



(CKAB)

Impression 3D : quels impacts pour la santé ?
Romain Pouzol - CKAB



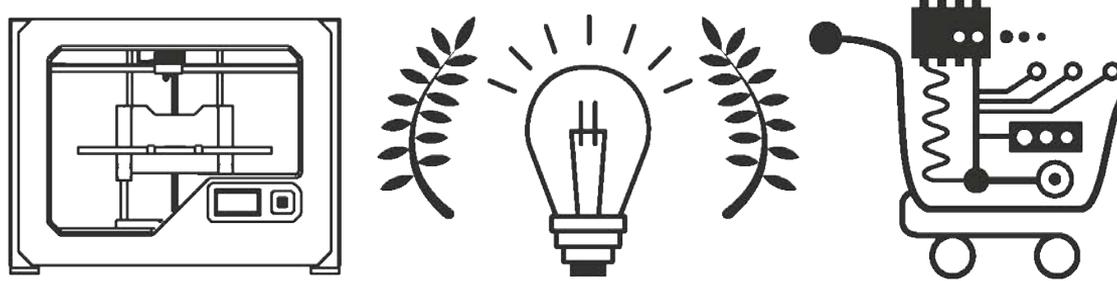
Académie nationale
de Pharmacie

Impression 3D – OSHW – Objets connectés

Pionnier européen de l'impression 3D individuelle (2009)

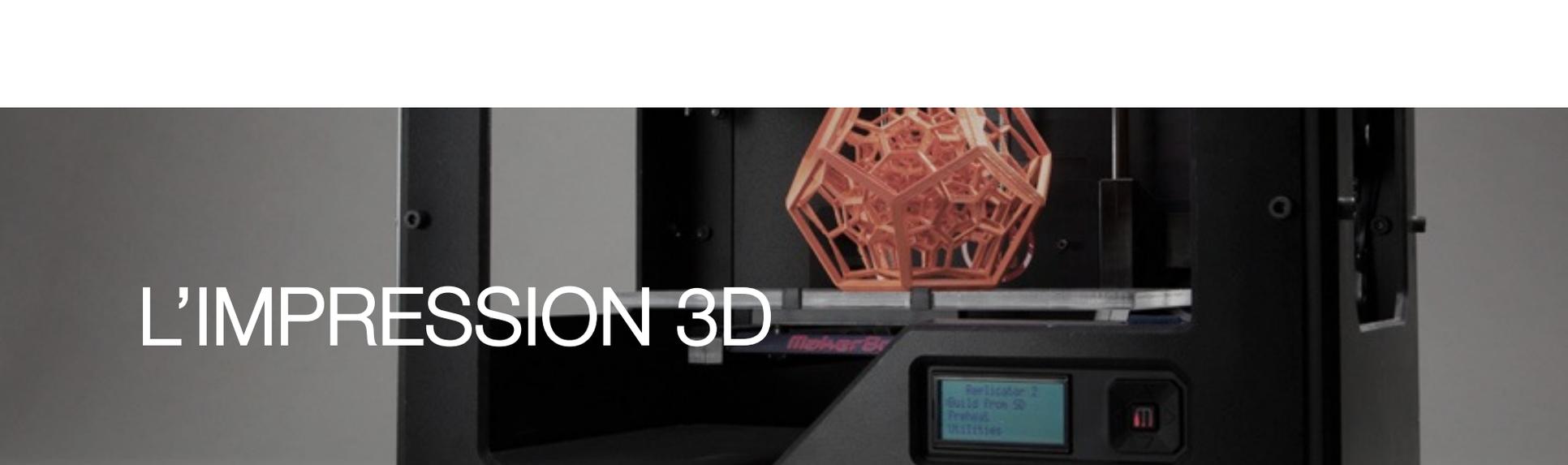
Partenaire historique de MakerBot en France.

1^{er} service d'impression 3D grand-public au monde avec Top Office (2013)



DISTRIBUTION – CONSEIL – CONCEPTION

Références : LVMH, Citroën, Gemalto, ST Microelectronics, CNRS, CEA, Air Liquide, Havas, Sciences Po, Polytechnique, Centrale, Orange, BNP Paribas, Auchan, État...

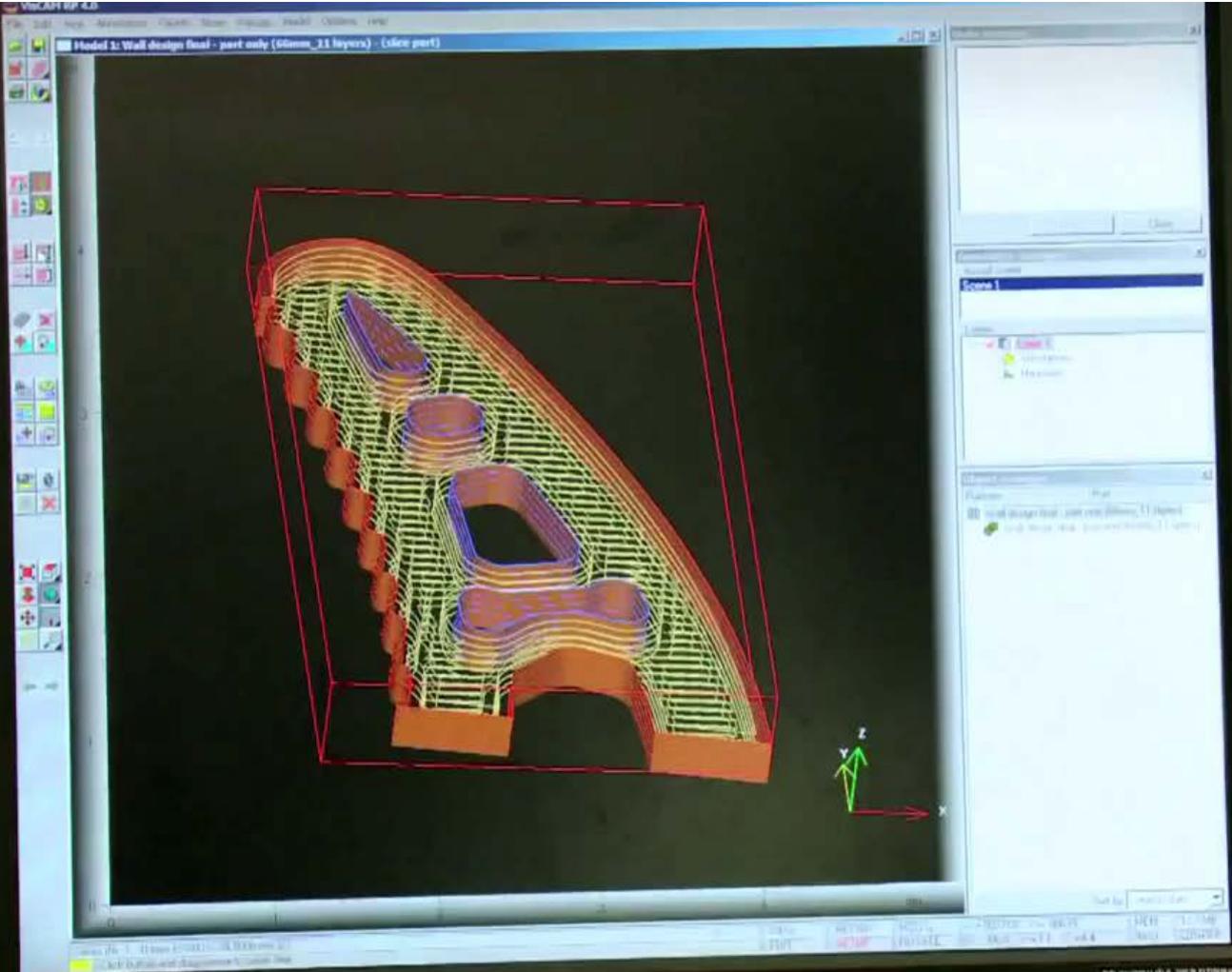
A close-up photograph of a 3D printer in operation. The printer is black with a transparent door. Inside, a complex, orange, lattice-like structure is being printed. The printer's control panel is visible in the foreground, featuring a small LCD screen and a red emergency stop button. The screen displays the text: "Replicator 2", "Build from SD", "Printed...", and "10:11:14".

