

On-demand (organ) printing

Spitting ultra-fine cell droplets instead of ink, a new breed of ink jet printer has printed live brain cells, a technique that opens the possibility of building replacement tissue cell by cell and giving doctors control over the tissue they graft. These “cell printers” do not force individual droplets of ink through a needle-shaped nozzle onto a sheet of paper.

Cell printers use an electric field to produce droplets 20 micrometers in diameter. Biologists are beginning to understand and manipulate some of the physical and chemical factors that regulate how cells proliferate and congregate. Tissue-engineering labs are investigating organ printing. Led by University of Missouri-Columbia biological physics professor Gabor Forgacs and aided by a \$5 million National Science Foundation grant, researchers at three universities are developing bio-ink and bio-paper that could make organ printing a reality. These labs have made tubes similar to human blood vessels and sheets of heart muscle cells, printed in three dimensions on a special ink-jet printer.

Tissue engineering is a broad discipline that aims to manufacture viable replacements for damaged or missing body parts such as skin, cartilage, bone, blood vessels, muscles, and livers. One of the field's pioneers is chemical engineer Robert Langer of MIT, whose lab in the 1980s developed a polymer scaffolding to mold into the shape of an organ or a chunk of tissue. Such scaffolds have become the most common way to build body parts; and researchers have begun to explore organ printing as an alternative to it.

DNA and RNA chips have been around for a while—but they have been printed in two dimensions. Scientists have figured out how to print not just molecules but clusters of cells.

A customized milling machine prints a small sheet of bio-paper. This “paper” is a variable gel composed of modified gelatin and hyaluronan, a sugar-rich material. Bio-ink blots—each a little sphere of cellular material a few hundred microns in diameter—are then printed onto the paper. The process is repeated as needed with sheets stacked on each other. Once the stack is the right size—about two centimeters' worth of sheets, each containing a ring of blots, for a

tube resembling a blood vessel—printing then stops. The stack is incubated in a bioreactor, where cells fuse with other cells in all directions. The bio-paper works as a scaffold to support and nurture cells and will be eaten away by them or naturally degrade. It can take less than two minutes to print a sheet of bio-paper with bio-ink, but it can take about a week for such a tube to fuse.

Printing involves depositing layer after layer of cells into a Jello-like support called a hydrogel, a substance that is suffused with nutrients that cells digest and then use to create their own support. The hydrogel physically and chemically mimics the surroundings of embryonic cells during development and allows the cells to migrate as they would naturally. The advantage of organ printing over polymer scaffold-based tissue engineering is that tissues can be built up in days rather than months, and no polymers need to be absorbed by the body—the hydrogel is made mainly from the same elastins and other molecules found in the extra-cellular matrix of biological tissue.

These tubes are precursors to the formation of more complicated structures, such as blood vessels, which are composed of endothelial cells that line the interior wall and smooth muscle cells on the exterior. Scientists are using animal cells such as chicken cells right now; but their goal is to perform the experiments with human cells. As a scientific tool on animal models, the late-state embryo cells are desirable experimental models because they will teach researchers about all sorts of properties of tissues.

Human embryonic cells are difficult to obtain and controversial to use, especially embryonic stem cells. Researchers will most likely turn to adult stem cells—cells taken from mature tissue with limited ability to become a specialized cell type.

DID YOU HEAR?

- Analog transmissions will become digital on February 17, 2009, and analog television sets based on the technology in use since 1945 will cease to operate (FCC).
- South Korea now delivers legal notices via cell phone. Reason: The postage bill for these notices is cut by half (Business Week).
- According to the Pew Internet & American Life and comScore Media Metrix, on any given day 60 million U.S. adults use search engines, up from 38 million in 2004. Pew's latest results show that the use of search engines climbed from 30 percent of the Internet population to 41 percent. ComScore shows that the average daily use of engines jumped 23 percent from 49.3 million users in 2004 to 60.7 million users in 2005.
- According to Gartner, printing costs equal between one and three percent of a company's total annual revenue.
- JupiterResearch found the average online consumer spends 14 hours a week online—the same amount of time they watch TV. “Even the most intensive users of newspapers and magazines spend less time reading these publications than they do online or watching TV,” says JupiterResearch Analyst Barry Parr (iMedia Connection).
- Targeted direct marketing (database marketing, direct mail, interactive marketing, insert media, and promotional marketing) are projected to average an annual growth of 7.8 percent between 2003 and 2007 (The Winterberry Group).
- I.T. Strategies estimates that worldwide revenues from wide- and narrow format ink jet hardware, media, and chemistry is set to grow to \$58 billion by 2009. The 2004 revenues were an estimated \$42.1 billion.

