

Computational model of cancer stem cell dynamics

Submitted By

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DESCRIPTION OF THE WORK

Cell types to simulate:

1. CSC
2. TAC
3. TDC
4. ES

```
16
17 #define ECMSite 0    // type 0 - ECM site or ES
18 #define CSC 1       // type 1 - Cancer Stem Cell
19 #define TAC 2       // type 2 - Transient Amplifying Cells
20 #define TDC 3       // type 3 - Terminally Differentiated Cell
21
22 #define ALPHA 0.5
23 #define BETA 2
24 #define GAMMA 8
25
26 class CellularAutomata
27 {
28     //class variables
29 }
```

DESCRIPTION OF THE WORK

Cell properties:

```
// Constructor initialising all values to zero
CellularAutomata::CellularAutomata()
{
    // identity = id++;
    // why not used - presence of padding of row and column
    // Cell starts at index 14 if above initialisation used

    type = ECMSite;

    age = 0;
    stiffness = 0;
    divisionRate = 0;
    size = 0;
    contractility = 0;
    invasiveness = 0;
    degradationPotential = 0;

    sensingRadius = 0;

    fiberDensity = 0;
    crossLinking = 0;
}
```

DESCRIPTION OF THE WORK

The rules to update the state of cells are based on parameters:

1. α : P(CSC dividing into TAC)
2. $1 - \alpha$: P(CSC dividing into CSC)
3. β : Number of divisions of TAC (after which they transform into TDC)
4. γ : Life time of TDC

DESCRIPTION OF THE WORK

```
void CellularAutomata::update( CellularAutomata CA[][12] )  
{  
}
```

W

```
// Increment age of All Biological Cells by a unit  
void CellularAutomata::incrementAge(CellularAutomata CA[][12])  
{  
}
```

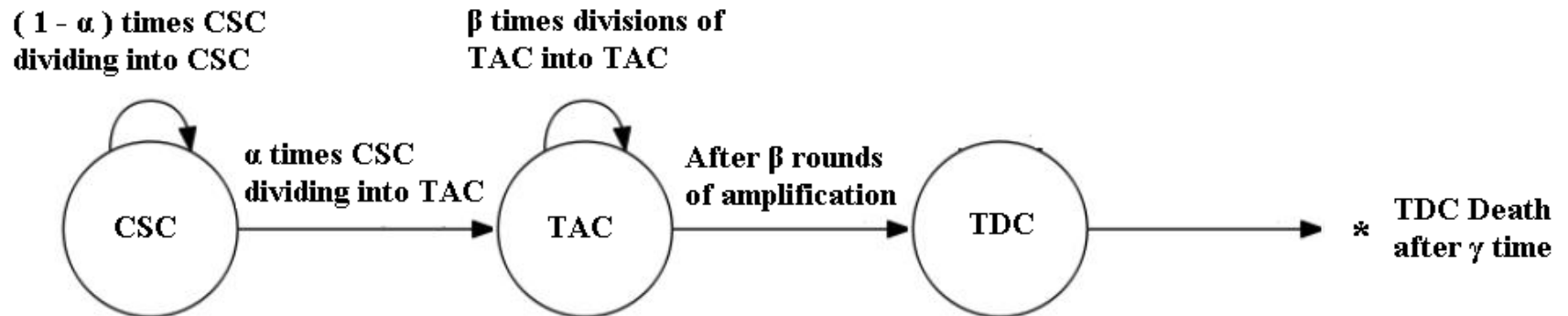
```
// Update state / Division of Cancer Stem Cell to Transient Amplifying Cell or Cancer Stem Cell  
// condition to ALPHA and availability of free neighbour  
void CellularAutomata::updateStateOfCancerStemCell( CellularAutomata CA[][12], int i, int j )  
{  
}
```

```
// Update state / Division of Transient Amplifying Cell to Terminally Differentiated Cells or Transient Amplifying Cell  
// condition to cell age , BETA and availability of free neighbour  
void CellularAutomata::updateStateOfTransientAmplifyingCell( CellularAutomata CA [][12], int i , int j )  
{  
}
```