L'IMPRESSIION 3D

Définition, méthodes et usages

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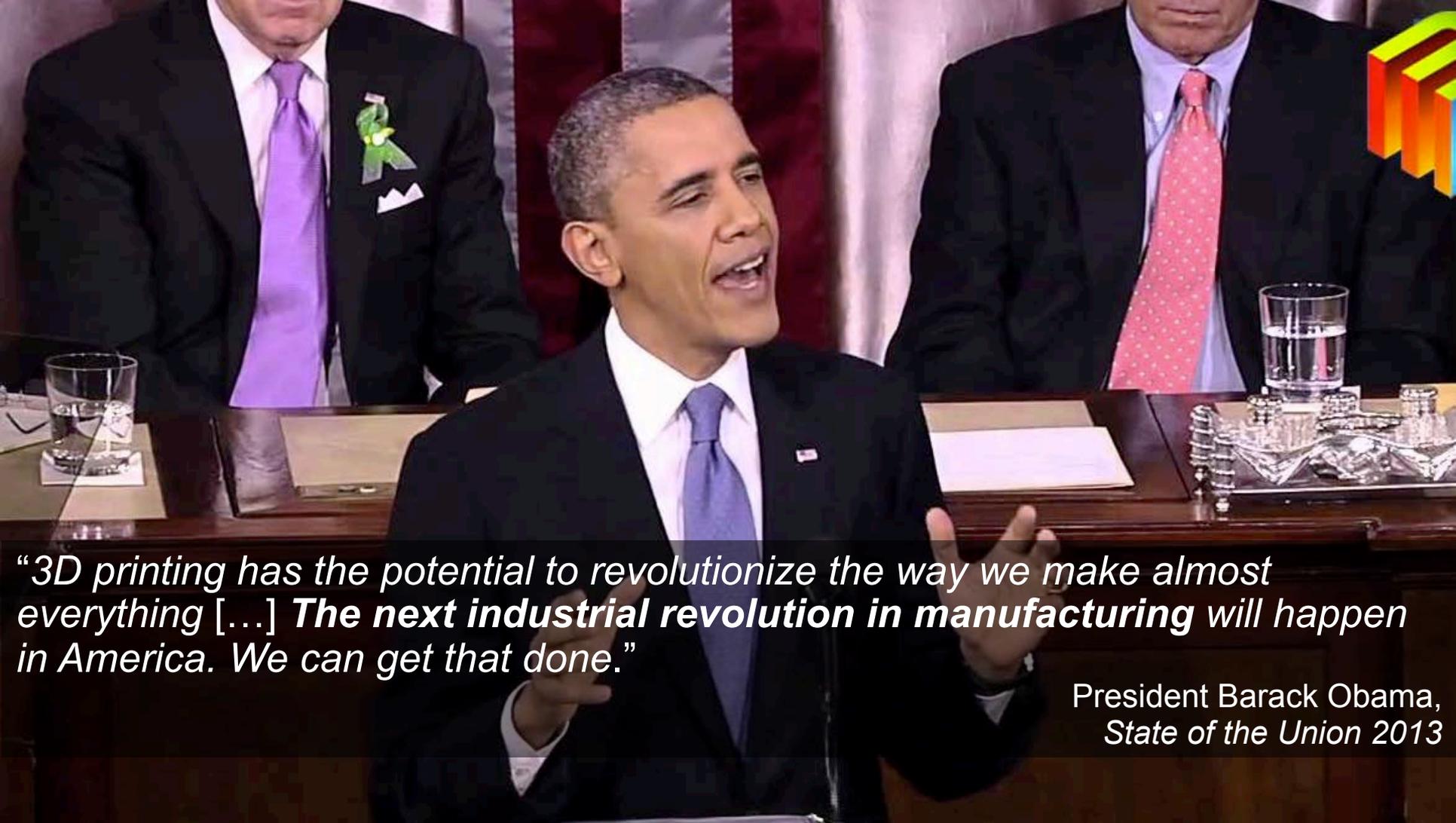
the
creators
project



DO IT UP
BETTER UP



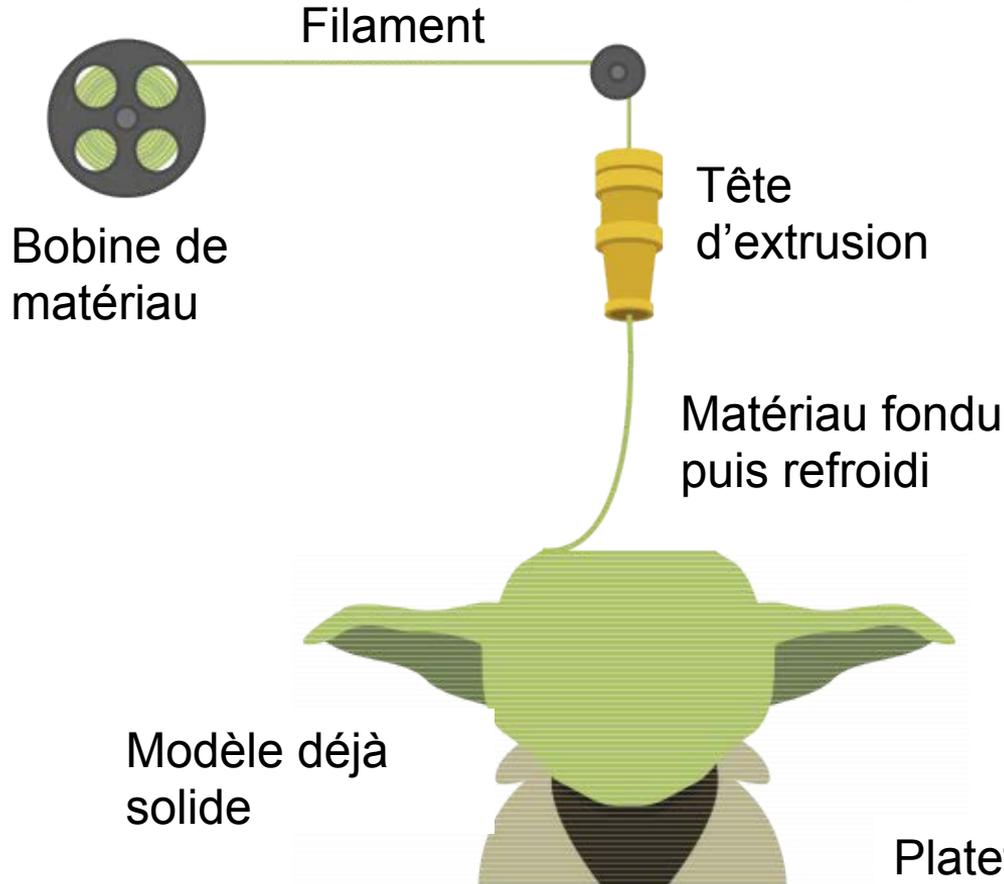
THE ORIGINAL & THE BEST
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A photograph of President Barack Obama speaking at a podium during the State of the Union 2013. He is wearing a dark suit, a light blue shirt, and a blue tie. He is gesturing with his hands while speaking. Two other men in suits are visible behind him, one on the left wearing a purple tie and one on the right wearing a red tie with white polka dots. The podium has a glass of water and some papers on it. The background is a dark wood paneling.

*“3D printing has the potential to revolutionize the way we make almost everything [...] **The next industrial revolution in manufacturing will happen in America. We can get that done.**”*

President Barack Obama,
State of the Union 2013

Dépôt de filament fondu (FDM)





Quels matières en filament ?

ABS (pétrole pur)

PLA (40% amidon de maïs)

HIPS (polystyrène)

Nylon, PETT

Élastomères



De nombreux dérivés

Bois

Mémoire de forme

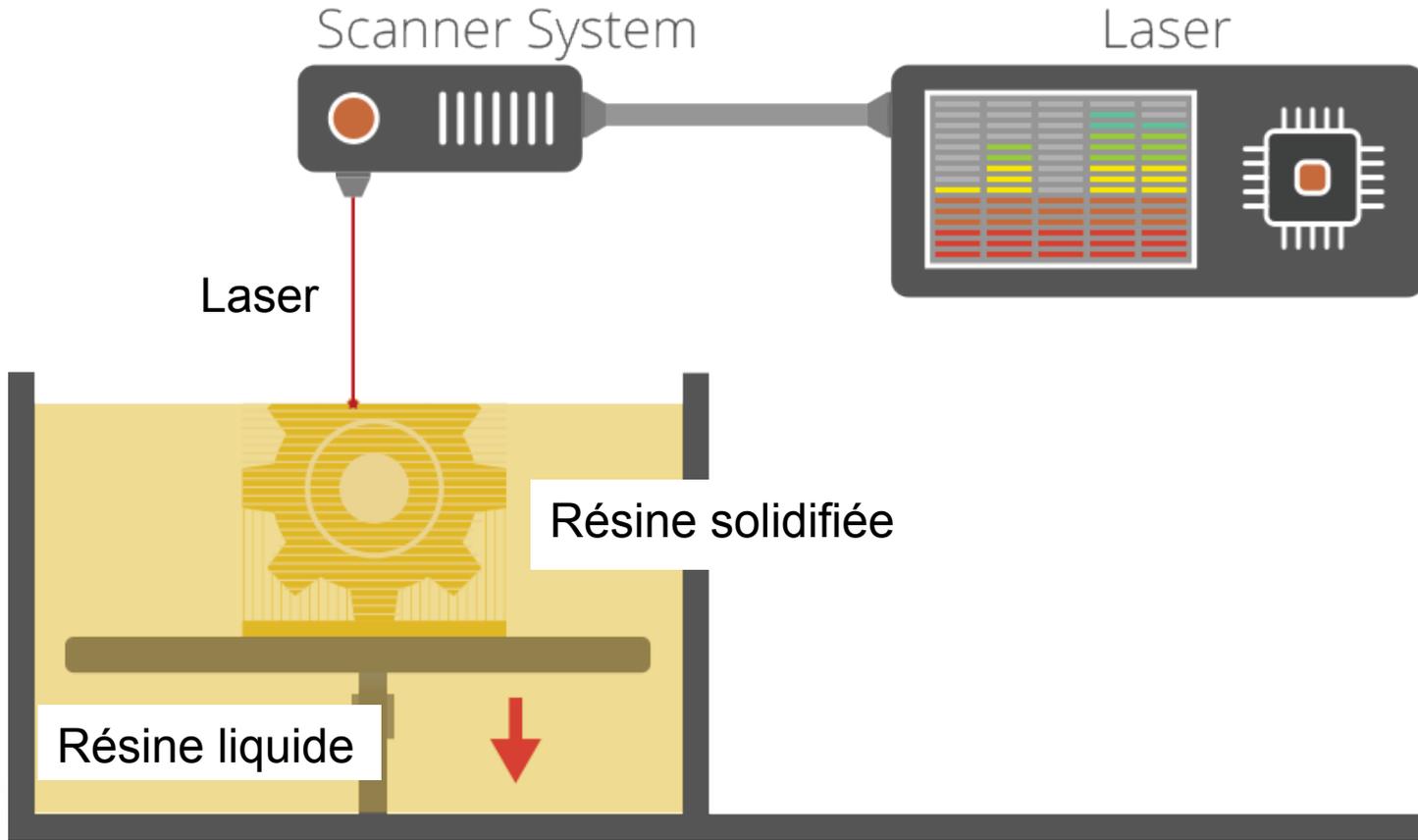
Bronze

Cuivre

Kevlar



Résine solidifiée par laser (SLA)

