New Changing Trends in Architecture in the 21st Century- http://www.architecture-student.com

Architecture has transformed from a complex creative process of integrating diverse functions, structural systems, myriad services and utilities, inter-related spaces and exterior-interior visual connections into a game of appliqué where one cuts and pastes decorations and ornament onto four sides of dull boxes.

Building having Exterior Metal finish with diffused Lighting Techniques

The building in the picture above has a facade that is completely covered with sheets of perforated metal and acryllic translucent sheets….

Diffused lighting techniques have been used to illuminate the facade of the building….
All of us agree that when we evaluate a building for its overall appeal, the exterior facade takes the first place. The exterior aesthetics has gained more importance than the interior functionality. The building has to be made look good.

Ornamentation without function is otiose. But the trend has changed which has changed the definition of Ornamentation…

According to the new trend, "Ornamentation is the function".

- Much in the same manner that effetism killed the early modern movement with the World Exhibition in Chicago in 1893 overshadowing the likes of Sullivan and Richardson. All the changes and want for external beauty of the structure has made Architecture commercial graphic art of decoration.
- Architecture is the art of connecting interior spaces to the exterior. But unfortunately this definition is no more viable.
- I thought cladding was some kind of finish done with a specific material to achieve certain function or add an element to the aesthetics of the building… But I now know that cladding is architecture.
- What happens behind that velvet covered box is out of scope of total Architecture and is relegated to structural and services designers who the architects need never ever meet.
- The role of architects is becoming limited to the design of outer envelope of buildings. If you do anything more, you are insulting art!
- The aesthetic revolution was caused by several transformational factors that are redefining the meaning of architecture.
- Cold shells whose functions are not known, or even clear during the design stage are replacing buildings with specific functions.
- Installation of Air-conditioning systems is leading to hermetically sealed buildings with no fenestration.
- Artificial illumination is supposed to be better than daylight and people inside working for 24/7 aren't supposed to know what is it anyway.
- Many new building types have no relationship between what is happening inside of a building and outside it. The client wants blank walls to be decorated later.

These new building types could be:

- Shopping Malls
- Multiplexes
- Business Parks
- Museums
- Exhibition Halls
- Libraries

The designing system has undergone a diverse change. Architect is not sole person who creates the total design along with functional and aesthetic aspects of the interior as well as the exterior.

The design profession is becoming atomized that is divided into fragments;

- Framework – Structural Designer
- Outside – Landscape Designer
- Networks – Utility Designer
- Inside – Interior Designer
- Illumination – Lighting Designer
- Sound and Acoustics – Audio Designer
- Signage and Graphics – Branding experience Designers

> *The Architect is left only to create volumetric box and to decorate the skin. His sights should be set on creating the most beautiful velvet box where the interiors and exteriors need not necessarily bear connections.*

- More and more, the only role of architects is to create volumes that achieve maximum FSI and achieve maximum saleable area.
- Highly articulate and determined spaces, structures and elevations are often considered dangerous, or bad investments, as they could limit the types and numbers of buyers, users, leasers and renters. Architecture in the modernist sense is bad business.
- Even new environmental considerations have made designers see the skin of a building more in terms of its insulation, reflection qualities and radiation factors. To many architects these new restrictions are in fact a kind of liberation. They no longer bother between the relationship of the interiors and the exteriors.
- This trend is responsible for the emergence of new facade technologies. Stainless steel clips allow us to paste thin sheets of stone across broad strips of wall.
- Various materials have been discovered for the cladding of the exterior facades of the building…
- The commercialism has replaced creativity in architecture. Various shapes and forms that is Freeform Architecture is no more in an ideal way of design…
- Architecture is a spiritual field of art. These technological advances have brought a great change in the field of architecture. Commercialism has become the core of design.
- We future architects must try to preserve the integrity of the Architecture. We should help preserve the principles of architecture that invoke creativity in the designer…

Creativity is the soul of Architecture and should not be replaced by commercialism.

Pinterest alters copyright, self-promotion rules

Silicon Valley / San Jose Business Journal

Date: Monday, March 26, 2012, 7:13am PDT

Pinterest, the photo bookmarking social network created by Cold Brew labs, has relaxed rules against self-promotion and dropped another clause from its terms or operation in which it had previously said it may sell content posted on its site.
Pinterest, the photo bookmarking site operated by **Cold Brew Labs Inc.**, over the weekend changed its terms to deal with copyright concerns and to allow self-promotion by users.

The rapidly-growing Palo Alto-based social network has come under fire from photographers and other content owners who said that users were illegally copying their work to their "pinboards" and that the company's terms and conditions gave it the right to sell what gets posted.
The company in a Friday blog post said it never intended to sell the work of others and has removed that clause from its rules.

Pinterest also said it has made it easier to report when photos get posted without their owners' permission.

In another change, the company has lifted its ban on self-promotion.

Its old rules included this one: "Pinterest is designed to curate and share things you love. If there is a photo or project you're proud of, pin away! However, try not to use Pinterest purely as a tool for self-promotion."

The reference to self-promotion is now gone. Now they just urge users to "be authentic."
"We think being authentic to who you are is more important than getting lots of followers. Being authentic will make Pinterest a better place long-term," the rule now says.

The new terms are effective as of April 6.

Written by Cromwell Schubarth. Contact him at cschubarth@bizjournals.com or 408.299.1823.

What is excel?- http://www.advanced-excel.com

Allow me to answer what is Excel first to those who have never use or seen it before

It is a popular spreadsheet program that was developed by Microsoft. It is usually bundled with Ms Word and MS Outlook and sold together as a package of programs known as Microsoft Office. Each Ms Excel file is known to most users as a workbook. Each workbook consists of one or more worksheets. Each worksheet is made up of rows and columns.

Because of its layout and widespread availability, it is often used as a tool to create and maintain a list. More seasoned users use it to store database records, create charts or graphs. A lot of organization uses excel to manage

their budgets, business planning, customers records, business intelligence, analysis of sales data, customer data, performance dashboard, etc.

Answer #1 to what is Excel: Analytical Tool

Excel is a great analytical tool for business. The pivot table contained within Excel has gone through many revision. In each revision, we see its power being enhanced. It has becomes a strong competitor of business intelligence tools available in the market. The advantage over its competitors is that it is readily available to almost all the business computers. It cost business nothing to use it because MS Excel is bundled in MS Office, a must have office productivity tool. In the new version of Excel 2007, we see the power of Pivot Table being enhanced again with the capability to work directly with database servers. With the increased in memory, a million rows and over a thousand columns, it becomes a formidable foe to business intelligence tool in the market.