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Design courtesy of Lightbulb Press, Inc.
Printing courtesy of PIP Printing & Document Services
Mailing courtesy of IBM Printing Systems Division

Price: \$50

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SHORT TAKES: FACTS AND OPINIONS

Donald Jackson, calligrapher and personal scribe to Her Majesty Queen Elizabeth, is currently working with an international team of artists and scholars to create the first handwritten Bible since the invention of the printing press. The £2 million project has been commissioned by the Benedictine monks of St John's University in Colledgeville, MN. Jackson is five years into the eight year project and so far, four of seven volumes of the Bible have been completed. Since 1964 Donald Jackson has been the scribe to the Crown Office, a role in which he is responsible for Historic Royal documents such as Letters Patent under the Great Seal and Royal Charters. In 1984 he was awarded the Medal of The Royal Victorian Order (MVO), a decoration given for personal services to the sovereign.

With hand-carved goose quills, hand-made inks, and calfskin parchment, Donald Jackson's work harks back to the middle ages. Finished volumes are gilded with 24-carat gold leaf and bound in leather with Welsh oak covers.

Didn't Gutenberg eliminate handwritten Bibles?

Annoying someone via the Internet is now a federal crime. President Bush signed into law a prohibition on posting annoying Web messages or sending annoying e-mail messages without disclosing your true identity. A new federal law states that when you annoy someone on the Internet, you must disclose your identity. Bill sponsors slipped it into an unrelated, must-pass bill to fund the Department of Justice. The bill cleared the House of Representatives by voice vote, and the Senate unanimously approved it.

Even if I know the sender, it may still be an annoyance.

Traditional magazines have started cyberspace versions to keep up with the demand for round-the-clock news and online communities. Now the tables have turned. Webzines are launching print versions to boost their readership and advertising. Internet publishers, helped by low costs that go with signing up their online members, are venturing into the print world they once viewed as an albatross of paper and distribution expenses. Even in a less-paper age, Web publishers find the physical presence of paper brings credibility.

That living room magazine pile will be around for a while.

After 145 years, Western Union has stopped sending telegrams. A precursor to the Internet in that it allowed rapid communication across great distances, telegram use began to decline in the 1980s when long-distance telephone service became cheap enough to offer a viable alternative. Faxes piggybacked on phone service. E-mail was considered as the final nail in the coffin. The world's first telegram was sent on May 24, 1844 by inventor Samuel Morse. The message, "What hath God wrought," was transmitted from Washington to Baltimore.

Telegrams dead Stop

Vertis presented the results of its proprietary Customer Focus 2006: Retail study, its third consecutive survey to reveal that advertising insert readership levels are consistently at 85 percent or above. Additionally, the study finds Web-savvy individuals still rely on advertising inserts—88 percent of Sunday newspaper readers surveyed via the Web said they read Sunday newspaper advertising inserts; but only 79 percent of those surveyed by phone read them. Ad inserts drive consumers to stores and to Websites.

An insert sent to a cell phone is a *Cellsert*.

Digital cameras dominate the sales mix but sales are growing at a slower pace. Sale of 35mm cameras declined 43.7 percent and unit sales of one-time-use cameras declined by 17 percent. Demand for analog cameras declined by 45 percent. The sales volume of SLR cameras also posted losses of 21 percent in unit terms. Demand for digital cameras was up 19 percent. Almost 7 of 10 units sold were cameras of 5 million pixels or more. New camera buyers, 49 percent of total sales, now expect 5 to 5.9 megapixels in entry-level cameras. Average price points seem to have increased slightly as unit volume increase (19 percent) trailed dollar volume increase (24 percent). The camera market is almost completely digital and major camera makers have stopped making analog cameras.

What's film?

NEW EDSF RESEARCH ON SUPPLIER AND SERVICE PROVIDER PRIORITIES

Printing industry analysts at InfoTrends/CAPV and faculty at Clemson University collaborated with The Electronic Document Systems Foundation to study the current state of business, evaluate future trends, establish perceptions of customer expectations, and identify and understand gaps in perception between print providers and the vendors who supply them.

