August 2006

Trends eMagazine

CRUCIAL TRENDS AND HOW THEY'LL IMPACT YOUR BUSINESS, YOUR CAREER, AND YOUR LIFE

The Rise of Crowdsourcing

Biotech and the New Era of Germ Warfare

The Fabulous World of Bio-Fabs Arrives

Kill All the Trial Lawyers

Is Methane Hydrate Our Long-Term Energy Solution?

PLUS: The Skyscraper Boom • The New Science of Marketing Ethnography

Trends
eMagazine

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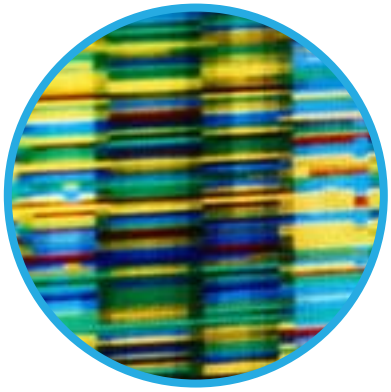
Biotech and the New Era of Germ Warfare

There is a struggle going on today that makes the War on Terror pale by comparison. It's a steadily escalating war between rapidly mutating super-bugs and the super-drugs we use to fight them. Just how big is this threat, and how big are the opportunities? We'll explain.



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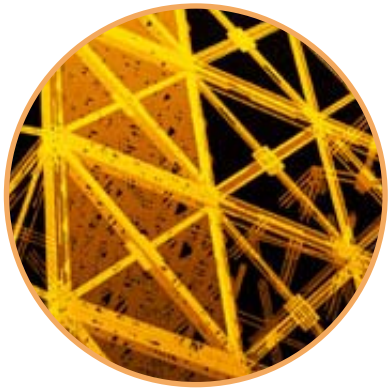
The Fabulous World of Bio-Fabs Arrives

It's been more than 30 years since man discovered how to cut and splice genes. However, it's remained a tedious manual job in the research lab, rather than becoming an automated industrial process. Now that's about to change, and the implications are enormous. Just as making circuits changed from soldering components together in the 1940s to designing libraries of silicon logic for machines to synthesize in the 1980s, bioengineering is being transformed. We'll examine the opportunities and threats you need to understand.



Trend #6: *page 26*

The Skyscraper Boom

In spite of the anxiety that followed the September 11, 2001 terrorist attacks and the recession of that same year, skyscraper building is back with a vengeance. From Dubai to Chicago to Shanghai, relatively low interest rates and booming economies are motivating investors to put up tens of billions of dollars to construct ever-taller buildings. What's up? We'll give you a bird's-eye view.

Trend #7: *page 31*

The New Science of Marketing Ethnography

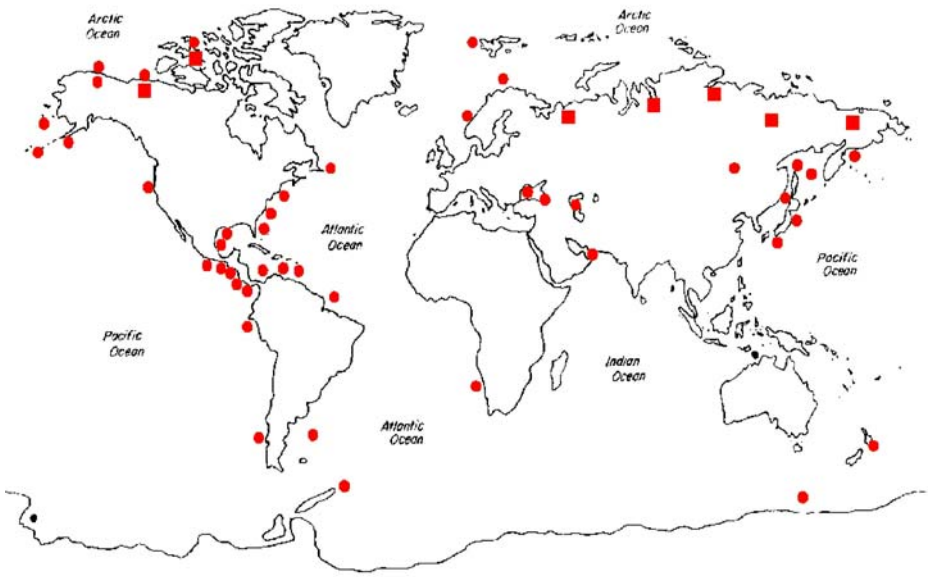
Product designers, ad agencies, and marketing executives are aggressively turning to anthropology, a previously untapped field of science, for insights into reaching and satisfying customers. What are the implications and opportunities? We'll show you.

Methane Hydrate, Our Long-Term Energy Solution

In the 1970s, Russian scientists first reported finding a miraculous form of ice in the Black Sea that burned with an intense orange flame. Then, in the 1980s, researchers from other countries began drilling into the ocean and started finding the magic ice everywhere they looked.

When they analyzed it, they found that it was methane hydrate, a pure white crystalline lattice of water ice that has methane molecules trapped in it.

Abundant methane hydrate deposits exist in the Arctic and many undersea locations



Each methane molecule has six water molecules holding it in place. And, a single unit of methane hydrate, when heated and depressurized, releases 160 times its volume in natural gas.

Methane hydrate is formed under great pressure, at temperatures near freezing, beneath the ocean floor as one tectonic plate is forced under another. It has now been found virtually everywhere anyone has bothered to drill deep enough beneath the continental shelf.

Methane burns much cleaner than coal or oil, and is therefore preferable as a fuel. Methane, or natural gas, is composed of one carbon atom bonded with four hydrogen atoms. The total amount of energy trapped in methane hydrate is believed to far exceed all the energy stored in the conventional natural gas, oil, and coal deposits now known to exist in the world. And, new reserves of methane hydrate are now being found almost weekly.

So it's quite possible that this discovery holds the key to the world's energy future. Deposits off the coast of the U.S. alone are so big that if just 1 percent could be recovered, it would double our natural gas reserves, according to a report in the *US Fed News*.[1] And, according to an article published earlier this year in the *Nikkei Report*,[2] a team of researchers from the University of Tokyo recently found a huge, and much shallower, deposit of methane hydrate off the coast of Japan.

Computer simulations indicate that thermal recovery methods, such as the use of hot water or steam flooding, could make hydrates a technically recoverable resource. Alternatively, methods that dissociate the gas by reducing the reservoir pressure may be possible. Chemical injection to decrease the stability of the hydrate lattice could be another approach.

Japan has been at the forefront of the effort to mine methane hydrate, having established a comprehensive program of test drilling in the mid-'90s, according to *The Oil and Gas Journal*.[3] In 2004 alone, the Japanese drilled 16 new methane hydrate wells. According to *Natural Gas Week*,[4] Russia and India also have methane hydrate projects underway.

In 2002, the Canadians began exploring methane hydrate, conducting on-shore test drilling in what they called the Gas Hydrate Production Well Program.[5] The work involved scientific expeditions to the Mackenzie Delta, as well as in the Beaufort Sea off the Northwest Territories. The Canadians believe that commercial methane hydrate production is as close as the year 2020, and that it

will take place first in the North American Arctic, where reserves are closer to the surface and can be extracted using traditional natural gas technology.

In light of this trend, we offer five forecasts for your consideration:

First, methane hydrate is going to become a big business in the next 20 to 25 years. Japan is leading the way, but the U.S. and Canada are going to catch up. However, this is probably going to require a shift in priorities. Out of the $1.7 billion committed to enabling the so-called "hydrogen economy," the U.S. Department of Energy has earmarked just $3.3 million so far to methane hydrate research.

Second, within 10 years, all the major oil companies will be involved in methane hydrate recovery and will be competing to be the most efficient at extracting it and distributing it. Chevron Texaco is at the head of an international consortium that is surveying the most promising methane hydrate sites in the Gulf of Mexico. Test wells have already been sunk, and progress continues. Since the U.S. has been producing the same amount of natural gas for 30 years, even as consumption has soared, this couldn't come at a better time.

Third, exploiting methane hydrate will reduce our vulnerability to the politics of the volatile Middle East. Like oil sand, oil shale, and ultra-deep offshore oil drilling, methane hydrate is an energy resource controlled by the world's industrialized nations. Increasingly, national security interests will force the United States, Japan, and China to exploit these resources.