Answer #2 to what is Excel: Corporate Budgeting

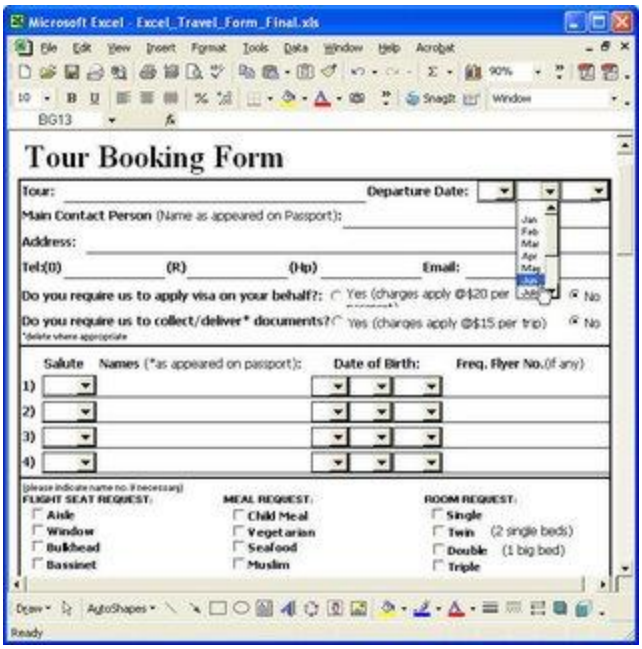
A major business application of Excel is in corporate budgeting. Many companies, from big corporations to small companies use Excel for their budgeting. Despite numerous calls by suppliers of Business Performance Management Systems (BPM) to move away from Excel as a budgeting tool, 70% to 80% of all corporations still use Excel as their primary budgeting tool. Find out why in thiscorporate budgeting article.

Answer #3 to what is Excel: Inventory Management

Excel provide many functions and formulas that will not only help you manage your data records efficiently but will also make sure that you could analyse your data based on your constantly changing business environment. Through the use of Microsoft® Excel formulas, you can create comprehensive drop down boxes to facilitate data inputs and reduce erroneous entries. And through the use of pivot tables, you could get a good detailed analysis of your stock movement and also your inventory level at any point in time. For more details, read up this inventory management write-up.

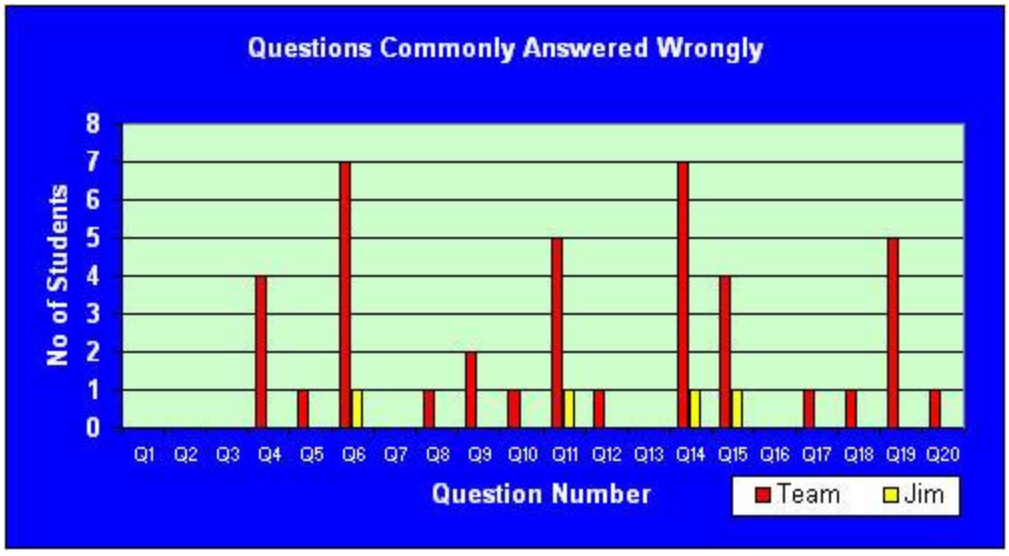
Answer #4 to What is Excel: Create forms and consolidating results

Excel can also be used to create forms. We are not talking about simple form that contains just boxes for you to type in your answers. We are referring to professional forms which contain option buttons such that user can only select only one answer (Yes, No), check boxes that allow them to select multiple answers, dropdown list to select a particular answer from list of items. Here is an example of such a form:



Learn more about the benefits of **Excel Form**.

Together with charts, you can use Excel to compile answers to tests or quizzes and analyze the profile of the class (If you are a teacher) or your team (If you are a supervisor). The chart below helps us analyze the performance of an individual against that of the team.



Answer #5 to what is Excel: Finding Profit Breakeven

Finding breakeven is never easy without using Excel. To manually find out the breakeven for a project, you have to perform many calculations using different numbers as it's inputs. And the calculation becomes even more complex if the components include fixed cost and step up cost. But with the goal seek function in Excel, this task can be completed in a few seconds.

Answer #6 to what is Excel: Manage name list or data records

Excel is commonly used to manage data records and name lists for the following 3 reasons:

1. The preset layout allows users to create their tables on the fly. This means that users do not have to plan in advance on how the table should look like. The table is developed on the go as information is filled in.
2. Excel allows printing of tables based on the selection we made. Adding new columns and rows to the table is a breeze. What's more, Microsoft Excel allows us to fit the table into one page irregardless of the number of columns we have. If the print out is too small, we can set to print the table into 2 or more pages. The ability to repeat the table header and left column label on every page of the printout make it one of the best tools for creating data list.
3. An even more attractive reason for using Excel to compile data list is its ability to sort the list and filter the listing like a database tool such as Microsoft Access.

Why Designers *Still* Can't Think-http://www.printmag.com

by Joe Marianek

Last year, when I was preparing a syllabus for my students at the School of Visual Arts, I came across a paint-covered folder that I'd kept from my college days but hadn't touched in nearly ten years. In it was a robust variety of classic design writing: Wassily Kandinsky on color, Beatrice Warde on invisible typography, and Steven Heller on pretty much everything else, along with excerpts from Baudrillard and Barthes, to confuse and upset, respectively. I also found a heavily worn second-generation scan of a third-generation photocopy of a 24-year-old essay titled "Why Designers Can't Think," by a then-rising designer named Michael Bierut.

I first saw the essay as an undergraduate, and it practically became required reading for employees of Pentagram (where I now work) when it was republished in *Seventy-Nine Essays on Design*. Rereading it here was difficult—I'd forgotten that some of my professors had the habit of typesetting handouts in Linotype Syntax at a bracing 6.5 points on canary-yellow paper. Luckily, I had decorated the pages with some doodles.

Bierut's essay, which distinguishes between process- and portfolio-based schools ("Swiss" versus "slick"), remains a sobering plea to designers and teachers to improve design education through cultural literacy. Many themes still hold true, and a few others are in desperate need of updating.

What's the same: The schools still hate each other.
Bierut writes: "To the portfolio schools, the 'Swiss' method is hermetic, arcane, and meaningless to the general public. To the process schools, the 'slick' method is distastefully commercial, shallow, and derivative."

I was lucky to have gone to a process school (the Rhode Island School of Design), and I'm happy to teach at a portfolio school, but my loyalties are to neither. Students from process schools are trained in the meticulous iteration of formal issues. Josef Albers, Wolfgang Weingart, and various contributors to *Dot Dot Dot* are their heroes. Assignments are most often cultural or pro-bono projects that deal with complex structures—a poster for a Steve Reich performance, an Amtrak schedule, a logo for the architect Mario Botta. Projects like these may yield a career in planning, crafting, and deploying identity, environmental, or digital programs—all in happy, ascetic isolation for so-so wages. These students are picky about typefaces and kerning, and scorn lowbrow commercial clients unless absolutely necessary.

"Educators deserve a noogie and a raise. In addition to their previous responsibilities, they now must also act as traffic directors, conductors, and filters."