Print providers and vendors share a common market. Factors that benefit print providers indirectly benefit vendors as printers will buy more. Print providers also benefit from the technical knowledge and expertise vendors can provide. The study anticipated that the two groups would have common perceptions of the market, but it found, that in some cases they do, while in others they do not.

1. Both groups were optimistic about print revenue moving forward with the strongest growth over the next two years expected to come from variable data printing and digital full color printing.

2. While print providers forecast growth for offset printing, fulfillment/kitting, and for facilities management, suppliers forecast a decline in offset print revenue and less robust growth in other categories.

3. Providers identified PostScript as the most common print language, PDF as the most popular file format. They had a high level of use and interest in a PDF enabled workflow.

4. Vendors and print providers have very different views on technology adoption. Forty-four percent of the print providers described themselves as early adopters of new technology, 40 percent as mainstream adopters, and 16 percent as laggards. Vendors had a much different view: 25 percent of print providers were early adopters, 45 percent were mainstream, and 30 percent were laggards.

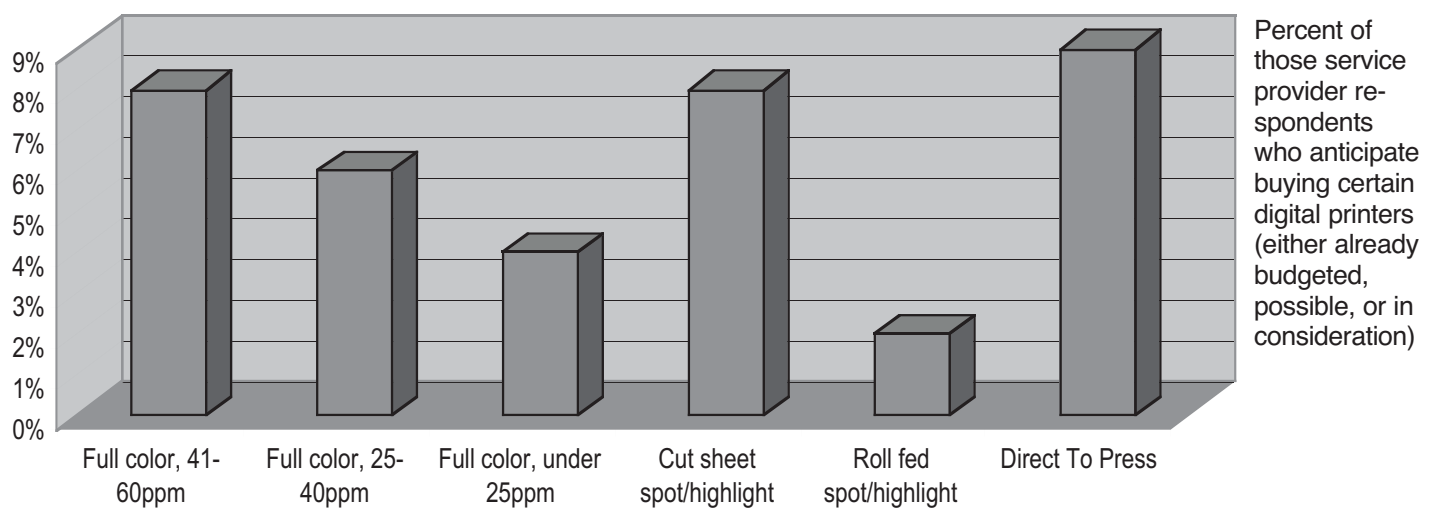
5. Significant differences existed on a number of equipment categories related to investment planning. Vendors were more bullish about planned investments than were print providers. This gap was most surprising around digital color, where vendors forecast strong interest in slower speed devices while print providers were more interested in 60+ ppm devices.

6. Vendors were more pessimistic about the sales expertise of print providers. Print providers were optimistic about evaluating existing expertise.

7. Significant changes have occurred in the market since the 2000-2001 Xplor Technology Directions Survey as is evident in the widespread use of digital color, the adoption of PDF, and support for a PDF-enabled workflow.