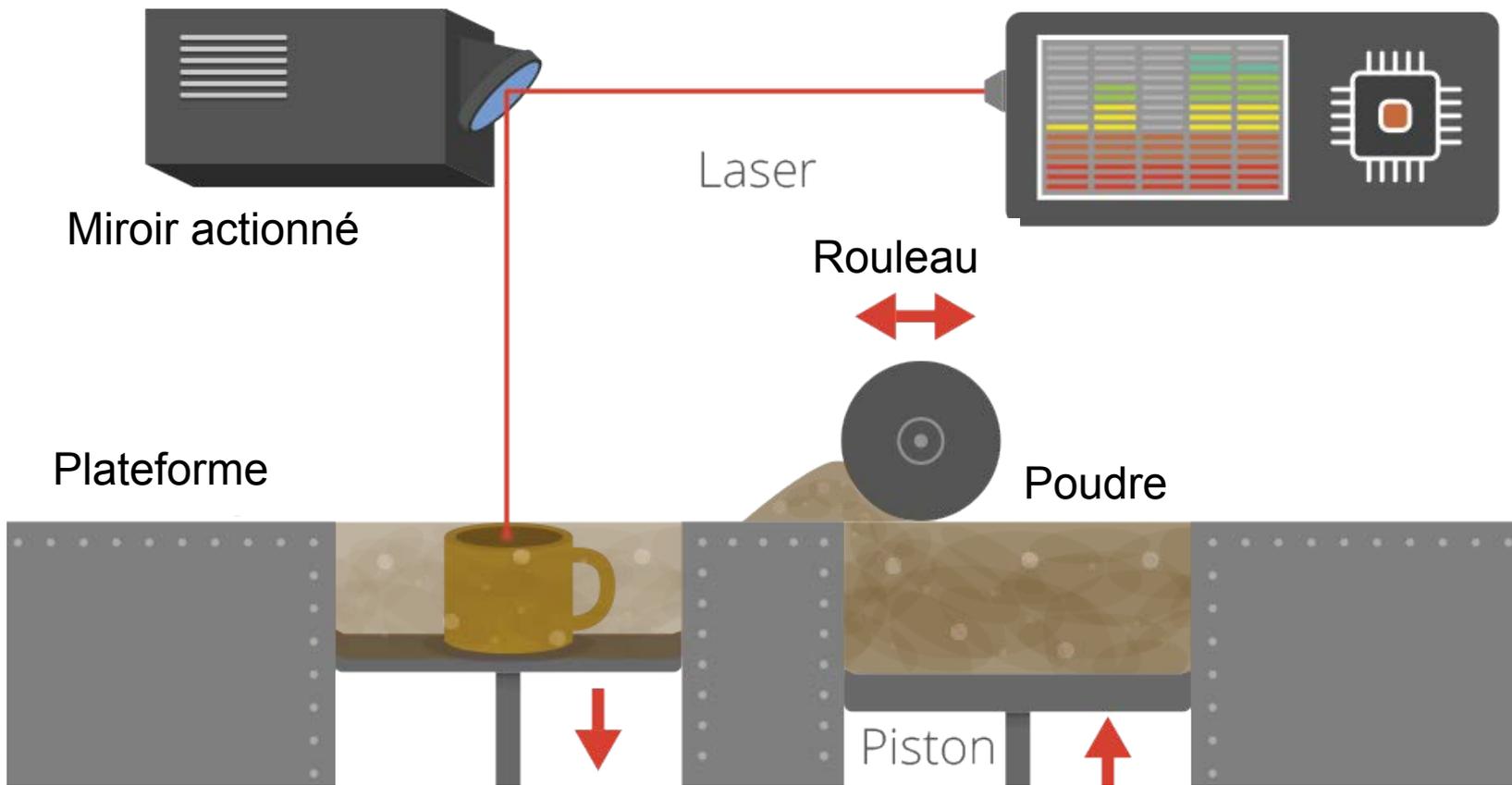


PRINT

Job: "3 Parts"
04:02:58 remaining
Layer 1 of 625



Frittage laser sélectif (SLS)





D'autres matières

Plastiques

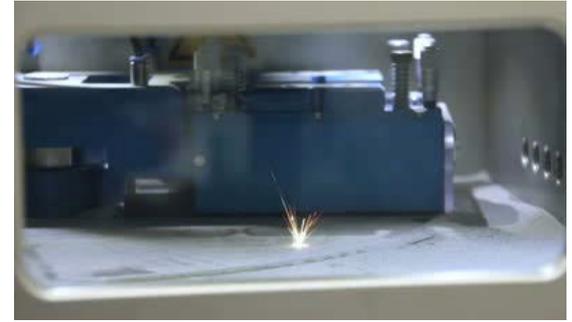
Résines

Métaux

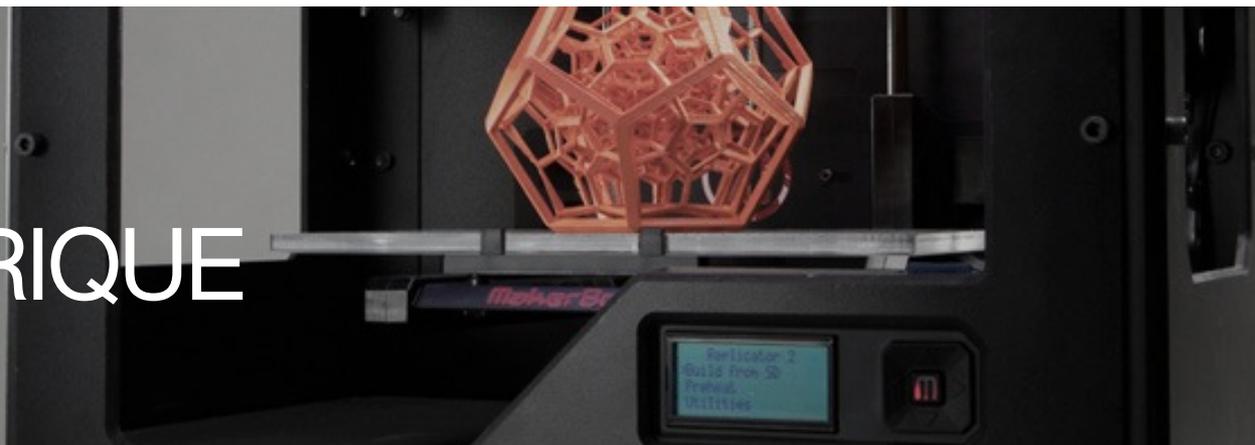
Cires

Multi-couleurs

Multi-matériaux



HISTORIQUE



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1964 – *a replicator machine*

Arthur C. Clarke prédit l'impression 3D avec 50 ans d'avance



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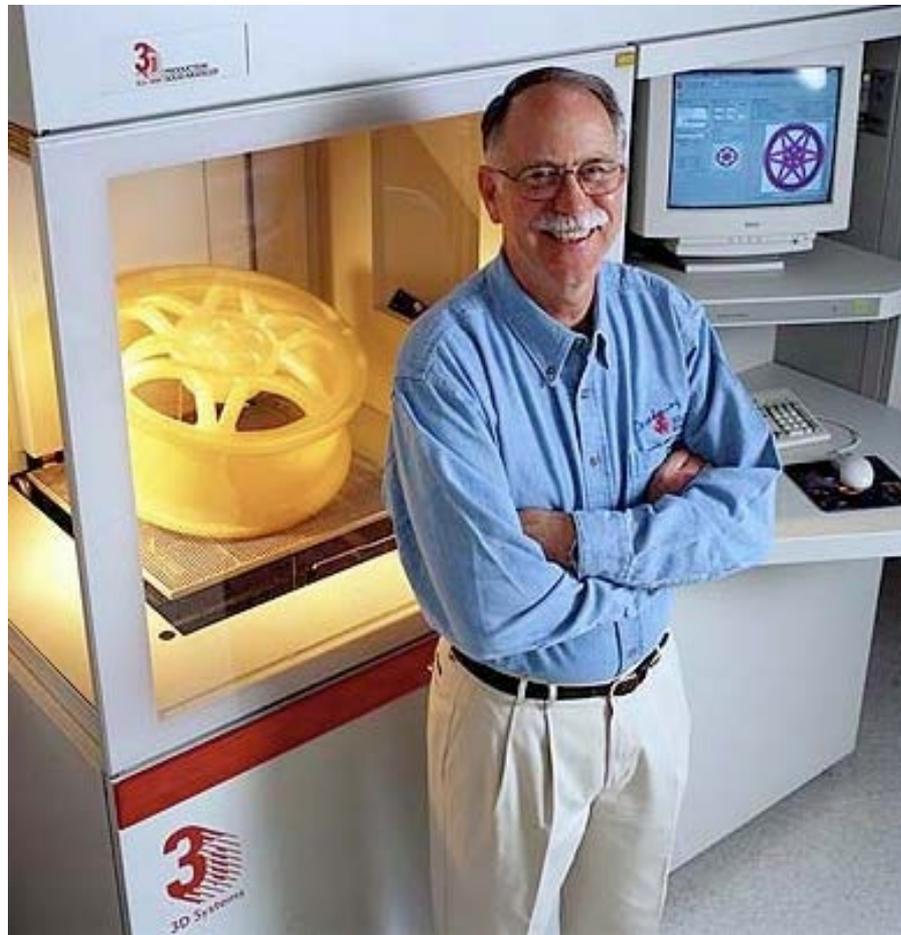


1984

1^{er} brevet par Charles Hull.

