SAMPLES OF WRITING BY ROBERT FRIPP

Thank you for accepting samples of my commercial writing. The clips on the first seventy-four pages were published in trade magazines or in books. My clients subsequently gave their consent to let me use their material in this format.

I have removed bylines from features that I ghosted for trade magazines.

This document is text-only, in order to cut transmission and memory demands. Graphics and clips are available.

This selection represents a fraction of my output. If you work in science or technology—from landing on Mars, to network security to hard-rock mining—the odds are good that I have written for a related field. Please feel free to ask.

Pages 74 to the end offer a touch of light relief.

Thank you,

Robert Fripp

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IBM's Teraplex Experience: Pushing the limits of Business Intelligence

(*Byline by my client*)

Pushing the limits, now as then

The present experimental stage of exploiting information technology (IT) in pursuit of business intelligence (BI) recalls an earlier age of commercial exploration. Magellan, Hudson and Columbus set out to discover new worlds for commerce without a critical navigational aid: knowledge of longitude. The stars told navigators how far north or south they were. But, without accurate clocks, position with respect to east or west was a matter of guesswork.

It took courage for early navigators to sail east or west after sunset. They were gambling. Did they have a night of clear sailing ahead, or would they break up in the dark on an unseen shore?

I open with that analogy between sixteenth century voyages of exploration and IBM's ultra-modern Teraplex Integration Centers because our Centers were built to help and enhance that same spirit of commercial enterprise. Shifting the paradigm to serve a new millennium, our Teraplex Centers sustain commercial, competitive voyages into IT and BI unknowns. Briefly, IBM spent $47 million to set up sites where our BI customers and business partners can fine-tune their proofs of concept while scaling up to terabyte sizes, using all sorts of database and software combinations on S/390, RS/6000 and AS/400 frames. The S/390 and RS/6000 Teraplex Centers are in Poughkeepsie, New York; AS/400 customers go to Rochester, Minnesota.

Pushing the limits New Age-style

The Teraplex Centers' mandate is specific. They exist to explore the outer limits of BI in an age when massive computing power meets massive commercial data warehouse information demands.

Take different combinations of IBM hardware; software and databases from IBM and many independent vendors; add a variety of warehouse architectures; then scale any given configuration up from gigabytes to terabytes. At some point *any* integrated system must hit the rocks. Teraplex users scale up until something snaps; then we help them to fix, patch, rewrite code and go again. As we scale into unknown new worlds of terabyte demands, our Teraplex Centers reveal those critical break points which allow us all to chart our own route maps into the next stage and the next age of commercial penetration.

Drive it till it drops

The best analogy I can give is that of a test track for high performance vehicles, where you drive a product past its limits. Valves blow, bearings seize, brakes fail or the radiator bursts. Then you strip it down, analyze the failure, correct it, put it back on the track and kill it all over again. That is what the Teraplex Centers do for integrated BI systems. We put a premium on achieving system failures, because that's the only way to work through a problem before pushing the envelope again.

Let me illustrate the Teraplex Centers' mission by describing what can happen without them. I can describe this scenario because it's the sort of thing IBM set up the

Centers to eliminate. Let's say a chief information officer is under pressure to scale up a data warehouse from a couple of hundred gigabytes to something over half a terabyte. The CIO does his homework and selects software to match his business function. But already there's a problem. Neither the customer not the software vendor has the resources to test an integrated system that is supposed to scale seamlessly into the stratosphere. Scaling up a data warehouse trips multiple stress points. How many concurrent users will the projected system handle? What happens to query response time set against a huge amount of data? What if the system crashes and you can't recover it or back it up?

Exit Big Bang. Enter trial and trial again

In the pre-Teraplex Dark Ages our hypothetical CIO might build his system, turn the key and — crash! That's what I call the Big Bang theory. Meanwhile he's spent a lot of money, managers are screaming for results on commercial deadlines and his staff has never handled anything that size before.

That's the nightmare we work to eliminate. Teraplex staffs are dedicated to serve our customers and business partners; Teraplex users have three terabytes at their disposal; there are no commercial pressures; and the only reason customers and software vendors come is to scale their BI systems and test their proofs of concept until they get them right. Major scaling up requires a tight rein on the whole integrated infrastructure — hence emphasis on Teraplex Integration Centers. It's back to the test track analogy: you're looking for the next stress point, the weak link in the chain.

Scale to any level: food for thought

A lot of IBM customers, business partners and software vendors have had the Teraplex experience. The stories they go home with are positive, and instructive.

For example, a team from Parts America spent thirty days testing their proof of concept for a data warehouse designed to manage inventory at 640 auto parts stores. Parts America had plans to scale up JDA's Retail IDEAS software on an AS/400 from 275 gb to half a terabyte. We thought of the AS/400 as a midrange machine until Parts America scored a first by scaling it up to 510 gb. Adam Brown, Parts America's Systems Director for Merchandising, had plans to scale up to 750 gb. But "as it went up we discovered so much we had not anticipated that 510 gb was as far as we needed to go."

Parts America's experience is typical. They had a debate at the Teraplex as to how their warehouse design would affect its size; and whether Parts America or JDA (the Retail IDEAS folks) were correct about data configuration. Apart from proving their concept, Parts America's Teraplex experience saved a lot of grief by probing their warehouse architecture step by step, showing how each change they made affected its growth and performance.

MicroStrategy also went home happy from a Teraplex experience. MicroStrategy's DSS Server analytical processing application was new to the S/390. We helped them stress-test their product running with DB2.

A real customer environment, without the customer

Ashutosh Jhaveri, MicroStrategy's Engineer for the Very Large Database Technology Group, told us they came because "We were getting strong customer demand for certification of DSS Server Version 5.1 for DB2 390. The Teraplex Center is probably the best place we knew that could recreate a real customer environment and simultaneously run large-scale tests."

In the end, Jhaveri says, "We had a good time. The experience we got there led to us being able to fully integrate and optimize Version 5.1 for DB2."

Working with Teraplex users, IBM has discovered that the experience is a two-way street. We provide a dedicated resource staffed by people who debug problems as they arise in an environment free of commercial deadlines. Our users soon discover that knowing an IBMer who has fired up terabytes on a daily basis for a couple of years is a good friend to have. Meanwhile, we are also making changes to match our users' experience. As MicroStrategy's Jhaveri puts it: "IBM made several code changes as well as we did, so it was a mutual relationship that we established."

Mass suicide: a test bed for survival

I think the ultimate test of the Teraplex ideal to date has been the work we did on Sears' proof of concept. Sears wanted to see if Makuro merchandise planning software would scale successfully to their massive, multi-terabyte data warehouse.

So Sears set out to simulate an environment as close as possible to production conditions. Sears' Director of Merchandising Systems, Joseph Lichocki, sent a team to the RS/6000 Teraplex Center with one criterion: we have 800 stores, 8,000 classes of merchandise. Let's see this thing work from the perspective of concurrent users.

Sears was tough. They pushed the system to 300 concurrent users and then — even Lichocki admits they weren't being fair to Makuro — they had those 300 users do the same intense update simultaneously. The way he tells it: "We had them all commit suicide at the same time."

To see it from Sears' point of view, you have to put yourself in the position of a major retailer. "We were really looking at start of day type pressures on the software and the hardware," says Lichocki. Could an RS/6000 supporting Makuro sustain the workload? "On a typical day we'd be heavy in the morning and then taper off, but when our financial month ends, the question becomes: can the system sustain 300 concurrent users for 48 hours?"

The Teraplex Centers: designed to take the load

Sears' team worked through their proof of concept at the Teraplex in February before implementing Makuro- based production on August 3rd, giving Lichocki a breathing space for shake-down and roll-out. The way he tells it, "I was able to jump six months ahead and say, will this work? How often do you have a chance to do that?"

The Teraplex experience helped Sears assess hardware decisions, too. "In the end," says Lichocki, "we were able to tell — with tremendous help from IBM — that beyond a point it really doesn't pay to get more equipment. So we ran our tests not only from a concurrent viewpoint, but from the number of nodes in the planning engine and the data engine. There were probably 2,000 combinations of environments that we ran."

Look at the thing from the point of view of a CIO charged with the responsibility of setting up a system of unprecedented size. "It's got to be a crystal ball," says Lichocki.

"No matter what kind of experience you and your team have had at lower levels, all kinds of things happen when you start to stress them up."

Too true! But, to return to our analogy with old seafarers' voyages of exploration: if we're all in the same ship steering in the dark, we can at least shift the major stresses. We can take the loads off information managers and shift them to the Teraplex Centres. That's why they're here.

The last word goes to Joseph Lichocki's verdict on Sears' Teraplex experience. It speaks volumes. He says, "It gave me peace of mind." [Robert Fripp, Final]

The Importance of Automated Summary Tables in Large-scale Data Warehouses

(*Byline by my client. Commissioned by TSI, New York, for placement in* Data Management Review)

Large-scale data warehouses have become the key to competitive positioning and profitability in many business sectors which generate large volumes of transactions. In retail we can include almost all enterprises selling consumer products and services. Catalog retailers and banks come to mind. To this list we can add merchants selling business to business products and services.

Warehousing has become important in almost all markets, but what makes the scale—and the technical challenges—large is the sheer volume of transactions required in a given data warehouse. The term "large-scale" applies nowadays to data warehouses containing one or more terabytes of information. If the past is any guide to the future, two years from now we may reserve the term "large" for databases of three or four terabytes, or more.

To explain the rapid increase in the size of many data warehouses, let us look at the example of a major bank. If its marketing managers are to understand the full potential of providing services to a given customer they must first understand the total picture of their company's relationship with that customer. Until recently that bank was content to view its relationship with each customer on a "product by product" basis, with departments such as personal checking, mortgages and auto loans dealing with that customer directly, each generating its own promotions and loyalty inducements. That silo by silo approach is breaking down. Instead, new "relationship marketing" techniques are attempting to capture the full profile of a customer's potential value to the bank's full spectrum of services, not just his or her actual relationship to the bank's individual offerings.

Successful relationship marketing, therefore, demands that marketers understand the status and complete history of all customer accounts: that means extrapolating trends from detailed customer histories. Extend that requirement to several million accounts and the demand for data mining increases by geometric proportions.

E-commerce presents another fast-growing opportunity for vendors. Marketing managers must understand not only what the customer is buying, but what she or he is thinking about, looking at, and rejecting. This means that the whole "click-stream" of a browser's selection or rejection sequence may be filed in a data warehouse. One of Sherlock Holmes' best-known lines comes to mind: "Why didn't the dog bark?" Each mouse click leading to a final decision not to buy—or to buy—supplies valuable raw data about a browser-customer's behavior and interests.

Another powerful motivation driving the trend to large-scale data warehousing is that marketing managers know it is easier to keep a customer than to gain one. Hence the trend to loyalty programs, credit card links to air-mile points, and so on. All these trends lead managers to go far beyond past practice, where it seemed sufficient to mine only the stream of actual transactions.

All the above reasons explain why 30 percent of installed data warehouses will exceed one terabyte by the start of the year 2000. "Large-scale" is no longer the exception. It is becoming the norm.

[*REMOVED: 2,300 words*]

We learn, they learn, we all learn together

Quite apart from the specifics of AutoZone's agenda at the Teraplex, one of the most important aspects of what goes on in our four centers is that we want to transfer everything we know about the appropriate technology to the employees of our customers or business partners. Let me upgrade that remark: knowledge transfer is the most important aspect of all! AutoZone entered into the spirit of their six week stay with us by cycling just about their whole database administration team through there.

Meanwhile, IBM learns from our customers, too. We learn from AutoZone's experience, and from the work we do with each and every other customer who tests a major warehouse design with us. There we were, deliberately loading down our system and pushing it ever harder, scaling up until it crashed, then patching the system, and scaling up again. In the course of events problems will occur—that is our mission—so we want to be there to observe the performance of ASTs as we scale up, fixing problems, discovering little errors in DB2, in AIX, in the hardware, in whatever! Whatever problem crops up gets fast attention. At IBM's Teraplex Centers, everyone learns!

[*Technical Sidebars 1, 2 and 3 followed the main text*]

Closing the Circle: the Integration Imperative (in insurance)

(*Client: TSI New York for IBM Media Relations. Published in* Best Review (*an Insurance periodical*) *Technology Insight column. Byline by my client*)

It is tough to tell a circular story in a straight line. But we confront that situation when dealing with change in the insurance industry today. Large components are as follows: changing competitive dynamics are sensitive to shifting customer needs and expectations; in part, those expectations drive regulatory change; on the other hand, expectations and regulatory changes respond to, and are driven by, rapid technological evolution, including the growth of business via the Internet. That returns us to aggressive competitive dynamics and shifting consumer needs. My challenge is to cut into this circle in order to analyze your industry's dynamics sequentially.

Where better to open than with open markets? Worldwide, relaxed regulations are eliminating national borders as barriers. The World Trade Organization leads the way, with regional treaties such as NAFTA and EU accords playing important roles. We should also credit many national governments for dismantling internal barriers to trade.

We are researching three key aspects of the new scenario: the ease with which a firm established in another field can enter the insurance business in the region where it already operates; the ease with which foreign insurance vendors can enter the U.S. market; and, the ease of doing business in a given country, having regard to domestic regulations. Measuring various countries against those yardsticks reveals vastly different environments for insurance vendors.

However, all are marching in the same direction. A fascinating finding emerges from our joint research with the Tower Group. We compared protected versus open insurance markets, starting in 1996 and projecting to 2005. In 1996, 45% of profits came from protected markets. As borders fall, that figure drops to 25% by 2005.

The lesson is: prepare to compete in an open market. As always, that situation opens doors to both challenge and opportunity. Falling barriers expose insurers to rapid changes. On the other hand, the fast and the fit will keep abreast of the pace of deregulation, carving themselves new markets.

One factor forcing the pace of change in favor of e-commerce is the recent advance of electronic "four-corner trust models." Engineering and research companies have exchanged technical drawings and designs over the Internet for years. However, security concerns delayed commercial document exchange for many years. Until now. Limited space prevents me describing four-corner trust models. Suffice to say that, by the end of 2001, two hundred of the world's major financial institutions will subscribe to this technology. A combination of public key infrastructure (PKI), PIN numbers and smart cards will let the customers of these financial institutions enjoy absolute confidentiality in the electronic transfer of sensitive commercial documentation. When that happens, expect the same rush to electronic data interchange (EDI) in commercial sectors that drove engineering companies such as Boeing into "paperless" design.

I mentioned that competitive advantage will go to the fast and the fit. European insurers are already well-rehearsed, having been involved in several bruising mega-mergers in recent years. American insurers' best defense is to be well armed with technology and systems that are thoroughly integrated, scalable and capable of adapting fast to new business conditions.