Fourth, the long-term outlook for energy will involve a mixture of technologies, in which methane hydrate plays an important role. For example, heating the methane hydrate to release the trapped gas might be a perfect application for next-generation nuclear technology. These new nuclear reactors could also provide the energy for transforming methane into hydrogen without generating carbon dioxide. For example, a new type of nuclear reactor is being built in China and South Africa that could make cheap, clean, safe nuclear power. It's called the *pebble-bed modular reactor*, or *PBMR*, and is radically different from today's giant nuclear piles with their hot uranium rods. The PBMRs employ small spheres of uranium encased in ceramic shells so that they resemble billiard balls. These balls interact to heat the helium gas, making them safer and 35 percent more efficient. China will build 30 of these reactors in the next two decades. An exploratory PBMR project is also underway in Idaho, sponsored by the Department of Energy.

Fifth, as methane hydrate comes on-line, people who panic over the depletion of the world's resources will once again be proven wrong. Methane hydrate will enable mankind to provide dramatically greater affluence to a growing population, without exceeding the Earth's physical limits. Validating this conclusion requires only a back-of-the-envelope examination of the facts we have before us:

The latest estimates of the worldwide natural gas potential of methane hydrate deposits average 425 quadrillion ($4.25*10^{17}$) cubic feet, a staggering figure when compared to the 5 quadrillion cubic feet that make up the world's known reserves of conventional natural gas.

According to the United Nations, the world's population will plateau at about 8 billion around 2050. It's an empirical fact everywhere:

As education and affluence rise, birth rates and death rates decline toward zero population growth.

Today, Americans have by far the highest material standard of living of any large nation at any time in history. To maintain this standard of living, we consume roughly 6.3 times the energy per capita of the average resident of this planet; this is the amount of energy in 320,000 cubic feet of natural gas per person per year.

Since 1970, America's GDP per unit of energy consumed has increased by 114 percent, and technological innovation should enable global energy efficiency to improve by at least another 100 percent by 2050. In fact, advances in infotech, biotech, and nanotech make this target almost laughably easy to achieve.

Assuming that the world population plateaus permanently at 8 billion people, that the average global GDP per capita rises to the level we see today in the United States, and that the energy efficiency of the economy doubles what we see today in the United States, commercializing the world's estimated methane hydrate potential would meet *all* of our energy needs for at least 315 years.

More realistically, if fission power, fusion power, solar power, wind power, tidal power, and geothermal power, coupled with dwindling supplies of conventional fossil fuels, are combined to supply half of the world's energy needs, we'd have at least enough for 630 years at a level of affluence unimaginable to at least half the world's people today.

That's why the *Trends* editors confidently reject the sort of "limits to growth" hysteria put forward every few years by a new generation of neo-Luddites.

August 2006 Trend #1 Resource List:

1. *US Fed News,* November 7, 2005, "D.O.E. Announces $2 Million for Methane Hydrate Projects." © Copyright 2005 by HT Media Ltd. All rights reserved.

2. *Nikkei Report,* February 21, 2006, "Researchers Tap Methane Hydrate Deposit Off Coast of Japan." © Copyright 2006 by Nihon Keizai Shimbun, Inc. All rights reserved.

3. *The Oil and Gas Journal,* September 5, 2005, "Japan Explores for Hydrates in the Nankai Trough," by Hideaki Takahashi and Yoshihiro Tsuji. © Copyright 2005 by PennWell Corporation. All rights reserved.

4. *Natural Gas Week,* May 16, 2005, "Safety Key Factor Behind Need Seen for Methane Hydrate Study," by John A. Sullivan. © Copyright 2005 by Energy Intelligence Group. All rights reserved.

5. *Gas Daily,* May 31, 2005, "Gas Hydrate Production Not Far Away." © Copyright 2005 by The McGraw-Hill Companies, Inc. All rights reserved.

TREND #2

The Rise of Crowdsourcing

Companies that want to outsource work to low-paid, highly productive workers often don't need to look overseas to India and China. Instead, the new source of cheap labor can be found almost anywhere, from a teen in a basement to a stay-at-home mom at her kitchen table to a professional moonlighting as an amateur in another field.

Because of the convergence of cheap computing, powerful software, high-speed Internet access, and the networked relationships among Internet users, suddenly the best solution to many problems is to ask for help from millions of people who just might have what you need.

Consider the humdrum but highly lucrative world of stock photography. When a publisher or a graphic designer is putting together a brochure or an annual report and needs a photograph of the Eiffel Tower, a board meeting, or a cat, the usual practice is to order the pictures from a photographer or from a Web site, where prices can run to several hundred dollars per image.

But now, as Jeff Howe recently explained in a *Wired* magazine article,[1] designers are discovering a much cheaper alternative: a Web site called iStockphoto, where standard pictures cost between $1 and $5. For clients, the savings typically amount to more than 99 percent. For professional photographers used to raking in fees from stock photos, it's a disaster.

How can iStockphoto price its pictures so low? It gets its content from "the crowd" — specifically, the 22,000 amateur photographers who do something else for a living but contribute their pictures to iStockphoto. Currently, about 1 million photos are available on the site.

For the millions of businesses and professionals that use stock photography, iStockphoto is a perfect opportunity to take advantage of crowdsourcing. Crowdsourcing, according to Wikipedia,[2] "relies upon unpaid or low-paid amateurs who use their spare time to create content, solve problems, [and] even do corporate R&D."

The phenomenal success of Wikipedia itself is the result of crowdsourcing. The online encyclopedia's slogan is "the free encyclopedia that anyone can edit." Though it was launched only in 2001, it already contains more than 4 million articles in 200 languages, and more than 1,000 new articles are added every day.

But with about 50,000 registered users who can write and edit articles on any topic, regardless of their educational background or expertise, how reliable is the content? That question gets at the heart of the controversy over crowdsourcing: By entrusting the work to amateurs, crowdsourcing might not produce the same level of quality that results from paying top rates to professionals.

To see if the skeptics are right, the prestigious scientific journal *Nature*[3] compared entries on scientific topics in Wikipedia and the *Encyclopedia Britannica*, which is considered the gold standard in exhaustive research and accuracy. *Nature* used the rigorous peer-review process, assigning experts in each topic to study entries in both encyclopedias, without being told which publication provided the article.

Of the 42 entries they compared, *Nature*'s experts found very little difference in accuracy: The average science article in *Britannica* contained three errors, while Wikipedia contained four.

Considering that anyone can contribute to a topic on Wikipedia, that level of accuracy might seem amazing. However, because the vast community of users continuously updates the entries, the content is constantly being reviewed, and errors can be corrected instantly.

The crowdsourcing movement also gives companies an advantage they can't get from their in-house experts: the broad range of perspectives and the wealth of creative ideas that emerge when thousands of brains, not just a few, focus on new ideas.

A case in point is InnoCentive. The pharmaceutical company Eli Lilly created the Web site as a "virtual talent pool" in 2001, and it has become a place where corporations turn to outsiders

for innovative ideas. Among the 30 leading corporations that have registered as "seekers" of ideas on InnoCentive are Procter & Gamble, Boeing, and DuPont.

When they have a problem their in-house staffs can't solve, seekers post it on InnoCentive's Web site, where more than 90,000 scientists in 175 countries can compete to solve the problem for awards that can be worth as much as $100,000.

Alpheus Bingham, a scientist and the president and CEO of InnoCentive, told the *New York Times*,[4] "We are talking about the democratization of science. What happens when you open your company to thousands and thousands of minds, each of them with a totally different set of life experiences?"

One answer is that you get solutions that your own scientists might have missed. InnoCentive's Web site lists more than 100 award-winning solutions. Jill Panetta, the chief scientific officer at InnoCentive, told *Wired*[5] that 30 percent of the seekers' problems are solved, "which is 30 percent more than would have been solved using a traditional, in-house approach."

Another answer is that you save money. According to *BusinessWeek*,[6] "The success rate has been far higher than in-house performance, at around one-sixth of the cost of doing it all in-house."