On the other side, portfolio schools pressure students to attend to the realities of commercial practice by building a thick and pretty portfolio. Students are pushed into "hot" apprenticeships at name-brand agencies and design firms, and count Milton Glaser and George Lois as their idols. Their portfolios show a dizzying array of theater posters, organic-tea packaging, and fast-food-chain websites. These clean-cut, linked-in young guns can jump in at any agency; deploy ideas, trends, and clip art; play Foosball; network; drink beer; work; drink more beer; and repeat. They can jam out ads that any half-awake subway rider will understand and snicker at. Their portfolio websites are updated daily, while the process-school students are busy choosing a content-management system.

What has changed: The best graduates don't want full-time employment, which is hard to find.
Bierut writes that "the best graduates of either camp are equally sought after by employers." The new reality is that there are fewer traditional graphic design jobs than there are graduates. The smartest students know this and are more likely to be entrepreneurs, finding their own niche. The best-trained graduates are their own designers, illustrators, photographers, project managers, writers, editors, social-media strategists, and typographers, and they need to be able to work with anyone.

Like me, most of my students grew up in the 1980s and '90s and witnessed the internet boom and bust. They know that being adaptable and collaborative is crucial to their survival, and they've plotted out careers around their interests with self-initiated enterprises and projects. UnderConsideration, the Feltron Annual Report, and Airbnb are just a few models.

What's the same: Designers still talk to themselves.
In the second part of his essay, Bierut criticizes both camps for giving too much attention to design at the expense of meaning: "Programs will pay lip service to meaning in design with references to 'semiotics' (Swiss) or 'conceptual problem solving' (slick), but these nuances are applied in a cultural vacuum. In many programs, if not most, it's possible to study graphic design for four years without any meaningful exposure to the fine arts, literature, science, history, politics, or any of the other disciplines that unite us in a common culture."

Learning the language of design and the technical practice in four years is hard enough. It's implausible to expect a designer to accumulate multiple degrees in that time. And while half-hearted attempts at integrating the liberal arts into the design-school vacuum exist, they're rarely applied in the design classroom.

Instead of engaging with the larger world, many students "worship at the altar of the visual," as Bierut writes. One new culprit is the tools that aggregate visual "inspiration." Ffffound, Tumblr, and the other design-porn galleries are addicting but tacitly encourage sameness and self-referential practice in lieu of meaningful communication. (Trendlist.org has collected most of these.) A positive side effect is peer-to-peer bonding around mutually agreeable work, but who wants to see diagonal hairlines or black-and-white pictures of outer space on everything? Bierut writes: "Until educators find a way to expose their students to a meaningful range of culture, graduates will continue to speak in languages that only their classmates understand. And designers, more and more, will end up talking to themselves."

Even when a valuable site like Brand New attempts to host an intelligent dialogue about a well-executed identity project, the comments devolve into snipes over superficial qualities at the expense of critical thinking about the work in a broader cultural context. The conversation tends to end in naive arguments over good taste. I wince every time an outsider (or a client) stumbles onto one of these blogs and posts a comment like "You guys are a bunch of arrogant jerks."

What has changed: Cultural literacy is only as strong as the weakest internet signal (or educator).

It's the subject of all search- engine commercials: Everyone is an expert or can quickly fake it. Whether my client makes forklifts, forks, or foghorns, I can quickly get up to speed in the ten- minute cab ride to the meeting. What you can't fake is breadth of knowledge. It's easy to use quick searches to plug holes and spout facts, but it's certainly not enriching, and it seems as though it's making us stupid.

I had a professor who always hammered at us: "You have to read *The New York Times* every day. It's good for you." (I didn't then, but I do now.) I've tried this tactic on my students, and it didn't work. One protested, "We're really busy." The rest of them just lied about reading it. Rather than accept defeat, I send my students articles related to their projects and interests. I don't know if they read them, but I cross my fingers that they do.

But it's rare to find a design student, Swiss or slick, whose only interest is design. They tend to be pack rats of idiosyncratic topics, from thermodynamics to the art of Ukrainian Easter-egg decoration. There is a huge opportunity to build on students' esoteric interests while also building self-reliant designers.

Educators should encourage curiosity and direct students away from the navel of design, toward broader topics. Design Observer, Kottke.org, and Brain Pickings are exquisite portals to both design and nondesign content. They are easy gateways to cultural literacy, and I don't know what I'd do without them. Besides collecting books at the Strand to fill in the gaps, I've also been lucky to find accidental paths to enlightenment through projects, coworkers, and even clients.

Educators deserve a noogie and a raise. In addition to their previous responsibilities, they now must also act as traffic directors, conductors, and filters. Content is cheap and there is too much of it. Employable designers are everywhere, but no one necessarily needs them. Given the new economic realities and lack of traditional employment, design schools are responsible for producing culturally engaged graduates who are resourceful, open-minded citizens of the world and who also happen to be designers. Until then, we still won't be able to think.

Ruler illustration by Dina Ravvin
Line illustrations by Joe Marianek

Joe Marianek *is an Ohio-born designer based in New York City and Providence, Rhode Island. A graduate of the Rhode Island School of Design, he has worked with Pentagram, Landor Associates, and other firms on a variety of interdisciplinary projects ranging from institutional identity to book design. His work has been recognized by the AIGA, Art Directors Club, Type Directors Club, the Society of Publication Designers,* Communication Arts*, and* I.D. *He is a faculty member at the School of Visual Arts, where he teaches typography and senior thesis.*

So Big! What Kids' Growth Charts Don't Tell YounThe way kids grow, and what to expect, age by age-

parenting.com

By Margaret Renkl

There are few issues that preoccupy new parents more than this: Is my baby growing normally? When the percentiles seem off-kilter, we worry -- but experts say there's rarely reason for concern. For starters, healthy kids come in a wide range of shapes and sizes, and they don't grow at a steady rate, either. Your child can look very different from your friends' kids -- or from his own siblings at the same age -- and still be completely normal.

What influences growth

At birth: A baby's size when he's born is based partly on genetics. Firstborns tend to be smaller than subsequent children because the uterus is smaller and tighter in first-time moms. Boys are larger than girls, and multiples, boys and girls, are smaller than average.

Some environmental factors that can influence a newborn's size:

- the mother's weight -- very heavy women tend to have larger babies
- weight gain during pregnancy -- a very low gain (under ten pounds) usually means a smaller baby
- whether or not Mom smokes or drinks a lot of caffeine -- both of which can limit an unborn baby's growth
- a mom's chronic illness -- diabetics, for instance, often have very large babies.

During the first two years: A baby's growth is based on a combination of her birth size and the size she's genetically programmed to be: A small newborn who's going to be a big child will grow faster in the first two years than a big baby who's going to be a small child. Laura Hileman's son, John, was 23 inches long when he was born -- the average newborn is just 20 inches -- and his pediatrician joked that he might be seven feet tall as an adult. "But based on my height and my husband's, the doctor didn't think that would happen," says the Nashville mom. Sure enough, by the time John was 3, his growth had slowed and his height was just average for his age.

During childhood: Both weight gain and increases in height come in short bursts of what can seem like rapid growth -- which is why kids can sometimes look almost chubby one month but lean the next. The duration of a growth spurt, as well as how much a child grows during one, differs from child to child (and from spurt to spurt in the same child). But it's not uncommon to see a visible difference in a very short time: At age 10, my son Sam once outgrew a pair of dress pants in less than a week.