Those new conditions include the recent emphasis on building strategic partnerships. In the past, the insurance value chain was largely contained within a large company. Now, that chain is becoming a value network, as new business to business partnerships coalesce. For these to be empowered, partners must integrate their IT systems and middleware.

American insurers already have a strong shield and partner in ACORD. Its role is changing from standardizing paper forms to suggesting standardized technologies. Many converging forces suggest an urgent need for industry-wide system integration: the need to secure competitive advantage; the widening value net; new customer channels; the trend to business via the Internet. Finally, there are the opportunities offered by newly-opened markets as well as challenges from competitors moving into that space. As the standards body for the insurance industry, ACORD is currently working to migrate member firms to XML for business to business Internet-driven transactions. In both defense and attack, ACORD's initiative in striving for industry-wide integration and common technical standards makes excellent sense.

Science and deep computing

(*Byline by my client*)

I want to use this paper to map out what scientists, researchers and engineers can expect from IBM in the next few years. The news is good and getting better.

Briefly, IBM is rapidly overtaking Silicon Graphics/Cray, vendors who long dominated the science, research and development market. Two factors are pulling us ahead: major investments in technology; and major investments in the people needed to build that technology into premium solutions for each and every customer.

Before I explore these two investment areas I want to touch on a recent trend. Computer science is seeing real convergence: between computing for the business of science, and computing for the science of business. That convergence has led IBM to coin the term "Deep Computing" to describe challenges that employ four interlocking components: powerful, super-fast hardware; high-performance software; expert domain knowledge; sophisticated algorithms.

Business and science both benefit from this convergence. Business Intelligence (BI) computing gives us a technique called "horizontal" or "total relationship marketing." This lets a bank, for example, respond to a specific customer's total relationship with it rather than having individual departments—accounts, loans, mortgages—marketing to that customer independently. At IBM we have adopted a similar horizontal approach to a customer's requirements, letting us pinpoint people-resources right across the RS/6000 Division and IBM Research to handle any given problem.

We can summarize this trend at IBM as introducing refined business management skills to the allocation of compute-resources in science, research and engineering.

This leads us in three directions, each with distinct investment needs: the research segment covers government laboratories, educational institutions and pharmaceutical companies. Many of these customers are doing what we continue to call "grand challenges," numeric-intensive research at the frontiers of science in all sorts of fields, from integrating oceanic and atmospheric circulation models to simulating the "docking" or repulsion of virtual antibodies by virtual viruses; and, of course, the design of new prescription drugs.

The petroleum sector includes oil and gas reservoir mapping based on seismic traces, extraction modeling and resource processing. And hard rock mining, too. The cost of blasting and excavating hard rock in nickel and gold mines is such that computer-assisted optimal resource utilization means the difference between profit and loss.

Our third sector, manufacturing, comprises everything from metal forming to directing numerical cutting machines; crash and safety analysis; automotive and aerospace design and manufacture. Just one example: Boeing built its 777 without blueprints, giving it a place in aviation history as the first "paper-less" civilian airplane. 238 design-build teams created the

777. Many of those designers used CATIA software on almost 4,000 RS/6000 workstations. Boeing estimates savings in error and rework alone fell between 60% and 90%. And that was five years ago! We have advanced a long way since then.

In computer-assisted design and manufacture (CAD/CAM), IBM may already be the high-end market leader. Also in electronic data analysis (EDA), which is used to design computer chips and test electronic circuit simulations.

Across the board we are finding that science and engineering sectors benefit enormously from the convergence and coupling of computing skills with business-oriented techniques, such as data warehousing and mining. The product of this marriage, the “Deep Computing” I mentioned earlier, is penetrating many markets, testing new applications as yet unknown.

Which brings us back to my starting point, those two critical investment sectors: in people; and in technology.

In May, IBM opened an Institute of Deep Computing within IBM Research. Our Director of Mathematical Sciences, William Pulleyblank, has brought together a team of over a hundred top-flight people who understand the implications of science computing: they are helping customers migrate their projects to the RS/6000 SP. Our researchers are also pressing forward in new directions, such as bioinformatics, the new numeric-intensive field in the life sciences. Genome research comes into this heading, gene-mapping, in humans and many other species.

Since a primary focus of genome research is to map the individual characteristics of genes—traits, differences and similarities—you can readily see where such a science can benefit from an infusion of BI techniques; as, for example, discovering subtle differences and similarities of customer preferences in numeric-intensive business functions such as data mining. Both focus on discovering miniature needles in mountain-sized haystacks.

So Bill has people in deep computing working on large-scale business functions. When you bring together BI algorithms with scientific algorithms, really exciting things start to happen. Those people are charting new paths to brand new applications for very large supercomputers, in business and in science.

Steering new directions along new paths depends on striving for breakthroughs that let the hardware keep up with human intellect and imagination. Well, we have those, too.

From the first, what has made the RS/6000 platform so excellent for science and engineering is the fact that the system is fully scalable from bottom to top. You can sketch out a project on a laptop and eventually migrate it to the hundreds or thousands of nodes on an SP, if that is the direction the research needs to go.

Our latest offering here is the Nighthawk node. This is going to be IBM’s flagship product in the near future. Nighthawk is an 8-way symmetric multiprocessor (SMP) high node for the SP; a node with a very high performance memory switch which lets it scale up to eight processors in its first incarnation. We have plans to take it further. This technology has evolved very rapidly. Just over a year ago we released the PowerPC 604e (Silver) node, unleashing five times the processing power of Deep Blue, the computer which won the chess series against World Champion Garry Kasparov. (We are considering the possibility of a rematch.) Then came the Winterhawk node, and now the Nighthawk. You can see that IBM developers are in an aggressive frame of mind!

[*EDIT*: 200 words]

Just as deep computing is the product of converging antecedents, the Nighthawk node also has a solid pedigree rooted in converging architecture. A wealth of new applications for the manufacturing sector is drawing a lot of excitement because of the Power 3 processor on which the Nighthawk node is based. The Power 3 itself merges the traditional Power 2 processor with IBM's Power PC. So the coming together of those two architectures will accelerate everything—and simplify things, too!

It is important for customers to know that we have a strong, well-directed road map. Much work in the R&D sector is done on customer-developed applications. Customers take comfort in knowing that IBM RS/6000 architecture scales as far as you want to go; and they take more comfort knowing that IBM has a strong product road map. The Nighthawk node and the T70 departmental server are now key mileposts along that road.

[*EDIT*: 200 words]

One final item: IBM's Deep Computing Institute is making major breakthroughs in algorithmic scaling, not just getting more out of each processor, but scaling those applications to higher and higher levels of performance. The focus here is not to do the same things faster—though that's good—but to evolve the tools to do completely new science and research.

This raises the prospect of creating whole new fields of endeavor, which in turn depends on all of us thinking way past where we have been, truly understanding the potentials which computer simulation offers. When we truly come to grips with whatever the future state of the art holds for us, we will have to boost the tools available to bring it about. For example, we will have to give more attention to data management and storage. And it is more than likely that we will borrow at least some of those tools from BI.

But that lies in the future. My immediate mandate is to make quite sure that the research segment of IBM's RS/6000 Division is positioned to make the best of today—as well as tomorrow. I can assure you of this: I firmly believe that we are making the right investments in the right places to place IBM as the world leader in scientific and engineering computing, tomorrow, as well as today.

Data Warehouse Versus Data Mart: the Great Debate, Part 1

(*Byline by my client. Written for TSI New York & IBM GBIS. This is a monthly column placed in the subscription-only e-trade journal* DS*)

Customers exploring the field of business intelligence for the first time often lead with: What is the difference between a data warehouse and a data mart? The next question follows as predictably as night follows day: which one does my company need? Let me start by saying that the two terms are often confused. Indeed, some people in the industry use them virtually interchangeably, which is unfortunate, because they do reflect a valuable hierarchical difference.

The Data Warehouse
A "data warehouse" will typically contain the full range of business intelligence available to a company from all sources. That data combines transaction-processing records, corporate and marketing data, loans, credit card statements, demand deposits, or statistical and demographic information obtained from outside sources. The cross-divisional nature of the data on file means that a data warehouse is often called an "enterprise warehouse" because the wealth of data it gathers supports the informational needs of the corporate enterprise as a whole.

The Data Mart
Here we move to the next level down in the information hierarchy. A company's marketing, purchasing and finance departments will all make use of data stored in the enterprise warehouse. In many cases they will use the same data, but each department will massage that data in different ways. So each department sets up its own "data mart" designed to extract data from the enterprise warehouse. The key point here is that each mart processes the data in a form which suits its own departmental needs.

Differences defined
Here we see the difference between the two hierarchical levels. At the top of the information chain, a data or enterprise warehouse is "application-neutral." The task of the warehouse is first to store, and then supply, information to different users.

By contrast, a data mart is "application-specific." Data held in the warehouse will be downloaded by several departments or divisions, each of which has a specific "single-subject" interest in the warehoused data, be it finance, human resources or marketing. Each area will set up its own "data mart" to service closely defined user-specific needs. From this we see that a mart is designed to solve one business problem well; it is not set up to cope with a variety of needs.

Ideally, warehouse and marts should coexist, complementing each other's roles. Technology cannot keep pace while human minds dream up ever more complex business demands. So we have to evolve strategies to determine when to build marts and when to build warehouses. Let's assume that a major corporate division's IT group finds that several marts are using much the same data. The question arises: "Why not combine the marts?" The reason is usually that one of the marts is delivering a specific price performance objective, an objective which would be impossible if data for other concepts were merged into that mart. In such cases, the desired analysis depends on some specific denormalization to achieve its goal. But even if no such over-riding objective stands in the way of merging two marts, one still has to ask: "Does the combined data model give me an analytical capacity I didn't have before?" This question usually yields several answers, many of which point in the direction of creating a warehouse. After sober second thoughts the debate usually turns to more important considerations than an immediate need to reduce "redundant" storage costs. This tells us that, if combining the loans data mart with the credit card mart and the checking account mart will enhance our understanding of customers' purchasing habits, we should be thinking about setting up a warehouse to service several needs.

The decision to set up a mart or warehouse usually starts in that part of an organization with the most business "pain." Hence the opportunity for greatest gain. So a mart is born.

A warehouse usually comes into being when a senior executive notices a business problem recurring in several departments. Subsequent discussion reveals a greater need for cross-divisional data analysis than anyone thought. So a warehouse is born to collectively help all divisions behave as a single corporation.

In summary, a mart is born from a single department's urgent need to solve a problem. A warehouse is born when executives discover a common problem affecting different departments AND decide that they can obtain added value by getting a cross-departmental view of the data. Ideally, the warehouse is the best place to start, but that may not reflect the real world. Ultimately you pick your starting point knowing that, over time, you may end up with several warehouses and marts.

So the debate should not be mart versus warehouse, but rather which applications are best served by a mart or warehouse design, followed by how the highest priority implementation will fit into a three to five year plan. And the difference itself, summarized in business terms, depends on whether the system is inter-departmental, pulling data from multiple major subsystems (loans, credit, trust, checking, etc.). A mart might model a small number of major entities; a warehouse by definition models several. Thus, a mart will model just customer loans, payments and forecasts, whereas the warehouse would combine this with checking account transactions, credit card transactions, and so on.

Marts tend to heavy summarization. The epitome of this characteristic is represented by the Essbase OLAP cube — all summary, no details. Thus marts focus on solving predefined questions. Knowing that lets us fine-tune their performance responses.

Let's phrase the question "either/or," not "versus"

I hope by now it is clear that we are not looking at a "Warehouse versus Mart" debate. There is nothing adversarial about the process. Selection revolves around complementary roles. In the next edition of DS* we will discover which architecture and which configuration fits a carefully analyzed, specific customer need.

[End of Part 1]

Drilling into Web Space: The Thrust of BI Database Marketing Probes Deep
For Direct Marketing *magazine*

(*Byline by my client*)

Direct marketers are breaking down traditional business segment walls in order to generate new revenue. Attaining high profitability demands that marketers fully engage their customers by building their loyalty and trust beyond what is attainable through traditional customer relationship management (CRM) models. To win customer confidence, marketers are abandoning single business-model approaches, such as stand-alone bricks-and-mortar stores. They are turning instead to multi-channel strategies and optimization, linking their store operations with e-commerce, catalogs and call centers. This customer-centric approach lets companies build a complete picture of how each consumer interacts with the business across its full spectrum of product or service lines. Multi-channel strategy takes every possible synergy into account, building marketing initiatives to implement more effective, targeted campaigns.

Let me cite one specific multi-channel approach. In one sense paper catalogs are becoming ineffective. But by complementing them with a second channel—the Internet—the standard catalog regains its value. Here is what happens. People open their paper catalog and then order through the Internet by typing the product number into the vendor’s web site. This trend seems to show that consumers demand the satisfaction of perusing a “real” catalog in order to buy through the web. We know this because a merchant who mails a catalog experiences a spike of sales via the web. Another surprising discovery is that a customer ordering from a catalog through traditional channels returns twenty percent of purchases. If a customer orders from *the same catalog* and then types the product number into the vendor’s web site, the rate of merchandise returned drops to ten percent. No one knows why.

The multi-channel approach

To solve this and other mysteries, and to leverage that knowledge into additional profits, merchants are implementing multi-channel optimization strategies: data from all possible channels are tracked, cleansed, warehoused and analyzed to reveal each customer’s online, catalog and store-based retail habits. The result is a greatly improved understanding of buying patterns, and a higher level of customer service.

However, reaching that level of sophistication is not easy. For example, in 1997 the catalog retailer Fingerhut mailed 467 million catalogs in 120 editions, selling an enormous range of products to 71 million people. Fingerhut’s IT team has created more than two hundred finely tuned models of consumer behavior to serve these customers. To cite two examples: one specific customer cohort buys significantly more jewelry than others; and couples who change their address buy more household wares within twelve weeks of moving. Fingerhut purchases change of address information from the U.S. Post Office, then mails a ready-made, tightly targeted catalog to the movers group.

Optimization cuts costs, boosts profit

Sales spike after a vendor mails a catalog. In the past, that often resulted in good customers being pummeled with promotional mail. New, multi-channel CRM strategies eliminate this as vendors learn to merge promotions, thereby translating cost savings into more profit. The industry refers to this as "avoiding saturation." In the case of Fingerhut, IBM Consulting assisted the company to refine what it calls Mail Stream Optimization (MSO).

The first step was for IBM consultants to thoroughly understand the issue of over-promotion. Using Fingerhut's "as is" model as our baseline, we subjected it to advanced analytics, adding a number of processes as work progressed. Fingerhut subsequently increased its returns while reducing its mail stream. Hence the company's term Mail Stream Optimization. For example, optimization revealed that, in the past, one cohort of customers required a direct mail expenditure of $9.14 to yield $64.22 in revenue. Now, cutting mailings to an outlay of $8.44 returns $62.23. The result: a five percent revenue increase per mailing.