Invention de la stéréolithographie

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Jusqu'en 2007

Juste un outil industriel parmi tant d'autres...



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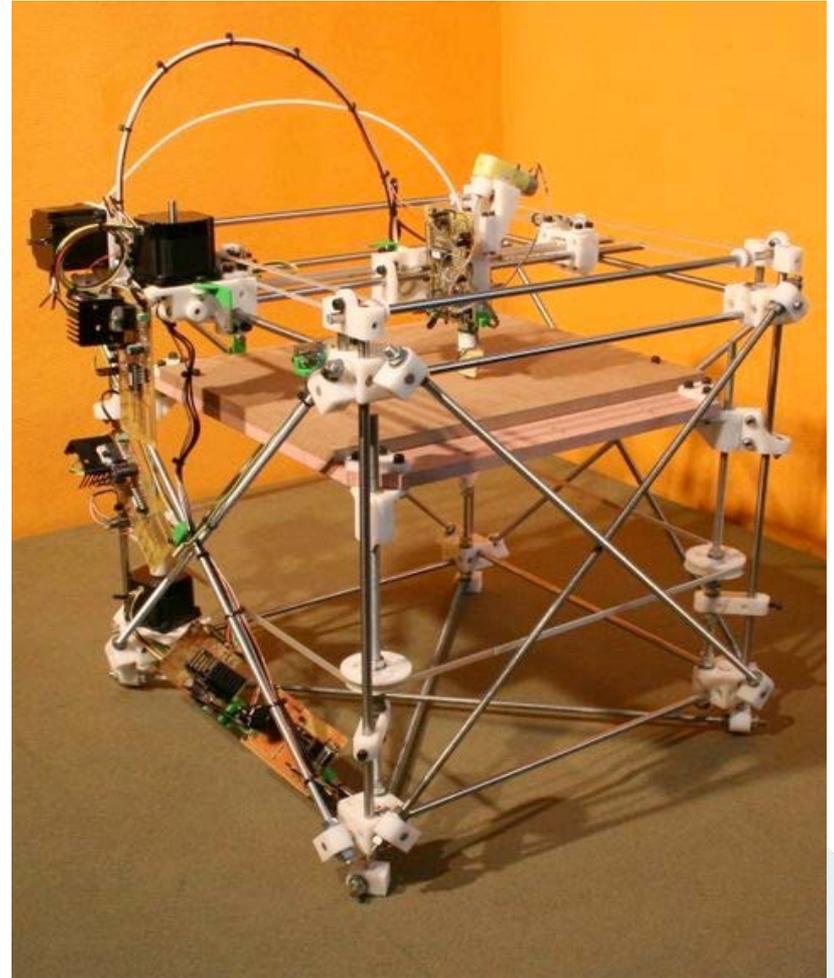


2007

La “RepRap Darwin”

Par Adrian Bawyer - Bath University
(UK)

- En kit – Matériel Libre
- Pour Geeks & Makers





2008

Thingiverse.com – Banque de modèles 3D

La première et toujours la plus importante plateforme.

