From Anti-Ageing Creams to Alzheimer's, this Biotech 'Milks' Tropical Plants

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What if a biotech company would run its business with plants as raw materials? We looked at the biotech Plant Advanced Technologies (PAT) (France) aims to push back the frontiers of plant 'sourcing', by producing industrial biomolecules in plants without killing them!

PAT
Plant Advanced Technologies

Only a few thousand of plants are quite well exploited in green biotech over around **450,000 species of plants** identified. Plants feed and treat us thanks to **active compounds**. Within a phenomenal reservoir, a substantial part of **biodiversity potential** is yet to be discovered.

PAT was born in 2005 in Nancy (East France), by the co-founders **Jean-Paul Fèvre** (CEO), Frédéric Bourgaud and Eric Gontier. They aimed to use plants to reveal and produce rare and new biomolecules for pharmaceutical, cosmetic and agro-chemical industries.

Using tropical plants in Greenhouses for natural compound extraction, and the Plant Advanced Technologies Team in one of their Greenhouses (Source: Plant Advanced Technologies / JDE Lorraine)

With more than **450** species of plants cultivated in their greenhouses, PAT already owns rights to around **25** active compounds which they have discovered. And its focus as a biotech is built on the relevance of its patented technologies to green movements at the **French National Institute of Industrial Property**, and last year during the **COP21** **summit** (initiative for Climate change).

A partnership with the Biochemical giant **BASF**, has helped the business development of PAT to really diversify, with the the development of **bio-pesticides** and takeover of several French companies. These include **Synthelor** (fine chemicals), Strati-Cell (a dermatology testing company for cosmetics) and Couleur de Plantes (working on natural dyes).

With its 30 employees and 4 hectares of greenhouses, PAT has developed 2 innovative technologies to produce active compounds with high added value

Indeed, **€1M** of its turnover has been generated thanks to its first product developed for a global leader in the luxury sector, **CHANEL**.

In 2012, when this Cosmetics and fashion leader signed the deal with PAT for the launch of a new**Anti-ageing** cream range, over **1,200 square metres** of soil-less culture was developed in PAT greenhouses. This was to produce and purify a polyphenolic *Edulis* extract (a powerful cosmetic anti-ageing compound).

PAT's technology has even been used by Cosmetics A-lister Chanel in an anti-ageing cream range (Source: Open Source Graphics remix by Labiotech – no Chanel products shown)

So how does PAT extract these useful biomolecules? There are two main technologies…

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1. PAT PLANT MILKING Technology

Pat Plant Milking is a world exclusive technology platform licensed from **INRA** and **University of Lorraine.** It is a **sustainable** sourcing solution to produce exclusive and personalised (and ethical!) active chemicals extracted called **Exudactive.** It is a living process using living plants root **exudation**to extract **specific active compounds**.

Actually, PAT uses **aeroponics** systems (without the use of soil) to grow plants without then killing the plants during extraction. The plants are 'bio-stimulated', which allows them to produce high yield of high value natural compounds.

This stimulation works by mimicking an attack on the the plant using bio-agents, and this then triggers the natural defences of the plants to produce the desired compounds.

The extraction solution ('Exudactive') is harvested by plunging the roots, then purified and concentrated according to the quality expected. This unique non-destructive process of milking is manageable on the same plants up to **8 cycles per year**, so valuable medicinal compounds can be produced sustainably and even amplify yield by up to **30 times**.

For example, one Mexican species being 'milked' by PAT has a compound being used to treat Osteoporosis. And another Carnivorous type has is being investigated for anti-cancerous properties. Other species are also being studied for therapeutic benefits in Alzheimer's Disease…and even anti-inflammatories.

Plants roots are pictured at the Plant Advanced Technologies (PAT) company greenhouse in Laronxe near Nancy (Left: PAT / Right Photo Credit: Vincent Kessler/Reuters)

The potential is massive…and according to PAT the key value here is that many other uses lie**undiscovered** in these species, so keeping them alive for research is a big benefit in **drug discovery**.

2. The PAT FRIDAY Platform

PAT also aims to be the world first to extract human **therapeutic proteins** for medical research fromgenetically modified carnivorous plants – such as *Drosera* (commonly known as 'Sun dews').

'PAT Friday' is the technology platform which targets plants like these – i.e. those that naturally secrete substances externally, such as *Nepenthes* (tropical pitcher plants) or *Drosera's* sticky modified leaves.

PAT Friday presents **2** main advantages. First, PAT offers a secure technology platform avoiding the health risk related to animal viruses and prions (since neither bacteria nor mammalian cells are used). Secondly, according to PAT, the transgenic plants used represent an economic benefit because the harvest of therapeutic proteins is technically easy and non-destructive (and easy to scale up!).

The Nepthes (picther species) is an example of a carnivorous plant used for its natural secretory system in PAT Friday technology (Source: Plant Advanced Technology)

Moreover, the **cost** of the purification is strongly reduced because the number of unwanted proteins is reduced substantially.

This is an interesting opportunity for the pharmaceutical industry using the natural mechanism of secretion from leaves. And according to **Jean-Paul Fèvre** (CEO), one therapeutic protein can worth between **€1-10 million** per gram (!) on the market.

In 2009 the company had already raised about **€2M** in 2 years after being listed on the Paris **NYSE Euronext**. Last year, PAT also undertook a transfer on **Alternext** Paris Euronext and has since risen around **€7M**. This recent increase in capital has therefore helped PAT to really accelerate its development…

For example, PAT is in the process of launching an R&D greenhouse: **PAT Zerbaz** as a subsidiary on the tropical French island, **Réunion Island** in the Indian Ocean.

So, with such a lucrative market, and a diverse number of sectors interested in this environmentally friendly, green (and attractive) approach to chemical production, the future of Plant Advanced Technologies certainly seems bright!

Quick Animation of how PAT extracts biomolecules from Carnivorous plants…

PAT – Friday from Plant Advanced Technologies on Vimeo.

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Feature Image Credit: Remix of Graphics by Labiotech (Source: PO / 'Sun Dew' from Plant Advanced Technologies)

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