That apparently simple statistic belies the huge volume of data retrieval, purging, storage, expertise and advanced mathematics needed to derive it and many others like it. IBM's Global Business Intelligence Systems (GBIS) is working with IBM Research to deploy Optimization Subroutine Library (OSL) in the interests of multi-channel marketing and data mining.

Multi-channels, different desires

We need to satisfy two sets of customers in the multi-channel world: new "dot.com-only" vendors want to pull the many click-streams together, tracking anonymous trends to help draw browsers to the "center" of a dot-com vendor's web, their own site. Then we have traditional channel vendors—catalogs, stores, conventional database marketers. These vendors are "going multi-channel," establishing their existing brands on the Internet, and refining data-handling techniques so that they are consistent with their other, established channels. To achieve this, multiple-channel marketing requires not only the best science that data mining can supply, but the best optimization.

The Internet: a valuable on-line test vehicle

The Internet is already a valuable tool for conducting on-line market surveys, giving rapid turn-around between experiment and result. For example, some major merchandisers build web sites in such a way that if you open them several times in rapid succession you may not see the same home page twice. These merchants are using testing-control to sample consumer response to different appearances and pathways. We are working with IBM Research to automate this process.

The science of database marketing has become so complex that IBM has pressed into service the computer which beat world chess champion Garry Kasparov, Deep Blue. In essence we are playing chess against people who browse the web. Sophisticated people know their moves are being logged and move through the web in “stealth” mode. Next come people who neither know nor care that their moves are tracked. They yield a lot of data. Then there are people who sign in by registering but otherwise yield little information. The least sophisticated browsers supply a wealth of information: they feel they are members of a community, they like your site, they buy from you, they complete your surveys.

We all have a way to go

This is where Deep Blue comes in. Eventually we hope we can learn to predict where people will go. Traditional store designers have known for years that when customers walk into a “real” store, they turn right. E-business research has a way to go before we can predict a customer’s next move in a multi-channel world. But we are getting there.

XM Satellite Radio set to stir radio revolution

For *Storage Management Solutions* magazine, Vol. 5, Issue 6

By Robert Fripp

When XM Satellite Radio starts broadcasting in the second quarter of 2001, it will operate out of the largest all-digital studio and broadcast complex in the United States. XM took over 56,000 square feet at a former Washington D.C. printing plant, turning it into a state-of-the-art radio complex. 82 in-house studios will produce two thirds of all radio programming for broadcast on 100 channels. Independent suppliers will produce the other third. A single subscription buys all channels, which will broadcast from two satellites covering the United States.

Kyle Whitney, General Manager of XM Satellite Radio, describes XM's mission as "hitting the little niches left behind by broadcasters." Having targeted one hundred niches to date, XM may reach beyond. "With some compression we find we can squeeze more bandwidth out of our FCC allocation. We're examining the possibility of expanding that."

XM has contracted to obtain and convert all CDs coming on the market. Two million songs will enter XM's data bank as digital files: the process continues daily. "Right now," says Whitney, we are "gathering the complete library of everything we find."

Nor are songs the only audio files being imported for storage and play. "Where you might be lucky to have just one classical station in an urban market, XM Satellite Radio subdivides 'classical' into opera, chamber music, symphonic and so on," says Whitney. "One of our partners, Radio One, will provide Afro-American music on five channels; everything from hip-hop to soul. We have an arrangement with HBC for Hispanic channels. Then there's comedy, Nascar racing, and every kind of popular music broken down by genre."

From Punk to Puccini, and every taste between. It doesn't stop there. XM Satellite Radio subdivides popular music content by channels to the extent of breaking down fifties, sixties and seventies oldies.

The task of building XM's studios up from the concrete floor falls to vice president of operations Tony Masiello, who describes his task as more like constructing a computer facility. XM's information technology (IT) requirement includes a vast, and growing, data warehouse. With 22 terabytes of stored digital audio to date, XM's facility has the capacity to expand storage rapidly. And scale its application, too. More about those aspects of XM operations later.

A three-way strategic partnership made possible the IT heart of this ambitious enterprise. Dalet creates advanced broadcast solutions for radio stations. In the case of

XM Satellite Radio, Dalet was asked to create a wholly digital solution capable of being accessed from 310 Dalet workstations. Champion Computer Products, an IBM reseller, designed XM's major 22 terabyte storage solution, sourced the hardware and provided design support and implementation services based on Dalet's input. IBM provided the storage solution hardware and verified the concept for the business team. Dalet spent 45 days at IBM's Advanced Technical Support (ATS) laboratory in mid-1999, returning again to Dallas, with Champion, in November 2000. It was there, after a total of eight weeks work, that IBM's ATS Personal Systems Solutions Center gave solution validation to the unprecedented scale of the strategic partners' ambitious design.

Key to XM's operation is the need for broadcast channels, editors and producers to gain virtually instantaneous access to a song or some other piece of digitally stored audio.

Dalet's Robin Wang explains: "Dalet offers a digital audio system that lets XM and other broadcasters store audio and multimedia content in their database, along with the tools needed to acquire that content, tag it, edit and produce it." Furthermore, a radio station needs tools to manage its database. It is not just a matter of filing and instantly retrieving a song. All the metadata attached to that audio must be instantly available, too: the artist's name, album title, catalog number, date, publicity copy for color commentary such as the session musicians involved, and contractual information. "The system needs to manage all that," says Wang, "so that DJs and others can easily identify songs and put them into the play-out."

In addition, each play-out on each of the one hundred channels must be logged on a broadcast schedule. In some cases broadcast may involve a play list triggering songs automatically. Other broadcasts involve "live assist," where a DJ gives color commentary before clicking a mouse, manually triggering a play.

"The key word here is scale," says Wang. "This is the largest installation Dalet has been asked to do. When you talk about 100 streams of content, that is just on the broadcast side. You also need streams for intake, production and editing: there are many reasons why content streams in or out of storage. You're talking upwards of 200 channels in simultaneous use."

Simultaneous use is another critical issue. "This is not a text document, it's an audio stream," comments Wang. "One channel passes upwards of 64 kilobits per second of continuous audio. Multiply that by up to 200 channels, add the demand for immediate availability and you need a very high performance system. Through IBM, we were able to test and configure the system so that it met the needs of XM."

The technical solution itself involves an IBM reseller, Champion Computer Products. "We did the first testing with IBM," says Wang, "and now Champion is doing the nitty-gritty design work on site to make the system happen. Champion is our interface in getting this done."

System architecture revolves around two servers. One of these controls 440 36 gigabyte drives: the other controls 220 similar drives. Allowing for the fact that the second server could accommodate a further 220 drives, and that all drives could be upgraded when 72 gb disks become available, the potential for scaling up is enormous.

In addition to the 660 installed disk drives in the storage area network (SAN), part of the strategy ensuring rapid availability involves linear tape open (LTO) technology. “It’s a very high speed tape,” says Wang. “We’re looking at integrating it for our hierarchical storage. The speed of access is so high that it’s nearly online. It doesn’t have hard drive speed, but it’s very close.”

The implementation partner, Champion Computer Products, is working on integrating the LTO with system control and the massive IBM SAN. Champion’s point man for the XM project, Bob Ward, comments that Champion thinks it possible to make another 16 terabytes of storage available without having to increase the number of clusters in the environment. He, too, sees the sheer scale of XM’s project as the major challenge.

Ward elaborates on the system architecture. “We have our two nodes operating in a Microsoft cluster backed by two fiber-channel hubs,” he says. “That attaches to a fiber-channel storage controller serving up the disks. That is the technical solution XM has.”

Ward has a lot of praise for the Dalet5.1 application. “In terms of file management they have a number of excellent tools to extract the files they need in a logical, methodical way,” he says. “My best synopsis of their application is that it runs a database application which tracks the location of every one of the media files stored in those large audio servers. When a Dalet workstation needs a piece of audio it queries the database for that set of files, which then calls on the audio servers to serve that piece of audio to the requesting workstation.” Unless, of course, it is needed for on-air broadcast. “Then the file immediately goes on air, up to a satellite.”

“It’s a really elegant solution,” says Ward. “Elegant in its simplicity. The database is designed to handle and track all two million titles that XM can call on for broadcast.”

Now comes an additional challenge. Some pieces of audio are more in demand than others. Top Forty songs will be called up for broadcast or editing by several channels and editors at once. The several uses overlap without being actually simultaneous. Thus, one channel may be ten seconds into broadcasting *Love Me Tender*; another channel may be ten seconds from the end; and an editor needs it to assemble a profile of Elvis Presley.

XM will have the option of storing frequently used audio in several places. Champion’s Bob Ward explains how Dalet’s application solves the challenge posed by overlapping multiple uses. “If, by some quirk, four or five studios want the same Allan Greenspan quote at exactly the same moment, the way the system is designed from an IBM hardware perspective is that the file will be served to the NT machine holding the audio, and then distributed through the network to the various users.” There is a benefit to assigning the feed this way. “If there is a ten second difference between the first and second requests, I don’t have to reload that ten seconds of audio back into the controller’s cache memory or the NT system. It’s already there. So my next access to that piece of audio will be much faster.”

While Champion’s Bob Ward describes the XM solution’s multiple feed strategy, Dalet’s Kyle Whitney is tapping a calculator. “I estimate an average audio feed at about 4 megabytes per minute,” he says.

Ward responds: “So I can hold 250 minutes of audio in cache.”

That settled, discussion turns to logging the utilization of files for optimum management of cached materials. “We hope to provide XM with tools to let them examine utilization frequency in their disk environment,” says Ward. “We offer a product called Storage Minder, where we can analyze file utilization in great detail.” Storage Minder gives a user precise I/O throughput data on which to base hierarchical storage management. “Extending the capabilities of managing stored audio is the least costly and the most effective way of managing such a large and dynamic resource.”

XM Satellite Radio has acquired an impressive list of strategic investors, General Motors and Honda among them. Auto makers welcome this service, which will provide their customers with reliable radio signals during long drives across the country. GM will begin offering a three-band satellite radio as an option in several 2001 models. In 2002, Honda will incorporate XM and Sirius receivers in Honda and Acura models. (XM’s rival, New York-based Sirius Satellite Radio, was the only other company granted an FCC license to start transmitting satellite radio services.)

Bob Ward has seen the three-way Dalet-Champion-IBM strategic partnership from several perspectives. He was working at IBM’s Advanced Technical Support facility when Dalet was testing its solution for XM in 1999. Then he moved to Champion, just in time to work on the XM project, returning with Dalet to the ATS Center, where IBM verified the solution. As a veteran of the eight week verification process he describes the partners working relationship as “a marriage made in heaven for all of us.” And that includes XM’s solution, a radio “first” for all concerned.

IBM Visions

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This story describes how the Boeing Corporation designed and built the 777, the world's first "paperless airplane" (meaning, without blueprints). This version ran in the British edition.

Boeing's "Paperless" 777

by Robert Fripp

June 12, 1994 marked an historic milestone for the Boeing Company. On that day, the world's largest twinjet lifted off from Paine Field, near Seattle, for its first flight. Boeing 777 chief pilot, John Cashman, later reported that the flight had gone "amazingly well". That first flight was a sweet sight for the 777 design and production teams. Investing an estimated $4 billion in a new venture takes courage even more so when the human energies which that investment represents must work through a major paradigm shift. There were no blueprints for the 777. No mock-ups. Before the first 777 took shape and took off into a grey Seattle sky, several billion dollars worth of design and tooling existed as a massive database developed, stored, refined, tested and perfected in computer memory and three-dimensional computer space.

Producing a new aircraft from start to finish entirely on computers was an informed decision based on several years experience. "We started pilot programs on a Rolls-Royce strut years ago," says Larry Olson, director of information systems, Boeing Commercial Airplane Group. "That evolved into some CAD work on the 767. At the same time, the Helicopter Division looked at doing parts of helicopters. We got our confidence up that we could cut down the change and rework by 30 per cent, based on pilot programs."

That figure was based on success with partial projects. What might happen if a complete program took shape in CAD/CAM? "We felt there would be larger reductions," says Olson, "so we set a target of 50 per cent saving in error and rework. We're actually attaining a higher percentage. We tracked the numbers and it's between 60 per cent and 90 per cent."

Boeing achieved these savings in spite of primary design costs that are 40 per cent higher. To understand this paradox, one needs to look at how things used to be done. In a lecture to the Royal Aeronautical Society, Boeing's president Philip Condit described the company's growth from the early days when a few people could sit around a table and design an aircraft.

"As specialties grow within an organization, they tend to seal off one function from another," Condit said. A plane designed for the next millennium demanded a new approach, one that would "break down some of the artificial barriers that isolate functions and organizations". Given the technical complexity of modern aircraft, combined with sophisticated customer demands, old methods just don t cut it any more.

“We looked at the old serial process where you’d talk to the customer, then you’d do a preliminary design, then you’d do a design, and you just kept throwing the design work over the fence," explains Olson. "We looked at that and said there’s got to be a better way, and the better way was the design-build team."

“Traditionally, an aircraft was designed at hundreds of drafting tables. Blueprints went to manufacturing where it might be discovered that a cable bundle cut through a structural support beam. Boeing uses the term interference for this type of clash. The larger the project, the greater the chance for error.

To reduce interferences on the 777, Boeing put 238 design-build teams (DBTs) to work developing every component and space utilization factor in the aircraft. Each DDT included tool makers, designers, people from manufacturing, structural and maintenance engineers, systems experts, payload specialists and customer representatives.

Dozens of specialists may have an interest in a given component or a given cubic inch of space. Having every possible scrap of available data accessible in the same CATTIER database allowed members of DBTs to study images on large screens, "to critique the models and improve them, and look for things like producibility: can a mechanic get in and change something afterwards?" asks Olson. "And simply looking at it: Can it be assembled? Do we have interferences?"

Boeing developed software to highlight interferences and to let DBT members walk through a design. "Once we created an individual part, the next step was: how does that part relate to another part on the airplane? says Olson, "and we got to the point where we could look at over 1,000 of these parts, assemblies and major sections of the airplane."

In addition to avoiding potential problems in manufacturing, the software provided a means of communication between DBT members, the teams themselves, and all the other people involved in designing and creating components.

"They’ve got to have a way to communicate, and to look at the designs that an engineer develops over time," explains Olson. "That’s one reason why we decided we were going to use 3D solids, because of the visualization capability you look at an object the way you see it, and a lot of the people were not engineers, they were toolers or manufacturing people or whatever. They had to be able to visualize the part as the engineer created it, rather than looking at things the old way, which was 2D drawings. If you’ve ever looked at 2D drawings you’ll know they’re really hard to conceptualize."