The strength of InnoCentive is that it attracts ideas from people who aren't working side by side with people from the same backgrounds in the same research labs in the same cities. For example, Procter & Gamble's staff of 9,000 scientists and researchers is likely to approach a problem in the same way. But a truly novel idea might come from someone with a completely different perspective — a person in a different company, a different industry, or a different country.

According to *Wired*, when a team from MIT studied problems at InnoCentive, they found that "the odds of a solver's success *increased* in fields in which they had *no* formal expertise." That makes sense, because the seeking company's in-house chemists could probably find a solution to a chemistry problem just as well as an outside chemist. However, a physicist or engineer can bring an entirely different background and frame of reference to the problem.

That's what happened when Edward Melcarek spotted a problem posted on InnoCentive by Colgate-Palmolive. The company couldn't figure out how to pump fluoride powder into a toothpaste tube without losing most of the particles as they sprayed through the air. Melcarek, a 50-year-old Canadian with a Master's Degree in Engineering Science who says he "designs painting robots to pay the rent," lists his technical expertise on InnoCentive's site as encompassing aerospace, electronics, remote sensing, particle physics, and machinery.

What Melcarek *doesn't* have is an education in chemistry or biology, the two types of problems that seekers bring to InnoCentive. He simply applies what he knows from particle physics to each challenge, and tries to come up with a solution within 30 minutes of brainstorming.

Using this approach, Melcarek instantly recognized the solution that had eluded Colgate's top minds. All they had to do was ground the toothpaste tube and then positively charge the fluoride particles. The powder would then be drawn to the tube like metal to a magnet, without getting lost along the way.

Melcarek won the $25,000 award

for the idea, and Colgate saved hundreds of thousands of dollars in research costs.

Based on the crowdsourcing trend, we offer the following three forecasts:

First, companies will increasingly turn to crowdsourcing as an alternative to in-house R&D — and they will find huge savings. Procter & Gamble's vice president of innovation and knowledge, Larry Huston, points out, "Every year, research budgets increase at a faster rate than sales. The current R&D model is broken." P&G's goal is to increase the number of innovations that originate beyond the company, from 15 percent to 50 percent. It now draws on the expertise of 1.5 million researchers through networks like InnoCentive. Using that approach, its R&D productivity is up 60 percent.

Second, crowdsourcing will boost the economy by boosting productivity. Just as previous trends like outsourcing and advances in information technology accelerated the growth of the economy over the past several years, crowdsourcing will make a positive impact on GDP. Costs will fall as more companies enjoy the benefits of lowering the costs of work that was once done only by highly paid in-house professionals, and productivity will increase as firms solve crucial problems that once stood in the way of new innovation.

Third, expect to see established companies strive to acquire upstart competitors that threaten their business models with crowdsourcing. For example, Getty Images, a leading professional stock photo company, recently realized it couldn't compete with the miniscule rates charged by iStockphoto — so Getty bought the company earlier this year for $50 million. While it is unlikely that cash-strapped *Encyclopedia Britannica* can afford to buy the upstart Wikipedia, it would not be a surprise if Microsoft made a bid for it to minimize Wikipedia's impact on its free *Encarta* on-line encyclopedia and its $50 *Encarta* Premium CD set.

■ ■ ■

August 2006 Trend #2 Resource List:

1. *Wired,* June 2006, "The Rise of Crowdsourcing," by Jeff Howe. © Copyright 2006 by The Condé Nast Publications, Inc. All rights reserved.

2. *To access general information about 'crowdsourcing', visit the Wikipedia website at:*
en.wikipedia.org/wiki/Crowdsourcing

3. *Nature,* December 15, 2005, "Internet Encyclopaedias Go Head to Head," by Jim Giles. © Copyright 2005 by Nature Publishing Group. All rights reserved.

4. *New York Times,* March 26, 2006, "Here's an Idea: Let Everyone Have Ideas," by William C. Taylor. © Copyright 2006 by The New York Times Company. All rights reserved.

5. *Wired,* June 2006, "The Rise of Crowdsourcing," by Jeff Howe. © Copyright 2006 by The Condé Nast Publications, Inc. All rights reserved.

6. *BusinessWeek.com,* January 9, 2006, "Business Must Learn to Let Go," by Linda Sanford. © Copyright 2006 by The McGraw-Hill Companies, Inc. All rights reserved.

TREND #3

Kill All the Trial Lawyers

If any elected official stood before Congress and proposed raising taxes for the average family of four by $3,380 per year, he or she would find himself voted out of office in the next election. Yet, that's the amount of the hidden cost that Americans pay to support tort litigation in the U.S.

Every man, woman, and child pays an average of $845 a year in tort costs. Between 2000 and 2003, those costs soared by 35.4 percent. And it's not just a recent phenomenon: The relentless rise of tort litigation expenses has exceeded the growth of the Gross Domestic Product by two to three

percentage points for the past half-century.

To illustrate, think of the economy as a sprinter gaining speed with every step; now, imagine that same sprinter with a backpack filled with bricks strapped to his back. That will give you a sense of how the costs of wasteful, frivolous lawsuits create a drag on our economy.

According to a report issued by Jim Saxton, the vice-chairman of the Joint Economic Committee of Congress,[1] the United States pays more than twice as much in tort costs as most industrialized nations. Research conducted by Tillinghast-Towers Perrin shows that the cost of such litigation in the U.S. went from $67 billion to $152 billion in the 10 years between 1984 and 1994.

The U.S. tort litigation system is not only expensive, it's inefficient. It returns less than 22 cents on the dollar to repay actual economic losses to claimants, while the rest goes to lawyers and administrative costs. It doesn't help that, according to the *Washington Times*,[2] some attorneys are now charging fees at a rate of $30,000 per hour. How can a system that costs so much, and does so little, continue to exist?

The answer is that the tort bar has become "a beneficiary of pork barrel politics at best" and "an enormous criminal enterprise at worst," through a system of perverse incentives. To illustrate, consider the high-profile example of Vioxx, the painkiller made by Merck.

In September 2004, Vioxx was linked to heart attacks and strokes. Smelling profits, lawyers filed more than 10,000 lawsuits against Merck. In one of those cases, a jury awarded $253 million to a Texas woman whose husband died of a heart attack while taking Vioxx. That is equivalent to earning more than $6 million a year for 40 years. Not surprisingly, an entire industry sprang up to milk these cases.

The Vioxx case is reminiscent of the lawsuits against makers of asbestos, which began when scientists in the 1970s linked the fire-retardant material to various diseases. Lawyers sought out favorable jurisdictions and the suits bankrupted 70 American companies, causing the loss of 60,000 jobs.

In addition, another 138,000 jobs that would have been created in the asbestos industry never materialized, according to the RAND Institute for Civil Justice.[3] Without tort reform, another half-million people will lose their jobs from similar actions. In other words, out-of-control litigation hobbles the economy and hurts everyone.

More than 8,000 companies have been named as defendants in asbestos lawsuits. Without reform, another 2.4 million claims could be filed in the next few decades. Unchecked, the cost of asbestos suits alone could total $300 billion, more than the cost of all Superfund sites, Hurricane Katrina, or the 9/11 attacks. Therefore, it's not an exaggeration to say that the tort system is a national catastrophe.

Making matters worse, there is ample evidence that many of the asbestos suits were fraudulent. *Senate Report 109-097*[4] pointed out faked medical tests and illegal coaching of clients, who were encouraged to lie under oath. The report found that more than 90,000 of the claimants had no illness related to asbestos, yet had the support of medical experts who profited from those cases. Of 850,000 cases examined in the report, 600,000 were found to be baseless claims.

Asbestos litigation has spawned some of the most egregious cases in legal history. According to a

report in the *Palm Beach Daily Business Review*,[5] a prominent Miami plaintiff's attorney, Louis Robles, spent a decade stealing $30 million from his 7,000 clients, many of whom were poor, old, and sick. With the money from their asbestos settlements, he bought a mansion worth $15 million in Key Biscayne and a condo in Colorado, and financed movie productions. The clients received little or nothing.

The most notorious class-action law firm in the U.S. is Milberg Weiss Bershad & Schulman. The firm filed hundreds of dubious class-action lawsuits until some of its partners were indicted by a Los Angeles grand jury on charges of conspiracy, racketeering, obstruction of justice, mail fraud, money laundering, and filing false tax returns. In one case, Milberg Weiss filed at least 70 lawsuits on behalf of the same plaintiff.