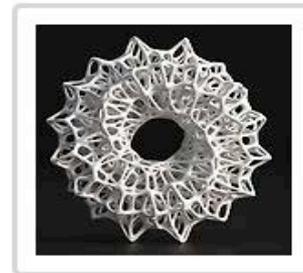
Partager – Collaborer - Personnaliser

100 000+ fichiers

Creative Commons



3D Printing



Art



Hobby



Household



Tools



Toys & Games



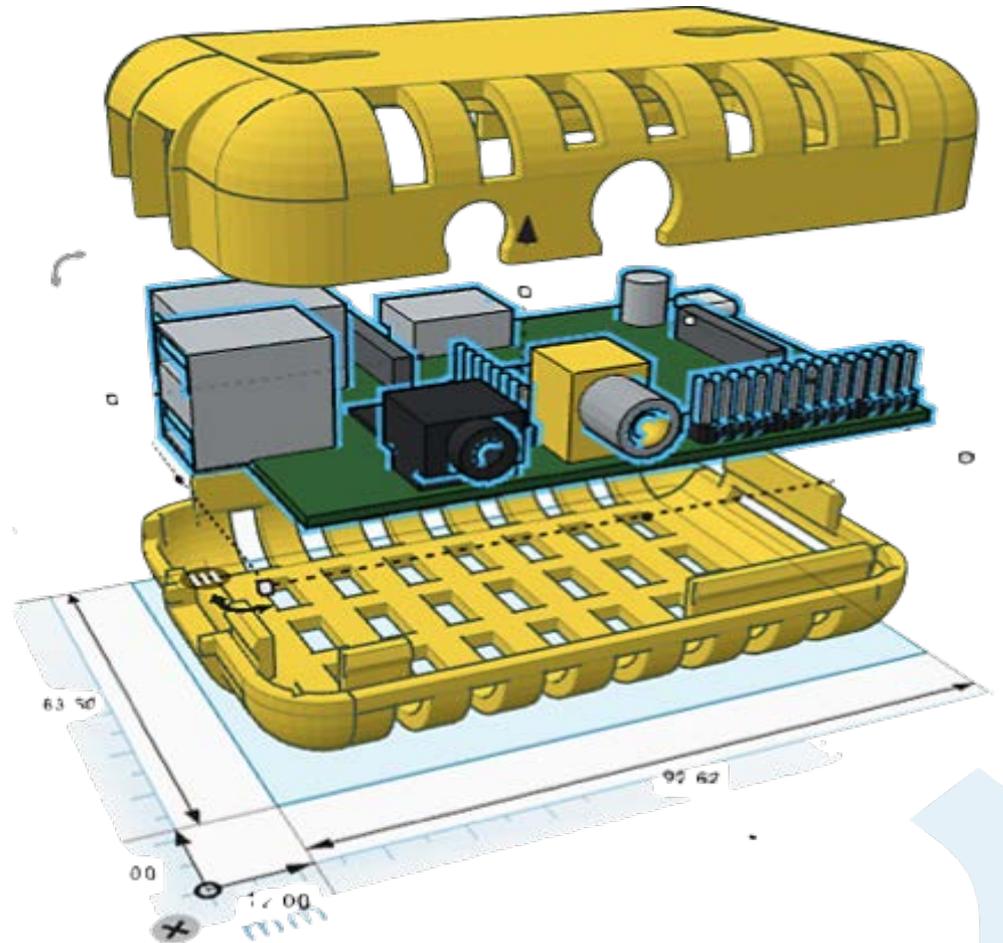
2009

TinkerCAD.com

CAO pour tous

Facile et gratuit

Optimisé pour l'impression 3D



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2010

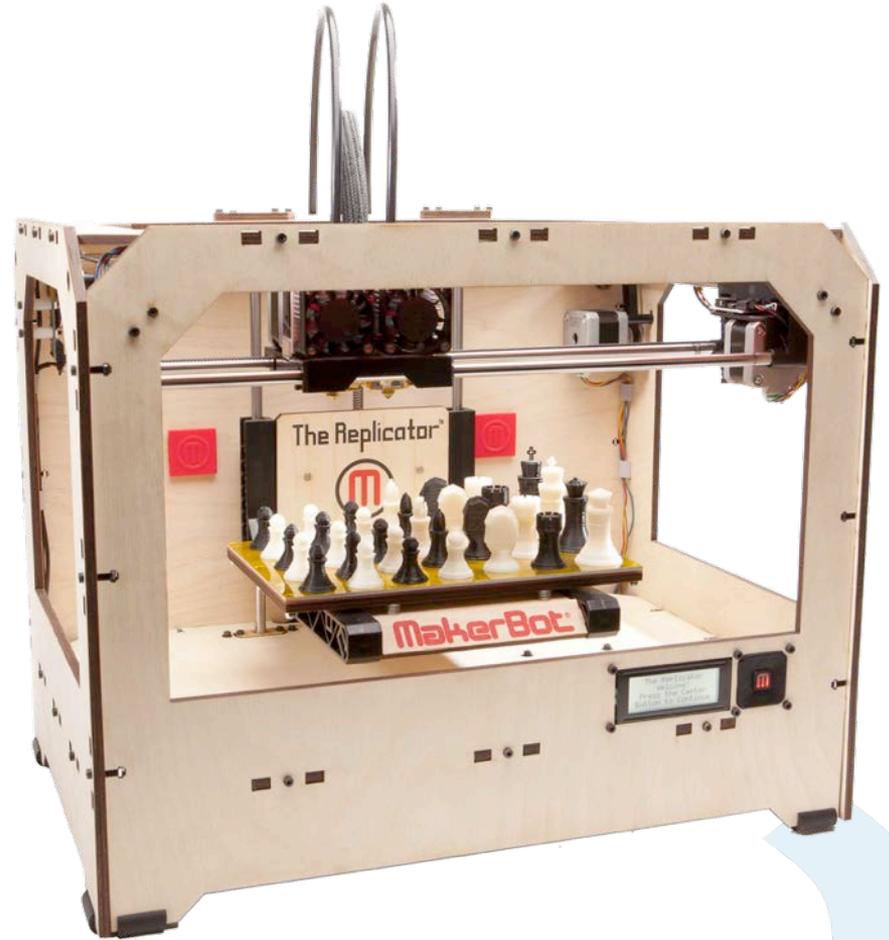
MakerBot Thing-O-Matic

Le mouvement décolle aux USA



2012 MakerBot Replicator

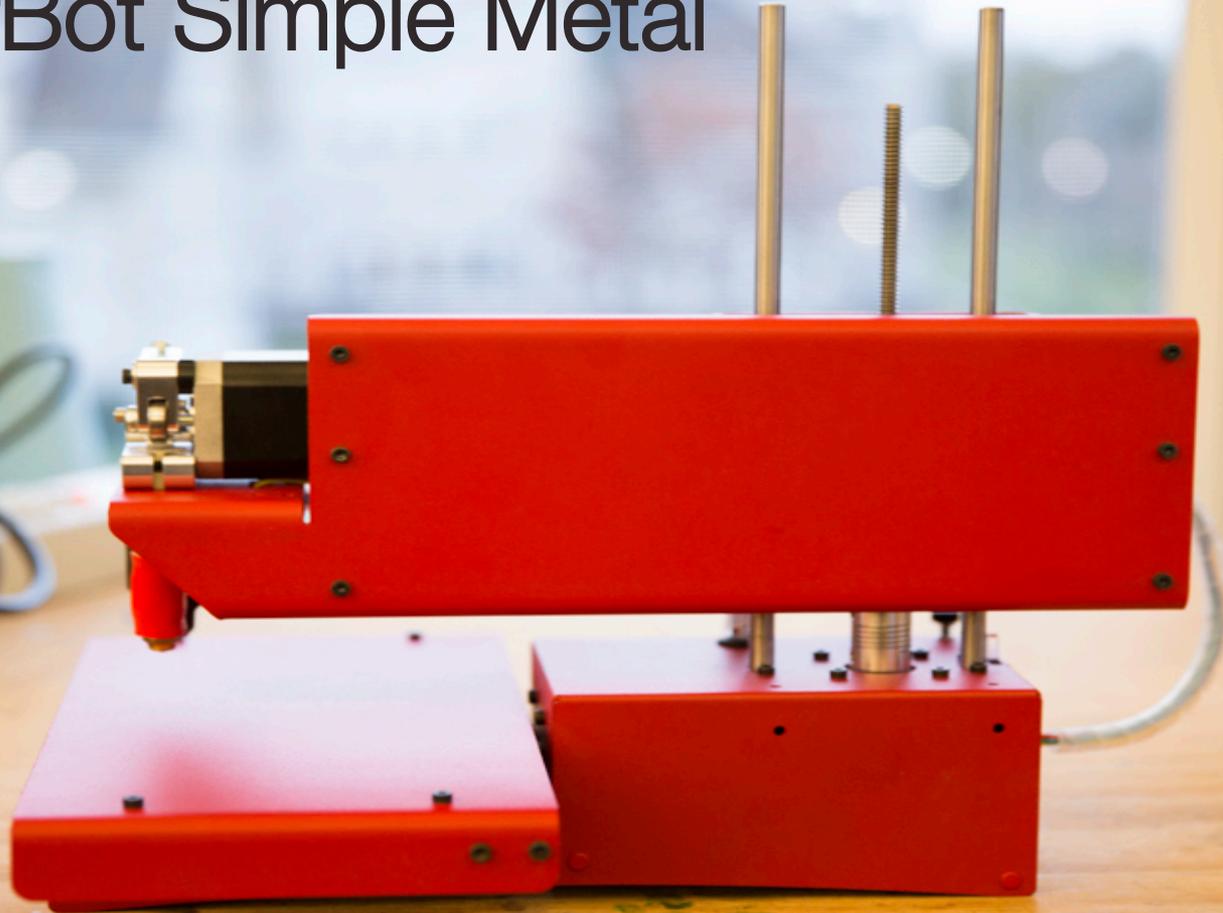
Deux têtes (2 couleurs, 2 matériaux)
100 microns par couche



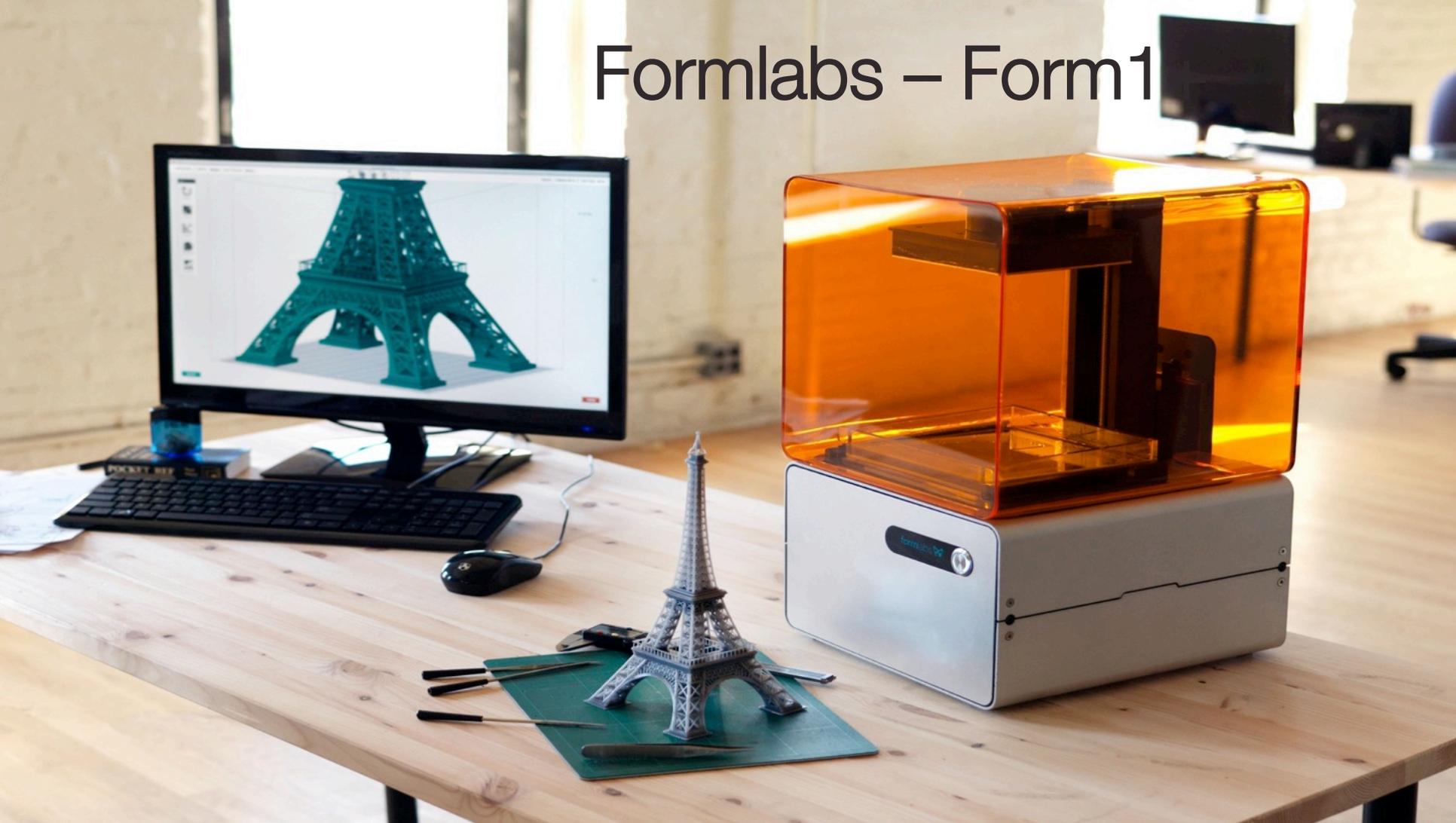
5^e génération des MakerBot Replicator



PrintrBot Simple Metal



Formlabs – Form1



Printer Manufacturers



Printing Services



Scanners



Printing Networks



Marketplaces



3D Printing

181 Companies
\$201M Funding

See the updated scan and more:
venturescanner.com/scans/3dprinting

Communities



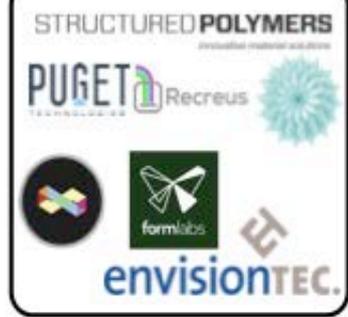
3D Printing Applications



CAD Software



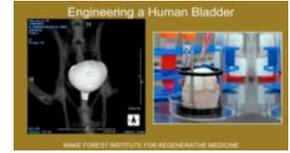
Materials



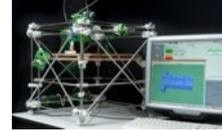
Dates clef

Charles Hull - la stéréolithographie

1984
Stratasys – 1^e machine FDM
1989



1999
Première greffe humaine imprimée (vessie)



2007
Projet RepRap



MakerBot

Sculpteo (France)

