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Supplemental Information

Dynamic Model for Characterizing Contractile Behaviors and Mechanical Properties of a Cardiomyocyte

Chuang Zhang, Wenxue Wang, Wenhui He, Ning Xi, Yuechao Wang, and Lianqing Liu

This PDF file includes:

Figs. S1 to S2;
Tables S1 to S3;
The code for measuring the deformation of the tops of the micro pillars.

Supporting Figures

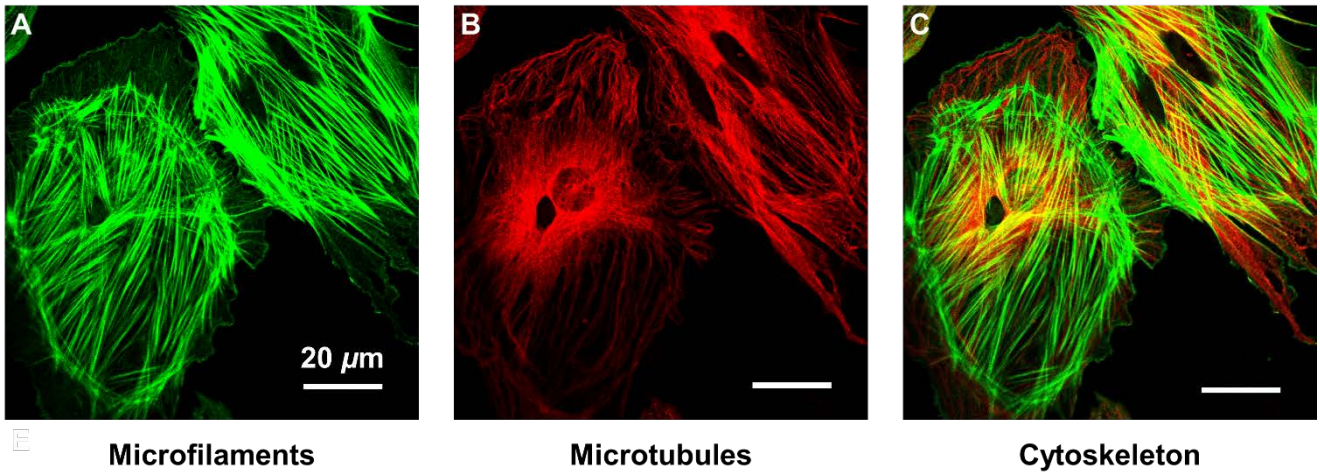

Fig. S1. Confocal fluorescence images of the cytoskeleton of cardiomyocytes in normal medium. (A) is the microfilaments attained with Actin-Tracker Green. (B) is the microtubules stained with Tubulin-Tracker Red. (C) is the merged image of the cytoskeleton of the cardiomyocytes. The scale bars in the figures are 20 μm.