This approach also allows you to do things that would have been impossible otherwise. Olson gives an example: "We have the capability of having a folding wing. No-one has bought it but if the airports get more crowded they’ll be forced into it. The hinge that was created for that folding wing is extremely complex. You could not draw it in 2D and make anyone understand what it looks like."

With the software, over 12,000 potential interferences were identified and corrected, representing a huge saving in time and money. And the benefits were felt outside of Boeing. The three biggest partners in the 777 project were Japanese: Mitsubishi, Fuji and Kawasaki. Their engineers, planners and toolers came to Boeing and were trained on the tools. Boeing installed the software applications in Japan in a central data center, connected to the Japanese firms’ sites over distances of up to 200 miles. "We had a dedicated center where we sent information every day, explains Olson, "and we had to maintain configuration control here in Seattle. We sent back and forth over 1.8 trillion bytes of data."

Without the IT systems, this kind of co-operation would have been impossible, or at least terrifyingly slow and expensive. So the computer systems became more than a design tool: they were a catalyst that enabled Boeing to forge the most suitable and profitable business alliances, regardless of the location of the other firms.

The benefits of the system are felt by the customers, too. Olson sees the two great advantages being cost reductions and quality.

"It's a much, much higher quality plane. For the first time, the mechanics out there are saying the parts snap together they don't have to use shims and rework. The other element is that you have a very accurate airplane. Everything fits together. If you were to measure from the nose of the airplane to the tail, it's off by only hundredths of an inch, and the same with the 200-foot wing. That means less drag it's a much more aerodynamic aircraft. The airplane is flying faster than even the specs."

The digital design data is also used directly by the manufacturers for creating the parts, and for the technical training documentation, so that what the engineer sees in the manual looks exactly like the part in the aircraft. The computer-based approach has benefits for the future, too. "You can make changes faster," says Olson. "One of the things we're doing now is building derivative airplanes, a larger plane that will fly a bigger payload and a shorter plane that can fly further. Because all this data is digitized, to make gauge changes or change brackets and so forth, you can go in and do this across the airplane very quickly. In the old days, each engineer would have to change each part consistently, and when you're talking about thousands of people involved, that's a big cost."

Achieving all this required some serious computing power. Boeing ran the IBM/Dassault CATIA software on mainframes up to eight of the largest supporting 2,800 workstations. At the peak of the 777 development, the company had almost 4,000 CATIA seats at several locations.

The firm used the RS/6000 for structural analysis. "It gave us a familiarity with the workstation and the confidence that we could expand it and use it as a distributed workstation," says Olson, explaining that Boeing is moving away from a mainframe approach. "We're taking the next step, to a distributed environment using RS/6000s. We have about 300 workstations, we have another 200-300 being shipped to us by IBM and we'll probably be implementing over 1,000 by the end of the year."

But it wasn't just technology that made the 777 project a success. It was an attitude, for which Boeing has a label: Working Together. It required complete openness on the part of all team members, who were encouraged to criticize others, though only if they had something constructive to offer. And it extended to suppliers, too.

"We had a Working Together agreement with IBM and Dassault that helped us get workstations and mainframes without formal contracts and without even some paperwork in some cases, just to meet our schedules," says Olson. "That was really helpful. That was working together with a lot of trust and faith that the equipment would work and that the manufacturer would get paid. It was quite a paradigm shift for everyone!"

Designing and digitally pre-assembling the 777 in CATIA was not an end in itself. It was Boeing's means to a specific end: the cost-effective design of a major new aircraft combining exacting tolerances, maximum manufacturing efficiency and optimal utilization of airframe space.

And it worked. The new approach has given Boeing a competitive edge in a tight market. It meant that a hugely complex project running over several years met every one of its major milestones. And it's a reflection of the importance of technology. "I was one of the first five people hired on the program," says Olson, "because it was recognized by the leaders that they had to have the IS/IT technology people involved up-front or they couldn't have pulled this off."

IBM Visions

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Appointment Antarctica: RADARSAT

"Venus has been mapped better than much of Antarctica," says Robert H. Thomas, polar research program manager for NASA's Mission to Planet Earth. "We propose to map the whole Antarctic ice sheet in less than a month." His tool: RADARSAT, an Earth observation satellite designed, owned and operated by the Canadian Space Agency (CSA), launched by NASA last November. The international effort involved 100 organizations.

RADARSAT will provide unprecedented coverage of both poles, with Arctic mapping based on two data-hours per week, beamed in real time to downlink receivers in Canada, Norway, Singapore, the United Kingdom and the United States.

Designed for a five year life, RADARSAT will map topography and plot land use: it will monitor coasts, oil spills, agriculture, and forests; measure moving ice; and detect ships. "It will facilitate maritime navigation, search and rescue operations, and provide valuable information on natural resources and the environment," says Canada's Industry Minister, John Manley.

Prime contractor Spar Aerospace Ltd. built the 2,750 kg satellite for US$450 million. A majority of Earth observation satellites rely on sunlight to record images. In contrast, RADARSAT's Synthetic Aperture Radar (SAR) transmits and receives microwave pulses through clouds, darkness, haze, and smoke. Sun-synchronous, RADARSAT orbits Earth 14 times a day, returning to an identical orbit in 24 days.

As the world's first spaceborne SAR satellite with a commercial focus, RADARSAT offers multiple beam modes (image swaths from 50 to 500 km) at resolutions from 10 to 100 meters, and incidence angles ranging from less than 20° to more than 50°.

In preparation, the Alaska SAR Facility (ASF) at the University of Alaska (Fairbanks) Geophysical Institute is adding three 8-node RS/6000 SP systems. For years, ASF has supported other satellites' radar with its current hardware, which can also handle RADARSAT data, except for the ScanSAR (multiple beam) mode. But to process and feed ScanSAR data to the National Ice Center in Suitland, Maryland within six hours, ASF chose SP machines. Tom Bicknell, NASA's Jet Propulsion Laboratory systems engineer involved in developing software for the project, explains, "We did an extensive evaluation of different systems, and chose IBM because one technical superiority it had was that it did scale linearly. We did our benchmarks on multi-node (32-node and up) systems. Our application speed kept increasing whereas other machines with shared memory type architectures didn't." ASF director Carl Wales adds, "Three SPs give us the throughput for the data we're anticipating." Hence the SPs.

After a year in orbit, RADARSAT will be positioned to fulfil Robert Thomas's goal of mapping Antarctica. Edward Langham, CSA's director of RADARSAT's mission systems and operations, comments that a detailed map of 20 meters resolution has never before been made.

Scientists will be able to measure rates at which Antarctic ice shelves are breaking up. Significant shrinking has serious implications for all coastal regions. “That shelf contains enough water to raise sea level about 200 feet,” says Thomas. RADARSAT may soon tell us how much of that figure to expect.

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Container molecules open gates to discovery (UCLA)

The mission: to travel the capillaries and veins of a human body and deliver a drug to a cancerous cell. Sound like sci-fi? It's not as far-fetched as it seems.

Professor Kendal Houk's group at UCLA uses an RS/6000 SP to study molecules which act as "containers" and a phenomenon called "gating." A container molecule can admit and transport a guest molecule within its own structure – then release it at a target site unchanged.

Dr Houk describes the way in which guest molecules enter and leave the container as gating. "The guest molecule enters the host molecule through a gate. The host's structure forms a barrier which holds the gate closed, keeping the guest inside," says Houk. When the gate is closed, the guest is protected from the external environment. UCLA's Nobel laureate, Dr Donald Cram, designed the concept of the container molecule. He called its barrier "constrictive binding."

Releasing the guest molecule is another story. Houk and colleagues had to determine whether the guest molecule's energy pushed it out of the container, or whether the container's barrier had to be eliminated to let the guest out.

Houk and his Computational Chemistry group discovered it was possible, in theory, to control gating by designing container molecules in a particular way. Houk's group believe that if a guest can be safely contained until "placed" in a target location, the container molecule concept would have vital importance, in pharmacology, for example.

"However," he says, "nobody had ever tried to design molecules with controlled gating before. Cram designed his molecule to contain a guest, but he theorized at the time that the guest would have to force its way through a porthole to get out. By accident, we discovered that his molecules already had the controlled gating feature."

Cram designed his container molecules using plastic models – before the UCLA team had access to high performance computers like the RS/6000. Houk explains, "Computer calculations mimic reality much better than a model you hold in your hand. Real molecules are flexible. Computational molecules reflect that flexibility."

Using molecular dynamics calculations, Houk and colleagues discovered the key to the gate mechanism: the guest molecule does not force its way through; rather, when enough energy is supplied, the container molecule moves atoms aside, opening a gate. They also found that the sides of a container molecule produce gates, not the top and bottom as they first thought.

"Our additional research idea," Houk says, "is to use these molecules as catalysts to speed up experiments." Many reactions happen too slowly in water or polar solvents. Houk explains, "In theory, If you build these catalytic groups inside the molecule's cavity, the gating phenomenon will keep the solvent out. When you want a catalytic reaction, the gate will open, the reactant will go inside, and the reaction will occur. It comes back out transformed."

Houk believes the cavities inside Cram container molecules could be used to mimic enzymes. In addition, he says, "Certain peptide drugs, for example, don't survive long in the bloodstream. Either enzymes break them up, or they can't cross blood-brain barriers. Now it might be possible to devise a drug delivery system."

Houk hopes that his team's discoveries will make this concept possible. "No one is developing such a thing right now," Houk says. "Yet."

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University of Alberta: a molecular merry-go-round

When the University of Alberta's Professor Mariusz Klobukowski looks out his window at the trees, he doesn't just see green leaves. He also sees an organo-metallic compound. "Leaves are green because they contain chlorophyll, which is magnesium connected with an organic compound – 'Organo-metallic,'" he explains. "We also have organo-metallic compounds in our bodies." For example, our blood is chemically related to chlorophyll. Where the hemoglobin in our blood contains iron, chlorophyll contains magnesium. These two compounds are at the center of life itself.

In his lab, Klobukowski has the freedom to play with molecules. "You could call it Virtual Chemistry," he says. "It's only been in the last few years that we've had the technology to observe reactions in almost real-time." Klobukowski probes structure, properties and behavior of organo-metallic compounds, solving quantum-mechanical equations which explain how molecules react. Parts of a molecule can affect action in the whole. Klobukowski wants to find out how, and why.

Using HONDO software, Klobukowski is studying a system known as di-manganese deca-carbonyl, Mn2(CO)10. If you heat this compound to 130°C, and interpret its nuclear-magnetic resonance spectrum, the result will tell you that the CO ligands (bonds) are running around the manganese atoms, moving from place to place. This is called the Merry-Go-Round effect. If you alter the system by replacing four of the carbonyl groups with two molecules of dppm – "a nice compound with a long and ugly name," says Klobukowski – you'll get the same Merry-Go-Round effect without heating it. Why?

Klobukowski's challenge is "to dismantle the Merry-Go-Round and find out why you need to heat this molecular system in one case and not in the other." He is trying to figure out how and why bonding properties of carbonyl and (dppm) are different and how they turn on the Merry-Go-Round. "We produced a preliminary image on the computer, but the study isn't finished. We're excited that we can do it at all," Klobukowski says. Before the development of parallel processing and the affordable SP, he could not.

Klobukowski takes delight in studying the whys and wherefores at the life's core. "I get very excited looking at these things," he says. "In the long run, I hope this will help us predict how pieces of molecules affect the behavior of whole molecules, and in the future synthesize a molecule designed for practical application."

Land of Lincoln Linking Distance Learning Nets

(*Distributed by my client to regional newspapers in the State of Illinois*)

The concept of “distance learning” in early nineteenth century Illinois involved a young man leaving his family’s log cabin and going to town to study law, mostly by candle light, from borrowed books.

Abraham Lincoln’s early life probably never came up for discussion when the Illinois Board of Higher Education (IBHE) decided in 1997 to link ten regional networks, or “consortia,” into a single state-wide video-enabled distance learning and teaching tool.

The term distance learning refers to the pooling of a limited teaching resource, sharing it out to a dispersed student population in an efficient and cost-effective manner.

The IBHE embarked on the first phase of its distance learning project in 1993, installing video networks in all institutions of higher education in the State of Illinois. The ten regional video conferencing consortia built at that time were all distinct from each other. The only thing the ten consortia had in common was that they were based on broadband high technology video delivery systems.

That first phase provided more than 350 video-equipped rooms from which teachers could reach students in distant classes. The one disadvantage was that professors and students in one consortium could not easily communicate with those in another.

IBHE’s next step, launched in 1997, was a far-reaching, ambitious initiative, the “connectivity project.” IBHE decided to link the ten regional consortia into a single state-wide unit, voting funds from the distance learning budget for this connectivity project.

To spearhead its connectivity project, IBHE chose Ameritech as the prime contractor. Ameritech was well positioned with state-wide infrastructure already in place. Noting the major switching challenges involved, Ameritech enlisted Madge Networks as a key business partner. Madge, a worldwide supplier of networking solutions, is renowned for its wide area network (WAN) video access switches, as well as its local area network (LAN) Video Gateway product line.

The first challenge faced by Ameritech and Madge was that the ten regional consortia lacked a universal dialing plan. Although telephone companies have perfected the science of tele-conferencing, the equivalent in video systems is not yet routine. Forging a unified statewide network from 350 video-enabled classrooms grouped into ten distinct consortia demands state of the art technology.

A major factor limiting the original ten consortia was the need to install a multi-point conference unit (MCU) port for every video site — each consortium typically involving from 25 to 60 sites. Partners Ameritech and Madge bypassed MCUs and cascaded MCUs entirely, basing the new unitary system on Madge Models-20, -60 and -200 switches from the company’s video switching product line. Multiple access configurations built into Madge switches let systems grow easily (in computer terms, they make a system “scalable”). In addition, they let an existing system accommodate add-on video-support components, such as multipoint control units.

Ameritech and Madge faced a second challenge. They had to merge ten legacy systems from different manufacturers, all with different specifications, into one effective, transparent network. Ed Brizzolara, Ameritech’s account manager for the connectivity project, describes his company’s close working relationship with Madge when he says, “IBHE set us a task, to make them all sing.”

And sing they will. As of April 1998, two of the ten consortia have been linked. By August, eight out of ten will be up and running as one. When the job is complete, Ameritech and Madge will have completed the task set by IBHE: to put into place a state-wide educational video conferencing network. In the process, the partners have created the largest distance learning network in the world.

For its part, by commissioning the connectivity project, IBHE has in effect expanded each regional consortium by a factor of ten, and leveraged its entire distance learning system exponentially, at the same time keeping costs to a flatline budget. One professor can now address students in multiple classrooms scattered across the system, rather than confining a lecture to those in the same consortium.

IBHE’s mandate is to make faculty members’ teaching resources available to the largest possible student market. Predictably the system will serve not only the citizens of Illinois, but also the wider world. Meanwhile, the new state-wide video network gives enormous leverage in terms of value-added, from two points of view: each tuition-paying student will find his or her course options greatly enhanced; and faculty members will reach bigger audiences, amortizing teaching salaries across the system as a whole.