2009

Premiers drones



1986
Création de 3D System



1995
Z Corporation – Techno MIT (3DP)

2002
Prototypes de rein



2007/2008
Shapeways

Vaisseaux sanguins



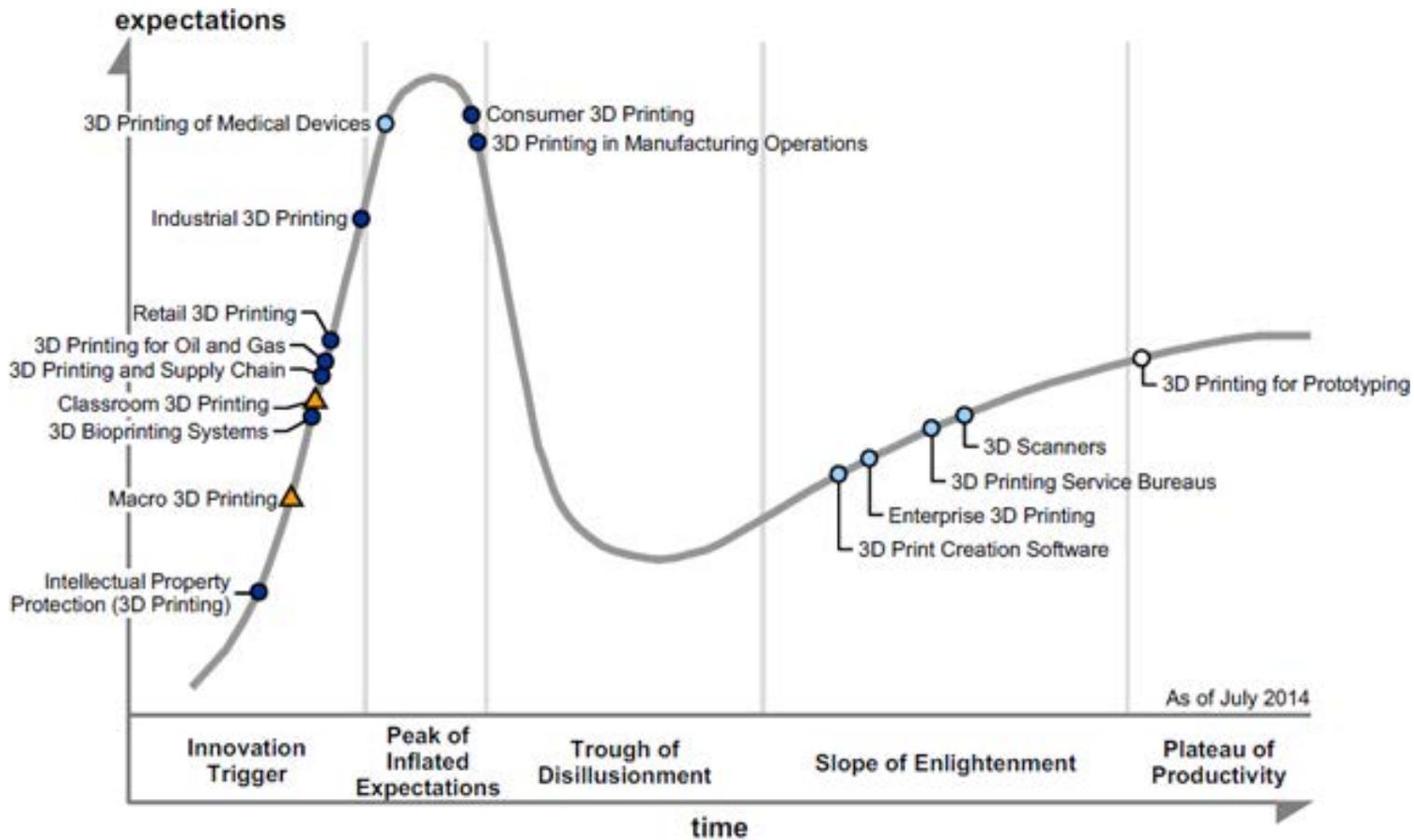
2010

2012
Prothèses dentaires

2013
Liberator



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Plateau will be reached in:

○ less than 2 years

○ 2 to 5 years

● 5 to 10 years

▲ more than 10 years

○ obsolete

⊗ before plateau

2006

2007

2008

2009

2010

2011

2012

RepRap Family Tree

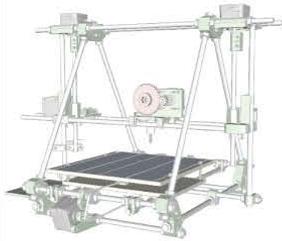
v4.0 (14-04-2012)



Emmanuel Gilioz

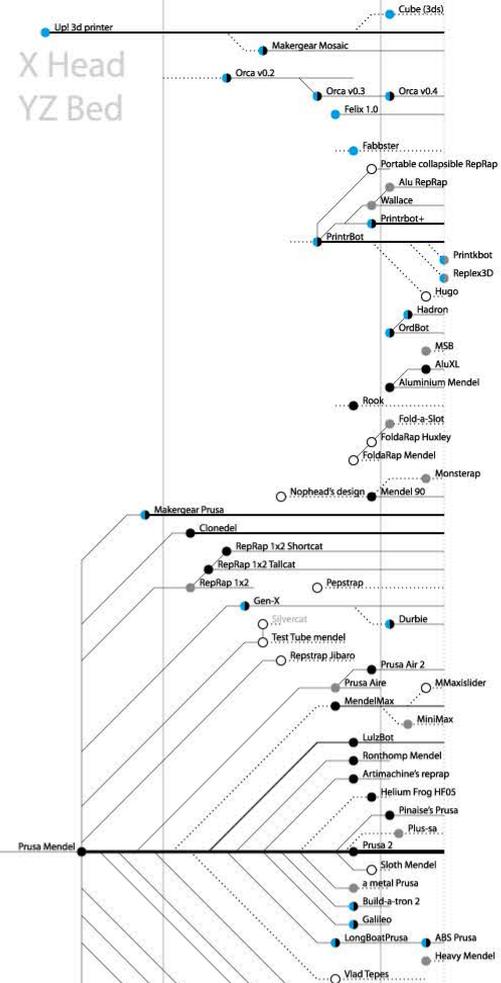
- Working
- Experimental
- Concept
- Other oshw project
- Commercial

- Common
- - - Less common
- ⋯ Work in progress



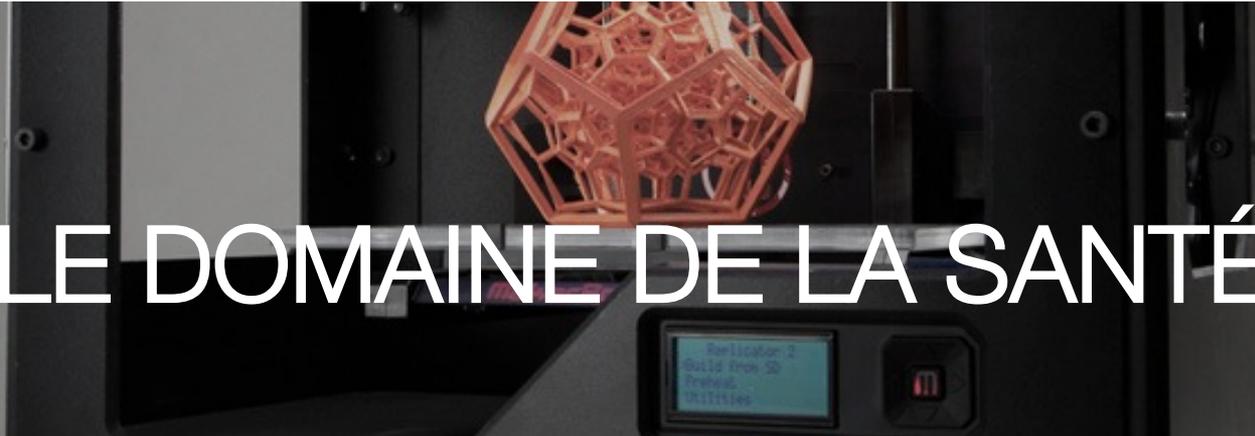
CARTESIAN

X Head YZ Bed



Synthèse de mi-parcours

- Capacité à créer des formes très complexes.
- Ne consomme que la matière nécessaire
- Rôle clef des amateurs – Recherche distribuée

A close-up photograph of a 3D printer in operation. The printer is dark-colored, and a complex, orange, lattice-like structure is being printed on a platform. The structure consists of interconnected hexagonal and pentagonal cells, resembling a honeycomb or a biological scaffold. The printer's control panel is visible in the lower right, showing a small screen with text and a red emergency stop button.