No one knows what causes a kid to shoot up one month and not another, but there does seem to be a seasonal pattern. "Although we don't have a good explanation for it, children seem to grow fastest in the summer and

slowest in the fall," says Joseph Gigante, M.D., associate professor of pediatrics at Vanderbilt Children's Hospital in Nashville.

Doctors do know what triggers growth in the first place: It's the human growth hormone, a chemical produced in bursts throughout the day but released largely during sleep. That's why it's important for kids to get the shut-eye they need throughout childhood and adolescence.

During puberty: After infancy, the tween and teen years are the period of most rapid change. For girls, the growth spurt begins between 10 and 11 and lasts until around 15; for boys, it starts about two years later and lasts until age 17 or so. Girls typically stop growing about three years after they've had their first period, but boys continue to grow throughout their teens.

How To Make Information Security Everyone's Problem

Use self-interest and propaganda to change employees' attitudes about endpoint security.

By Jonathan Feldman
March 26, 2012
URL: http://www.informationweek.com/news/global-cio/interviews/232700106

IT pros tend to focus solely on technology to solve endpoint security problems. After all, if malicious software is the poison, it's logical to look to signatures, heuristics, and cutting-edge detection for the antidote. But that's a mistake. Human vulnerabilities--ignorance, inattention, gullibility--are just as exploitable as software vulnerabilities, if not more so.

That means everybody has to be part of the security program. And the message that security is important has to come from the top and reach all levels of the organization.

Of course, it's easy to say, "Get everyone on board with security." It's hard to make it happen. You can dramatically increase the priority placed on information security through good processes and, dare we say, propaganda campaigns. A blend of policy, human resources management, and good old-fashioned self-interest can get employees to take your security program seriously.

6 Ways To Make Users Care About Security

You might think enforcement—public embarrassment, getting written up, disciplinary action—would be the best way to get employees to follow IT security rules. It's not. Before you start with enforcement, you need to work on participation. Once you have 90% of the company on board, punitive measures may help get the remaining 10% in line. But most companies don't have the 90% yet. Encourage participation in your security program with these six steps.

1 Run A Phish Test

Conduct a password phishing drill, and don't be surprised if as many as 60% of your employees fall for it. That stat will get the attention of top management.

2 In-Your-Face Propaganda

Partner with marketing on an awareness campaign, complete with hokey slogans and images with emotional appeal. Keep information security top of mind.

3 Self-Interest Works

Let employees know there's something in it for them. Explain that what they learn at work can easily be applied to their home PCs as well as personal accounts and transactions.

4 Make It Personal

Communicate face to face with employees about security. Think ice cream socials and brown-bag lunches, along with the usual meetings and walk-arounds. And make sure you listen, too.

5 Stay Credible

Providing good IT service to employees 364 days of the year helps on that one day when you must be the enforcer. Make the IT org a strategic partner that people want to work with.

6 Action At The Top

Get your CEO and other top execs talking to employees about how important what they do is to the company's online security.

For more on these six steps, check out our full *InformationWeek* report on Security: Get Users To Care.

Nevin Berger - nberger@techweb.com

There are two types of employees you really have to watch out for. Security professionals know all too well about rogue users--the ones who ignore or actively subvert security controls. These people aren't out to steal

information or cause damage, but they do believe security controls are inconvenient, slow down their devices, and interrupt their workflow. They bypass security processes and procedures, and introduce massive risk to the organization.

It can be difficult to rein in rogue employees because they don't report to you, often business leaders won't listen, and you or someone above you may need to spend valuable political capital to take care of the problem.

Think you can address rogue behavior simply through new tech controls? Think again. The physical control of the workstation that users have trumps anything you can dish out. Many years of experience have taught me that management, not technology, must solve this problem.

Also watch out for the clueless. They, too, can cripple your organization's security posture. These folks read the email from "The SysAdmin Desk" saying, "You have exceeded your email quota," and dutifully go to Google Docs and provide user names, passwords, network IDs, and birth dates, without even questioning who this SysAdmin actually is and whether this problem is real.

Don't laugh. If you haven't run a password-phishing fire drill at your company, try it--but get ready to be surprised. The "take rate" for a malicious phishing expedition (that is, the percentage of employees who get fooled) typically runs at least 30% for random attacks and higher for directed attacks. Security consultant and *InformationWeek* contributor Michael A. Davis says targeted phishing fire drills he's run sometimes net nearly 60% of the organization.

IT's answer to this is usually training and more training. And training is certainly a piece of the solution. The harder and more important part, though, is getting employees to take info security seriously in the first place. You want them to consider infosec to be as important as their personal safety in the parking lot because they understand the threat.

The people who get fooled by phishers and other cyberscammers aren't idiots. They just haven't yet made the connection between their computing behavior and the organization's well-being.

You need them to make that connection, and you're more likely to get them to do that with positive steps than with punitive measures. Try the six steps we outlined on p. 1 of this story and see if they get you closer to a security-aware workforce.

Jonathan Feldman is a contributing editor for InformationWeek and director of IT services for a rapidly growing city in North Carolina. Write to him at jf@feldman.org or at @_jfeldman.

Challenges facing women in medicine- http://www.mommd.com

With an increasing number of women with a medical career, the challenges faced by these women can be immense. MomMD members share their thoughts.

Taking on too much?

"We all want to be SuperDoc, SuperMom and SuperWife - and it's impossible to do it all" states Dr. M. She continues, "many of the women physicians I know who have survived both marriage and training, think the keys are a helpmate who understands that he does not "babysit" his own children, and the ability to hire outside help for the necessary drudgery of household life.... when you get right down to it, how many of our children will notice

a little dust - or remember it when they've grown. They really only remember that we dropped everything to give them our undivided attention".

In some instances taking on too much unfortunately results in "burnout". The desire to quit can affect women at all stages of their medical career, from the early premedical days, through medical school, residency and on throughout professional life. Knowing when to 'quit' a project, course, marriage, commitment, job or career, obviously requires careful thought and consideration, especially when some women are apt to consider themselves failures by 'giving up'. Sometimes it helps to say no to 'smaller' concerns or commitments adding unnecessary stress, leaving time to focus on the bigger issues. A difficult, yet worthwhile skill is knowing when and how to say no. Discussing issues to friends, colleagues or family often helps.

Part-time work

Going part-time allows women physicians to spend more time with family. "First of all, most women leaving residency are already with a young family or soon to start one... My pediatrician women friends found themselves taking part-time schedules and becoming second class citizens in their practice. Also, part-time usually means part-time pay with more than part-time work. A lot of women I know who go into a practice part-time in order to be there for their family end up never becoming a partner, and therefore have no security and little decision making power about, not only their hours, but their practice as well," says Dr. D.S.

Dr. D.S., a pediatrician and mother of three, developed her own solution to this problem by starting her own practice. "Being in private practice for 10 years, I strongly suggest taking the extra effort to start your own private practice if your specialty allows, and you will give yourself a whole lot of flexibility. I started working for other practices and found that you are feeling guilty about getting pregnant, and no one will give you a mommy schedule except yourself".

How did she do it? "I joined another woman to build our own practice. Granted, we did not take a salary for six months, however, we quickly become well known and within three years I have three more doctors working for me, and I work 16 hour as a week. I make the schedule with a lot of 10am-3pm shifts and I take 6 weeks vacation. Best of all, I make about $175,000 a year. I can't ask for more than that".