Options are endless. A university administrator could deliver advanced nursing courses directly to state hospitals, offering nurses ongoing education and, in the process, creating a civic benefit. Guest lecturers, Nobel Prize winners perhaps, could address every interested student in the state. Benefits will be as mundane as reducing faculty travel time, and as exotic as a project now entering its fourth year at the University of Geneva, where first year dentistry students train on interactive dummies linked to a central processor, letting them compare their own technique with interactive digital images of correct procedures fed back to them in real time via an ATM switch.

IBHE has seen the future; Ameritech and Madge are putting it in place. It is a future which allows for growth, in quality as well as quantity. Better still, while that future escalates the range of opportunities, it does so without escalating costs.

For IBM Visions magazine

A Look at the Futures / *Potsdam Institute for Climate Impact Research* (*PIK*)

By Robert Fripp

What will happen to water supplies and land-use patterns if human population doubles in the next forty years? If long-term climatic change is inevitable, what are the likely consequences, for the biosphere, and for us? Impelled by a sense of urgency, the German Federal Government and the Land of Brandenburg joined forces to create the Potsdam Institute for Climate Impact Research, PIK for short.

PIK strives to perfect our understanding of present climate and its impacts in order to assess future possible states with the highest possible degree of accuracy.

Its mission goes beyond anticipating changes. Every living thing makes an impact on the ecosystem in countless ways – human beings more than most. So PIK researchers merge data from natural sciences, sociology and economics in attempts to discover, on one hand, the natural and societal impacts of climatic change. On the other, how must human society change if we are to prevent damage to natural systems – and ourselves? Attempts to solve these difficult questions require integrated systems analysis.

This holistic approach, fully integrated analyses of human and natural trends on System Earth, is the special study of PIK's Director, Professor Dr Hans-Joachim Schellnhuber. It is not enough to anticipate change: Schellnhuber aims to evolve control strategies. "What leeway do we have," he asks, "if we are not to force our ecosystem into a depleted state?"

Simulation is the only way to gain insight into the many complex systems interacting with each other. PIK's primary tool in this effort, a 43 node SP computer, will be upgraded to 70 nodes by the end of 1995. Among other projects, the SP is calculating the global carbon cycle. Changing concentrations of heat-storing "greenhouse" gases in the atmosphere are expected to be the major cause of climate change. Schellnhuber warns that measures to absorb excess carbon dioxide are not enough: researchers must plan strategies to deal with human behavior. Science, on this level, not only examines forces external to ourselves – as if we were dispassionate observers of fish in a bowl. As PIK sees it, we too are the fish in the bowl.

Privacy in the age of data warehousing

(*An Op.-ed. piece about privacy issues and information technology, commissioned after the enactment of new U.S. banking legislation by Congress. Byline by my client*.)

Congress has at last updated America's banking laws. The Glass-Steagall Act, a legislative product of the Great Depression, which for more than sixty years enforced separation between commercial and investment banking, has been consigned to history by the Gramm-Leach-Bliley Act.

The new legislation might have passed through Congress without comment except that one aspect has touched a nerve. The law bolsters protection of privacy regarding customer records, but lets partners in corporate mergers share personal and financial data they hold on customers. Thus, if a bank merges with a brokerage and a credit card company, each party will be able to access customer data in the others' files.

A number of technologies and skills which make possible the electronic collection, storage and precise analysis of data fall under the term business intelligence (BI). At one end of the spectrum BI helps a bank keep close watch on the profitability of products and services; at the other, BI enables banks, and other companies, to develop detailed customer profiles. But customer profiles as such are not the central concern of BI analysts and marketing managers, who are looking for links between consumer buying habits and the products and services offered for sale.

Nevertheless, now that the law allows merger partners to access each others' data, fears have been raised of digital red-lining, by which banks or insurers could create a profile of a customer's credit or insurance risk based on the combined records from banking, insurance, credit card and brokerage transactions. The New York Times of October 25 quotes Frank Torres, legislative director for the Consumers Union, as saying, "How can you trust [banks] if they have all this information on you?"

Let us look first at the benefits of BI. Powerful computers and software tools combined with deregulation position financial services on the cusp of enormous opportunity. BI is about personalizing a sale without getting personal. Learning about consumers through their behavior lets banks and other financial institutions develop products and fully integrated services for their customers. That includes offering appropriate investment products that best suit a customer's lifestyle and portfolio.

BI is a powerful competitive tool helping companies boost speed to market, gain market share and pursue closer customer relationships. In so doing it improves margins and cuts costs. It is no coincidence that the 1990's, marked by low inflation and flat retail prices, saw BI techniques come of age.

Vendors and users of BI products and services share an interest in making sure this tool is not abused. BI is taking commerce to new heights at less cost. But that does not make anyone in our business complacent about the rights of consumers to their privacy.

At IBM we have made specific recommendations forming a cogent policy respecting consumer privacy.

In the first place, it should be easy for customers to manage their data, by giving them access to their own files online and by providing an easily-exercised option of letting them choose not to have their data sold to a third party.

We recommend that customers should only shop at Internet web sites displaying an easy-to-find, easy-to-understand privacy policy. Consumers should always be able to exercise the choices offered before they share personal information.

Privacy protection should take the form of an explicit partnership between businesses and consumers. Businesses must make their online customers feel that their individual privacy is respected; customers must take common sense steps to protect their personal information.

Our industry as a whole can learn from codes of practice such as the European Community's Data Protection Directive, and the Direct Marketing Association Guidelines. The Online Privacy Alliance also promotes respect for consumer privacy.

IBM has created a consulting service to help businesses implement privacy policies. We also commissioned the Louis Harris organization to conduct worldwide research on consumer and corporate attitudes regarding handling private information. Our own Business Intelligence and Privacy policy continues to evolve.

In the October edition of the Atlantic Monthly, Peter F. Drucker argues that e-business "is to the Information Revolution what the railroad was to the Industrial Revolution… and like the railroad 170 years ago, e-commerce is creating a new and distinct boom, rapidly changing the economy, society, and politics."

E-business is too important to our economic destiny to let it stumble because we fail to do the appropriate work on the vital issue of privacy. We note that the new legislation requires financial institutions to set up privacy policies. We further note that Senate Banking Committee Chairman Phil Gramm described the new bill which bears his name as an interim measure which will be updated within ten years.

Which is all the more reason why we who are in the business, as well as our legislators, must strive to define and refine a policy setting appropriate standards for privacy in e-business. At IBM we will keep working at this until we get it right.

Pulling Secrets from the Air
(*Improved Limb Atmospheric Spectrometer (ILAS*, *Japan*)

By Robert Fripp

For several decades we have known that ozone gas in the upper atmosphere screens living organisms from excess ultraviolet radiation. In the early 1980s, we learned with a shock that Earth's ozone shield was at risk. Winter in each hemisphere finds man-made chlorine compounds accumulating in the atmosphere over polar regions. (CFCs, chlorofluorocarbons used as coolants, before they were banned, are well-known examples.) In spring, sunlight breaks these compounds down, freeing chlorine to react with, and destroy, ozone. Springtime depletion over high latitudes has created continent-sized holes in the ozone layer.

We now know that chemical reactions in the high atmosphere protect the living world. We are just beginning to learn how little we know about our first line of defence, the stratosphere.

That will change for the better when the Advanced Earth Observation Satellite (ADEOS) will carry aloft the Improved Limb Atmospheric Spectrometer (ILAS). ILAS will measure concentrations of nine gases in high latitudes, including ozone, CFCs and the nitrogen-oxygen (NOX) pollutant family.

Launched by the National Space Development Agency of Japan (NASDA), the "ILAS Science Team" will put ILAS into a polar, sun-synchronous orbit. Its period of 101 minutes means that it will pass through one sunrise and one sunset within that time. During each such event, the spectrometer will be on the far side of Earth from the sun, so that light will reach ILAS through the thickest possible column of atmosphere. ILAS will monitor this light, deriving data from spectral absorption signals: 43 channels will sample 180,000 spectral lines in the infrared, and 300 in the visible band. Pressure and temperature readings are also critical. Then there are 76 atmospheric "layers" to account for. Sunlight reaching ILAS via the thin, high atmosphere traverses just one layer. But light which plunges through the atmosphere, almost grazing Earth at a tangent before emerging to reach the spectrometer, is subject to absorption by all 76 layers.

NIES researchers take the view that: "It is still difficult to describe or predict what is going on in the real stratosphere with accuracy." Aboard a satellite with a life expectancy of three years, the far-seeing eyes of ILAS will certainly help.

Every advance brings new challenges: GMD
(The German National Research Center for Information Technology)

By Robert Fripp

August saw at least one “first” in European supercomputing. The German National Research Center for Information Technology (GMD), together with project partners Daimler-Benz Aerospace Airbus, and Deutsche *Forschunganstalt für Luft und Raumfahrt* (DLR) resolved six million grid points in three dimensions on one test model, running a CFD application. The model showed the benefit of using highly parallel systems for a challenging flow problem around an aircraft wing/body configuration. “So far as we know, this is the biggest run ever calculated in Europe,” reports Dr Ulrich Trottenberg, Director of GMD’s Institute for Algorithms and Scientific Computing (SCAI).

Leading GMD’s major projects are: studies in CFD (with the German aircraft industry); computational chemistry (GMD is parallelizing codes and developing algorithms in molecular dynamics with Hoechst, and parallelizing quantum chemistry codes for Bayer); and climatic research (with the German weather service).

“Our philosophy is twofold,” says Trottenberg. “We contribute to porting existing software to parallel systems, and we develop new algorithms. Ideally we do both in all our projects.” He plans further refinements. Challenges on a grand scale involve multi-grid programs, and “what makes multi-grid interesting is the option of having adaptive local refinements in a natural way.” Indeed, local refinements must be dynamic in order to let industrial users calculate the full Navier-Stokes on a complete plane in its design and development environment. By way of a simile, Trottenberg likens the challenge of local refinement to zooming with an electron microscope to study fine detail.

“Local refinements give parallel computers new problems,” he says. “You can no longer map the original grid to your configuration of processors. You don’t know in advance where grid structures will appear, so you have to re-configure, re-map and re-load-balance evolving refined grid structures on a parallel machine at run-time. In addition, you have to communicate volumes of data, not just boundaries. I think we have shown that this can be done efficiently.”

Every advance brings new challenges. In molecular modeling, for example. Hoechst wants to calculate chemical processes along highly complex membranes. “How do you visualize molecules which contain more atoms than we have pixels on the screen?” asks Trottenberg. “Our present tools are restrictive. We just have to find new ideas.

From my book, "Let There Be Life"

by Robert Fripp

Published in Britain as "The Becoming" in 1998, I made substantial revisions and additions before Paulist Press released a U.S. and Canadian edition as "Let There Be Life" in September 2001. ISBN: 1-58768-004-1 This passage starts on page 70:

To study life's origin is to collide with one indisputable fact: that, however it came about, life resulted from a falling together of appropriateness.

Whatever was appropriate for the origin of life did come to pass. Having said that, it is clear that too much has been made of the wondrous quality of life's origin. Some sense of wonder is essential. It represents the human capacity to gaze back into the long void of coincidence and happenstance so vital to the creation of animal intelligence and its predecessor, instinct. It was chemical instinct, after all, which provided the essential force through which certain organic chemicals fell together, reproduced themselves, and thus begat life. This is not to deny the possibility of divine guidance. William Cowper resolved the question to his own satisfaction with "God moves in a mysterious way his wonders to perform." On the other hand, Aleksandr Oparin spent a long and fruitful career studying the "origin of life." He introduced that phrase to the public, using it with complete objectivity and a scientist's dispassion. Oparin sought only to explain mechanism: questions touching on the possibility of divine motive and governance he left to others.

Indeed, to approach the origin of life armed only with a sense of wonder is to ignore the natural tendency of appropriate things to happen. Starting from first principles, simple organic chemical compounds have a tendency to organize themselves, and this is surely not much more than another step in the grand continuum of evolving systems. Chemical self-replication may be the source of organic intelligence and the beginning of life, but it stems from an older inorganic electrochemical intelligence that orders form and substance according to universal natural laws.

Cosmologists tell us that if our universe is destined to expand for ever, then its eventual fate will be entropy. That's to say, matter in all its diversity will eventually break down, to be replaced by the frigid and inert uniformity of a nothingness that is the ultimate simplicity. J.R. Newman described entropy as the universe's general trend toward disorder and death--a cosmologist's notion of apocalypse.

Until such time, it lives to harness its energies and its matter into an ordered hierarchy of relatively simple material and energetic forms. Thus it happens that the ninety-two elements in the periodic table combine into no more than six crystalline systems. This tendency to simplify things is Nature's own. For example, though laws of probability demonstrate that no two snowflakes can be identical, yet all of them conform to the strict hexagonal symmetry appropriate to the water molecules in their crystalline lattice. So it is with all Creation, living or inert. Its seemingly endless diversity represents sophisticated variation on the central theme of Nature's pragmatism, a pragmatism that ultimately renders everything into simple components.

Almost half a century of experimentation has shown that it is easy to produce complex organic chemicals in laboratory conditions. Great quantities of such compounds were formed on the juvenile Earth through the action of heat, radiant energy and electrical lightning discharge.

The usual residue left in experimental apparatus is a broth of amino acids, fatty acids and simple sugars. Sidney Fox, investigating pathways by which pre-biological chemistry gave birth to life, compared the many experiments involving laboratory-created atmospheres. He concluded that those yielding the largest number of life-compatible amino acids were those in which the experimental mixture of gases was subjected to steady, high heat in the presence of silica sand. Again we come back to sand.

At one time or another, similar experiments have given rise to each and every amino acid found in living things. And when amino acids combine in such experiments to produce synthetic proteins (proteinoids), they do so in proportions similar to the amino acid ratios in living things. Furthermore, these amino acids are selective about how they combine with each other to form larger molecules. Their arrangement is in no sense random. Indeed, they show a high degree of chemical direction and arrangement, even at this simple molecular level. But then, so do snowflakes. Perhaps the sophisticated chemical arrangements that we find in organic compounds reflect nothing more than the evolution of inert intelligence. The recipe is eternal, for it combines ingredients in the present and in the forever-after as it combined them in the past. The great falling together of appropriateness continues as it always has.

For a long time it was thought that life's chemistry was the end-product of such eons of random chance that no amount of investigation would reveal the paths by which it was first conceived. However, taking its lead from the self-directing nature of molecular chemistry, science has discovered that it is really quite simple to assemble primordial cell-like spheres of protein. George Wald pointed out that appropriate molecules could, often did, assemble themselves into microscopic structures with strong resemblances to living cells.