For years, reformers have been stymied in their efforts by the political clout of tort lawyers. But, increasingly high-profile stories of abuse and fraud like the ones we've been discussing are undermining the political clout of trial lawyers, and giving tort reform increased momentum. In addition, popular opinion is moving against this type of litigation, because it is ordinary citizens who pay the costs in the form of higher insurance premiums, higher medical costs, and higher prices for goods and services.

Moreover, entrepreneurs, who create the new jobs and new industries that fuel the economy's growth, are increasingly discouraged by the threat that their innovative products will attract lawsuits. A company that gets caught up in lengthy litigation can spend years in court, at a cost of hundreds of millions of dollars in legal costs and lost productivity.

This in turn means that each of those companies does less business, which slows down job expansion and economic growth in general. That results in lower wages and fewer jobs. One estimate, by the University of Texas, says that the economic output of the U.S. is reduced by $300 billion to $660 billion a year by our faulty tort system.

That's one reason that President Bush signed into law the Class Action Fairness Act in February of last year, representing the most comprehensive federal tort reform so far, according to a report in *Business Insurance*.[6]

Other significant reforms are underway at the state level, including limiting non-economic medical liability to $300,000 in Oklahoma and curtailing contingency fees in Florida. The effects of these types of reforms can be seen in Texas, where the legislature passed a bill in 2003 to limit non-economic damages to $750,000. Since then, Texas has enjoyed economic growth, increased jobs, and more accessible health care.

The American Medical Association dropped Texas from its list of states in "medical liability crisis." Malpractice claims are down, and insurance rates have dropped, collectively saving doctors $50 million. As a result, the Houston area has seen a net gain of 689 new physicians.[7]

Mississippi passed similar legislation in 2004 and experienced nearly $60 million in increased business investment, as well as a drop in insurance rates. Similar measures have recently been passed in Missouri, New Jersey, and West Virginia with comparable results.

Pennsylvania has seen a giant asbestos suit disintegrate as physicians refused to testify when their diagnoses were questioned. And in Texas, a grand jury is investigating fraudulent silicosis lawsuits. In Congress,

Ed Whitfield of Kentucky is holding hearings in the House Oversight and Investigations Subcommittee on silicosis fraud.

In light of this trend, we offer the following six forecasts:

First, over the coming decade, the burden of tort litigation will lift from the economy, as tort reform sweeps the nation. As we have been predicting for some time now, American citizens are fed up with a legal system that delays legitimate awards for real damages, then hands over much of the money to lawyers instead of to the injured parties. Bear in mind, though, that the tort bar still has tremendous political influence, so this will be a slow process, moving state by state until at least 2015.

Second, one of the forces that will drive these reforms is the high cost of health care. As highlighted in prior issues of *Trends*, the United States is suffering from a shortage of physicians. Part of the shortage stems from the fact that so much of a doctor's income is eaten up by insurance premiums. A recent research study showed that states that limited medical malpractice awards have more doctors. Rural counties in states with limits had 3.2 percent more physicians per capita. For example, with a $250,000 cap, there were 5.4 percent more obstetricians than in states with higher caps. People will quickly catch on that if they want good health care, they have to vote for the reforms that will attract more doctors to their area.

Third, federal tort reform will continue, but most of the progress will be made at the state level. States are where most of the laws exist and where most of the cases are heard. *The American Tort Reform Association* designates certain jurisdictions as what it calls "judicial hellholes" that have a negative climate for defendants in civil litigation.[8] In its latest report, the association identified six such areas, including the Rio Grande Valley and Gulf Coast in Texas; Cook County, Illinois, including Chicago; West Virginia; South Florida; and two other Illinois counties. As federal laws are passed to reform the courts, such places will become obvious magnets for bad litigation. And, they will come under increasing pressure to reform themselves. Already Hampton County in South Carolina, once listed as a "judicial hellhole," has enacted reforms that removed it from the list.

Fourth, these reforms will ultimately put an end to nonsense lawsuits. According to the *Chicago Sun-Times*,[9] an Illinois couple sued American Airlines for more than $100,000 because they didn't have enough legroom on a flight to Paris and experienced leg cramps. Whether plaintiffs win these types of cases or not, such frivolous lawsuits result in direct costs to other passengers in the form of increased fares to cover the airline's legal fees and rising insurance premiums. Efforts are now underway to disbar lawyers who bring *frivolous* lawsuits to court.

Fifth, reforms at both the federal and state levels will put an end to venue shopping. Such reforms will require that a real or perceived injury must be litigated in the jurisdiction where it occurred. Plaintiffs won't be able to move their cases to jurisdictions where they would have the best odds of winning. This reform will open the way to a realistically fair system to right genuine wrongs, and will strip the system of the nuisance cases that make it so costly.

Sixth, by 2015, everyone, except for the trial lawyers, will experience the overall economic benefit of these reforms. Doctors will see

malpractice premiums go down — and patients will be charged less for health care. Manufacturers of all sorts of products will save on insurance, and pass at least some of those savings on to customers. Auto manufacturers will be encouraged to make cars safer, even while drivers see insurance costs reduced. Those who have truly been wronged will receive a higher percentage of their legitimate settlements or awards. And the courts will function more smoothly and rationally when freed from the inordinate burden under which they now labor.

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August 2006 Trend #3 Resource List:

1. *To download a copy of the Joint Economic Committee's report on the U.S. tort system, visit the JEC website at:* www.house.gov/jec/tort/tort/tort.htm

2. *The Washington Times,* September 24, 2003, "Lawsuit Industry Generates Billions," by Marguerite Higgins. © Copyright 2003 by The Washington Times. All rights reserved.

3. *To download a copy of the RAND Institute for Civil Justice's report on asbestos litigation costs, visit their website at:* www.rand.org/pubs/documented_briefings/DB397/

4. *To access Senate Report 109-097, visit the U.S. Government Printing Office websit at:* frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=109_cong_reports&docid=f:sr097.109.pdf

5. *Palm Beach Daily Business Review,* May 24, 2006, "Disbarred Lawyer Pleads Not Guilty to Federal Charges; Indictment," by Julie Kay. © Copyright 2006 by ALM Properties, Inc. All rights reserved.

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8. *Associated Press,* March 27, 2006, "Missouri Applauded for Tort Reform; Reports Says Illinois Lags," by Jeff Douglas. © Copyright 2006 by The Associated Press. All rights reserved.

9. *Chicago Sun-Times,* May 14, 2004, "Couple Sue Airline Over Legroom," by

TREND #4

Biotech and the New Era of Germ Warfare

Every year, a deadly illness kills 100,000 Americans, more than the combined deaths from AIDS and breast cancer, and it costs the nation $30 billion. It is a cruel irony that the victims typically are stricken in hospitals where they are surrounded by doctors and millions of dollars in medical technology.

The U.S. Centers for Disease Control and Prevention reports that of the 35 million people who are admitted to hospitals each year, 2 million patients come down with infections while they are there. And, two out of every three of those cases will involve infections that are immune to at least one drug.

Harvard Medical School infectious disease expert Robert Moellering was recently quoted on *Forbes.com*[1] as saying, "More and more bugs are

becoming dangerously close to untreatable."

Three reasons explain why super-bugs are proliferating:

Doctors have over-prescribed antibiotics for decades, even giving them to patients with non-bacterial infections like colds. This shortsighted practice has encouraged bacteria to mutate into strains that resist all of the current drugs. Today, standard antibiotics can successfully treat just 40 percent of hospital staph infections. That's down from 98 percent 30 years ago.

The pipeline for new antibiotic drugs is nearly empty. Between 1982 and 1992, pharmaceutical companies won approval for 30 new antibiotics. Since 2000, the number has dwindled to seven. The reason is that antibiotics are just not as profitable a business as blockbuster drugs that control cholesterol or heartburn.

Hospitals have become lax in preventing the spread of infections. Because of the heavy use of antibiotics that destroy less-dangerous strains of bacteria, hospitals are prone to drug-resistant bacteria, or "super-bugs." The problem becomes worse when poor hygiene is practiced by doctors and nurses who fail to wash their hands after they treat patients, and by maintenance personnel who fail to wash restroom faucets and doorknobs.