Less Pay

There are many factors that contribute to a women physician earning less pay than her true potential. "Professionally, since most of us still take on the bulk of responsibility at home, we may have a reduced salary for seeing fewer patients (whether or not we spend more time with each individual patient) and that, not the typical male/female salary discrepancy is an issue - most of us truly have salaries that are productivity based. If we choose to be on multiple hospital committees so that we can move up the administrative ladder, most of these are also not reimbursed so you lose even more family time - all a problem during the time we're raising our children," states Dr. M.

Dr.S., a surgeon, comments, "one of my biggest concerns about medicine has been the shrinking reimbursement. I know it is not politically correct to think about things like this, but it is a practicality. I am a surgeon. I have noticed many more women going into medicine and surgery. While this is a great trend, I think we should consider why this might be. Historically in this country, as the average pay of a particular profession decreases, more women are either encouraged to or tend to go into it. (Think about teaching 30-40 years ago) and now medicine. We will have 50% of the physicians in this country being female in the next 20 years, but we will work harder and make much less money than when the majority of physicians were male. In addition, that which we women tend to do best such as spending time with people, dealing with social issues, being an advocate affords little to no remuneration".

Restore and Improve Urban Infrastructure- engineeringchallenges.org

Good design and advanced materials can improve transportation and energy, water, and waste systems, and also create more sustainable urban environments.

In 2005, the American Society of Civil Engineers issued a report card, grading various categories of U.S. infrastructure. The average grade was D.

What is infrastructure?

Infrastructure is the combination of fundamental systems that support a community, region, or country. It includes everything from water and sewer systems to road and rail networks to the national power and natural gas grids. Perhaps there will be a hydrogen grid in the future as well.

What is the current state of our infrastructure?

It is no secret that America's infrastructure, along with those of many other countries, is aging and failing, and that funding has been insufficient to repair and replace it. Engineers of the 21st century face the formidable challenge of modernizing the fundamental structures that support civilization.
The problem is particularly acute in urban areas, where growing populations stress society's support systems, and natural disasters, accidents, and terrorist attacks threaten infrastructure safety and security. And urban infrastructure is not just a U.S. issue; special challenges are posed by the problems of megacities, with populations exceeding 10 million, which are found mostly in Asia. In many parts of the world, basic infrastructure needs are still problematic, and engineers will be challenged to economically provide such services more broadly.

Furthermore, solutions to these problems must be designed for sustainability, giving proper attention to environmental and energy-use considerations (though cities take up just a small percentage of the Earth's surface, they disproportionately exhaust resources and generate pollution), along with concern for the aesthetic elements that contribute to the quality of life.

What is involved in maintaining infrastructure?

Of course, maintaining infrastructure is not a new problem. For thousands of years, engineers have had to design systems for providing clean water and disposing of sewage. In recent centuries, systems for transmitting information and providing energy have expanded and complicated the infrastructure network, beginning with telegraph and telephone lines and now encompassing all sorts of telecommunications systems. Cable TV, cell phones, and Internet access all depend on elaborate infrastructure installations. Development of remote wind and solar energy resources will add more.
Much of the existing infrastructure is buried, posing several problems for maintaining and upgrading it. For one thing, in many cases, records of the locations of all the underground pipes and cables are unavailable or incomplete. One major challenge will be to devise methods for mapping and labeling buried infrastructure, both to assist in improving it and to help avoid damaging it.

A project of this sort is now underway in the United Kingdom, with the aim of developing ways to locate buried pipes using electromagnetic signals from above the ground. The idea is to find metallic structures capable of reflecting electromagnetic waves through soil, much as a reflector makes a bicycle easier to see at night.

How can you improve transportation systems?

Other major infrastructure issues involve transportation. Streets and highways will remain critical transportation conduits, so their maintenance and improvement will remain an important challenge. But the greater challenge will be engineering integrated transportation systems, making individual vehicle travel, mass transit, bicycling, and walking all as easy and efficient as possible. An increasingly important question is the need to provide better access to transportation for the elderly and disabled.
Cities around the world have begun developing integrated approaches, by establishing transportation hubs, for instance, where various transportation elements — rail, bus, taxi, walking and bicycle paths, parking lots — all conveniently meet. In Hong Kong, several

transportation services are linked in a system that allows a single smart card to be used to pay for all the services, including gas and parking.

A similar integrated approach combining energy, water, and wastes (liquid and solid) into “neighborhood” systems could be considered in certain urban areas. This approach would increase sustainability while relieving pressure to meet all citizens’ needs through city-scaled infrastructures. It would be best to introduce such systems in new development areas (e.g. urban revitalization areas) and new cities, which will spring up over the next few decades in places like China and India.

While such services can help support growing urban populations, they must be accompanied by affordable and pleasant places for people to live. Engineers must be engaged in the architectural issues involved in providing environmentally friendly, energy-efficient buildings both for housing and for business.

How do you build better infrastructure?

Novel construction materials may help address some of these challenges. But dramatic progress may be possible only by developing entirely new construction methods. Most of the basic methods of manual construction have been around for centuries — even millennia. Advances in computer science and robotics should make more automation possible in construction, for instance, greatly speeding up construction times and lowering costs. Electricity networks linking large central-station and decentralized power sources will also benefit from greater embedded computation.
All of these endeavors must be undertaken with clear vision for the aesthetic values that go beyond mere function and contribute to the joy of living. Major bridges, for instance, have long been regarded almost as much works of art as aids to transport. Bridges, buildings, and even freeways contribute to the aesthetical appeal of a city, and care in their design can contribute to a more enjoyable urban environment.

In previous decades, much of the rest of urban infrastructure has been erected without as much concern for its impact on a city’s appearance and cultural milieu. Recently, though, awareness of the aesthetics of engineering has begun to influence infrastructure design more generally. Integrating infrastructure needs with the desire for urban green spaces is one example.

Projects to deal with urban stormwater runoff have demonstrated opportunities to incorporate aesthetically pleasing projects. Using landscape design to help manage the flow of runoff water, sometimes referred to as “green infrastructure,” can add to a city’s appeal in addition to helping remove pollution. The vast paved area of a city needs to be rethought, perhaps by designing pavements that reduce overhead temperatures and that are permeable to allow rainwater to reach the ground table beneath. Proper engineering approaches can achieve multiple goals, such as better storm drainage and cleaner water, while also enhancing the appearance of the landscape, improving the habitat for wildlife, and offering recreational spaces for people.

Rebuilding and enhancing urban infrastructure faces problems beyond the search for engineering solutions. Various policies and political barriers must be addressed and overcome. Funding for infrastructure projects has been hopelessly inadequate in many areas, as the American Society of Civil Engineers’ “report card” documented. And the practice of letting infrastructure wear out before replacing it, rather than incorporating technological improvements during its lifetime, only exacerbates the problems.

And so, a major grand challenge for infrastructure engineering will be not only to devise new approaches and methods, but to communicate their value and worthiness to society at large.

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Advanced Health Informatics--engineeringchallenges.org

Stronger health information systems not only improve everyday medical visits, but they are essential to counter pandemics and biological or chemical attacks.

When you dial 911 for a medical emergency, the outcome may very well depend on the 411 — the quality of the information available about your condition and ways to treat it.

What is health informatics?

No aspect of human life has escaped the impact of the Information Age, and perhaps in no area of life is information more critical than in health and medicine. As computers have become available for all aspects of human endeavors, there is now a consensus that a systematic approach to health informatics — the acquisition, management, and use of information in health — can greatly enhance the quality and efficiency of medical care and the response to widespread public health emergencies.