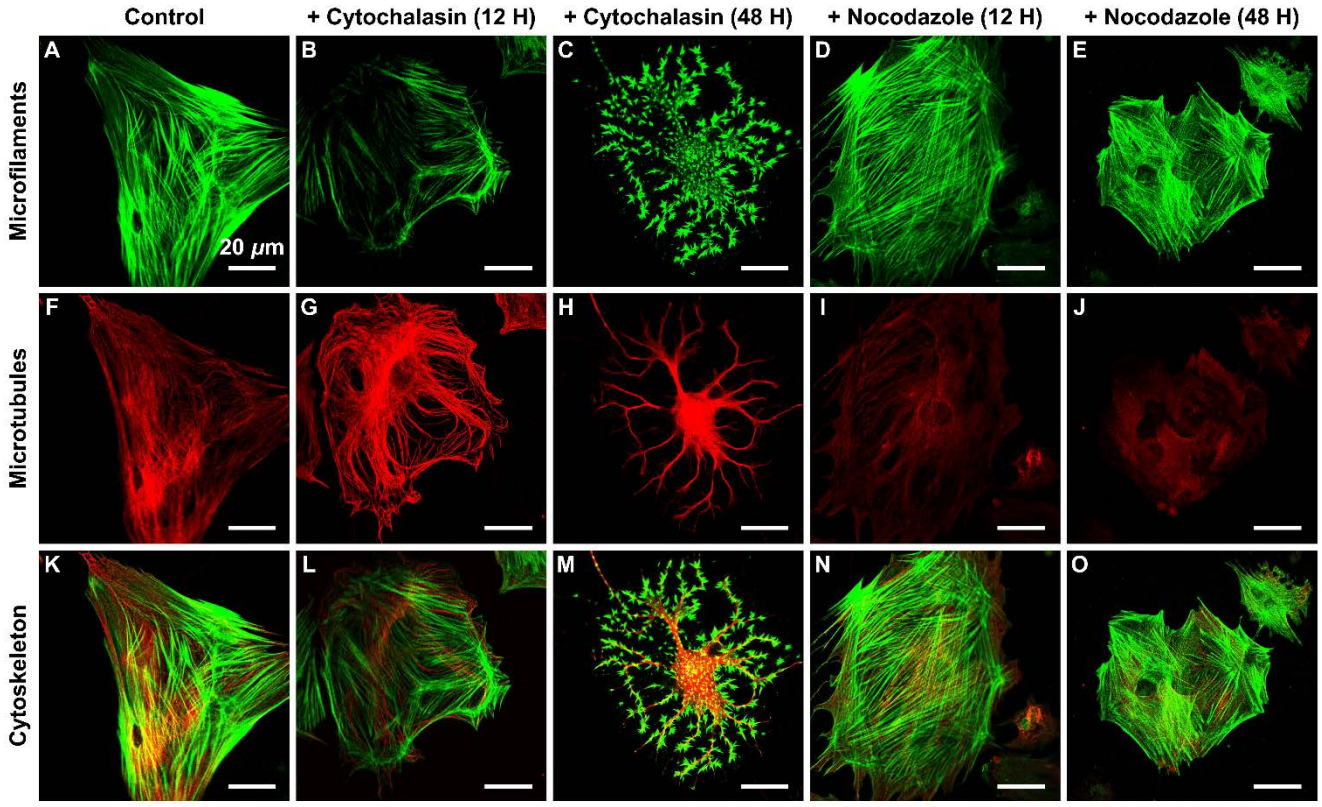

Fig. S2. Confocal fluorescence images of the cytoskeleton of cardiomyocytes. (A), (F) and (K) are the cytoskeleton of the cardiomyocytes in normal medium. (B), (G) and (L) are the cytoskeleton of the cardiomyocytes with cytochalasin for 12 hours. (C), (H) and (M) are the cytoskeleton of the cardiomyocytes with cytochalasin for 48 hours. (D), (I) and (N) are the cytoskeleton of the cardiomyocytes with nocodazole for 12 hours. (E), (J) and (O) are the cytoskeleton of the cardiomyocytes with nocodazole for 48 hours. Where the green areas are microfilaments stained with Actin-Tracker Green, and the red areas are the microtubules stained with Tubulin-Tracker Red. The scale bars in the figures are 20 μm.

Supporting Tables

To make an intuitive demonstration of the system parameters of individual cells identified with the proposed model, the important mechanical characteristic parameters of five cells randomly selected from each group (the control group and the two experimental groups with CD and Noc) are listed in **Table S1**, **Table S2**, and **Table S3** respectively.

Table S1. **Identified Parameters of Individual Cells in the Control Group.**

Cell	k_1	k_0	k_0'	d_{00}	d_{01}	d_{10}	d_{11}	m_0	m_1	r	b	c
1	1.144	0.631	2.986	0.113	0.330	0.114	0.346	0.008	0.013	0.128	0.419	0.209
2	1.100	0.653	3.323	0.112	0.260	0.154	0.415	0.009	0.011	0.064	0.475	0.214
3	0.821	1.034	3.177	0.099	0.228	0.088	0.232	0.010	0.015	0.192	0.356	0.292
4	1.108	0.682	3.311	0.111	0.334	0.126	0.345	0.005	0.011	0.103	0.495	0.333
5	1.145	0.663	3.380	0.117	0.357	0.102	0.307	0.009	0.017	0.100	0.432	0.206

Table S2. **Identified Parameters of Individual Cells in the Experimental Group with Cytochalasin.**

Cell	k_1	k_0	k_0'	d_{00}	d_{01}	d_{10}	d_{11}	m_0	m_1	r	b	c
1	0.402	0.994	2.235	0.004	0.009	0.075	0.042	0.011	0.017	0.195	0.329	0.016
2	0.416	1.196	0.809	0.004	0.010	0.076	0.037	0.012	0.017	0.125	0.201	0.184
3	0.296	0.910	1.238	0.004	0.010	0.077	0.046	0.011	0.019	0.059	0.309	0.104
4	0.475	0.916	1.421	0.005	0.009	0.073	0.041	0.005	0.016	0.102	0.270	0.041
5	0.476	0.670	3.008	0.004	0.006	0.071	0.039	0.010	0.013	0.063	0.418	0.061

Table S3. Identified Parameters of Individual Cells in the Experimental Group with Nocodazole.

