	1.4	41
Activated Carbon + Pt-Bi (540 µm)	Polypropylene (90 µm)	Activated carbon (400 µm)	0.1 %	Air	3.5	42
Pt (25 nm)	Polypropylene (50 µm)	Activated Carbon (200 µm)	0.1%	Air	1.1	This Study
	Polypropylene (50 µm)	Reduced Graphene Oxide (185 µm)			2.1	
	MPS (278 nm)	Reduced Graphene Oxide (185 µm)			5.3	
Pt (25 nm)	Polypropylene (50 µm)	Activated Carbon (200 µm)	0.42%	Air	3.5	40
	Polypropylene (50 µm)	Reduced Graphene Oxide (185 µm)			5.0	
	MPS (270 nm)	Reduced Graphene Oxide (185 µm)			6.25	
Activated Carbon + 5%Pt + 5% Bi (480 µm)	Polyether-sulfone (140 µm)	Activated Carbon (480 µm)	0.1%	4 %	3.3	21

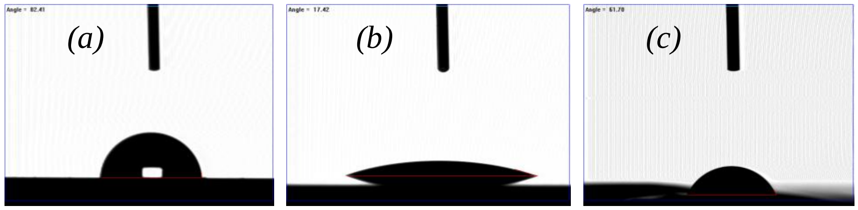

Figure S3: Contact angle measurements showing the water-surface contact angles for: (a) Platinum deposited on silicon wafer, (b) NP silica on Pt/Si anode; and (c) Surfactant coated polypropylene membrane. The values have been summarized in Table S.

Table S3: Summary of the various contact angles for different surfaces used in the experiments.

Component	Contact Angle (º)	Hydrophobic/Hydrophilic
Pt (25 nm) deposited on Si wafer	80.11 ±2.82	Hydrophobic
MPS on Pt (25 nm) deposited on Si wafer	17.80 ±1.57	Hydrophilic
Surfactant coated Polypropylene membrane	62.9 ±6.34	Weak Hydrophobic
Activated Carbon	91.15 ±1.62	Hydrophobic
Reduced Graphene Oxide	104.89 ±4.62	Hydrophobic

Table S4: Calculation of total thickness of various direct glucose fuel cells used in present study

BioFuel Cell	Membrane Thickness (µm)	Cathode Thickness (µm)	Total Thickness (µm)
Pt/PP/AC	25	200	225
Pt/PP/G	25	185	210
Pt/MPS/G	0.281	185	185.28

Section S1: Calculation of Normalized values

The effective glucose concentration gradient is given by:

$$G = \Delta C/\Delta d$$

where, G = concentration gradient

$\Delta C = [\text{Glucose}]_{bulk} - [\text{Glucose}]_{anode} = 1$ mg/ml
Δd = Total Thickness (µm)

Hence, the normalization equation:

$$I = i/G$$

Or,

$$I = i.\ \Delta d/\Delta C$$

Where, I = normalized current density
Since ΔC remains constant for all the cases, we compare the plots for:

$$I = i.\ \Delta d$$

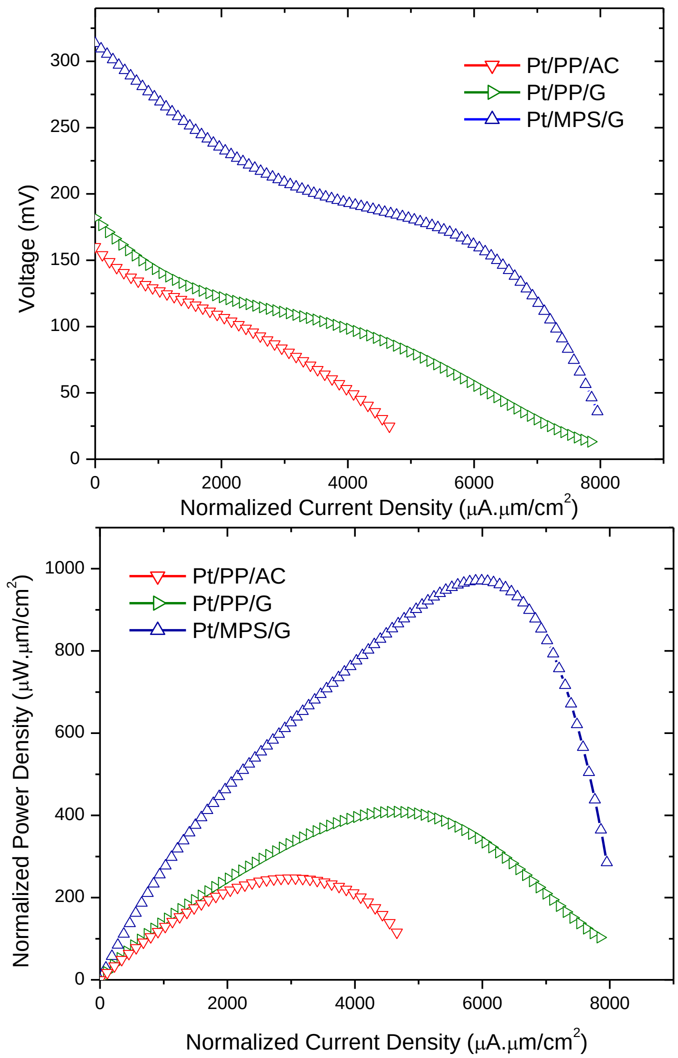

Figure S4: Comparison of (a) Polarization, and (b) Power Density plots for various direct glucose fuel cells normalized to the fuel cell thickness

Section S2:

For the electrochemical reaction

$$Glucose \leftrightarrow Gluconic\ Acid + 2e^{-}$$

The anode potential is given by the Nernst Equation:

$$E = E^{o} + \frac{RT}{nF}\ln\left(\frac{[glucose]}{[gluconic\ \ acid]}\right)$$

Where as, for the fuel cell,

$$E_{cell} = E_{cathode} - E_{anode}$$