Health and biomedical informatics encompass issues from the personal to global, ranging from thorough medical records for individual patients to sharing data about disease outbreaks among governments and international health organizations. Maintaining a healthy population in the 21st century will require systems engineering approaches to redesign care practices and integrate local, regional, national, and global health informatics networks.

On the personal level, biomedical engineers envision a new system of distributed computing tools that will collect authorized medical data about people and store it securely within a network designed to help deliver quick and efficient care.

Basic medical informatics systems have been widely developed for maintaining patient records in doctor's offices, clinics, and individual hospitals, and in many instances systems have been developed for sharing that information among multiple hospitals and agencies. But much remains to be done to make such information systems maximally useful, to ensure confidentiality, and to guard against the potential for misuse, for example by medical insurers or employers.

What needs to be done to improve health information systems?

For one thing, medical records today are plagued by mixtures of old technologies (paper) with new ones (computers). And computerized records are often incompatible, using different programs for different kinds of data, even within a given hospital. Sharing information over regional, national, or global networks is further complicated by differences in computer systems and data recording rules. Future systems must be engineered for seamless sharing of data, with built-in guarantees of accurate updating and ways to verify a patient's identity.

Keeping track of individual records is just part of the challenge, though. Another major goal is developing trusted systems that offer relevant decision support to clinicians and patients as well as archive medical research information. Doctors suffering from information overload need systematic electronic systems for finding information to treat specific patients and decision support systems to offer "just in time, just for me" advice at the point of care.

"There is a need," writes Russ Altman of Stanford University, "to develop methods for representing biological knowledge so that computers can store, manipulate, retrieve, and make inferences about this information in standard ways." [Altman p. 120]

How can health informatics improve health care?

Apart from collecting and maintaining information, health informatics should also be put to use in improving the quality of care through new technologies. Some of those technologies will involve gathering medical data without a visit to the doctor, such as wearable devices to monitor such things as pulse and temperature. Monitoring devices might even come in the form of tiny electronic sensors embedded in clothing and within the body.

Such devices are emerging from advances in microelectronic mechanical systems for health care delivery as wireless integrated microsystems, or WIMS. Tiny sensors containing wireless transmitter-receivers could provide constant monitoring of patients in hospitals or even at home. If standardized to be interoperable with electronic health records, WIMS could alert health professionals when a patient needs attention, or even trigger automatic release of drugs into the body when

necessary. In effect, every hospital room could be turned into an ICU. Seamlessly integrating the input from such devices into a health informatics system raises the networking challenge to a new level.

How can informatics improve response in public health emergencies?

On the local to global scale, a robust health informatics system would enable health professionals to detect, track, and mitigate both natural health and terrorism emergencies.
Biological and chemical warfare are not new to human history. From ancient times, warriors have tried to poison their enemies' water. Today, of course, the threat of such attacks comes not only from military engagements in ongoing wars, but from terrorists capable of striking almost anywhere at any time. Protecting against such assaults will require an elaborate and sophisticated system for prompt and effective reaction.

Meeting that challenge is complicated by the diverse nature of the problem — terrorists have a vast arsenal of biological and chemical weapons from which to choose. Perhaps the most familiar of these threats are toxic chemicals. Poison gases, such as chlorine and phosgene, essentially choke people to death. Mustards burn and blister the skin, and nerve gases, which are actually liquids, kill in the same way that pesticides kill roaches, by paralysis.

As serious as chemical attacks can be, most experts believe their risk pales in comparison with their biological counterparts. Of particular concern are potent biological toxins including anthrax, ricin, and botulism neurotoxin.

Anthrax has received special attention, partly because of the deaths it caused in the U.S. in 2001, but also because its potential to produce mass death is so large. It's not hard to imagine scenarios where airborne release of anthrax could infect hundreds of thousands of people. Antibiotics can be effective against anthrax bacteria if provided soon enough. But that window of opportunity is narrow; after the germs release their toxic chemicals, other defenses are needed.

How to you prepare against chemical and biological weapons?

Providing data to feed an informatics system in preparation for bio and chemical terror involves engineering challenges in three main categories. One is surveillance and detection — monitoring the air, water, soil, and food for early signs of an attack. Next is rapid diagnosis, requiring a system that can analyze and identify the agent of harm as well as track its location and spread within the population. Finally come countermeasures, powered by nimble operations that can quickly develop and mass-produce antidotes, vaccines, or other treatments to keep the effects of an attack as small as possible and track how effective the countermeasures are.
Efficient and economical monitoring of the environment to find such agents early is a major challenge, but efforts are underway to develop sensitive detectors. "Artificial noses," for example, are computer chips that can sort out and identify signals from thousands of potentially deadly chemicals. These systems are still much less sensitive than the canine nose, however, and their perfection is an engineering challenge. Toxins or viruses might also be identified using biological detectors. Ultra-tiny biological "nanopore" devices can be engineered, for example, to send electrical signals when a dangerous molecule passes through the pore.

Yet another novel method would track not the attack molecule itself, but molecules produced by the body's response to the invader. When exposed to bacteria, immune system cells known as neutrophils alter their internal chemistry. Profiling such changes can provide clues to the invader's identity and suggest the best counterattack. Databases cataloging the cellular response to various threats should ultimately make it possible to identify biowarfare agents quickly with simple blood tests.

How to you prepare against a pandemic?

Nothing delivers as much potential for devastation as natural biology. From the bacterium that killed half of European civilization in the Black Death of the 14th century to the 1918 Spanish Flu pandemic that killed 20 million people, history has witnessed the power of disease to eradicate huge portions of the human population.
In the 21st century, the prospect remains real that flu — or some other viral threat, yet unknown — could tax the power of medical science to respond. Bird flu, transmitted by the virus strain known as H5N1, looms as a particularly clear and present danger.

A major goal of pandemic preparedness is a good early warning system, relying on worldwide surveillance to detect the onset of a spreading infectious disease. Some such systems are now in place, monitoring data on hospital visits and orders for drugs or lab tests. Sudden increases in these events can signal the initial stages of an outbreak.

But certain events can mask trends in these statistics, requiring more sophisticated monitoring strategies. These can include tracking the volume of public Web site hits to explain acute symptoms and link them to geocodes, such as zip codes. Having an integrated national information technology infrastructure would help greatly. Closures of schools or businesses and quarantines may actually reduce hospital use in some cases, and people may even deliberately stay away from hospitals for fear of getting infected. On the other hand, rumors of disease may send many healthy people to hospitals for preventive treatments. In either case the numbers being analyzed for pandemic trends could be skewed.

New approaches to analyzing the math can help — especially when the math describes the network of relationships among measures of health care use. In other words, monitoring not just individual streams of data, but relationships such as the ratio of one measurement to another, can provide a more sensitive measure of what's going on. Those kinds of analyses can help make sure that a surge in health care use in a given city because of a temporary population influx (say, for the Olympics) is not mistaken for the beginning of an epidemic.

Similarly, mathematical methods can also help in devising the most effective medical response plans when a potential pandemic does begin. Strategies for combating pandemics range from restricting travel and closing schools to widespread quarantines, along with vaccinations or treatment with antiviral drugs.