DANS LE DOMAINE DE LA SANTÉ

Prototype

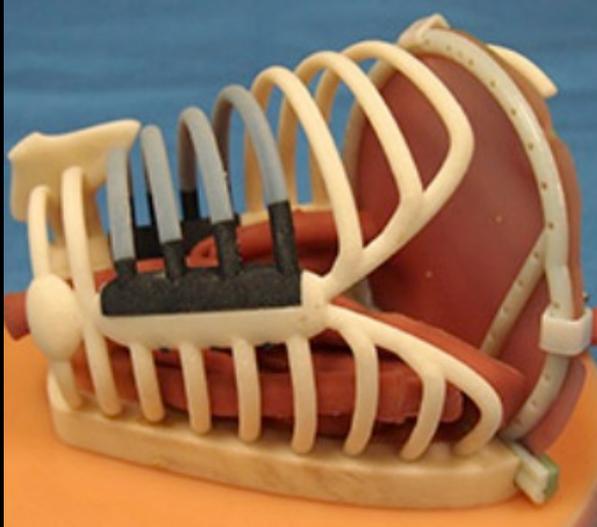
Prothèses

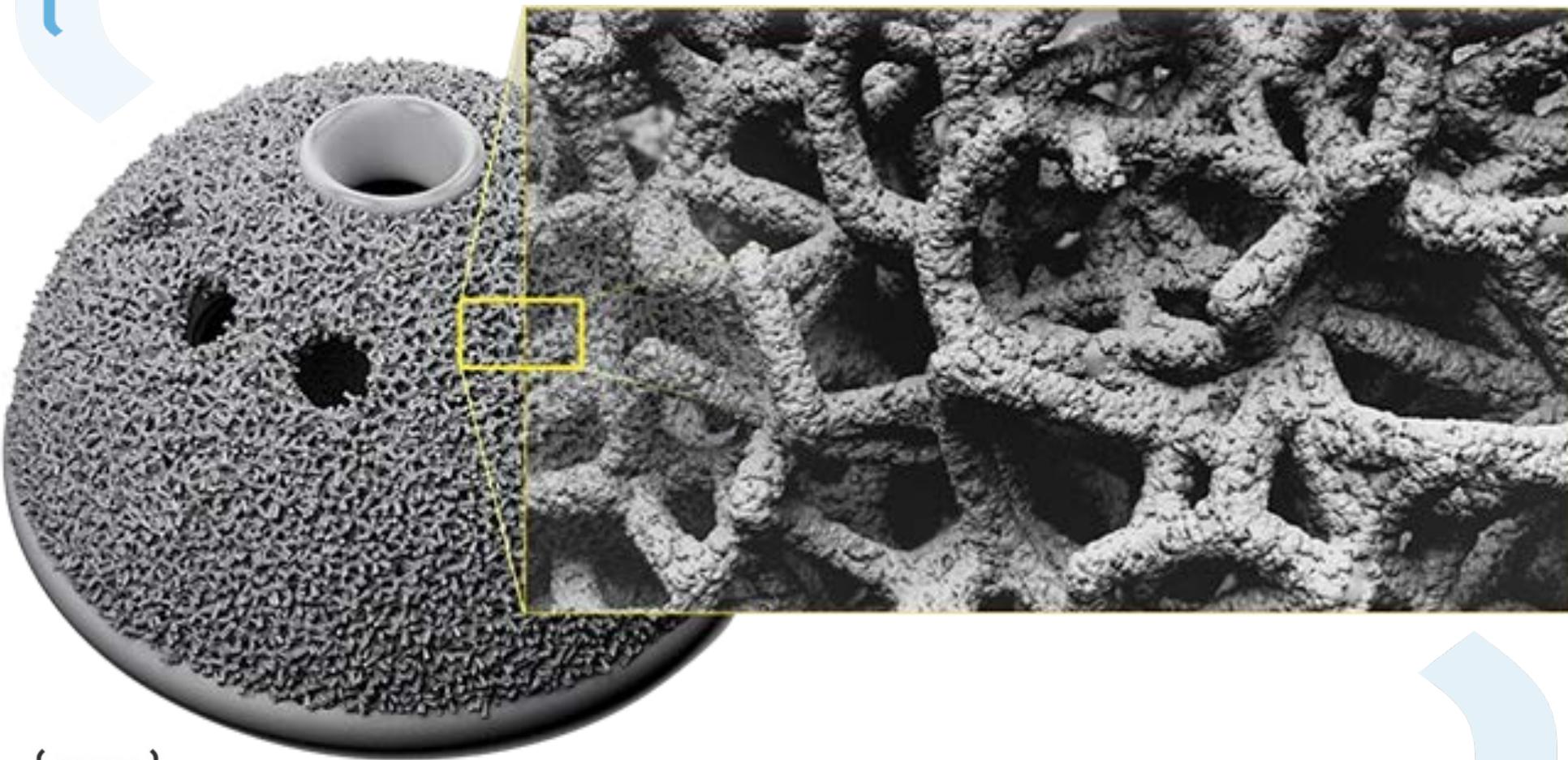
Implants

Médecine régénérative : tissus/organes & vaisseaux

Nourriture

(CKAB) Impression 4D ?!





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HOW LEN'S FOOT WAS SAVED

1

Len's right heel (calcaneus) must be removed before a cancerous tumour growing in it spreads



2

CT scans of the left foot are reversed to create an imitation 3D right foot on screen by Anatomics. That is used to help create an exact copy of the heel in titanium, using the CSIRO 3D printer



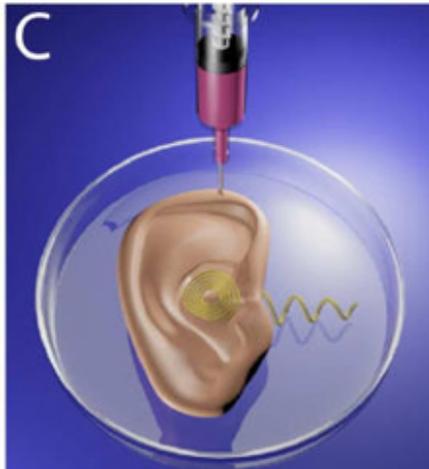
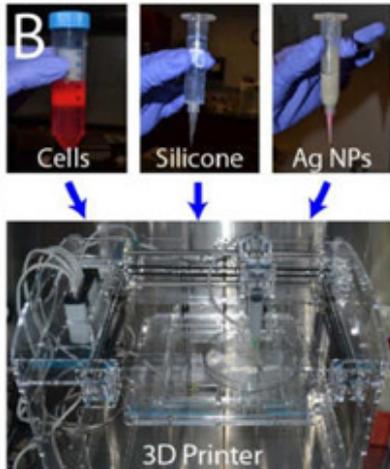
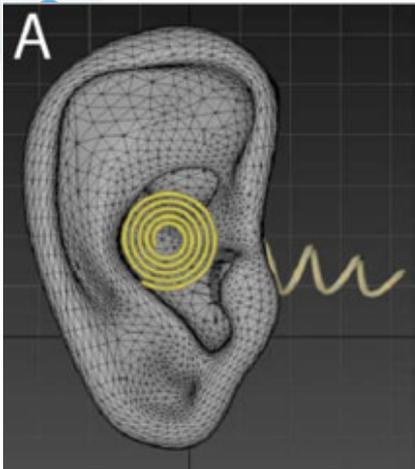
3

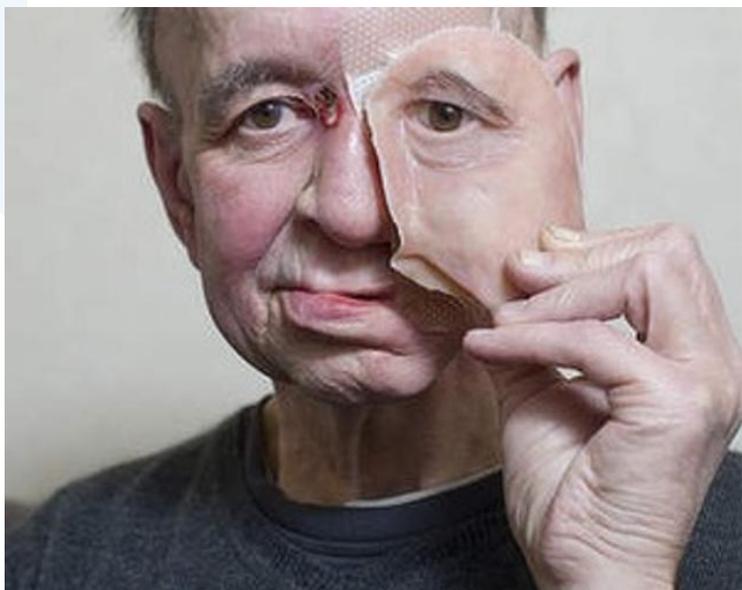
Professor Choong fits the titanium heel to Len's foot and reattaches the achilles tendon and muscles