It all adds up to a perfect environment for breeding super-bugs. The most worrisome of these is called *community-acquired methicillin-resistant Staphylococcus aureus*, or *MRSA*. Unlike other dangerous staph infections, MRSA isn't confined to hospital wards. It has been spreading across the country, transmitted from person to person on playground swings, on locker room towels, on computer keyboards, or on airplane tray-tables.

What makes MRSA more than just a regular staph infection is that it isn't stopped by normal antibiotics, such as amoxicillin or cephalexin. Also, according to a *Time*[2] magazine article called *"Surviving the Killer Bug,"* MRSA and other bacteria swap small strands of DNA that cause two changes in the bug: First, the bug becomes increasingly resistant to antibiotics; and second, the person who is infected with it becomes even more susceptible to other infections.

MRSA is sweeping through areas of California, Texas, Illinois, and Alaska, and is taking hold in New York and Philadelphia.[3] The Centers for Disease Control and Prevention reports that 130,000 people are hospitalized with MRSA every year. In Canada, according to *CBC News*, it is infecting previously healthy adults and children in provinces across the country. According to a report by the *British Broadcasting Corporation*,[4] MRSA is now cited as the underlying cause of 36 percent of deaths in England and Wales.

The bug is already carried by 30 to 40 percent of the population on their skin and in their noses, without causing any illness. It isn't until MRSA finds a pathway into the body, such as through a cut or scratch, that it can cause an infection. According to *Time*,[5] that's what happened to Jewaun Smith, a 9-year-old boy in Chicago who scraped his knee while riding his bicycle.

Within a few days, the infection spread from his knee and throughout his body, eventually eating holes in his lungs, before doctors stopped it.

The last resort in cases like Smith's is treatments with vancomycin, which is given by IV for several weeks. Usually,

vancomycin gets rid of the infection, but lately researchers have noticed a frightening development: A few new strains of MRSA have emerged that are immune to vancomycin, and scientists fear that they will soon have no defenses left to prevent an MRSA epidemic.

Based on this disturbing trend, we offer the following five forecasts:

First, hospitals will place a top priority on preventing the spread of MRSA and other bugs. Part of this will be a response to growing patient awareness of this crisis. Among the companies that are offering new products to help in this prevention campaign are iKey, the maker of a computer keyboard used by hospitals.[6] Studies show that the average keyboard contains 3,300 germs per square inch, compared to just 49 germs per square inch on the average toilet seat. iKey's cleanable medical keyboards feature silicon rubber keys for easier cleaning. This helps to prevent healthcare professionals from spreading germs when they enter data before and after treating patients.

Second, despite the magnitude of the threat, the *Trends* editors expect new drugs to keep the super-bugs at bay, at least for the next several years. Pfizer is one of the last big companies to continue its pursuit of new antibiotics to fight the drug-resistant bacteria. It has assigned 150 researchers to the problem, and its goal is to develop six new antibiotics for clinical trials by the end of 2006.[7] The best hope for now is Pfizer's Zyvox, with projected sales of $780 million in 2006.

Third, as other big pharmaceutical companies ignore the need for new antibiotics, small biotech firms will fill the void. For example, Paratek Pharmaceuticals is testing an enhanced tetracycline that appears to work on bacteria that have resisted older drugs. Theravance, a biotech firm led by the former CEO of Merck, is combining existing antibiotics to build stronger drugs. *Forbes.com*[8] reports that Theravance is in clinical trials on a compound based on vancomycin, called telavancin, which could cut the time to stop a staph infection from nine days to three.

Fourth, in some cases, innovative approaches to treatment will prove to work more successfully than new classes of antibiotics. For example, one reason why super-bugs are so deadly is that the overuse of antibiotics destroyed the less toxic bacteria in many people, which wiped out the competition and allowed the more potent bugs to take control. So, one novel approach being tested by ViroPharma is to "infect" people with harmless strains of bacteria that preempt the environment needed for the worst strains of bacteria to survive. Studies on hamsters showed that getting a "*harmless* bacterial infection" prevented 90 percent of the test subjects from getting a "*toxic* infection."

Fifth, beyond 2010, our best hope lies in genetically engineered weapons against MRSA and other super-bugs that by-pass the problems we have with antibiotics. According to the *BBC*,[9] researchers at the University of California at San Francisco have sequenced the genome of USA300, one of the most virulent strains of MRSA. The team is working backwards from USA300 to the more benign version of the staph infection, in hopes of discovering a drug that will reduce the severity of the infection. Meanwhile, other scientists are targeting the process by which bacteria communicate

with one another. In a phenomenon known as "quorum sensing," bacteria produce signal and receptor molecules as they grow. As the number of bacteria in a host increases, the stronger the signals become. When the bacteria can sense they have reached "critical mass," they go on a rampage. Scientists in the U.S. and in Europe are working to block the communication between bacteria, either by shutting off the signal molecule or by preventing the receptor from getting the message. If either strategy works, the bacteria will not be able to spread the signal to attack, and they could be rendered harmless.

■ ■ ■

August 2006 Trend #4 Resource List:

1. *Forbes,* June 19, 2006, "Germ Warfare," by Robert Langreth and Matthew Herper. © Copyright 2006 by Forbes, Inc. All rights reserved.

2. *Time,* June 26, 2006, "Surviving the New Killer Bug," by Christine Gorman. © Copyright 2006 by Time, Inc. All rights reserved.

3. *For more information about MRSA, visit the Vanderbilt University Medical Center website at:*
www.mc.vanderbilt.edu/reporter/index.html?ID=3835

4. *For more information about MRSA deaths in The United Kingdom, visit the BBC website at:*
news.bbc.co.uk/1/health/4742770.stm

5. *Time,* June 26, 2006, "Surviving the New Killer Bug," by Christine Gorman. © Copyright 2006 by Time, Inc. All rights reserved.

6. *For information about iKey's infection-control keyboard, visit the PR Newswire website at:*
sev.prnewswire.com/health-care-hospitals/20060627/DATU03227062006-1.html

7. *Forbes,* June 19, 2006, "Germ Warfare," by Robert Langreth and Matthew Herper. © Copyright 2006 by Forbes, Inc. All rights reserved.

8. ibid.

9. *For information about the work being done to target antibiotic-resistant germs, visit the BBC website at:*

T R E N D # 5

The Fabulous World of Bio-Fabs Arrives

Malaria kills 853,000 children under the age of five every year. Some 3.2 billion people in 107 countries are potentially at risk for catching malaria. Up to 500 million people contract the disease every year, and more than a million deaths are directly caused by it.

This is made even more tragic by the fact that there is a cure for malaria. It's called *artemisinin* and is a natural compound found in the sweet wormwood tree in northern China.[1] It completely eliminates the parasite from the body. So why isn't it being distributed worldwide?

The answer is that the tree doesn't make enough artemisinin to extract it on an industrial scale. Before even a dent could be made in the treatment doses needed, all the sweet wormwood trees would vanish from the earth.

You might suggest that the compound be synthesized, and that would be a good idea — except for one thing: To do that requires copying the collection of genes, known as the genetic pathway, that makes artemisinin in the tree. Those genes, once copied, would have to be inserted into a suitable organism that could grow the compound, such as yeast cells.

If that sounds like genetic engineering, it is. Yet despite the fact that we've had the basic techniques of genetic engineering mastered for several decades now, it's not as simple as it sounds.

For one thing, the genetic pathway for producing artemisinin consists of nine genes. Each gene has 1,500 DNA bases on average. If scientists wanted to create an artificial way of making the drug, they'd have to try out various versions of the pathway and discover one that would make more of it than the tree does — preferably lots more. That means assembling different combinations of nine genes with 1,500 bases each, or roughly 13,000 bases for every new version of the complete pathway.

In addition, they'd want to make variations of each gene in the pathway to fine-tune the production for peak efficiency. Making just two versions of each gene would require 512 constructs, or six million nucleotide bases. The task of testing genetic pathways rapidly becomes overwhelming using today's manual techniques for synthesizing DNA.

In the 1980s, a scientist at the University of Colorado developed a way to synthesize DNA. DNA is made up of *nucleotides*, which contain the so-called bases: *adenine*, *cytosine*, *guanine*, and *thymine*. Each base has a different level of attraction to the others, and the researcher used that property to assemble the DNA. The technique is still in use.