The usefulness of these approaches depends on numerous variables — how infectious and how deadly the virus is, the availability of antiviral drugs and vaccines, and the degree of public compliance with quarantines or travel restrictions. Again, understanding the mathematics of networks will come into play, as response systems must take into account how people interact. Such models may have to consider the "small world" phenomenon, in which interpersonal connections are distributed in a way that assists rapid transmission of the virus through a population, just as people in distant parts of the world are linked by just a few intermediate friends.

Studies of these methods, now at an early stage, suggest that rapid deployment of vaccines and drugs is critical to containing a pandemic's impact. Consequently new strategies for producing vaccines in large quantities must be devised, perhaps using faster cell culture methods rather than the traditional growing of viruses in fertilized eggs. A system will be required to acquire samples of the virus rapidly, to sequence it, and then quickly design medications and vaccines. The system needs to have technologies to enable rapid testing, accompanied by a system for accelerating the regulatory process. If there is an emergency viral outbreak that threatens widespread disease and death in days or weeks, regulatory approval that takes years would be self-defeating.

"It will be imperative to collect the most detailed data on the . . . characteristics of a new virus . . . and to analyze those data in real time to allow interventions to be tuned to match the virus the world faces," write Neil Ferguson of Imperial College London and his collaborators. [Ferguson et al. p. 451]

The value of information systems to help protect public safety and advance the health care of individuals is unquestioned. But, with all these new databases and technologies comes an additional challenge: protecting against the danger of compromise or misuse of the information. In developing these technologies, steps also must be taken to make sure that the information itself is not at risk of sabotage, and that personal information is not inappropriately revealed.

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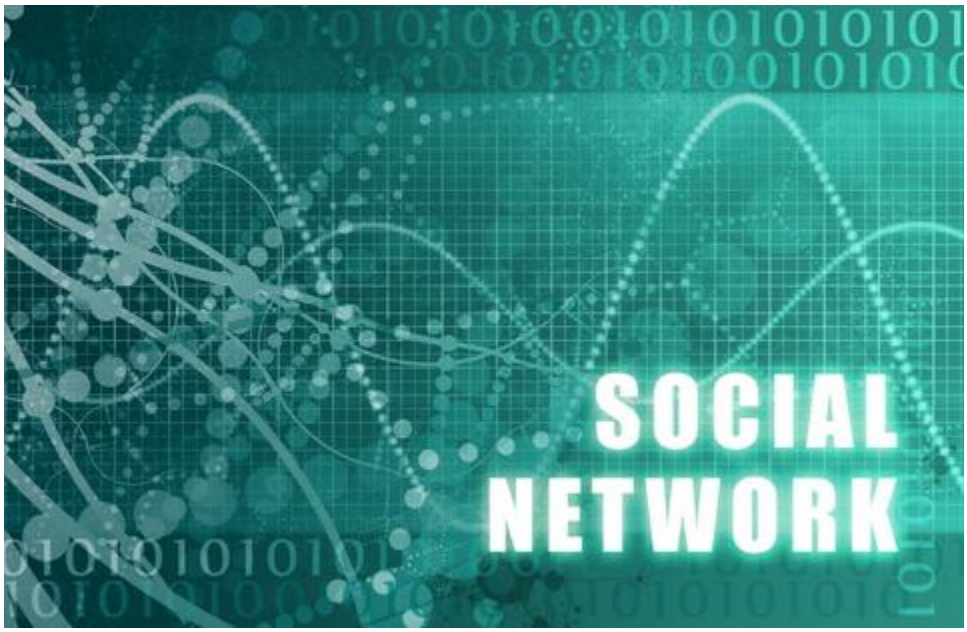
How Social Networks are Changing the Face of Marketing- http://www.allthingscrm.com



Networking has long been a form of marketing in the business world, even before the birth of the Internet. In an age where Web technology is growing at rapid rates, social networking offers ways to appeal to more and more people. Incorporating social media tactics in customerrelationship management strategies can influence a company's credibility, influence, and word-of-mouth advertising. Essentially, marketing is connecting to consumers, and social platforms can simplify the process.

With social media, such as blogs, Twitter, andFacebook increasing their number of users every day, customer potential is massive. Business owners can post valuable information, product videos, pictures, customer testimonials, create discussion forums, and much more. Different niches within these platforms sometimes rate products and services. Having a superior product, but a low budget for marketing won't matter if a company manages to rank high on such lists – their sales will increase. Since most social media is free, the return on marketing in these venues can be extremely profitable.

While there are many different channels to take in the social media platform, it is important to consider a few things:

1. Set Specific Goals: Begin your marketing strategy with your goal in sight. Know what you hope to achieve and then choose the best medium to reach that goal. Also, think about exactly what audience you want to target. Having this prospective can direct you towards the social media venue that will bring about the best results. In other words, simplicity and focus are essential.
2. Select a Social Platform: There are hundreds of social networking sites available on the Internet. With so many to choose from, again, remember to keep it simple and stay focused. One main thing to remember with social media is that it requires upkeep, which can become time-consuming. As a suggestion, pick only a few channels through research that have the most potential to bring about more business.
3. Don't Sell: In general, the social networking population isn't interested in being pushed into buying something. Keep in mind that social networking encourages genuine interaction between the consumer and the company. Customers what to be apart of the process, and lucky for them, social media provides the perfect platform for easy and simple communication.
4. Engage Your Customers: Simply creating and joining social networks won't bring in the traffic. Developing the discussion boards about your niche and in turn joining others will bring in the followers. Be sure to engage the customer, because more than ever, consumer want to be heard.

Connecting to your customers is easier than before. Companies can share and organize markets. Also, you can recommend articles that support or endorse your business. Another benefit to marketing with social media is associating with like-minded people and sharing best practices. Blogs, Facebook, and Twitter, as well as many others, offer companies the ability to share up-to-date information with their followers. For example, Facebook has fan pages that allow brands to create profiles and respond directly to its customers, while Twitter endorses posts no more than 140 characters so that important information gets out quickly.

Social media is hard to ignore. Consumers want goods and services that they can trust. Fortunately for social networking and businesses that use it, people trust other people who have had personal experience with a specific company. The social platform advocates this type of connection. In an economic environment where customers have access to a plethora of information, it is imperative to have your company stand above the rest.

Engineering Better Medicines- engineeringchallenges.org

Doctors have long known that people differ in susceptibility to disease and response to medicines. But, with little guidance for understanding and adjusting to individual differences, treatments developed have generally been standardized for the many, rather than the few.

How will genetic science change how medicines are made?

Human DNA contains more than 20,000 genes, all of which are stored in our cells' nuclei. A gene is a strand of chemical code, a sort of blueprint for proteins and other substances necessary for life. Cells make those molecules according to the genetic blueprints.

Each person's overall blueprint is basically the same, made up of about 3 billion "letters" of code, each letter corresponding to a chemical subunit of the DNA molecule. But subtle variants in about 1 percent of our DNA — often the result of just a single chemical letter being different — give humans their individual identities.
Beyond physical appearance, genes give rise to distinct chemistries in various realms of the body and brain. Such differences sometimes predispose people to particular diseases, and some dramatically affect the way a person will respond to medical treatments.

Ideally, doctors would be able to diagnose and treat people based on those individual differences, a concept commonly referred to as "personalized medicine." At its core, personalized medicine is about combining genetic information with clinical data to optimally tailor drugs and doses to meet the unique needs of an individual patient. Eventually, personalized medicine will be further informed by detailed understanding of the body's distinct repertoire of proteins (proteomics) and complete catalog of biochemical reactions (metabolomics).

