Electronic Supplementary Material (ESI) for Analytical Methods.


# Supplementary Materials

# Detection of cardiovascular drug and marine toxin using a multifunctional cell-based impedance biosensor system

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**S1: Typical high-time-resolution signals of cardiomyocytes at different time point.**

To acquire the beating of cardiomyocytes, we record 20 s data with high-speed sampling. **Fig. S1** shows the typical signals of cardiomyocytes at 32 h, 38 h and 46 h. As is shown, during the initial phase of beating (at 32 h), the beating signals of cardiomyocytes at 17k cells/well occurred to be low amplitude and long duration while no rhythmic beating were detected on the signals snapshot of cells at other seeding density. After several hours, at 38h, cardiomyocytes at 15k cells/well started beating but the amplitude was lower. Finally, at 46 h, cardiomyocytes at 12k cells/well represented low-amplitude beating status. During the period from 32 h to 46 h, cardiomyocytes at 17k cells/well kept beating rhythmically and cardiomyocytes at 17k cells/well remained stable besides some occasional pulses.

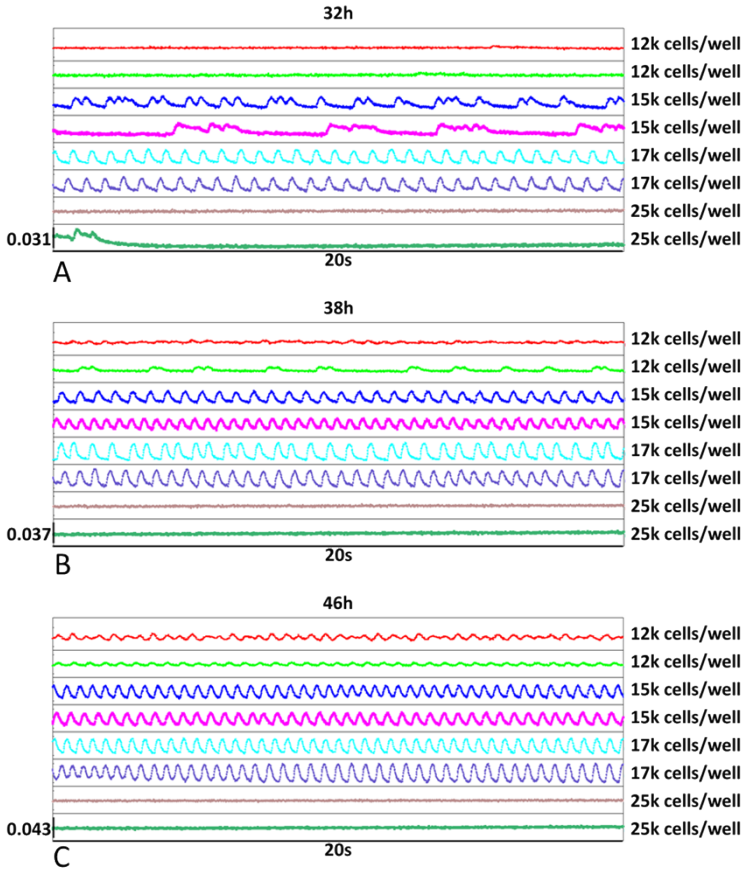


**Fig. S1** Typical signals of cardiomyocytes with four densities at 32 h (A) 38 h (B) and 46 h (C)

**S2: Typical cardiomyocytes status response to chromanol 293B.**

Chromanol 293B is a selective blocker of the slow delayed rectifier potassium channel current on repolarization in cardiomyocytes which is chosen as one of test compounds. As shown in Fig. S2 (A), compared with the control group, cellular growth curves of experimental groups had no obvious decline after chromanol 293B treatment. However, the typical beating signals of experimental groups represented arrhythmia 1 h after adding chromanol 293B which can be reflected from Fig. S2 (B), (C) and (D). After 12 h or 24 h, beating signals of experimental groups at concentrations under 11.11 μM returned to rhythmic beating while experimental groups at concentrations higher than 33.33 μM still had irregular beating. The experimental results were in accordance with the effect of chromanol 293B.

