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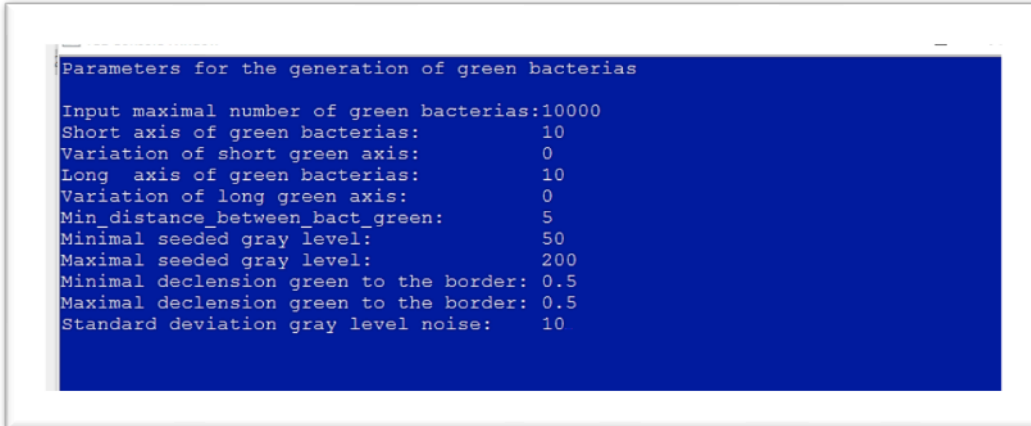
## General aspects of the Bacteria Generator

The Bacteria generator is written in C++ programming language and is a self-running algorithm. It generates 2D images of structures similar to cocci or rods by varying the size of two axes, as well as the shading and rotation of the objects and their overlapping. It generates to folders: 'green channel' and 'red channel'. The unit used by the algorithm are pixels and gray scale variations (0-255).

## How to generate the images?

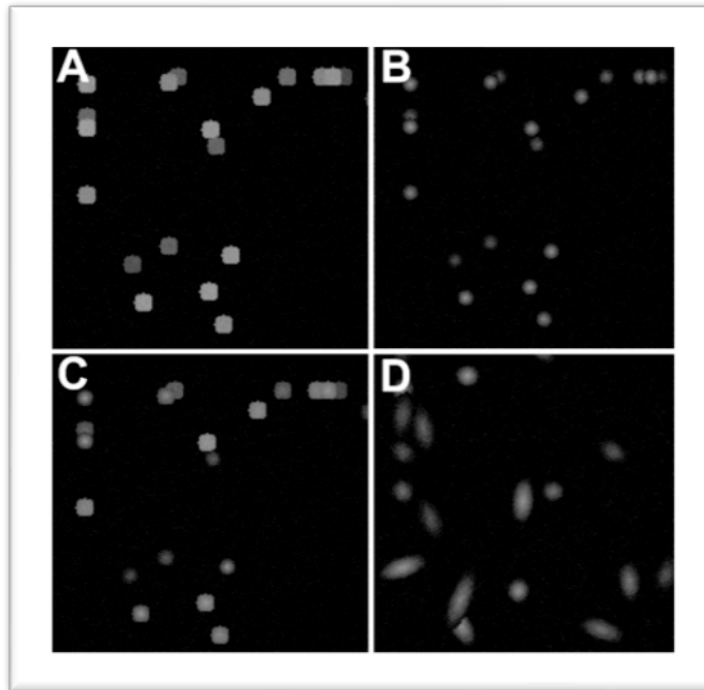
The algorithm asks first for the folder in which the images have to be insert.

After that the parameters have to be defined.



```
Parameters for the generation of green bacterias
Input maximal number of green bacterias:10000
Short axis of green bacterias:          10
Variation of short green axis:          0
Long axis of green bacterias:           10
Variation of long green axis:           0
Min_distance_between_bact_green:        5
Minimal seeded gray level:              50
Maximal seeded gray level:              200
Minimal declension green to the border: 0.5
Maximal declension green to the border: 0.5
Standard deviation gray level noise:    10
```

1. Input maximal number of green bacteria:  
This is a theoretical maximal number. If the number is very high this cannot be obtained because it will be prevented by the other parameters.
2. Short axis of green bacteria / Long axis of green bacteria:  
These are two axes that define the shape of the simulated cells. The dimension is in pixels. A value of 10 corresponds to 1  $\mu\text{m}$ . If cocci have to be generated both axes should have the same value. If rods have to be simulated the long axis represents the average length of the rods.
3. Variation of short green axis / Variation of long green axis:  
These parameters will stretch or press the short or long axis within the chosen pixels range. The dimension is in pixels. For cocci these parameters should be set to 0. It is recommended for rods to vary only the long axis by a value of max  $\frac{1}{2}$  of the pixels defined for long axis.
4. Min\_distance\_between\_bact\_green:  
This represents the distance/overlapping degree. The dimension is in pixels. If a value is chosen that is equal or similar to the longest axis value, the cells will not overlap. If a value is set that is below the axis length, the cells will overlap, thereby the lower the value the stronger the overlapping. The distance is calculated between the centromeres.
5. Minimal seeded gray level / Maximal seeded gray level:  
These parameters define gray scale range of the cells. The dimension is in gray tone between 0 and 255.
6. Minimal declension green to the border / Maximal declension green to the border:  
These parameters define how the shading of the cells decline. The dimension is 0 between 1 (corresponding to percent). Setting both value to 0 will yield homogenously filled cells (see figure below: A). Setting both to 1 will yield the maximal declension of all cells (see figure below: B and D). Varying the maximal and minimal value will yield mixed cell forms.

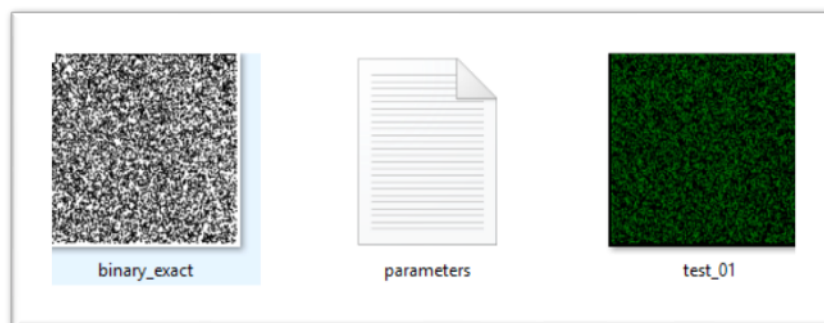


7. Standard deviation gray level noise:

This parameter seeds noise into the image. The parameter is in gray tone (0-255).

## Results

The resulting image is saved in green colour in folder 'green channel' and as a red copy in 'red channel'. The 'green channel' folder contains also a copy named 'binary\_exact' that can be used for comparison of the binary segmentations.



A text file contains all set parameters and the number of generated cells and the area covered by the cells. For Example 10000 cells were set as maximal input and 7286 were generated that cover 495029 pixels.

```
Parameters for the generation of green bacterias
Input maximal number of green bacterias: 10000
Short axis of green bacterias:10.000000
Variation of short green axis:0.000000
Long axis of green bacterias:10.000000
Variation of long green axis:0.000000
Min_distance_between_bact_green:5.000000
Minimal seeded gray level:50.000000
Maximal seeded gray level:200.000000
Minimal declension green to the border:0.500000
Maximal declension green to the border:0.500000
Standard deviation gray level noise:10.000000
Number of generated bacterias: 7286
Necromass (area):495029.000000
```