"Personalized medicine," writes Lawrence Lesko of the U.S. Food and Drug Administration, "can be viewed . . . as a comprehensive, prospective approach to preventing, diagnosing, treating, and monitoring disease in ways that achieve optimal individual health-care decisions." [Lesko p. 809]

Already, some aspects of the personalized medicine approach are in place for some diseases. Variants of a gene linked to breast cancer, for instance, can foretell a woman's likely susceptibility to developing or surviving the disease, a helpful guide for taking preventive measures. In certain cases of breast cancer, the production of a particular protein signals a more aggressive form of the disease that might be more effectively controlled with the drug Herceptin.
Still, multiple challenges remain in the quest for a widespread effective system of personalized medicine. They will be addressed by the collaborative efforts of researchers from many disciplines, from geneticists to clinical specialists to engineers.

What prevents you from creating personlized medicines now?

One engineering challenge is developing better systems to rapidly assess a patient's genetic profile; another is collecting and managing massive amounts of data on individual patients; and yet another is the need to create inexpensive and rapid diagnostic devices such as gene chips and sensors able to detect minute amounts of chemicals in the blood.
In addition, improved systems are necessary to find effective and safe drugs that can exploit the new knowledge of differences in individuals. The current "gold standard" for testing a drug's worth and safety is the randomized controlled clinical trial -- a study that randomly assigns people to a new drug or to nothing at all, a placebo, to assess how the drug performs. But that approach essentially decides a drug's usefulness based on average results for the group of patients as a whole, not for the individual.

New methods are also needed for delivering personalized drugs quickly and efficiently to the site in the body where the disease is localized. For instance, researchers are exploring ways to engineer nanoparticles that are capable of delivering a drug to its target in the body while evading the body's natural immune response. Such nanoparticles could be designed to

be sensitive to the body's internal conditions, and therefore could, for example, release insulin only when the blood's glucose concentration is high.

In a new field called "synthetic biology," novel biomaterials are being engineered to replace or aid in the repair of damaged body tissues. Some are scaffolds that contain biological signals that attract stem cells and guide their growth into specific tissue types. Mastery of synthetic tissue engineering could make it possible to regenerate tissues and organs.

What are the benefits of personalized medicine?

Ultimately, the personalization of medicine should have enormous benefits. It ought to make disease (and even the risk of disease) evident much earlier, when it can be treated more successfully or prevented altogether. It could reduce medical costs by identifying cases where expensive treatments are unnecessary or futile. It will reduce trial-and-error treatments and ensure that optimum doses of medicine are applied sooner. Most optimistically, personalized medicine could provide the path for curing cancer, by showing why some people contract cancer and others do not, or how some cancer patients survive when others do not.

Of course, a transition to personalized medicine is not without its social and ethical problems. Even if the technical challenges can be met, there are issues of privacy when unveiling a person's unique biological profile, and there will likely still be masses of people throughout the world unable to access its benefits deep into the century.

How do you fight drug-resistant infections?

The war against infectious agents has produced a powerful arsenal of therapeutics, but treatment with drugs can sometimes exacerbate the problem. By killing all but the drug-resistant strains, infectious agents that are least susceptible to drugs survive to infect again. They become the dominant variety in the microbe population, a present-day example of natural selection in action. This leads to an ever-present concern that drugs can be rendered useless when the microbial world employs the survival-of-the-fittest strategy of evolution. And frequently used drugs contribute to their own demise by strengthening the resistance of many enemies.

"Drug-resistant pathogens — whether parasites, bacteria, or viruses — can no longer be effectively treated with common anti-infective drugs," writes David L. Heymann of the World Health Organization.
A healthy future for the world's population will depend on engineering new strategies to overcome multiple drug resistances. One major challenge in this endeavor will be to understand more fully how drug resistance comes about, how it evolves, and how it spreads. Furthermore, the system for finding and developing new drugs must itself evolve and entirely novel approaches to fighting pathogens may be needed also.

Drug resistance is nothing new. The traditional approach to this problem, still potentially useful, is expanding the search for new antibiotics. Historically, many drugs to fight disease-producing microbes have been found as naturally occurring chemicals in soil bacteria. That source may yet provide promising candidates. Even more drug candidates, though, may be available from microbes in more specialized ecological niches or from plants or from bacteria living in remote or harsh environments (e.g. deep lakes and oceans).

Bacteria that live symbiotically with insects, for instance, may offer novel chemical diversity for anti-infective drug searches. Plants provide many interesting compounds with anti-bacterial properties, and genetic manipulation can be used to devise variants of those compounds for testing. And chemical engineers may still be able to create entirely new classes of drug candidate molecules from scratch in the laboratory.

Further strategies involve directing specific counterattacks at the infectious agents' resistance weapons. Treatments can be devised that combine an antibiotic with a second drug that has little antibiotic effect but possesses the power to disarm a bacterial defense molecule. Other hybrid treatments could be devised using compounds that impair the invading pathogen's ability to pump the antibiotic component out of the bacterial cell.

The drug-resistance problem is not limited to bacteria and antibiotics — anti-viral drugs for fighting diseases such as AIDS and influenza face similar problems from emerging strains of resistant viruses. In fact, understanding the development of resistance in viruses is especially critical for designing strategies to prevent pandemics. The use of any anti-microbial drug must be weighed against its contribution to speeding up the appearance of resistant strains.

What is engineering's role in creating personalized medicine?

The engineering challenges for enabling drug discovery mirror those needed to enable personalized medicine: development of more effective tools and techniques for rapid analysis and diagnosis so that a variety of drugs can be quickly screened and proper treatments can be promptly applied. Current drugs are often prescribed incorrectly or unnecessarily, promoting the development of resistance without real medical benefit.

Quicker, more precise diagnoses may lead to more targeted and effective therapies. Antibiotics that attack a wide range of bacteria have typically been sought, because doctors could not always be sure of the precise bacterium causing an infection. Instruments that can determine the real culprit right away could lead to the use of more narrowly targeted drugs, reducing the risk of promoting resistance. Developing organism-specific antibiotics could become one of the century's most important biomedical engineering challenges.

This could be especially challenging in the case of biological agents specifically designed to be weapons. A system must be in place to rapidly analyze their methods of attacking the body and quickly produce an appropriate medicine. In the case of a virus, small molecules might be engineered to turn off the microbe's reproductive machinery. Instructions for making proteins are stored by genes in DNA. Another biochemical molecule, called "messenger RNA," copies those instructions and carries them to the cell's protein factories. Sometimes other small RNA molecules can attach to the messenger RNA and deactivate it, thereby preventing protein production by blocking the messenger, a process known as RNA interference. Viruses can be blocked by small RNAs in the same manner, if the proper small RNAs can be produced to attach to and deactivate the molecules that reproduce the virus. The key is to decipher rapidly the sequence of chemicals comprising the virus so that effective small RNA molecules can be designed and deployed.

Traditional vaccines have demonstrated the ability to prevent diseases, and even eradicate some such as smallpox. It may be possible to design vaccines to treat diseases as well. Personalized vaccines might be envisioned for either use. But, more effective and reliable manufacturing methods are needed for vaccines, especially when responding to a need for mass immunization in the face of a pandemic.

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