First a nucleotide is attached to a styrene bead floating in liquid. A new nucleotide and some acid are added to the liquid, and a bond is formed. Then the new nucleotide is exposed to acid, which encourages it to form a bond with a third nucleotide.

This laborious process is repeated over and over until the desired gene is assembled. The error rate is about one incorrect base in 100, or 1 percent. That would yield 130 errors in the genetic pathway for artemisinin, and that would render the pathway useless. Typical living organisms, manufacturing DNA molecules, do so at a speed of 500 bases per second with an error rate of one base in a billion, roughly a trillion times better performance than the best man-made gene synthesis technique available today.

But what if you could *automate* that entire process? Better yet, what if you could do it all on a chip?

Enter the *micro-array*, the equivalent of a large computer chip that uses the natural properties of DNA and RNA to let scientists determine the expression level of thousands of genes in a single pass, with the results being read by computer.

A team of scientists called the Bio Fab Group has come together from institutions across the nation. The team has modified this technology to help them assemble and test the genetic pathway for creating not only a cure for malaria, but for AIDS and numerous other diseases as well. And the bio-fab movement is taking the world of genetic engineering by storm, according to *Scientific American*.[2]

The members of the Bio Fab Group founded a company called Codon Devices in Cambridge,

Massachusetts, which is applying the engineering principles of the computer chip manufacturing sector to synthetic biology. It is their aim to transform biotechnology, especially gene synthesis and manipulation, into an industrial mainstay of the scientific and medical worlds.[3]

Synthetic biology stands today at approximately the place that electronic engineering stood at the end of the 1950s, when integrated circuits were still soldered together by hand. In 1957, Jean Hoerni of Fairchild Semiconductor invented what's known as *planar technology*, which is the lithography technique in use today for making computer chips.

All at once, electronic circuits could be printed automatically and reliably, instead of laboriously assembled with a high error rate. It wasn't long before there was an entire library of standard circuits that engineers could simply plug together for various uses. The result, as we all know, was the rapid growth of computer power and shrinkage of circuit size characterized by Moore's Law.

This technology, known as *chip fabrication* or *chip fab*, has proven to be one of the most successful methodologies in history.

Today, genetic scientists are still, in effect, hand-soldering together their circuits of DNA components. Moreover, the methods and tools aren't standardized.

That's where The Bio Fab Group and Codon Devices come in. They've created the technology to build up a bio-fab industry in which standardized modular segments of DNA will be manufactured and used the way standard types of computer chips are used today. This will free the scientists to deal with the larger issues they're trying to address instead of, in effect, working as technicians in their own labs.

One of the things that makes real biological systems fast and accurate at assembling genes is that they run many different operations in parallel. The Bio Fab Group adapted existing micro-array technology to run such parallel operations at densities of a million DNA fragments per square centimeter.

These fragments are then chemically assembled into the desired gene sequences. By creating modular sequences of nucleotides, they can then readily assemble any combination to produce the desired gene.

A series of chemical washes removes any imperfections from the micro-array slide, thereby reducing the error rate. They now have that rate down to one in every 1,300 bases. They use a new technique called MutS, L, H, which employs DNA's own error-correcting properties to reduce that further to one in 10,000, which is sufficiently accurate to move ahead to the next step: industrial scale production.

According to the journal *Science Letter*,[4] Codon recently completed its pilot program under a National Institutes of Health grant to create a library containing every human and mouse gene, which had been synthesized with its automated system. In order to do that, the system had to faithfully reproduce 65,000 nucleotides.

The rapid delivery time and error-free operation demonstrate that a cure for malaria and other diseases is much closer. But this automated technology for gene synthesis, which is called the *BioFAB platform*, will also have a profound impact on molecular biology, drug discovery, vaccine development, pharmaceutical manufacturing, agriculture, and renewable energy, just to name a few.

The same technology that creates new genes can be tailored to make new proteins for industry, such as chemical catalysts or proteins that degrade environmental pollution. It can also build enzymes that will destroy disease organisms or even cancer cells. By using the BioFab methods, a

protein-based vaccine could be created on the fly for anything from SARS to bird flu. This would produce a vaccine much faster than even the most reliable traditional methods.

In another bold move, the Bio Fab Group members established a non-profit foundation they're calling *BioBricks* to create a vast library of components that will allow biological engineers to simply reach for the shelf in assembling more complex or multi-cellular devices.

This registry now contains more than 1,000 components, which the team is calling BioBricks, including biological versions of inverters, switches, oscillators, counters, amplifiers, and input-output display components. For example, in one experimental device, a complex of these components makes up a small area of cells that will glow fluorescent green when it detects the volatile chemicals given off by explosives.

Based on these successes, the Bio Fab Group began to teach a course in fab-style engineering with ready-made biological components in 2003 and started the International Genetically Engineered Machine contest, a competition that will involve the best talent from 30 universities this summer. Among the notable entries are a biofilm that can record and then display a photograph, and a digital counting device made of DNA that can count up to one million.

If that sounds trivial, consider that the counting device is now being incorporated into sensors that will monitor the production of the drug artemisinin, which will ultimately cure malaria.

Given this understanding of the bio-fab trend, we forecast the following four developments:

First, by 2020, genetic engineering will become a fully mature industry. Until now, it has proceeded by fits and starts, much as the computer industry did between World War II and the 1970s. At that time, there were numerous companies of varying sizes making computers and electronic components. All the technological pieces of the puzzle existed, but they had not yet been brought together or fully exploited. Moreover, no one yet knew which companies or business models would succeed or fail. Just as Fairchild failed to reap the rewards of the technology it pioneered, look for companies that are analogous to Intel, Microsoft, and Apple that can find and exploit the "sweet spots" in the value chain.

Second, in the next 10 to 20 years, we will see an intense period of rapid development in the bio-fab industry, which is actually the convergence of several fields that share common technologies. Already, dozens of labs exist that are creating drugs, vaccines, biological computers, sensors, and industrial chemicals through this means. As a systems biologist at Harvard pointed out in a recent *Knight Ridder* report,[5] scientists can now encode DNA to do virtually anything you can think of.

Artificial viruses are a reality, and scientists at State University of New York are programming an artificial bacterium, which is orders of magnitude more complex than a virus. Companies are springing up everywhere, claiming to do "synthetic biology" better than the other. And, it's only a matter of time before someone creates an artificial animal.

Third, expect a backlash as people express their fears of misusing genetic engineering, followed by an era of enormous progress. The journal *New Scientist*,[6] for example, recently explained how a terrorist could manufacture the smallpox virus by reengineering genetic material that can be ordered on the Internet. Add this to the controversy we've already seen regarding cloning and human embryonic stem cell research, and you have a major controversy on your hands. When the dust settles around

2020, synthetic biology, properly overseen and controlled, will combine with the burgeoning field of nano-technology to virtually eliminate the diseases we've known throughout history. For example, using genetic engineering and synthetic biology, there is no reason that a human liver couldn't be grown in a pig and then transplanted. The process would begin with the patient's own DNA, thus eliminating any possibility of rejection. Moreover, with industrial scale bio-fab technology, it will become cost-effective to target cures for every disease for which there is a known cause, even those that afflict only a few hundred people each year.

Fourth, by 2050, whole new classes of living materials that combine nanotech properties with synthetic biological capabilities will be in use. For example, smart clothing that not only provides heating and cooling, but also cleans the wearer and the clothing itself will be commonplace, as will carpeting that literally eats dirt. Crops will use photosynthesis to create starch and sugars, and then use a parasitic yeast-like organism to ferment it, thereby turning sunlight directly into ethanol for fuel. And artificial life forms that live off of various forms of pollution will rehabilitate the environment on a continuous basis.

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August 2006 Trend #5 Resource List:

1. *Scientific American,* June 2006, "Engineering Life: Building a FAB for Biology," by David Baker, George Church, Jim Collins, Drew Endy, Joseph Jacobson, Jay Keasling, Paul Modrich, Christina Smolke, and Ron Weiss. © Copyright 2006 by Scientific American, Inc. All rights reserved.

2. ibid.