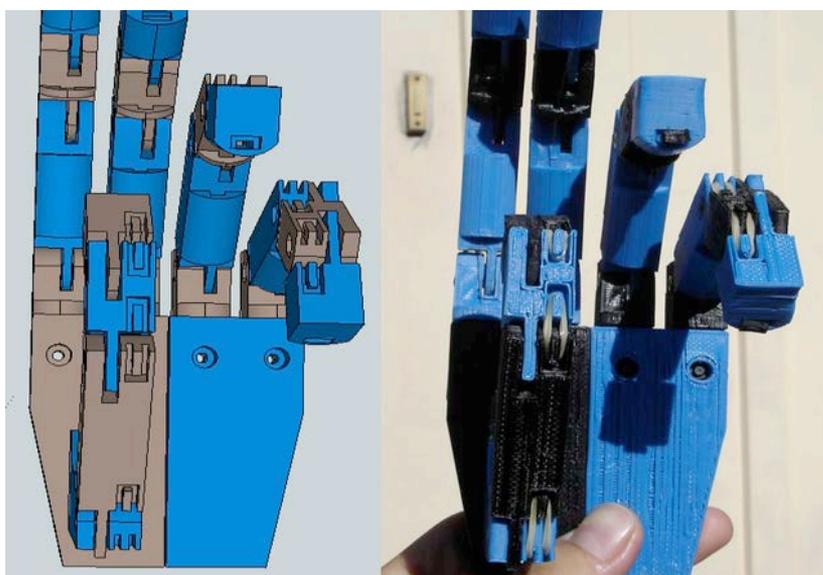
4

The heel is designed with holes to help reduce weight and to allow tissue to grow through





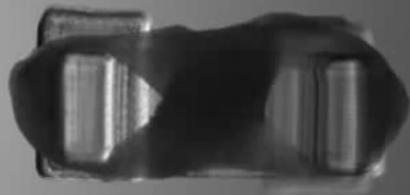
(c)



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1 Hz

00:00



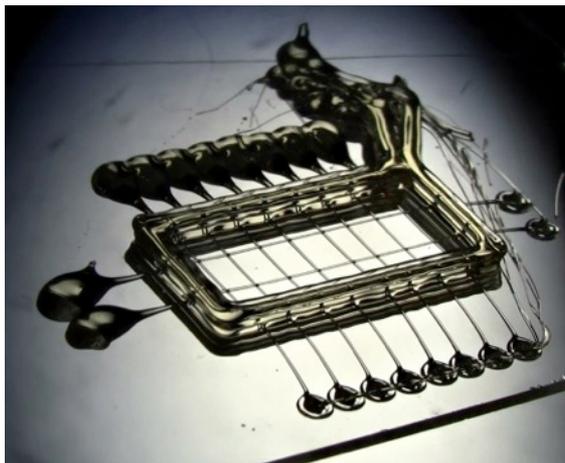
2 Hz

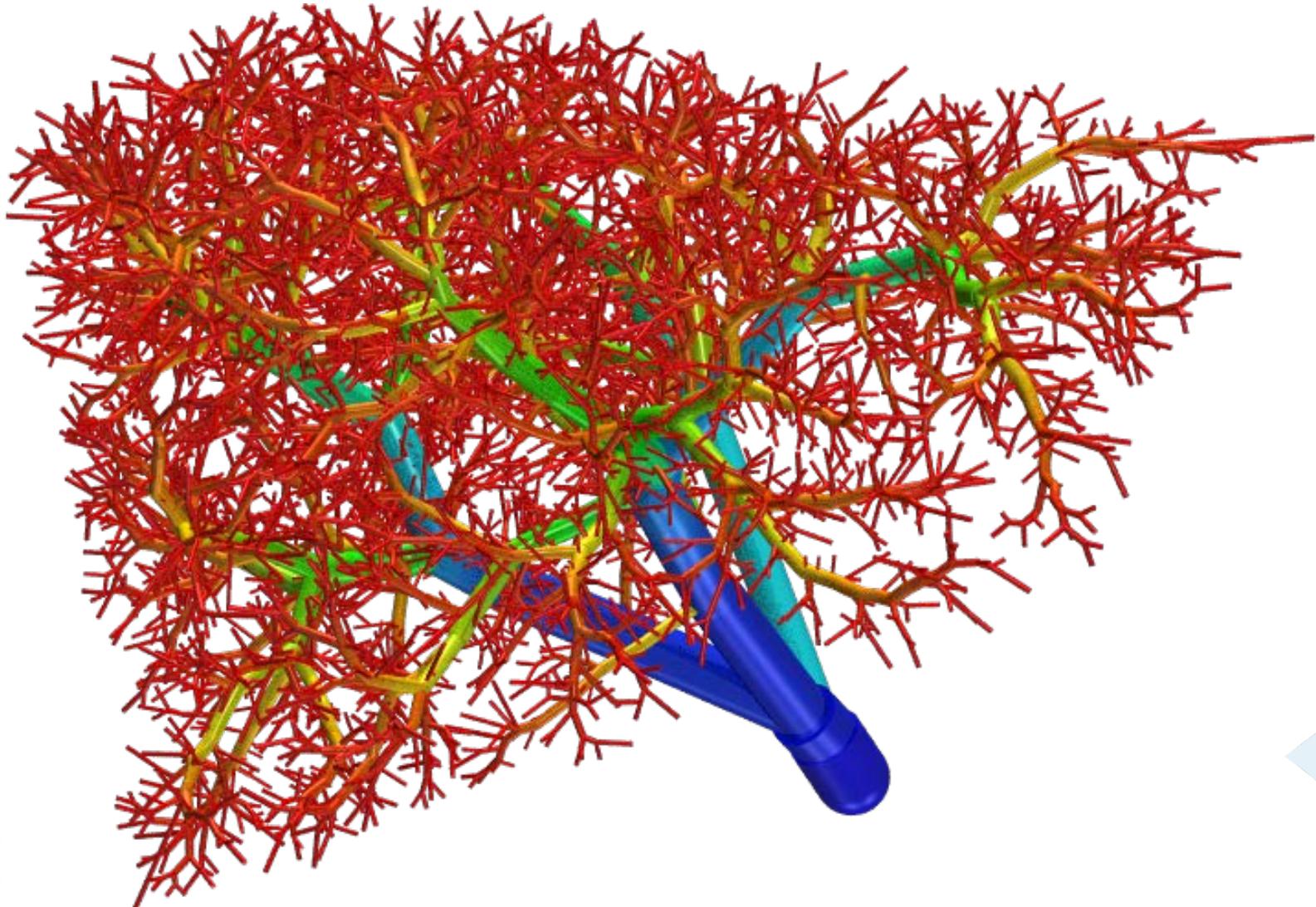


4 Hz



1 mm





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Engineering a Heart Valve



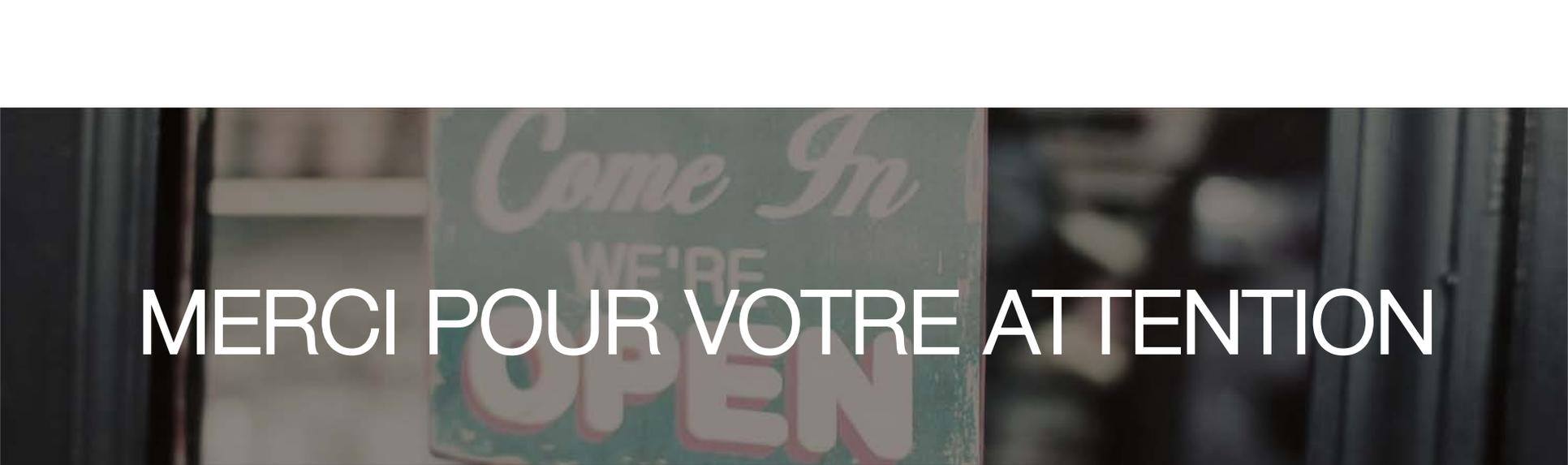
WAKE FOREST INSTITUTE FOR REGENERATIVE MEDICINE

Demain ?

- Fiabilisation & généralisation des impressions d'organes (cœur, poumons, reins...)
- Impression de médicaments en pharmacie ou...à la maison ?
- Questionnements sur l'encadrement législatif



(CKAB)



MERCI POUR VOTRE ATTENTION

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<http://ckab.com>

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