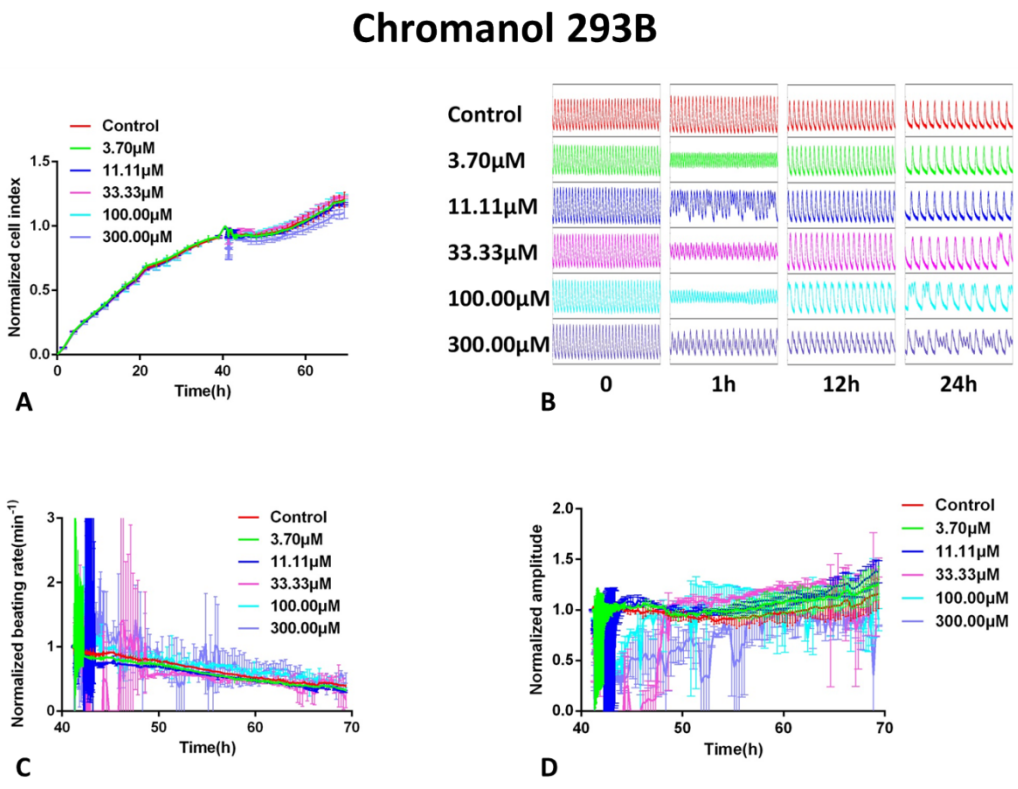


**Fig. S2** Typical cardiomyocytes status response to chromanol 293B. (A) Cardiomyocytes cellular growth curves under chromanol 293B at concentrations from 3.70μM to 300.00μM. (B) Beating

status snapshot before and after chromanol 293B. (C) Normalized beating rate statistical results before and after chromanol 293B treatment (D) Normalized amplitude statistical results before and after chromanol 293B treatment.

**S3: Typical cardiomyocytes status response to adriamycin.**

As cardiotoxicity of anti-cancer drugs is an important aspect of drug testing, adriamycin which is regular drug used in cancer chemotherapy was an alternative medicine during our experiment. Adriamycin is commonly used to treat some leukemias and Hodgkin's lymphoma, as well as cancers of the bladder, breast, and others. Though its vital function, the most dangerous side effect of adriamycin is cardiomyopathy, leading to congestive heart failure. To verify the side effect of adriamycin, adriamycin at concentrations from 61.73 nM to 15.00 μM was added to experimental groups with results shown in Fig. S3. From Fig. S1 (A), cardiomyocytes at concentration higher than 0.19 μM suffered cell death as the decreasing cellular after adding the medicine. The beating of cardiomyocytes at concentrations higher than 1.67 μM almost stopped right after adding the medicine and could not recover even after 12 h and 24 h. The side effect of adriamycin on cardiomyocytes was consistent with that on human.

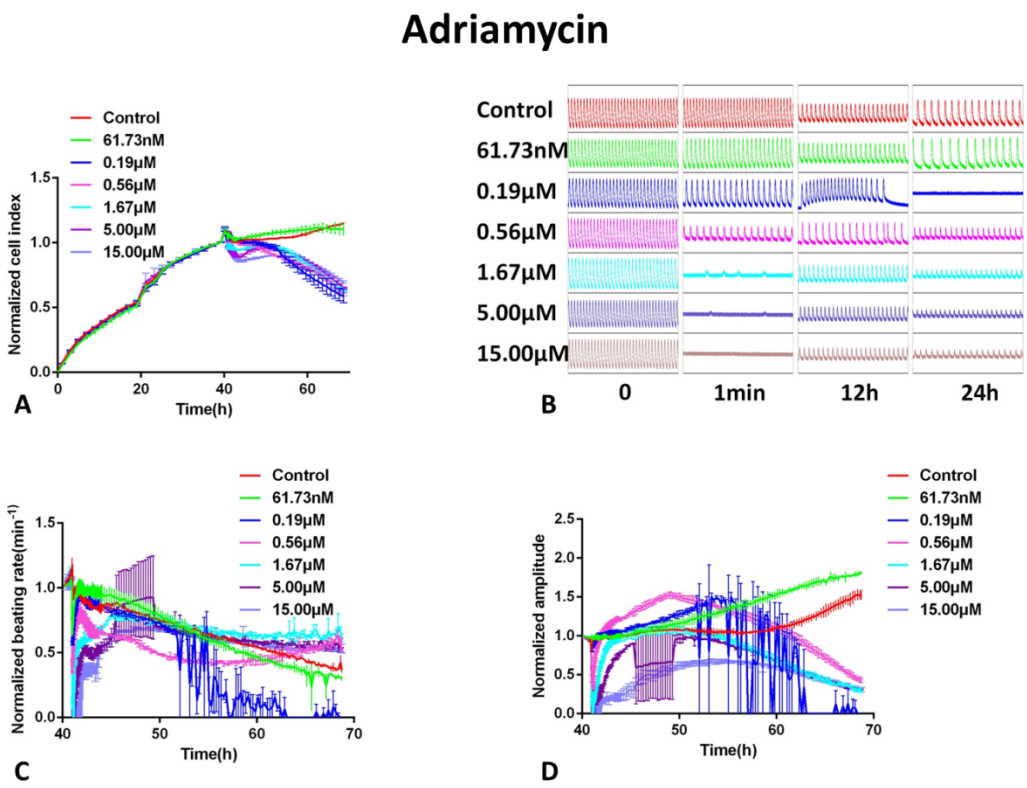


**Fig. S3** Typical cardiomyocytes status respoding to adriamycin. (A) Cardiomyocytes cellular growth curves under adriamycin at concentrations from 61.73nM to 15.00μM. (B) Beating status snapshot before and after adriamycin treatment. (C) Normalized beating rate statistics before and after adriamycin treatment. (D) Normalized amplitude statistics before and after adriamycin treatment.