3. *For information about the NIH pilot program discussed in Science Letter, visit the Codon Devices website at:* www.codondevices.com/news71b0.html

4. *Scientific American,* June 2006, "Engineering Life: Building a FAB for Biology," by David Baker, George Church, Jim Collins, Drew Endy, Joseph Jacobson, Jay Keasling, Paul Modrich, Christina Smolke, and Ron Weiss. © Copyright 2006 by Scientific American, Inc. All rights reserved.

5. *Contra Costa Times,* November 19, 2005, "Artificial Biology Gives Reasons for Both Hope, Fear," by Robert S. Boyd. © Copyright 2005 Knight Ridder, Inc. All rights reserved.

6. *New Scientist,* November 12, 2005, "The Peril of Genes for Sale." © Copyright 2005 by Reed Business Information, Ltd. All rights reserved.

TREND #6

The Skyscraper Boom

In 1885, the Home Insurance Building was completed in downtown Chicago. At 10 stories high, it was then the tallest building in the world. At once, the race was on to build taller and taller buildings, and it seems that the allure of skyscrapers has never really worn off.

There have been boom times and bad times over the decades since then. The last big boom in high-rise construction came in the 1960s and '70s, when the Sears Tower went up in Chicago and took the crown as the tallest building in the world from the World Trade Center in New York, which had been

The Burj Tower, Dubai

The Freedom Tower, New York City

completed just two years earlier. But the Sears Tower now stands in fourth place, and all its rivals are in Asia, the Pacific Rim, and the Middle East.

The Burj Tower in Dubai, scheduled for completion in 2008, is rumored to be 160 stories tall, but its builders are so determined that it will claim the title as the top skyscraper that they are keeping its actual height a secret. The design is such that they can add more floors at the last minute if a challenger appears on the horizon. Although there are buildings near that height proposed for Moscow, Seoul, and Katangi in India, the next tallest building that is actually under construction is the Freedom Tower being erected on the site of the World Trade Center. Scheduled for completion in 2011, the plans call for it to be a patriotic 1,776 feet tall, more than 300 feet taller than the Sears Tower. And the tallest existing skyscrapers are now, in this order, Taipei 101, at 1,671 feet; Petronas Towers One and Two at 1,483 feet each; and the Sears Tower at 1,451 feet. The next tallest building in the U.S. is still the 1931 Empire State Building at 1,250 feet.

There is no question that there is a global boom in skyscraper building underway, and although not all builders are vying to erect the highest buildings, they are nevertheless putting up some impressive towers. About 40 percent of the tallest structures have gone up since 2000, according to the *Economist*.[1] And in that same period, more than 40 buildings that are at least 50 stories tall were built or planned,

according to an *Associated Press* report.[2]

The 124-story Fordham Spire in Chicago will overshadow Donald Trump's 92-story hotel and condominium tower to become the tallest building in North America. With living space costing a record $1,000 per square foot and the penthouse going for $20 million, the Fordham will be the most expensive piece of real estate in Chicago.

The question remains, however: Do such projects make sense? Or are they simply displays of vanity for people with lots of money? The truth may involve a bit of both.

There's no shortage of big buildings that go bust. But Trump's new building is already 75 percent paid for through the sale of condos. Even so, residential skyscrapers are a big financial risk.

Many companies build their headquarters in tall buildings for symbolic reasons or to consolidate all their workers in one location. For example, Goldman Sachs is building a new world headquarters in lower Manhattan. But it's a modest 43-story building, appropriate to a financial firm. And while many companies have relocated to lower-rise facilities since 9/11, working in a skyscraper in a large city is still seen as a viable way of doing business.

While residential or mixed-use towers are generally speculative, and single-occupant towers are considered a cost of doing business, some of the most spectacular skyscrapers are funded by governments and aren't expected to make money. The Burj Tower in Dubai is one of many examples where the government is footing the bill largely for reasons of prestige.

Many newly wealthy nations are willing to pay the price to erect such status symbols. But, the most extreme example of hubris is probably the 105-story Ryugyong Hotel in Pyongyang, capital of the impoverished Communist state of North Korea.

In fact, as the "Main Report" pointed out in a recent *Health and Wealth Letter*,[3] most skyscraper projects are not driven by rigorous economic analysis. They're all about being noticed. That pattern continues to be as true today as it was in the 19th Century.

This reality is borne out by the fact that builders are still vying for the honor of having the tallest building in Europe. The latest entrant, according to the *BBC News Online*,[4] will be a mere 52 stories and just 560 feet high, making it something of a dwarf among today's great skyscrapers. It's specifically designed to be just six feet taller than Beetham Tower, the current European champion. Meanwhile, as reported by the Russian newspaper *Izvestia*,[5] Russia's Vneshtorg bank is pushing to build a 1,400-foot, 85-story monster in Moscow.

But while there appears to be no limits to the egos of the developers of skyscrapers, are there physical limits to how high a high-rise can be?

The truth is that every time someone puts a limit on how tall a structure can be built, new technologies come along to defy it.

New advances in materials have allowed walls and floors to be made thinner by using high-tech insulation material that was originally designed to carry human blood. Faster elevators and new HVAC technology make the infrastructure of extremely tall buildings increasingly manageable. And, engineers now believe that increasingly exotic materials mean that there may be no structural limit to how tall a building can be.

Given this trend, here are the five developments we foresee:

First, the worldwide boom in tall and super-tall buildings will continue for at least the next decade. The global economy will provide the means, and human aspiration will provide the motive. Even as Burj Tower rises over Dubai, structures more than 1,500 feet tall are either being built or planned in South Korea, Taiwan, Shanghai, Hong Kong, mainland China, and of course, Chicago. The highest buildings in the next 10 to 15 years will appear primarily in Asia and the Middle East for three reasons:

Asian and Middle Eastern *governments* are likely to fund such buildings, while any skyscrapers going up in the U.S. are strictly in private hands.

Because of the ambitions of the local governments, developers can largely ignore the kinds of regulations that would limit the height of buildings in American cities.

The booming economies in those locations will encourage governments and businesses to make bold symbolic statements, including competing aggressively to own the world's tallest buildings.

Second, such grand building projects should serve as warning beacons for smart analysts looking for signs of economic trouble ahead. It is typical for enormous buildings to be started at the height of economic booms, when a natural cyclical contraction is about to occur. For example, the Empire State Building was started just before the stock market crash of 1929, and the World Trade Center was started just before the onset of the rolling recessions that defined the 1970s. Expect some of the Asian and Middle Eastern economies to overreach and experience a period of contraction in the wake of extremely expensive and ostentatious building sprees. In places such as China, where local prestige and favoritism have already resulted in overcapacity, don't be surprised to see cities winding up with some very large "white elephants."

Third, despite the anticipated crises in the coming decade, the trend toward taller buildings will continue. Throughout history, whether people have built pyramids, totem poles, or skyscrapers, it seems to be human nature to build as tall as possible given the technology and the economic resources available at the time. We are now on the verge of breakthroughs in materials science that will make it possible to construct buildings that will dwarf those of today. In the next 15 to 20 years, look for buildings to top 3,000 feet and present some very unusual shapes on our global skyline.

Fourth, the biggest technological challenge for those building the tallest buildings will be managing the elevators. No matter how efficient the technology is, people have to wait for the next car to take them up or down. One innovative solution is being tried by KONE, a Finnish company. Its elevators will send text messages to occupants as they enter the building, telling them which elevator bank to use. Expect innovative technologies in this area, with the prize going to the company that can set the standard for moving people around ever-taller skyscrapers.

Fifth, by 2050, the global skyline will have been transformed by the advent of nanotechnology and green skyscrapers. J. Storrs Hall, author of *Nanofuture*,[6] predicts that, from a technical standpoint, the tallest towers could exceed 60 miles in height or higher. And, they won't just be big. They'll be chemically and biologically active parts of the environment,

taking in pollution and putting out clean air and water, as they process pollutants into their component chemicals for reuse. Even today, the new Bank of America tower in New York is cleaning air and using the heat produced by people, computers, and lights — not to mention sunlight — to make ice, which is then used to cool the offices the next day.

August 2006 Trend #6 Resource List:

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2. *Associated Press,* June 25, 2006, "Skyscraper Projects Booming in Chicago, Where the Term Was Born," by Don Babwin. © Copyright 2006 by The Associated Press. All rights reserved.

