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Letter to the Editor

Synthetic plasma and silicon tubular harness-based pure biological transistor amplifier circuit

Dear Editor:

Kosta *et al.*[1–4] first ever reported the development of biologic electronic components viz resistance R, capacitance C, diode D and transistor T using human tissues and human skin. In our early study[5], we have demonstrated the feasibility of liquid medium (synthetic blood plasma) to develop bio-transistor, bio-resistor, and bio-capacitor and combined them to form an amplifier using the metallic harness (the interconnecting copper wires and pieces).

In this paper, we replaced copper wire used in the earlier study by appropriate silicon rubber tube of appropriate length and diameter filled with synthetic plasma. This silicon rubber tube contained an electrically conducting liquid with both positive and negative ions formed by the components of synthetic plasma and was equivalent as a wire made of copper.

In this study, silicon rubber tubes of various lengths with different diameter were filled with synthetic plasma. Tube capacitance C and resistance R were realized by capacitor meter and multimeter. ***Fig. 1A*** and ***B*** show the realization of resistance variation with varying distance with tube diameter 1 mm and 2 mm, respectively. Resistance increased with increment in distance when the tube diameter remained constant. Capacitance was 4 nF for tube 1 mm in diameter and 2.3 nF for tube 3 mm in diameter and remained constant with distance. A pure biologic transistor amplifier circuit is shown in ***Fig. 1C***. This configuration shows pure biologic electronic circuit made from silicon rubber tubular harness. It consists of a main 5-mm silicon rubber tube containing synthetic plasma with the interconnecting harness made of tubes 2 mm in diameter, which were filled with synthetic plasma behaving as metallic interconnecting wires. Resistances R1, R2, Rc and Re were realized on the main tube by inserting two 2-mm diameter tubes with varying distances between two terminals. Resistances were observed due to the collision of charged material particles of the plasma. Capacitances C1 and C2 were also realized because of the property of synthetic plasma to form positive ions as well as negative ions and creating a parallel plate combination. Here, we used purely human implantable materials for the electronic

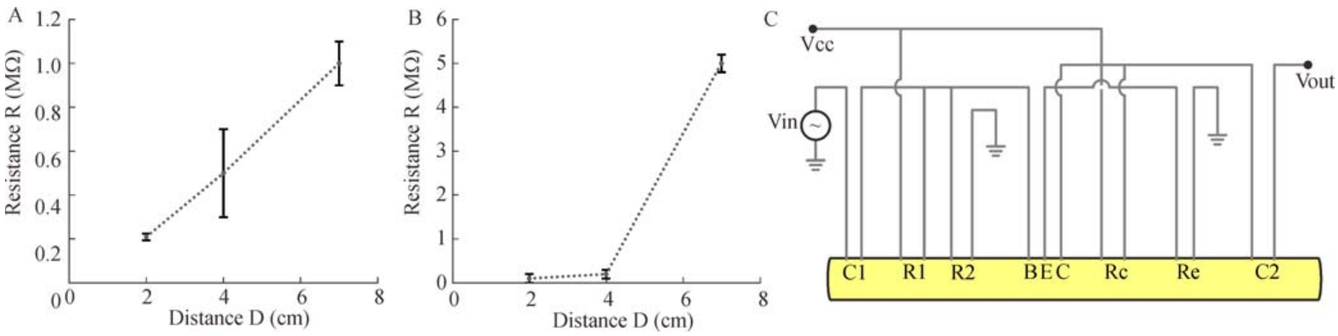

Fig. 1 **Graphical representation of resistance against distance and biological circuit layout.** (A) and (B) Effect on Resistance due to variation in distance with error bars (C) biologic electronic circuit. Experiments were done three times independently and data were expressed as mean +/- SD. A: Tube diameter 1 mm; B: Tube diameter 2 mm; C: Pure biological electronic circuit made using silicon rubber tubular harness.

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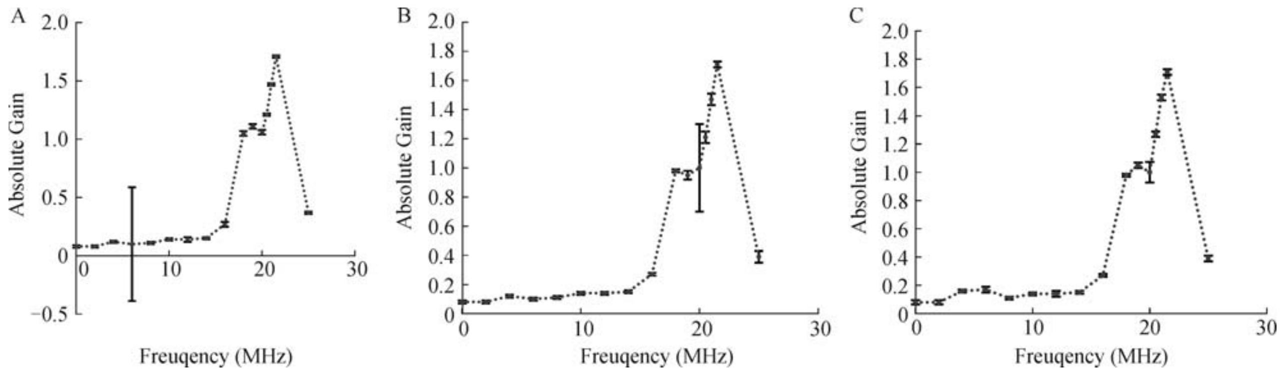

Fig. 2 **Graphical representation of absolute gain against frequency.** Experiments were done three times independently and data were expressed as mean ± SD. A: 1 L density; B: 1.3 L density; C: 1.5 L density.

circuit. This experimental study demonstrated a feasible pure biologic amplifier circuit consisting of different diameter silicon rubber tubes filled with plasma. This has enormous application in implanting electronic circuits inside the human body. One can put battery (power supply of the circuit) on the nearby human body skin surface[6].

The circuit was investigated with synthetic plasma of three different densities (1 L 1.3 L and 1.5 L) in order to realize the general behavior of the circuit. ***Fig. 2A***, ***B*** and ***C*** show graphical representation of absolute gain for plasma 1 L, 1.3 L and 1.5 L in density, respectively over a large frequency range. By keeping frequency variation in a similar manner, the circuit gives an almost similar response. So similar types of circuit could be worked as an amplifier circuit for certain range of frequencies. This behavior strongly supports the innovative idea to apply the similar liquid physics theory to other different density liquid which has similar chemical composition.

Yours

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