Early experiments along these lines involved collagen, a fibrous protein that binds animal tissues together. Briefly, when collagen-substance was precipitated out of chemical solution, new collagen fibers assembled themselves with the speed and efficiency of ice patterns freezing on cold glass.

Similarly, non-biological proteins can be induced to build themselves into complex cell-like beads called proteinoid microspheres. Here again, when protein molecules assemble themselves, the sequence of events is far from random. It appears carefully and chemically directed, with a few simple compounds undergoing specific reactions to create a structurally complex microsphere. For example, amino acids within the spheres sometimes show weak enzyme-like properties that assist and direct chemical reaction pathways. Sometimes spheres wrap themselves in a double wall analogous to the membranes of living cells: such barriers hold back large molecules but let small ones pass through. Finally, as if mimicking life, experimental microspheres have a "tendency to participate in the reproduction of [their] own likeness," writes Sidney Fox. They develop buds, some of which break away as new spheres, emulating the way in which yeasts and coccoid bacteria reproduce.

The pattern in which molecules assemble is consistent at every stage. It is non-random; it is chemically directed; and ultimately it is self-induced. At least, that is the careful illusion. Life, it seems, was the appropriate intention, outcome, and destiny of its chemistry.

Setting aside proteins, consider the nucleic acids that give each living cell its genetic code. Nucleic acids determine what protein a cell will produce, thereby endowing it with the inherited characteristics it will pass along in its turn.

In 1953, James Watson and Francis Crick published a short article in Nature suggesting a structure for deoxyribosenucleic acid (DNA), the long-chain molecules which encode, store and decode the genetic information essential to living cells (excepting certain viruses, which are differently equipped).

Crick, Watson, and Maurice Wilkins shared a Nobel prize for discovering the elegant and intricate structure of the long-chain DNA molecule. This comprised two inter-wound spiral strands, each complementary to the other, made of interlocking phosphate and sugar compounds linked by nitrogen-rich units known as bases. Hydrogen atoms bond the strands together. It seems appropriate that hydrogen, the first, the elemental form of matter, should bind the chemically-encoded storehouse of life's purpose and designs.

The double-strand model of DNA explains how genes replicate themselves so precisely. During cell division, hydrogen bonds between strands give way, leaving the two spiral chains unraveling from each other. But even as they come apart, new, complementary DNA-substance begins forming on nodal points along each of the dissevered strands. The process soon results in two complete DNA molecules where there was one before, each daughter-molecule composed half of new material and half of old.

The speed at which giant half-molecules of DNA can reconstruct themselves supports the contention that life's genesis "appears to have an explanation of the utmost simplicity," as Fox puts it. From small to large organic molecules, self-assembly mechanisms were "operationally simple at the same time that they were mechanistically complex." In short, appropriate reactions happened selectively, with fluent speed.

The first proto-cell's hold on life must have been tenuous. But for the arrangement of atoms in its molecular lattice, and the unique volition of that lattice, the first proto-cell would have been as dead as the rock beneath it. Just a few atoms endowed one particular cell with the gift of "life." Imagine, one living cell on a dead and hostile planet. What an awesome prospect lay ahead.

It is interesting to compare the respective roles of proteins and nucleic acids in this process from a philosophical point of view.

The protein molecules in this first "living" cell did more than allow it to reproduce itself. They embodied in this being the definition of mortality. Until then, Creation had known only the constant certainty of natural laws masquerading as patterns of energy and mass. Then, all of a sudden, the self-chosen interactions of a protein molecule gave rise to a mortal body--the soma of a cell--along with all that implies for Earth-bound mortality and the corruptibility of flesh.

A notion surfaces, borrowed from Christian burial rites. "For this corruptible must put on incorruption, and this mortal must put on immortality." The first organism's protein content represented its mortal body; the later development of nucleic acid long-chain molecules represented something else. They are life's tools for copying itself, passing down inheritance, and putting on immortality.

In one sense, then, a single-celled organism like a bacterium doesn't die. Splitting, it divides its life force into the bodies of two descendants, each endowed with the parent's genetic legacy.

Nucleic acid is the key to this inheritance, for in a real sense it carries the illusion of immortality along the ancient and continuing chain of life. Nucleic acid is the material tool with which life reaches out to touch eternity. "As it was in the beginning, is now, and ever shall be, henceforth and forever more. Amen."

Things may not be as they seem

The University of New Brunswick, Dr Saba Mattar

By Robert Fripp (for *IBM Visions*)

A chemist knows that some crystals in synthetically-produced organic compounds will have right-handed symmetry (dextro), others, left-handed (levo): the two may have identical physical characteristics, but different chemical properties. A carpenter must take into account the direction of grain in wood. And a sailor learns how to steer and trim sails depending on wind direction.

Which brings us to magnetic fields, and the work of Professor Saba Mattar at the University of New Brunswick. "The two sides of a symmetric molecule sliced down the centre look the same," Mattar explains, "so we all assumed they would exhibit the same properties." Science held that assumption for several decades.

Then, in 1979, Mattar was working on his Ph.D. thesis at McGill University, when he experienced one of those defining moments which scientists hope for. He realized that spatially equivalent – that is to say, physically symmetrical – molecules are not necessarily equivalent when subjected to a magnetic field. "The two halves look the same, but once you put a magnetic field in certain directions, all sorts of things start happening!"

Setting out to prove his hypothesis, he discovered a paper by Israeli scientists, Z. Luz et al (1969), describing hyperfine lines in nitrogen dioxide spectra that the authors could not explain. Mattar felt that he could, but "it wasn't until two years ago that I had a powerful enough computer to compute accurately the splitting of the two lines in the spectra that show magnetic inequivalency. Computing hyperfine splittings is the most difficult task in computational chemistry. I needed a dedicated computer for at least a month to calculate the splittings. That was where IBM came in." Mattar achieved his results on an RS/6000 Model 355, running at 20MFLOPS, with 6 GB of disk storage.

"Magnetic inequivalency is subtle," Mattar says, "not blatant." That is probably why "anomalous" lines in spectra went unexplained for years. However, since Magnetic Resonance Imaging (MRI) equipment plays an ever increasing role in diagnostic medicine – mapping brain function, locating tumors and other analyses of soft tissues – it will be interesting to find out whether new generations of more sensitive MRI machines will have to compensate for the effects of magnetic inequivalency.

Dr Mattar welcomes discussion, to Internet: <mattar@unb.ca>. Joyce Cameron, Information Officer at the University of New Brunswick, provided additional information. Ms Cameron welcomes phone inquiries to +506-453-4793.

CUTOUT:

Mattar's Rule: "Any two atoms in a paramagnetic molecule that are not related by a centre of inversion are magnetically inequivalent."

Mattar defines the centre of inversion: "If you reflect the x, y and z coordinates of every atom in a molecule to -x, -y and -z, and if equivalent atoms exist in those positions, then the molecule has a centre of inversion located at its origin."

A Cell's "Window to the World"
Molecular Dynamics at Penn State

By Robert Fripp

Pennsylvania State University's Center for Academic Computing (CAC) ranks second to MIT for U.S. industry-sponsored research, attracting $292 million in 1992-93.

Among the first to migrate to parallel processing was Ken Merz, Assistant Professor of Chemistry, who uses molecular dynamics simulations to explore the "window to the world" of living cells. "Molecular dynamics," he explains, "is an algorithm by which we generate the time evolution of a system." Integrating Newton's equation of motion, F=ma, he obtains new positions and velocities for systems of interest.

Merz is "looking at the structure, function and dynamics of lipid bilayers," which, he explains, are "unique biological assemblies." A thin double (bi) layer of lipid is one of the main structural materials of a cell's external membrane, in effect its "window to the world." The lipid bilayer also contains protein molecules (e.g. receptors) that essentially "float" in the sea of lipid molecules.

Merz has also studied peptides that bind to lipid bilayers. Peptides are breakdown products of protein resulting from, for example, digestion. As Merz explains, the peptide Carbobenzoxy-D-Phe-Phe-Gly "inhibits cell-cell fusion." Inhibiting such fusion could possibly prevent viral infection of a cell. A virus cannot reproduce on its own; it must fuse with a living cell. To reproduce, the virus injects its genetic material into a host cell, breaks down the host's genetic material and uses that to copy itself. If the virus cannot fuse to a host cell, then it cannot reproduce itself, nor infect the cell.

Merz is also working on protein folding. A protein that is stable at room temperature doesn't easily betray its secrets. "If you simulate it at a higher temperature, you can get things to happen much faster! You take a protein molecule and run a molecular dynamics simulation at 450° Kelvin, that's well over boiling, and watch the protein molecule unfold. You can get a molecular-level picture of how the protein molecule unravels and where the key intraprotein contacts are."

A typical molecular dynamics run covers less than 1 nanosecond (10-9 sec.). Given the geometrical step-up in computing power available on a parallel processor, future runs will give longer simulations, giving better insights into molecular properties and potentials. At the moment, "We take the molecular dynamics program and parallelize it and get something like a Cray C-90 performance with 8 nodes on the SP1," Merz says. What might be possible tomorrow?

Pro/ENGINEER at John Deere:
"It's really got us thinking"

By Robert Fripp (for *IBM Visions* magazine, 1997)

"The objective we're driving for is the concept of a product model," says David Wolak, Team Leader of Engineering Systems in Product Development at the John Deere Harvester Works. "We want to put everything required for a part or assembly right into the [electronic] product model. Using that as our focal point will pull disparate applications such as material, cost and product structure into one logical database." Does the data carry through to numerical control (NC) manufacturing? "Yes," says Wolak, "perhaps even taken to the level where we can assign an attribute to define turret location in our laser cutting/punch manufacturing process."

Wolak's factory designs and manufactures agricultural seeding and harvesting equipment. Parts and assemblies start life as models crafted in Pro/ENGINEER® design automation software running on 160 RS/6000 workstations supported by seven IBM fileservers. "It's a parametric, features-based program," says Wolak, describing John Deere's choice of Pro/ENGINEER. "Say I want to change the distance between two holes, I can do it more easily on Pro/ENGINEER. I can set up the parameters describing the holes and their relationships to other parts in the assembly. If the distance between them changes, the rest of the assembly automatically updates to reflect that change. It's associative, tied together parametrically."

John Deere is building advanced design rules into its product models. "I can have a standard library feature match my manufacturing operation, in other words, user-defined libraries for holes and slots. When I design a part I can go to the library and select a standard slot – I know it's available in production – and build it into my part. Now I can have attributes tied to features that flow downstream into manufacturing."

"The big bang for the buck is not just using Pro/ENGINEER as a design tool," Wolak continues. "You have to look at the forest, not just trees. We're investigating using these models downstream, in areas like purchasing, service parts and maintenance publications. It's easy to make exploded assemblies from the Pro/ENGINEER model, and that means I've instantly got my illustrations for parts catalogues. It's really got us thinking: how can we change our business with this product, today, and in the future?"

Rohr: Ahead of the Pack
The economies of computer-aided design and manufacture

By Robert Fripp

Rohr, Incorporated, a leading manufacturer of aircraft engine nacelles, weathered the economic downturn to emerge as a technological leader with a unique application of CAD/CAM techniques.

“Rohr has implemented a Concurrent Product Development (CPD) process which teams all major functions, including tooling and manufacturing, right from the start,” says Phil Card, Manager of Engineering Information Systems. “A project team is involved in development from conception right through the life cycle. At Rohr, CPD combines several initiatives, including facilities, organization and technology. CPD teams communicate via CATIA, using computer-generated solids modeling and pre-fit analysis.”

Rohr’s special achievement lies in its product definition process, one that stands the traditional sequence of design and manufacture on its head.

“One of many special features of our product definition process is that as we design we are developing tooling and parts concurrently, and reducing dependence on 2D detail drawings,” says Chris Probett, Manager of Design Engineering. On a recent project, a major thrust reverser redesign, Rohr had tools and parts made before the production drawings (2D datasets) were released. This is rare in industry.

[*EDIT*]

Rohr has products on about 150 airlines worldwide. Among its customers it lists major airframers, such as Boeing, Airbus, McDonnell Douglas and Lockheed, as well as major engine makers, General Electric, Pratt & Whitney, Rolls Royce, International Aero Engines and CFMI.

“We went through a tough learning curve to develop the process and implement control procedures,” says Probett. “Give the right tools and a constraint-free environment to a quality team of innovative people, and you have to be prepared to rethink your whole process. After a lot of effort we’ve got the foundations of an excellent process, and we’ve got the superior product to prove that our concept works.”

Flowfields and GRIDGEN: Thoughts about X, Y and Z
(For *IBM Visions* magazine)

By Robert Fripp

Three and a half centuries ago, René Descartes added a third dimension to space with his now ubiquitous Cartesian coordinates, x, y, and z. In so doing, he assigned numerical value to the abstract of space.

In the computer age, numerical space became bounded, defined in wire frame. The next step? Well, GRIDGEN software from Pointwise goes further, generating multiple block, structured grids for solving partial differential equations in, for example, computational fluid dynamics. But there's a twist. In the evolving business of describing space, some definitions may be too rigid, so GRIDGEN decomposes an experimental shape's 3D domain into contiguous sub-domains called blocks. Grids on the surface of each block are generated, followed by the volume grids within. "It's like a computer-aided design system," says Pointwise's president, John Chawner, "where instead of drawing the experimental shape we're creating the grid around it. Our approach to making complex problems as simple as possible is to make the code graphical and handle the bookkeeping automatically."

GRIDGEN's three interactive graphics codes come into their own when engineers configure a grid for an F-16 fighter plane with multiple propulsion inlets, wing flaps, nozzles, fuel tanks and underwing weapons. To map such a shape in Cartesian space is a challenge. Hence the concept of multiple block, structured grids, where 3D space can break into any number of contiguous blocks, each in its own computational space. The system defies memory limitations, too. For example, a flowfield demanding millions of grid points may exceed available memory. But, by apportioning grid points among several blocks and doing the calculations on them one at a time, the flowfield can be resolved.

From René Descartes, to F-16s, to an inner, conceptual space, a computer-drawn realm of flowfields slipping over supersonic skin. We've come a long way in time, speed, and space.

Turboméca: Reinventing Itself for Success

By Robert Fripp

Turboméca is Europe's leading manufacturer of medium-powered gas turbine engines for helicopters, training aircraft, and many other applications. 80% of revenues used to come from long term military contracts. Military clients would accept delays up to 18 months with corresponding cost over-runs. But that world has changed. In 1991, with the military market flat, Turboméca looked to commercial aviation. "Developing a new engine in military contracts could take 7 to 8 years," says Turboméca's Director of Information Systems, Jean-Yves Spinelli. "Now we aim for 3 to 4." Turboméca weathered the post-cold war shock, investing 25% of corporate revenues in research and development in 1993.