3. *The Week,* May 26, 2006, "The Skyscraper Boom." © Copyright 2006 by The Week Publications, Inc. All rights reserved.

4. *For information about the tallest building in Europe, visit the BBC website at:.* news.bbc.co.uk/1/hi/england/west_yorkshire/4950012.stm

5. *Bizekon-Russica Izvestia,* May 5, 2006, "Europe's Tallest Skyscraper to Be Built in Moscow," by Olga Sobolevskaya. © Copyright 2006 by Russica-Izvestia Information, Inc. All rights reserved.

6. *Nanofuture: What's Next for Nanotechnology* by J. Storrs Hall is published by Prometheus Books. © Copyright 2005 by J. Storrs Hall. All rights reserved.

A summary of the book Nanofuture *is available from* Audio-Tech Business Book Summaries. *Ask for* Reorder #2062.

TREND # 7

The New Science of Marketing Ethnography

Since the first human beings traded goods in ancient times, the holy grail of business has been to know what the customer wants. No other goal in business has occupied more brains, exhausted more resources, or confounded more leaders.

The most recent trend in the quest to learn from customers is known as *ethnography*, an offshoot of anthropology that traditionally was used to study remote populations in their natural habitat and learn about how they live. This was typically done

in places like the jungles of New Guinea, but now it's being used in advanced cultures like our own to gain a better understanding of the wants and needs of customers — and it's turning into big business.

According to *PC Magazine*,[1] Intel is one company that has invested heavily in ethnographic research. Microsoft has also been using ethnographers to identify new markets and to improve its product line.

Various social sciences have been used in business, at least informally, for many decades, going back to studies in the 1930s of how to make workers more productive. But in an age when customers are more and more in control of the transaction, it's essential to have some way of knowing not only what they want but also how they live. According to *BusinessWeek*,[2] that makes ethnography a perfect tool for market research.

It's one thing to get a customer to tell you what he wants or how he uses a product. It's another to watch him in his own home or office and see the subtle nuances that sometimes cannot be articulated. This has led to a boom in the anthropology business. IBM has a dozen such experts on staff.

Steelcase, which makes office furniture, uses a full-time ethnographer to learn how people use its products and to develop new ones. The hottest consulting firms, such as IDEO, Jump Associates, and Doblin Group, are all employing social scientists. This in turn is leading to a revolution in product design.

It used to be that a company would market from the inside out. They would think up a product and then go looking for a market that would buy it. Now researchers go out into the world to discover what the market wants, and then design products to satisfy that demand.

This boom in the ethnography business has also created a boom in the social sciences departments of universities. In addition, business schools and schools that turn out product designers, such as the Illinois Institute of Technology, have begun putting anthropologists on staff. In an interesting twist, a discipline that was once purely academic has migrated into the business world. And it is already paying off in opening up new opportunities and avoiding costly blunders.

For example, General Electric, which makes plastics for cell phones and cars, wanted to expand into the fiber industry to make materials for bullet-proof vests for police officers, and fire-retardant coats that protect fire fighters from flames. GE hired Jump Associates to help learn about that industry. Jump in turn employed ethnologists, who learned something GE didn't know. GE thought the fiber business was essentially a commodity industry, where being able to make lots of material cheaply would help them dominate the market.

On the contrary, the anthropologists found that this exotic fiber industry was far more like a small cheese maker that sells to a few fine restaurants: It was an "artisan business." The customers wanted to have custom-designed fibers and be in on the process from the start.

Based on this, GE quickly reformulated its strategy and began working much more closely with the engineering design staff instead of top executives. In this way, they could help the customer control the process and get exactly what they wanted. Without the help of anthropologists, GE might have made a very costly entry into that market with a misperceived idea of who its customers were and what they wanted.

At Intel, part of the push to learn from the social sciences involves the strategic initiative that the new CEO, Paul Otellini, is overseeing to transform Intel from a

chip maker into a consumer products company making high-tech devices ranging from entertainment systems to medical devices. They are essentially betting the entire company on getting this right, and are carefully deploying ethnologists to learn what customers want and how they live their lives in various settings. Intel now has ethnologists among its senior management positions.

■

In part, using cultural anthropologists to design products and marketing campaigns is an extension of a broader trend away from traditional research methods. This trend includes techniques like using "cool spotters" — people who hang around in shopping malls, nightclubs, or particular neighborhoods to see what others are wearing, what music they're playing, or how they're styling their hair.

These methods give insights that can be used in design and marketing. They've simply become more systematized by the use of academics in the field. In part, this trend has arisen because of broad dissatisfaction with methods such as focus groups, which can give misleading results.

This dissatisfaction has spawned new companies with names like House Visits and Ethnographic Solutions, which, according to a recent report on Minnesota Public Radio, are revealing some deep flaws in focus groups. For example, Whirlpool conducted focus groups that suggested there was a market for high-end appliances for the garage. People in those groups said their garages were outfitted with couches, comfortable chairs, and refrigerators and functioned like a "home away from home."

When Whirlpool sent the ethnologists out to check, however, they found that the garages were a mess and hardly a place to put a high-end appliance. The people in the focus groups *wanted* their garages to be a home away from home but hadn't been able to make that a reality. In response, Whirlpool set out to market a storage system for the garage so that people could eliminate the mess. A year after that successful product, it launched the appliances, and the strategy worked.

Likewise, according to a recent report on *Business Wire*,[3] Xerox used ethnographic research to develop software that categorizes documents in a much more dynamic and human way. It reduced the time it took technicians to categorize repairs from a week to a few minutes.

Another ethnographic development, reported recently in the *Financial Times*,[4] changed the way advertisers are looking at DVR-type technology that allows people to fast-forward through commercials. Before the research, it was assumed that the viewers would simply miss the commercials they fast-forwarded through.

Ethnographic researchers, however, found that even at high speeds, the viewers paid attention to the ads, remembered them, and slowed down to pay even closer attention to those ads in which they were interested.

In light of this trend, we foresee the following four developments:

First, we'll begin seeing a growing stream of better products and services defined by ethnographic research. Companies that take advantage of these methods will make fewer costly blunders and bring out products more effectively targeted to the real desires and needs of consumers. As a result, American corporations will maintain their edge in this global economy.

Second, employing cultural anthropologists in the creation and marketing of products and services is more than a passing fad. For decades, cultural anthropologists have labored in obscurity to produce valuable knowledge about "foreign" cultures. Their

techniques have been well honed to those uses. With the rise of the Internet, the customer has gained unprecedented power. Companies are now admitting that the only way to differentiate their offerings is by knowing more about the customer. Soon we'll be seeing experts who are able to harness those skills and modify academic methods to produce better customer research.

Third, those who can use ethnographic methods to generate actionable insights about modern consumers will find the business world falling at their feet. Expect to see a spate of best-selling books on the subject and a handful of new companies, largely derived from university anthropology departments, bursting onto the scene with great fanfare. With a great deal of money to be made, there will certainly be a flurry of start-ups and a shakeout. Traditional marketing and consulting firms will buy up the cream of the crop.

Fourth, corporate funding will pour into university anthropology departments, as they ramp up to train a growing number of students in this new discipline. They'll be readying ethnologists not for the jungle but for the world of business. And, the top business schools will begin offering more anthropological education for tomorrow's executives so they can "hit the ground running" in the real world.

August 2006 Trend #7 Resource List:

1. *PC Magazine,* May 9, 2006, "How to Build a Better Product — Study People," by Bary Alyssa Johnson. © Copyright 2006 by Ziff Davis Media, Inc. All rights reserved.

2. *BusinessWeek,* June 5, 2006, "The Science of Desire," by Spencer E. Ante, with Cliff Edwards. © Copyright 2006 by The McGraw-Hill Companies, Inc. All rights reserved.

3. *To access the Business Wire report on Xerox's use of ethnography, visit the FindArticles website at:* www.findarticles.com/p/articles/mi_mOEIN/is_2005_July_12/ai_n14734633

4. *Financial Times,* October 23, 2005, "Fast-Forward Puts TV Advertising to the Test," by Patrick Barwise and Sarah Pearson. © Copyright 2005 by The Financial Times Limited. All rights reserved.

Text printed in gray throughout this transcript is additional bonus information which is not included on the audio portion of *Trends*.

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