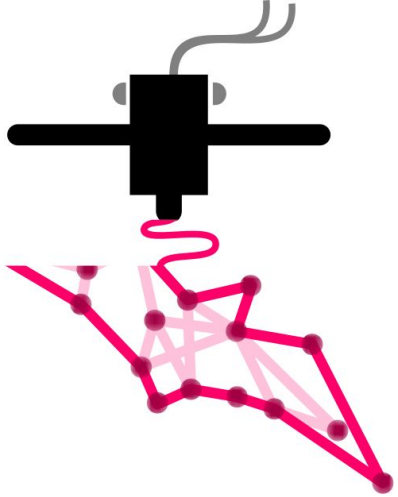
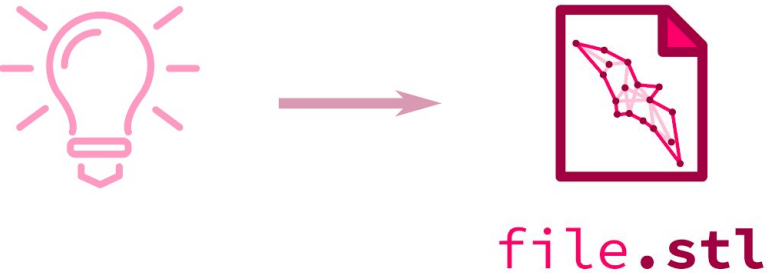
RUB ROSCOFF UNSEMINARS IN BIO*



#1: 3D printing

- Which sort of **dream object** would you like to print for your lab work?
- What are the **possibilities and limitations** of this technology, in the scope of your scientific work?

3D printing workflow

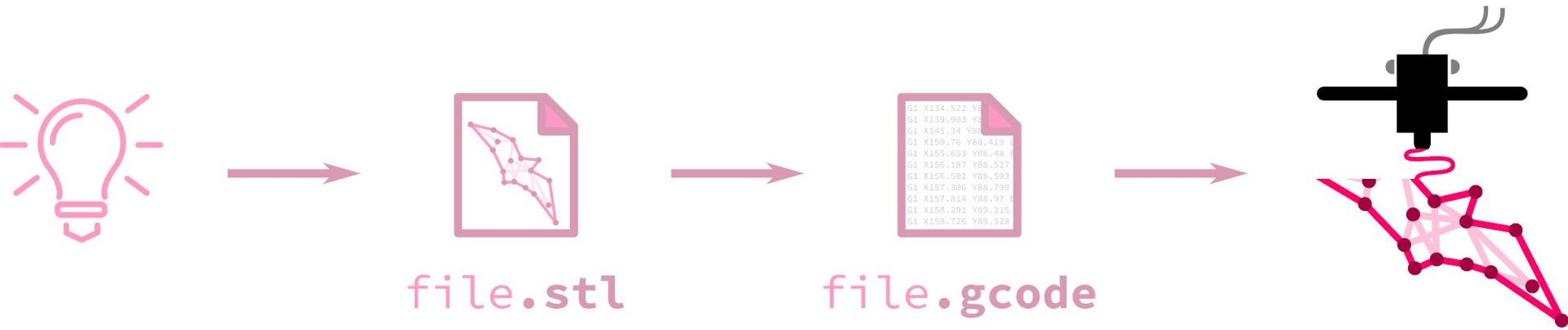

file.stl

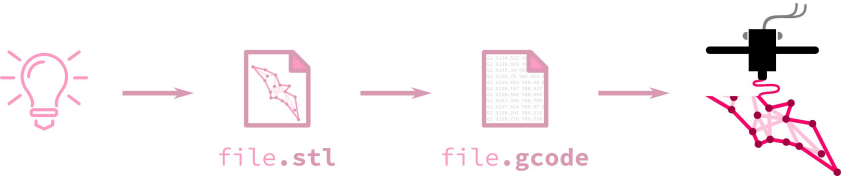
- Create your object using a 3D modeling software
  - SketchUp, Blender, tinkercad.com, OpenSCAD...
- Scan an existing object
  - 3D scanner, Microsoft Kinect hack...
- Download an stl file
  - thingiverse.com...


G1 X134.522 Y8
G1 X139.903 Y8
G1 X145.34 Y88
G1 X150.76 Y88.419 E
G1 X155.653 Y88.48 E
G1 X156.187 Y88.527
G1 X156.502 Y88.593
G1 X157.306 Y88.799
G1 X157.814 Y88.97 E
G1 X158.291 Y89.215
G1 X158.726 Y89.528
file.stl
file.gcode

> **Slicing**: converting the 3D object (**.stl**) to a language the 3D printer understands (**.gcode**)
    > Softwares: *Simplify3D*, *Cura*

> Many **parameters** to adjust!
    > fusion temperature, filling, support...