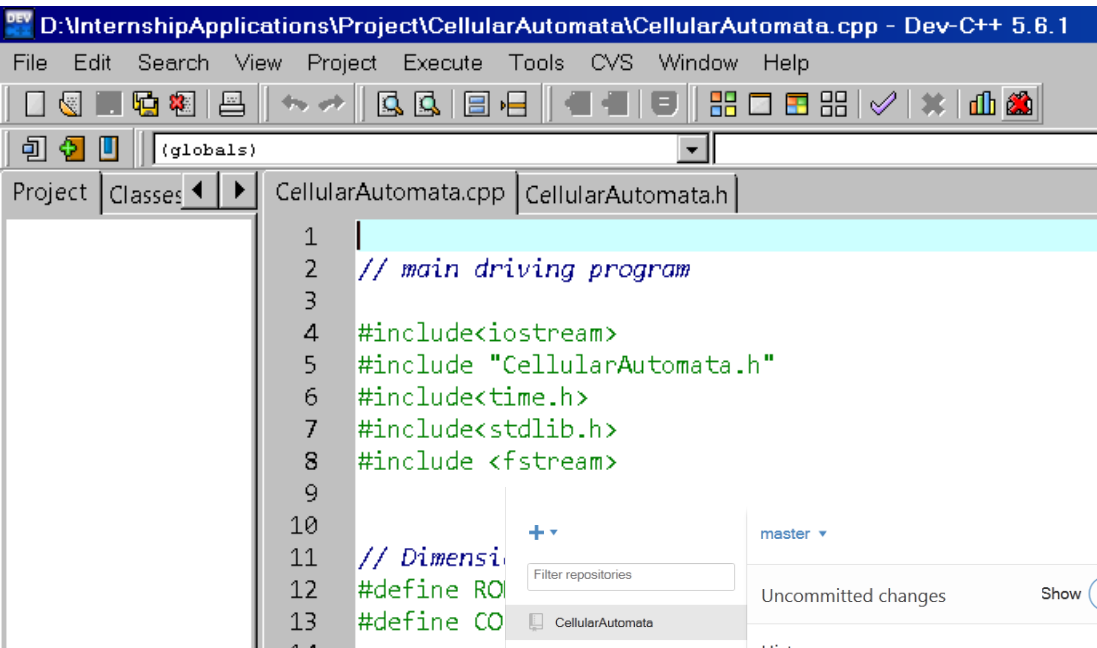
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```
// Update state of Terminally Differentiated Cell to ECM Site, condition to cell age and GAMMA  
void CellularAutomata::updateStateOfTerminallyDifferentiatedCell( )  
{  
}
```

DESCRIPTION OF THE WORK

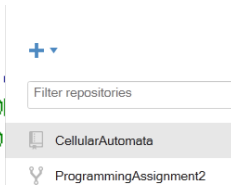


DESCRIPTION OF THE WORK

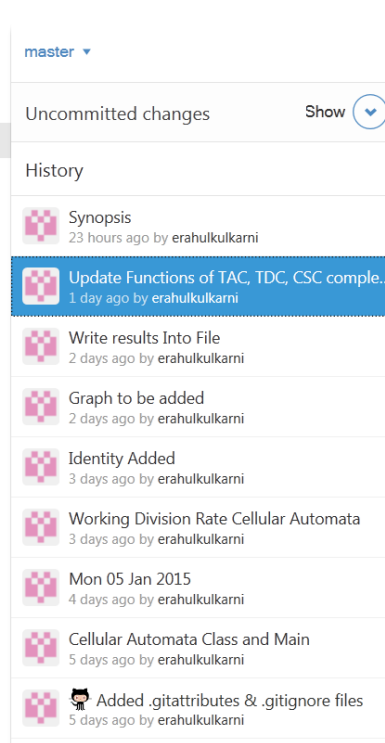


The screenshot shows the Dev-C++ 5.6.1 IDE. The title bar indicates the file path: D:\InternshipApplications\Project\CellularAutomata\CellularAutomata.cpp - Dev-C++ 5.6.1. The menu bar includes File, Edit, Search, View, Project, Execute, Tools, CVS, Window, and Help. The toolbar contains various icons for file operations and execution. The project explorer on the left shows the project structure with CellularAutomata.cpp and CellularAutomata.h selected. The main editor window displays the following C++ code:

```
1 // main driving program
2
3
4 #include<iostream>
5 #include "CellularAutomata.h"
6 #include<time.h>
7 #include<stdlib.h>
8 #include <fstream>
9
10
11 // Dimension
12 #define ROWS 10
13 #define COLS 10
```

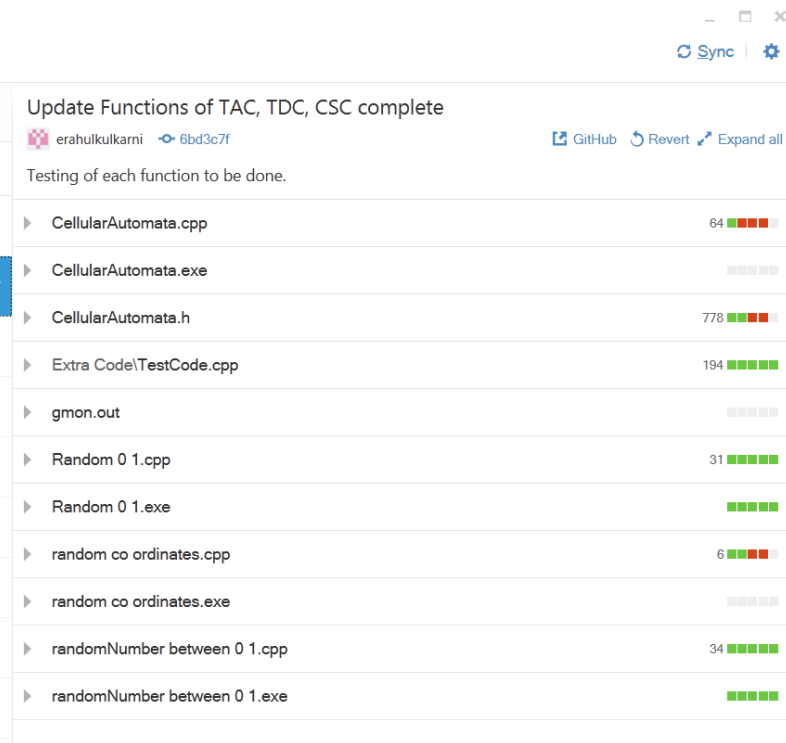


The screenshot shows the GitHub repository interface for the CellularAutomata project. The repository name is CellularAutomata. The current branch is master. The interface includes a search bar for repositories and a list of repository contents.



The screenshot shows the GitHub repository interface for the CellularAutomata project. The repository name is CellularAutomata. The current branch is master. The interface includes a search bar for repositories and a list of repository contents. The commit history is displayed, showing the following commits:


- Synopsis 23 hours ago by erahulkarni
- Update Functions of TAC, TDC, CSC complete... 1 day ago by erahulkarni
- Write results Into File 2 days ago by erahulkarni
- Graph to be added 2 days ago by erahulkarni
- Identity Added 3 days ago by erahulkarni
- Working Division Rate Cellular Automata 3 days ago by erahulkarni
- Mon 05 Jan 2015 4 days ago by erahulkarni
- Cellular Automata Class and Main 5 days ago by erahulkarni
- Added .gitattributes & .gitignore files 5 days ago by erahulkarni



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- CellularAutomata.cpp 64
- CellularAutomata.exe
- CellularAutomata.h 778
- Extra Code\TestCode.cpp 194
- gmon.out
- Random 0 1.cpp 31
- Random 0 1.exe
- random co ordinates.cpp 6
- random co ordinates.exe
- randomNumber between 0 1.cpp 34
- randomNumber between 0 1.exe

DESCRIPTION OF THE WORK

[illegible]

```
plot(x,y1,";t1";",y2,";t2;")
title("Degradation Potential")
xlabel("Time")
ylabel("Rate")
```


THANK YOU