Process re-engineering was essential if Turboméca was to conquer new markets. Data processing, with R&D, "became more and more important in our industrial processes," comments Spinelli. Turboméca's drive placed major demands on computer systems. "New project development is incredibly greedy in cpu time," says Ludovic Mézière, Head of Scientific Data Systems. "Experimental calculations make extraordinary demands. Our demand for scientific processing has more than doubled each year since 1987.

"If you try to amortize computer time over three years, the first year you have a surplus, the second it balances, and then you're short of cycles in the third. It's a challenge to balance computing power against cost. We expect to double our demand for cycles annually for the next four years."

Turboméca has gone from 20% to 50% of revenues from civilian contracts in just five years. As Spinelli puts it, "Our mission is to develop turbine engines faster." Of IBM's POWERparallel system he adds, "We parallelized two pilot applications, and got faster throughput than the performance measured using a Cray YMP, so we have achieved our performance objective.

"We've upgraded to an SP2 with 9 nodes of POWER2 technology, which we can allocate to different tasks dynamically, letting us find the best compromise between performance demands of one very large computation and those of multiple small jobs."

Turboméca is shaping a rapidly transforming business, assisted in part by a computer that can build, shape and evolve along with it, too.

Lynx Geoscience Modeling System at the Williams Mine: Getting the picture

By Robert Fripp

The Canadian Shield yields valuable ores: nickel, silver, copper and gold. The Williams Mine, near Marathon, Ontario is Canada's largest producing underground gold mine, extracting 4 million ounces of gold from 18 million tonnes of ore in the past ten years.

Hardrock mining is energy-intensive: access tunnels are blasted, excavated, and rock hauled out. Ore is lifted, milled, and tailings piped to engineered containment facilities. Optimal resource utilization demands a high degree of efficiency. But first, managers need a clear picture of an ore body's three dimensional form and the uneven distribution of gold within it.

The ore volume, location and grade (gold concentration) are evaluated based on core samples from drill holes. Each year, geologists at the mine log and sample about 20,000 meters of drill core. Ore volume models and interpolated grade models are created based on the 3-D location of this ongoing accumulation of data.

"Think of the ore zone as a sheet-like body," mine geologist Gordon Skrecky explains. "The long axis or 'strike' runs east-west about 1,200 meters." The deposit plunges 45° to the north-west and dips 60° to the north-east. Cost-effective decisions depend on managers understanding this complex form and its grade variations as well as the proverbial 'back of their hand.'

Keep it Simple…

…is the Williams Mine computer application philosophy. Senior Geologist Jim Gray says, "Overall procedures could be said to be computer assisted rather than computerized." Drill core logs on paper still serve as primary reference for interpretation, but Geoscience Modeling System (GMS) from Lynx Geosystems lets a multi-discipline team model, evaluate, create 3-D visualizations and make decisions based on the data.

"The Lynx software package lets us calculate ore grades and maintain accurate ore body models." says Skrecky. "We use inverse distance weighting to interpolate grades into areas between drill holes; volumes are based on the geologist's interpretation of the ore zone. That's part of the practical application of Lynx. It costs a lot to excavate a meter of rock. The less you have to take out to reach the ore the better. You're always moving rock against gravity," he says. "It's a very energy-intensive thing."

This is the Executive overview page from
"Future of Healthcare 2012"
a white paper commissioned by IBM Healthcare.
IBM created an inter-disciplinary committee of twelve specialists. I interviewed these experts before drafting several iterations of the following white paper.

(*Client: Mike Shore / 904 278 3234, IBM Media Relations / Healthcare*)

You can read the 29 page paper at:
http://www.kana.com/pdf/Healthcare2012_F2.pdf
or search for the title.

Executive overview

An IBM white paper on how e-business and information technology will have a profound impact upon healthcare and the practice of medicine during the next decade.

It is the year 2012. Over the past 10 years, consumerism and technology have merged. In the healthcare arena, consumers are in charge of selecting benefits and deciding the level of risk versus benefits they desire. More options are afforded employees through employer-sponsored healthcare plans. In addition, consumers maintain their personal health record on a secured Web page, and data from all relevant healthcare providers is included. Pharmaceuticals are increasingly biologically engineered and custom fit to an individual's genetic makeup.

Security and privacy issues have been resolved. The question of medical record ownership has totally shifted as consumers have embraced ownership of their own Personal Health Records (PHRs) through secured Web sites. While physicians and hospitals maintain their own medical records, consumers now routinely grant limited access to their complete medical records, and can include alternative and home care. Most important, information technology has revolutionized how care is delivered.

Wireless technology: a magic bullet aims at overload and errors

(*Wireless technology in Healthcare, Administration and Prescription. Bylined by my client*)

Before I prescribe a regimen for cure, let me diagnose the disease. Twin diseases, actually. Healthcare workers confront two, inter-related maladies on a daily basis. The first is that too often the wrong patient gets the wrong medicine or the wrong dose by the wrong route. That problem stems in part from a second, which is that efficiency and accuracy suffer in an overworked environment. A doctor speaks to a nurse or writes a prescription on paper. The shift changes. The chart is then transcribed. Too often, copying errors enter the system, decimal points become transposed and spelling mistakes and poor handwriting fall prey to subjective interpretation: "Does Dr. Doe mean this, or that?"

When wireless applications let a doctor write, confirm and transmit orders electronically, and when those orders can be retrieved—electronically—by nursing stations, other physicians, laboratories, pharmacies and care-givers, we will have gone far to solve problems of error. We will also have gone a long way to overcome a major hospital labor problem, that of nursing strikes caused by long working hours and mandatory overtime.

Three figures confirm our urgent need to find solutions. The Institute of Medicine estimates that medical errors cause 98,000 deaths a year, 7,000 of those attributable to prescription drug errors. The Agency for Healthcare Research and Quality suggests that electronic order entry could help eliminate more than 700,000 "medication errors and adverse drug events" each year. Meanwhile, the Institute for Safe Medication Practices notes that pharmacists make 150 million phone calls each year to clarify illegible prescriptions. At the receiving end of each call is a healthcare worker diverted from other tasks to find the answer. If a two-minute call involves two trained people, simple math tells us that highly skilled workers collectively waste ten million hours each year (that’s 1,142 calendar years) finding information that should have been clear.

Several major employer organizations are demanding that hospitals install computerized physician order entry systems. A recent survey of 1,000 hospitals reveals that two thirds have no such system. Thirty-two percent have them, but over half of those reported fewer than 10 percent of orders being placed electronically. So, of 1,000 hospitals, fewer than 160 use electronic order entry less than 10% of the time. Massaging that data another way, it’s as if 16 out of 1,000 hospitals use electronic order entry systems full time.

Physicians are not complacent about this situation. A survey by the Health Information Management Systems Society found that over 70 percent see improving operating efficiencies as their major concern. Some, such as Dr. Nelson C. Walker II, of Mansfield, CT., find the doctor-patient relationship "strained by growing administrative burdens."

IBM has entered several strategic partnerships to help automate the load borne by healthcare personnel. The great bulk of healthcare cost is spent in hospitals. Accordingly, IBM and PatientKeeper Corporation have teamed up to offer a mobile healthcare platform to hospitals and other medical facilities.

IBM and PatientKeeper both recognize that hospitals are well equipped with legacy systems, such as Cerner, Siemens and FMS, to name a few. Building on existing systems, IBM brings its e-business technology and implementation services to the partnership. PatientKeeper sits on top of hospital legacy systems as a solution helping to reduce medical errors.

PatientKeeper is an add-on. That is its advantage. It's wireless. It does not replace any existing lab., radiology or billing system. A physician at a patient's bedside carries a wireless web application in a personal digital assistant (PDA) smaller than a palmtop. Deciding that the patient needs drug X at dosage Y and frequency Z, the physician enters the order, confirms the readout, and transmits the message to the patient's file.

Some hospitals use such systems. But, as we have seen, not many. General acceptance lies in the future. However, we anticipate the day when, to quote Eric Pifer, M.D., of the University of Pennsylvania, collaboration between IBM and PatientKeeper "will enable us to retrieve vital information on our patients at the point of care and significantly reduce administrative paperwork."

The PatientKeeper solution is "rules-based." When I select a certain drug, the system will analyze the patient's data. Noting poor liver function, it may query the prescription. Or it might query the prescribed dose against a patient's age or body weight.

The system can be taught to challenge increasingly complex scenarios. Furthermore, it can start with rules affecting life-threatening conflicts before introducing additional features as physicians get comfortable with the solution and its many applications. What we are working towards here is nothing less than a fully portable, rules-based, point-of-care order entry system—with checks and balances built in.

We are confident that hand-held wireless devices capable of processing and sifting important data will be standard for hospitals and clinics in the near future. Indeed, the Institute of Safe Medication Practices has called for hand-written prescriptions to be eliminated within three years.

The 1996 Health Insurance Portability Act (HIPAA) has made everyone involved in healthcare provision acutely aware of the importance of flexible but secure handling of patient data. That includes billing, insurance and formulary compliance information as well as case notes. This magazine recently featured a story about HIPAA's impacts on laboratory information systems.

For our part, IBM has entered several strategic partnerships to address both patient care and the integrity of their data. We are setting up a new company with Pfizer and Microsoft to meet the system needs of office-based physicians, particularly the 70 percent working in smaller group practices. My colleague at Pfizer, Karen Katen, describes our venture as creating "a cost-effective, customized solution that responds directly to one of the most pressing issues facing physicians today." Using Microsoft's .NET Enterprise Server Platform, Windows 2000 and wireless devices, our product offerings will integrate clinical, financial and administrative tools to help physicians manage workflow.

At the same time, physicians will enter case findings using encoded security systems to insure that patient confidentiality is respected. Our product does everything from supply patient phone call relationship management to details of formulary compliance. When a patient calls to renew a prescription, the person taking the call enters the request in a database. That message shows up on the doctor's PDA. He or she can review case notes, insurance arrangements, and renew that prescription with a click.

I have followed doctors around while they use this system. It really eases their day. Another advantage is that they can dictate to the PDA. Someone still has to transcribe that voice message, but ultimately voice-recognition technology will do that, too.

This kind of wireless-based PDA removes administrative burdens. Most physicians have an existing billing system. Our solution communicates directly with that system.

I mentioned that the Institute of Safe Medication Practices calls for eliminating hand-written prescriptions within three years. Attaining that goal seems improbable, given the survey of hospital usage I quoted. However, it is not impossible. The nursing shortage we confront in the United States will see rapid adoption of this technology. Nurses do much of the manual data entry, the copying. And we lack enough nurses to work enough hours. At IBM we are betting we can ease the nursing shortage, cut doctors' administrative burdens and [ITALIC] administrators' costs with one bold move: by putting wireless technology in physicians' hands.

Caring for Healthcare:
Improving care and cutting costs with data mining

(*Byline by my client*)

Important insights into health *and* care are being learned as the result of a business intelligence (BI) installation at Florida Hospital, the largest private, not-for-profit health care facility in that state.

Two years ago, IBM assisted Florida Hospital's IT team to install a pilot project. That pilot proved to hospital clinicians and managers that BI solutions are valuable in establishing statistical patterns relevant to specific diseases. Even more exciting, the pilot showed that data mining can identify successful standardized treatments for those diseases. The pilot focused on patients suffering from acute heart failure or congestive heart failure, a logical choice for Florida Hospital, the first in central Florida to perform open-heart surgery and organ transplants.

Last year, Florida Hospital scored another first. After evaluating the pilot, physicians and managers elected to install a BI solution throughout the system. Among their priorities: to determine the optimal lengths of hospital stays for specific diseases; and to establish best practices for treating those diseases. Florida Hospital purchased IBM's Intelligent Miner for System 390, in order to take full advantage of its extensive, DB2-supported data warehouse.

BI, a tool to build standard care plans

Now that Intelligent Miner is installed in all eleven locations of the Florida Hospital group, the BI solution faces larger challenges. It has become the key tool in helping Florida Hospital construct its new Standard Care Plan. The pilot project in Year One analyzed factors specific to heart failure. In Year Two, the Data Management and Business Intelligence committee chose a second major project. Pneumonia and acute pneumonia were close to the top of many lists, so the BI solution was run to identify "clinical best practices" to treat those diseases as well as other ills. It is now expected that the BI solution will help standardize many aspects of hospital care. Alex Veletsos, the director of information services at Florida Hospital, explains, "Our president launched the clinical best practices initiative with the goal of developing a standard path of care across all campuses, clinicians and patient admissions." The U.S. Government assigns a code number, called a DRG, to specific diseases. Florida Hospital's current goal in medical data mining is to develop a standard care plan for every patient admitted with pneumonia (DRG 79) or acute pneumonia (DRG 89). Standard paths of care for other DRGs will follow.

Florida Hospital is now comparing the before and after statistics regarding its pilot plans of care. At this writing the "after" category contains data from only thirty days. However, physicians have already noticed that the time, in hours, of first medication after admission is important. One emergency room doctor hopes that I-Miner will help establish a guideline for all physicians.

That is one of several interesting results derived from BI to date. Another finding is that specific zip codes in the Orlando area produce more patients suffering from pneumonia, and also from certain gastric problems. One zip code cluster revealed 25 patients—2 percent of a study group—who required exactly the same gastric procedure, and others with the same type of pneumonia.

As he discusses these findings, Veletsos adds proudly, "We're one of the first health care institutions to go into data mining so extensively."

BI to streamline the pace of patient flow

Another benefit has to do with what we might call "patient flow." Anyone who has spent time in hospital has a story of long waits for X-rays or other procedures. Florida Hospital is using BI techniques to track where patients spend time during their stay. When combined with results from clinical best practice models, it is hoped that data on individual patient movements through medical departments will aid clinicians to make what Veletsos calls "predictive modeling decisions." He is sure that "predictive models leading to decision-trees or other types of decision process will be established for our physicians' and nurses' groups." In the long term, Florida Hospital hopes to deliver better patient care while streamlining the flow of people through the system by eliminating extra tests, which will also cut costs.

However, Veletsos emphasizes that such decisions will be taken by medical personnel. "It's safer to give a patient all kinds of tests," he says. "Doctors must err on the side of caution."

Florida Hospital is helped in its push to advance the use of BI in a health care setting by the fact that it has kept a centralized warehouse of clean data for years. "Our patient registration associates populate the necessary data" during the admission process, says Veletsos. To someone checking into an emergency room, the request for a zip code might seem at best redundant, at worst callous. But, as we have seen, that information can play an important part in building an epidemiological picture of health, disease—and ultimately, treatment—in a hospital's service area. So, just to make sure nothing is omitted, the I-Miner solution helps flag missing data: zip code, smoker or non-smoker, allergies, *et cetera*.