In many areas, significant gaps in beliefs are evident between print providers and vendors who responded to this survey. To benefit the industry as a whole, vendors should work more closely with print providers to understand their trends and beliefs and to provide the advice and counsel expected of them—as well as more accurately forecast sales. Print providers must focus on aligning investment plans with strategic intent. To achieve “super efficiency” requires investments in software and services that many print providers are not planning to make. If this gap persists, many print providers will exit a competitive landscape.

“Supplier and Service Provider Priorities: 2005 Survey Results” was authored by Charlie Corr, Group Director, InfoTrends/CAP Ventures, and John Leininger, Ed.D., Professor, Clemson University. The study is available for download at www.edsf.org.



INFORMATION ACCESS — ANY TIME, ANY WHERE, ANY FORM

Information is available on many digital devices in many digital forms—recorded or downloaded media. More information is more accessible to more people than at any time in the history of the world.

Music is online more than on CD. Books and magazines are being scanned to make them searchable online. Television broadcasts are being recorded and archived. Radio shows are becoming podcasts. Soon we will be able to link to much of the world’s knowledge—in any format—from nearly anywhere.

With a generation growing up expecting everything on the Internet, companies like Google, Yahoo, and Microsoft are committing millions of dollars to scan books and other printed materials so they can be indexed and retrieved online. Publishers of all kinds plan to digitize their holdings. Online access will let scholars and others obtain instant information from Websites, digital files, scanned books, and other scanned publications directly.

Television shows formerly stored in network or studio vaults will soon be online. For

the past year, Google has been digitally recording news and other programs. America Online and Warner Bros. will offer free access to dozens of old television shows.

TiVo has expanded its digital recording system to provide video transfers to iPods and Sony’s PlayStation Portable. National Public Radio has posted free podcasts featuring clips or entire programs. Anyone with a music player can listen anytime, anywhere. Materials born digital, like photos from digital cameras can now be easily shared with anyone.

The U.S. (parking) space race

The resident population of the United States is now about 298 million, a baby is born every 8 seconds, someone dies every 12 seconds, and the nation gains an immigrant every 31 seconds on average—thus the population grows by one person every 14 seconds. America's population grows by just under 1 percent annually. Somewhere around the time of the Autumnal Equinox, the 300 millionth American will be born.

The United States ranks third in population behind China and India. It is still gaining people while other industrialized nations, such as Japan, are not. The 300 millionth American will be born in the year when the first Baby Boomers turn 60 and the one billionth person signs on to the Internet.

- 100 millionth person: Born in 1915, perhaps to a white, ethnic, city family in New York City or a rural family in upstate New York or Pennsylvania.
- 200 millionth person: Born in 1967, probably a white son to middle-class suburbanites in Los Angeles or New York City.
- 300 millionth person: Born in the fall of 2006, will likely be a Mexican Latino in Los Angeles County with parents who speak Spanish at home and bilingual siblings. The 300 millionth American will have a longer life span than earlier Americans, to 85 or 90 years on average.
- The Census Bureau projects that even with the nation growing more slowly, population will top 400 million before 2040.

If you think parking is bad now, just wait.

Someday my prints will come

The Photo Marketing Association reported on photographic imaging trends for 2005. The volume of prints (all sizes) made from digital-still camera images increased by 69 percent. Online ordering grew 159 percent. Printing at retail minilabs grew by 142 percent, more than twice as fast as the overall printing growth. Growth in home printing remains positive, but below the market average—the volume of prints made at home grew by 43 percent.

Home printing accounted for about half of the printing volume in the year ending November 2005. Retail channels accounted for a total of 41 percent of prints made—specifically, 15 percent of the prints were made instantly by consumers on a kiosk, and 22.5 percent were sent from a kiosk/ordering station to a minilab for printing, or customers gave their memory card to a store clerk. 4.1 percent of the total prints were ordered online and later picked up at a retail location; and 9 percent of the total prints were ordered online and mailed to customers.

Traditional film processing continued to decline rapidly—total volumes were down 13.6 percent.

Online and kiosk channels gained share at the expense of supermarket (lost 1.9 percentage points), warehouse-club (lost 0.7 percentage points), and mail-order (lost 1.0 percentage points) channels. Supermarkets have been reluctant to invest in digital labs and have reduced their overall emphasis on photo processing of any kind. The next few years will see a virtual war for your photographic print business.

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On-demand organs

300 million Americans

Information access

Digital cameras