file.stl
file.gcode

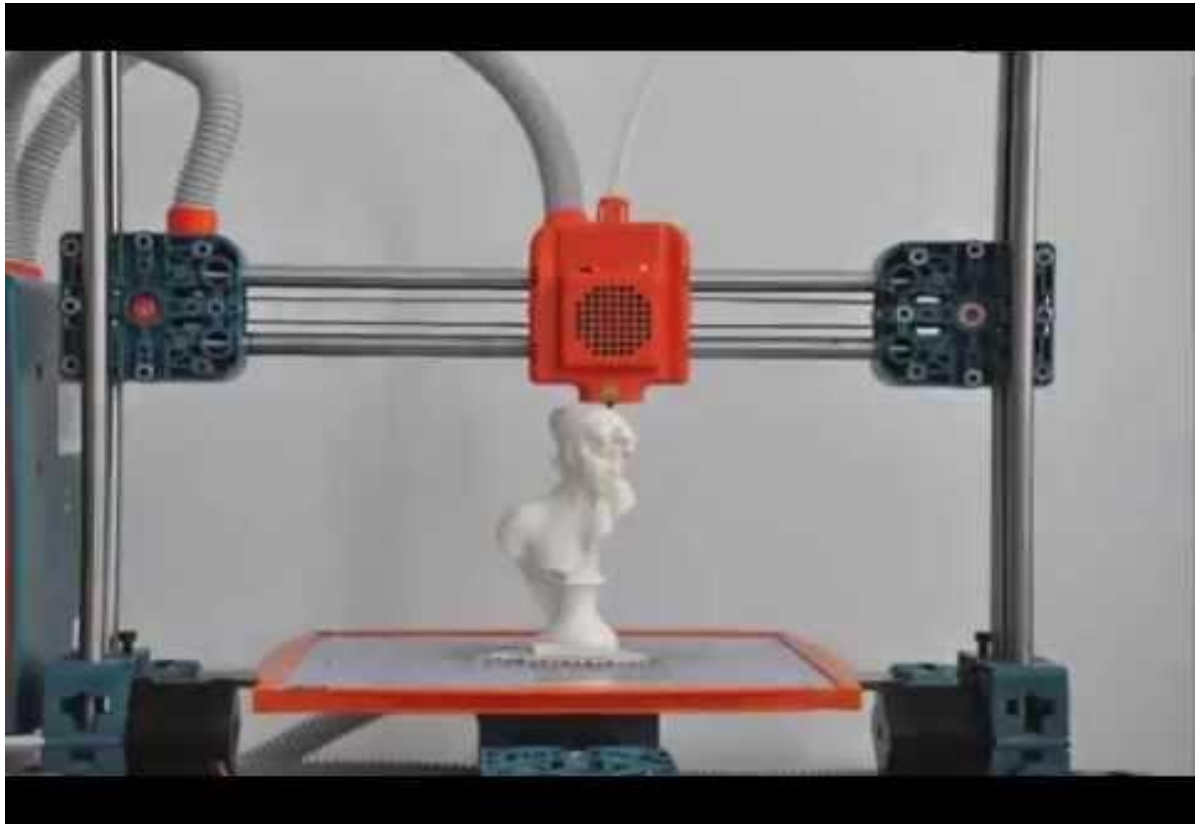


- **Actual printing**
  - Different technologies
  - The printer follows the **.gcode** file instructions

Technologies

Technologies

> Fused Deposition Modeling



Technologies

> Powder bed fusion

Technologies

> Stereolithography (SLA): UV laser on a photopolymer resin

Technologies

> NEW! 3D printing with light

Questions

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- What are the **possibilities and limitations** of this technology, in the scope of your scientific work?

Technologies

> Filament types

	 ABS	 Flexible	 PLA	 HIPS	 PETG	 Nylon	 PETG Carbon	 ASA	 Polycarbonate	 Polypropylene	 Metal Filled	 Wood Filled	 PVA
Resistance Maximale	40 MPa	26 - 43 MPa	65 MPa	32 MPa	53 MPa	40 - 85 MPa	45 - 48 MPa	55 MPa	72 MPa	32 MPa	20 - 30 MPa	46 MPa	78 MPa
Rigidité	5 / 10	1 / 10	7.5 / 10	10 / 10	5 / 10	5 / 10	10 / 10	5 / 10	6 / 10	4 / 10	10 / 10	8 / 10	3 / 10
Durabilité	8 / 10	9 / 10	4 / 10	7 / 10	8 / 10	10 / 10	3 / 10	10 / 10	10 / 10	9 / 10	4 / 10	3 / 10	7 / 10
Température d'utilisation maximale	98 °C	60 - 74 °C	52 °C	100 °C	73 °C	80 - 95 °C	85 °C	95 °C	121 °C	100 °C	52 °C	52 °C	75 °C
Coefficient D'expansion Thermale	90 µm/m-°C	157 µm/m-°C	68 µm/m-°C	80 µm/m-°C	60 µm/m-°C	95 µm/m-°C	57.5 µm/m-°C	98 µm/m-°C	69 µm/m-°C	150 µm/m-°C	33.75 µm/m-°C	30.5 µm/m-°C	85 µm/m-°C
Densité	1.04 g/cm³	1.19 - 1.23 g/cm³	1.24 g/cm³	1.03 - 1.04 g/cm³	1.23 g/cm³	1.06 - 1.14 g/cm³	1.05 g/cm³	1.07 g/cm³	1.2 g/cm³	0.9 g/cm³	2 - 4 g/cm³	1.15 - 1.25 g/cm³	1.23 g/cm³
Prix (par kg)	8 - 32 €	24 - 57 €	8 - 32 €	19-26 €	16 - 49 €	20 - 52 €	24 - 65 €	31 - 32 €	32 - 61 €	49 - 98 €	40 - 97 €	20 - 45 €	32 - 89 €