Press Release

Is 3D printing going to revolutionise the healthcare sector and its business model?

Focus on surgery, bio-printing and therapeutic drugs

The technique of 3D printing has become an essential production process in the healthcare sector, where it enables unequalled customisation of the therapeutic arsenal. Alcimed, consultants in innovation and development of new markets, is considering the various applications of 3D printing in healthcare and the prospects that it offers for a profoundly-changing sector that ***could require the economic models in use today to be rethought****.*

Paris, 23 February 2016 - Available in the healthcare sector for many years, with a **market now estimated at 490 million euros**[1], 3D printing stood out as an essential technology.

In the **surgery**, it offers a huge palette of customisation tools applied to the design and manufacture of implants, prostheses or models. But in reality surgery is only a part of the set of applications for 3D printing in healthcare, currently less well-known.

Today, the industry is mastering printing of materials as varied as plastic, titanium and ceramics, but tomorrow's objective is to be able to print biological tissues. **Bio-printing would therefore open new prospects in regenerative medicine**. Finally, emerging technologies already make it possible to produce**therapeutic drugs using 3D printing** and could lead to a revolution in the pharmaceutical industry.

Key dates and figures

3D printing market in healthcare

Today	IN 2020
$490m	$2.13bn

1999	3D printing a model of a bladder enabling cell culture on its surface and so reconstituting an appropriate shape and size of bladder
2008	First leg prosthesis, entirely 3D-printed
2009	First 3D-printed blood vessel
2015	FDA approval of the first 3D-printed medicinal product

3D printing in surgery, today's flagship sector

Surgery is currently the main field for application of 3D printing in healthcare. It is based on very similar technologies to those used in other industries (aeronautics, automobile, *etc.*), particularly printing plastics and titanium. **3D printing makes it possible to create customised medical devices in this field where every patient is unique**. We current know three applications for 3D printing in surgery:

[1] Fabulous consultancy

- **Manufacturing customised implants or prostheses** designed using new 3D scanning techniques. For example, it is possible to create hip prostheses for patients whose bone is partly destroyed, where the attachments are located in areas of healthy bone. Here 3D printing is therefore used for the patient's direct benefit, offering a therapeutic response as close as possible to their needs.

The other 2 applications are intended more for use by the surgeon.

- 3D printing, also combined with 3D scanning, makes it possible to create **guides, specific to each patient, used by the surgeon during the operation, to speed up his manipulations and make them safer** (e.g. to secure vertebral implants).
- Finally, the last application relates to **manufacturing the organ or bone model, enabling surgeons or students to train using a faithful replica of the body part to be operated on**. This technique is used particularly by dentists because it enables them to make a perfect replica of the patient's jaw in a material reproducing the properties of bone, and so practice fitting implants.

Tomorrow, repairing the human body using bio-printing

While 3D printing now makes it possible to manufacture customised medical devices, in the near future it will be possible to produce biological tissues used in regenerative medicine. For from printing whole organs such as the heart or a lung, which is still something from science fiction given their biological complexity, **bio-printing would enable manufacturing, rapidly and in large quantities, of tissues such as skin, cornea or bone**. **The first clinical trials using these tissues could take place in the next 10 years[2].**

Beside the therapeutic benefit deriving directly from this technology (e.g. skin grafts for third-degree burns), bio-printing could be used by the pharmaceutical industry to design more representative study models, which would make it possible to reduce animal experimentation (in 2015, L'Oréal established a partnership with the American start-up Organovo to produce 3D-printed skin to test its cosmetics[3]).

Is 3D drug printing going to revolutionise the healthcare sector?

The application of 3D printing to surgery and regenerative medicine represents a major innovation in the healthcare sector, but another application of 3D printing appears to be totally 'destabilising' in nature. **In August 2015, the FDA approved the first drug produced using 3D printing, *Spritam* from the American company Aprecia Pharmaceuticals**. This drug, placed on the market at the beginning of 2016 in the USA, is a treatment for epilepsy using levetiracetam as the active ingredient (traditionally used in epilepsy drugs). This treatment, obtained by 3D printing, is presented in the form of very porous tablets, enabling them to dissolve much more rapidly than conventional products. 3D printing also makes it possible to dose the active ingredient of the medicine more accurately and so produce tablets where the dosage is appropriate to the patient's needs. In addition to these therapeutic advantages, marketing *Spritam* poses new issues that could revolutionise the pharmaceutical industry.

In fact, if 3D printing offers us the promise of being able to design, at home or at the FabLab on the street corner, our furniture or our car parts, why couldn't we print our medicines ourselves? Currently there is no major technological barrier to applying this production technique to all types of molecules: it would therefore be possible to imagine a world in which doctors would actually prescribe 'inks' used to produce your own medicine

[2] Fabien Guillemot, Inserm researcher in tissue bio-engineering
[3] Organovo press release, "L'Oreal announces research partnership with Organovo to develop 3D bio-printed skin tissue"

based on the personally-required dose. Or course, this theory, developed by the chemist Lee Cronin, is very futuristic and it seems unlikely that governments would grant the general public free access to molecules that could be dangerous. Nonetheless, **a much more plausible hypothesis is that hospitals and pharmacies could be equipped with such machines to produce medicines themselves based on the precise needs of their patients**. The demand for drug production by the pharmaceutical industry could therefore be greatly disrupted by the **arrival of 3D printing for medicines and could require the economic models in use today to be rethought**.

Vincent Genet, Associate Director of Alcimed, concludes: "*If the boom in 3D drug printing is confirmed, the pharmaceutical industry's economic models will be profoundly upset: it is therefore necessary for companies to be prepared in advance to offset the risk of disintermediation*".

ABOUT ALCIMED

Alcimed (www.alcimed.com) is a consultancy company in innovation and development of new markets, specialised in life sciences (healthcare, biotech, food processing), chemistry, materials and energy, as well as aeronautics, aerospace, defence and Public Policy. Alcimed counts on a team of 180 employees, sub-divided by sector and able to handle extremely varied missions from marketing & sales subjects (market surveys, targeting new needs, positioning a new product, etc.) to strategic issues (development strategy, research & assessment of acquisition targets, organisation of an activity, design/assessment/deployment of public policies, etc.). The company's head office is in Paris and it also has offices in Lyon and Toulouse, as well as in Germany, Belgium, Switzerland, England and the United States.

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