Cell	k_1	k_0	k_0'	d_{00}	d_{01}	d_{10}	d_{11}	m_0	m_1	r	b	c
1	0.663	0.750	2.351	0.060	0.235	0.029	0.056	0.010	0.012	0.154	0.197	0.135
2	0.914	0.487	2.814	0.051	0.217	0.011	0.019	0.008	0.013	0.273	0.094	0.123
3	0.747	0.635	2.285	0.028	0.162	0.054	0.071	0.006	0.012	0.137	0.207	0.163
4	1.032	0.512	2.795	0.007	0.030	0.083	0.235	0.006	0.011	0.089	0.258	0.231
5	0.688	0.870	2.556	0.019	0.052	0.014	0.044	0.006	0.016	0.112	0.157	0.837

Supporting Code

The code for measuring the deformation of the tops of the micro pillars:

“

```
mov = VideoReader('position\name');
OpenTime = clock;
tempstr = strcat(int2str(OpenTime(1)), '-', int2str(OpenTime(2)), '-',
int2str(OpenTime(3)),'-',int2str(OpenTime(4)),'-',int2str(OpenTime(5)),'.txt');
DatasetId = fopen(tempstr,'a+');
for i=1:mov.NumberOfFrames
close all;
clear all;
clc
mov = VideoReader('position\name');
OpenTime = clock;
tempstr = strcat(int2str(OpenTime(1)), '-', int2str(OpenTime(2)), '-',
int2str(OpenTime(3)),'-',int2str(OpenTime(4)),'-',int2str(OpenTime(5)),'.txt');
DatasetId = fopen(tempstr,'a+');
number=40;
for i=1:number:mov.NumberOfFrames
imdata(:,:,:,i)=read(mov,i);
imagesc(imdata(1:720,1:1280,:,i));
hold on;
[cx1,cy1] = ginput(1);
plot(cx1,cy1, 'Blue')
i
headx(i)=886.06/1600*cx1(1)
heady(i)=886.06/1600*cy1(1)
pause(1)
singleData = [i, 886.06/1600*cx1(1), 886.06/1600*cy1(1)];
fprintf(DatasetId, '\n %s \t', singleData);
end
fclose(DatasetId);
dlmwrite('headx.txt',headx,'delimiter', '\t')
```

```
dlmwrite('heady.txt',heady,'delimiter', '\t')
close all;
clear all;
clc
mov = VideoReader('position\name');
OpenTime = clock;
tempstr = strcat(int2str(OpenTime(1)), '-', int2str(OpenTime(2)), '-',
int2str(OpenTime(3)),'-',int2str(OpenTime(4)),'-',int2str(OpenTime(5)),'.txt');
DatasetId = fopen(tempstr,'a+');
for i=1:mov.NumberOfFrames
imdata(:,:,:,i)=read(mov,i);
imagesc(imdata(1:1200,1:1600,:,i));
hold on;
[cx1,cy1] = ginput(1);
plot(cx1,cy1, 'Blue')
i
headx(i)=886.06/1600*cx1(1)
heady(i)=886.06/1600*cy1(1)
pause(1)
singleData = [i, 886.06/1600*cx1(1), 886.06/1600*cy1(1)];
fprintf(DatasetId, '\n %s \t', singleData);
end
fclose(DatasetId);
dlmwrite('headx.txt',headx,'delimiter', '\t')
dlmwrite('heady.txt',heady,'delimiter', '\t')
imdata(:,:,:,i)=read(mov,i);
imagesc(imdata(1:1000,800:1600,:,i));
hold on;
[cx1,cy1] = ginput(2);
plot(cx1,cy1, 'Blue')
[cx2,cy2] = ginput(2);
plot(cx2,cy2, 'Red')
i
```

```
s=[cx1(2)-cx1(1),cy1(2)-cy1(1)];
t=[cx2(2)-cx2(1),cy2(2)-cy2(1)];
theta1=acos(dot(s,[0,1])/(norm(s)*norm([0,1])));
theta2=acos(dot(s,t)/(norm(t)*norm(s)));
headx(i)=cx1(1)
heady(i)=cy1(1)
Angletheta1(i)=theta1;
Angletheta2(i)=theta2;
pause(1)
singleData = [i, cx1(1), cy1(1), cx1(2), cy1(2), cx2(1), cy2(1), cx2(2), cy2(2)]';
fprintf(DatasetId, '\n %s \t', singleData);
end
fclose(DatasetId);
dlmwrite('Angletheta1.txt',Angletheta1,'delimiter', '\t')
dlmwrite('Angletheta2.txt',Angletheta2,'delimiter', '\t')
dlmwrite('headx.txt',headx,'delimiter', '\t')
dlmwrite('heady.txt',heady,'delimiter', '\t')
”
```