Doctor! Doctor! BI health care models need a medic on the team

Veletsos finds that it is critical to have physicians sponsor individual data mining projects. Projects need "a sponsor from the clinical side to keep checking the data and driving the model forward. IT and finance people cannot do it on their own." Veletsos therefore supplies physician-sponsors with "executive summary-type" data. "It's a fine line between asking for their help and giving them value."

BI pinpoints reduced mortality

The Florida Hospital system's total patient population falls into ten statistical clusters. The middle of the bell curve contains more than 80 percent of the total sample. Other clusters account for between 1.5 and 4.5 percent each. The "expensive group" interests everyone. This cluster (4.5 percent of the total) comprises medicare patients only. They appear to incur higher charges than other groups. Given their higher average age, one expects increased mortality in spite of the higher cost of their hospital care. In fact, says Veletsos, "given the type of procedures we administered, this group had below-average death rate, and I mean below the normal rate of the entire population." Physicians will be taking a careful look at drill-down data from the expensive group to discover what works so well. The key question here: is it possible to reduce mortality and also the cost of treating these people? That is one of many queries which Florida Hospital will be asking BI to answer.

Florida Hospital uses data mining techniques in more traditional, commercial applications, as well. Debt collection, for example. Apart from using conventional techniques to establish credit ratings, the accounts payable department is building a socio-economic model to assess when bad debts can likely be recovered by collection agencies, and when it is best to just write them off . Discussing this aspect of hospital affairs, Alex Veletsos stresses that, when patients present themselves in the emergency room, "we treat them right away. Florida Hospital never turns patients away."

BI, prescription drugs and medical claims

I have emphasized IBM's work with Florida Hospital because it is a "people" story representing a breakthrough into a highly sensitive area. In that respect, adapting BI technology to health care is significantly more complex than employing it elsewhere.

On other health care fronts, IBM continues to work with major insurers and administrators: with Aetna U.S. Healthcare, one of the world's largest private health insurers, which processes 500 million medical and pharmaceutical claims; with the Health Care Financing Administration (HCFA), processing claims for 10 million uninsured children in the U.S.; and for Empire Blue Cross, processing 50 million claims a year for 4.5 million subscribers.

Features of our work with Aetna include: alerting parents and guardians of 10 to 12-year olds of the need to vaccinate children; notifying people with congestive heart disease of specific treatment options; advising diabetics of sight-saving interventions. We worked with HCFA to develop a data warehouse and BI solution capable of handling a 12 terabyte database of claims. And Empire Blue Cross saved $110 million in the first three years after installing IBM DecisionEdge for Fraud and Abuse Management, a 12:1 return on investment.

We also worked with PCS, a subsidiary of Rite-Aid, serving 56 million Americans by managing and monitoring over 300 million prescriptions each year. PCS and IBM are building a warehouse to manage 1.5 billion prescription claims.

Furthermore, the BI solution allows 70,000 physicians to access PCS data on patients and prescription drugs faster. At the same time, the system lets 50 million PCS cardholders order prescriptions online.

BI in health care: coming of age

If BI has been slow to adapt to the most intimate, most "human" aspects of health care, that is because medical administrators, physicians and IT professionals are acutely aware of their responsibilities: treating people for medical conditions raises ethical considerations beyond those inherent in processing claims or mining consumer and commodity data. Having satisfied their ethical considerations, pioneers such as Florida Hospital are showing that BI can play important roles, both in improving medical treatment, and reducing its cost.

HR.com / COMPANY FOCUS SECTION
Sandy Asch of The Alliance for Organizational Excellence,
and Timothy Bentley and Esther Kohn-Bentley of Panoramic Feedback.

360-degree feedback: promises and problems

Human Resource and Organizational Development professionals are turning to 360-degree feedback to improve performance and increase people's job satisfaction. 360-degree feedback uses a specially-designed survey that is completed by each employee's manager and peers, as well as the people reporting to that employee. The purpose of the survey is to help all members of the workforce see themselves as others do.

360-degree feedback is a powerful tool. Powerful tools, however, impose a degree of risk. Unless 360 is administered well, its results may not live up to its potential, and may in fact do harm.

Tim Bentley and Esther Kohn-Bentley, principal officers in PanoramicFeedback.com, worked with consultant Sandy Asch to design the *Complete 360-Degree Feedback Resource Kit*. Their intention was to provide vital information and program designs for people administering 360. The kit also flags potentials and pitfalls for organizational leaders as well as HR, OD and training professionals considering purchasing 360 tools. Sandy and Tim spoke to HR.com:

The big change to doing 360-degree feedback assessments has been a burgeoning of software solutions entering the market. Have these solved the problems HR faced in using 360 assessments?

Owning a software tool is often the smallest part of the process. At its core, 360 taps the complex inner world of human psychology. There's a wonderful line in the Chinese classic, the *Tao Te Ching*: "If you try to carve wood like a master carpenter, you may hurt your hand." 360 is a very sharp tool. So it is crucial to prepare thoroughly before applying it to an organization. Otherwise the benefits will be reduced and the risks increased. 360 has to be delivered with sensitivity, analyzed with skill, and the feedback reported with clarity and compassion. We think HR needs to follow a precise path from the first moments of preparation, to administration, to reporting, to the all-important one-on-one coaching that may follow that.

You seem to approach 360 with the Hippocratic Oath in mind: "Above all, do no harm."

Exactly. Expectations rise at every level when an organization applies 360. But unless the recipients get the kind of preparation and support we describe, the tool is so powerful that it may adversely affect people with low self-image or low self-esteem. In the great majority of cases, 360 works as an enormous force for good. Unfortunately, we know of occasions where the organization's productivity actually declined after 360 was used. That should never happen.

Do you face skepticism from potential clients who say: "Look, I bought software designed to take people step by step through the process. We don't need to invest on the soft side."?

That's a good question. 360 is a fast-growing force in HR and OD. It's becoming more affordable and accessible all the time, making it attractive to organizations of all sizes. But, whatever the organization, no matter what application it chooses or the size of its investment, there remains one inflexible constant: you have to apply 360 with care and thoughtfulness. So, when expert wisdom is readily available, why not use it? Our kit is completely vendor-neutral, by the way. It's strictly non-partisan. It sets out the universal principles for best practices in every phase of the experience. We designed it to help users cover all the bases. That includes people who come to 360 with little previous experience.

Established HR, OD and training professionals will also find a valuable range of ready-made resources. Having conducted 360 with international clients for several years, there were times when we thought we knew everything necessary to implement a 360 process with total success. But, as we began to collaborate on developing our kit, we discovered several key issues which 360 practitioners tend to overlook—and critical processes they could handle more effectively. So, we compiled 360 best practices in a user-friendly format that saves time and resources.

What specific things do HR professionals need in a resource kit?

We can best answer that by describing what we considered important in ours. Briefly, a *Process Management Handbook* tells you how to harness the power of 360 for the organization as a whole, takes you through the seven steps of designing an effective process, and explains four key factors to keep in mind when planning a 360 project.

The Art of Receiving Feedback and *The Art of Giving Feedback* lay out two fully-scripted, 3-hour workshops designed to prepare the people on whom the success of the 360 project depends. These offer training professionals specific strategies based upon tried and true practices. They help build an environment in which both the person receiving feedback and the person giving it can be sure of receiving the maximum benefit from the process.

Unless you help people recognize the benefits of providing and receiving frank feedback, the whole process is compromised.

In what way?

Giving or receiving feedback is not easy. It's not just a matter of applying a tool. People need to be confident that the process provides a safe environment that has their well-being at heart. For example, responders need help knowing how to offer feedback that won't "turn off" recipients. They also want to be sure there will be no recriminations. Recipients have to know that feedback won't be used against them by the organization, and that they will be supported in making any changes that may be suggested.

All of us get feedback from those around us. It happens every day. It may be positive, negative, neutral—or just silence. If we are thick-skinned, we may ignore feedback—even be ignorant of it. The special quality of 360 is that it brings the fuzziness of workplace feedback into clear focus. That's very positive—for the individual, and for that person's team.

Another thing. From the moment people provide feedback, they are waiting to see what action will result from their input. Closing the feedback loop by informing people about the outcome is integral to the process. It affects the credibility of the organization—but it's often overlooked.

Is that where the last phase of the process, the one-on-one debrief, comes in?

Yes. The most powerful use of 360 is often when a coach or manager, or an HR or OD professional, goes through the report with the person receiving feedback, helping them find their way, helping them draw conclusions from an emotional, and intellectual, point of view. Many recipients need this stage before they can turn ideas into action. This is also a great time for them to plan how to check back with those who responded.

Coaching is really helpful at this point. We outline two types of coaching session (in Volume 5).

When we talk about coaching we must be far beyond the realm of software tools—and perhaps beyond the coaching resources available in many organizations.

That’s true, but we would say that every organization using 360 should be working towards the goal of providing some one-on-one coaching. It really adds power to the exercise, helping people learn in a positive, constructive way.

One positive result of 360—and the coaching function supports this—is that it provides people with positive feedback about things they do well. By contrast, the everyday workplace often draws attention to our weaknesses. A well-administered 360 reinforces our value to the organization. That motivates us to perform even better!

If someone is considering purchasing a 360 application, we would advise reading up on best practices such as the ones that we cover. It will help them discover the issues involved—quite apart from managing the tool itself. All vendors describe their products as “easy to administer, accurate, reliable…” That includes us, when we advertise our Panoramic Feedback application. The *Feedback Resource Kit* lays bare deeper issues in a non-partisan way.

What do you mean by deeper issues?

360 touches on the human journey of learning in a way that managers who come from harder-edged business sectors may not have experienced. That journey is propelled by our human desire to learn to do things better, and to feel ourselves valued within our community. It matters a lot to us how other people think of our performance. When you ally this awareness of human nature with the strength of 360-degree feedback, you create a valuable stepping stone to personal growth.

From the book "Let There Be Life"

by Robert Fripp

Published in Britain as "The Becoming" in 1998, I made substantial revisions before Paulist Press released the U.S. and Canadian edition at "Let There Be Life" in September 2001. ISBN: 1-58768-004-1 The following passage starts on page 70, passim:

The first thirty-one verses of Genesis describe a creation myth which was never intended to be taken literally. It was written in the Jewish tradition to be interpreted in the Jewish tradition, which is to say as a midrashic, non-literal reading of the text. The Talmud suggests that the first chapter was written in a manner which is deliberately ambiguous, and that literal interpretation limits, rather than conveys, a deep sense of meaning. Genesis Chapter One gave us a magnificent myth, a poem. Moses, on the very day of his death, exhorted the faithful to read it as such.

The texts of the Torah, the Creation story among them, were written to inspire as well as to instruct. So let us be inspired.

We live in a fortunate time. For much of the previous millennium, Religion Triumphant suppressed science. Then, through much of the twentieth century, Science Triumphant seemed to relegate religion to the rags of superstition. But now, the more we know, the more these great branches of human thought seem to be seeking compromise with each other. They may eventually sustain, succor and complement each other. In 1595, Johannes Kepler celebrated his work thus: "Behold how through my effort God is being celebrated in the study of the stars." Kepler's comment may prove truer in the third Christian millennium than in the second. Science and western religions are indeed discovering each other once again.

Before the Enlightenment launched us into a belief in the absolutes of science, the human mind reserved a special, central place for God. Medieval Europe understood that God created the world, presided over destiny, assigned fate and assured the faithful that, despite the miseries of mortal life, a place beside their Maker was prepared for them in the hereafter. God in His all-encompassing heaven looked upon an Earth which stood unmoving at the center of His Creation. All that lay below was enveloped by the disk of the sky and the infinite love of God.

In time, those ancient certainties were all-encompassing and wonderful to contemplate. But in time those props fell or were torn away. Jewish seers were ahead of their Christian counterparts in this regard. The thirteenth century mystic Nachmanides described the creation of a world without substance in which the concept of time had no meaning until matter was born. In Christian Europe the age of absolute faith was challenged as early as the twelfth century, when Peter Abelard exhorted the faithful to "Think!" This heresy was repressed, to be sure, notably by the ascetic and powerful advocate of absolute faith, Bernard of Clairvaux. But Bernard's death, in 1153, marked the start of the end of an age.

That age would take four centuries to die. But it was already fading when Copernicus (d. 1543) demonstrated that God's Sun did not exist to shine on Earth alone. In the new scheme of things, Earth became one of several satellites circling their source of heat and light. The exhortation to think, which once stood as a challenge to the established order, gradually replaced that established order. After Copernicus came Newton, for whom the solar system represented the mechanism of fine clockwork. This relegated the Almighty to serve as the winder and oiler of moving parts. Two centuries later, the work of Darwin and Wallace had the effect of removing God from His role as conceiver and producer of living Creation. The wonders of life became the aseptic products of fortune and chance. As for the precise mechanism by which the game of life was lost or won, Gregor Mendel explained the basics of modern genetics as mere permutations: where Copernicus, Kepler and Newton saw planets as giant balls in orbit, Mendel explained genetics in effect as the click and clash of billiard balls on baize.

The trend of repudiating religion would accelerate with neither let nor hindrance for a further century and a half.

Which brings us to now.

It is easier to say what took place in the past than to describe what is happening in our own era. The passage of time lends perspective to the view. Verses 17 and 18 treat of the rise of modern physics: suffice to say here that the introduction of quantum mechanics, chaos theory and Heisenberg's uncertainty principle--among other discoveries--introduced a valuable commodity, doubt, to the impetuous rush of modern science. The rhythms of the cosmos no longer resemble clockwork; time is no longer an absolute; even cause and effect come in for serious challenge. An age when mass and energy are equivalent gives significant scope for wonder; that includes rediscovering something of the wonder of religion. The turn taken by modern science is also a vindication for Animists past and present, for whom "external forms of matter were the merest accident" (Verse 1). For Animists, everything that exists is in some way animate. In the ancient and modern scheme of things-cum-energy, Nature itself becomes a subtle web of spirit and connectedness.

A Nobel Prize winner in physics, Sir Arthur Eddington was struck by the fact that most people found "solidness"--physical mass--more real than the governing principles of natural law. Eddington himself described his writing desk as "a shadow table," adding, "The frank admission that physical science is dealing with a world of shadows is one of the most significant advances of recent times" (1935). Eddington's comment brings to mind the apocryphal tale of a learned physicist who took to wearing oversized shoes lest he fall into the void of molecular space which lesser mortals believe to be a solid, material world.

Where cosmology once put tight bounds around the physical universe, modern cosmologists discern few constraints. Space/time is/are equivalent; time varies with mass; and the enormity of the universe is the product of the spacial nothingness from which it was born. Our new concepts of cosmos are at least as much the product of mind as of matter; as much the product of thought as of explosive force. Recent evidence that component parts of the cosmos are moving apart at an accelerating rate seems to suggest that it is destined to expand for ever, becoming both boundless and eternal.

Long ago, humans knew less about matter and cared more about the energy of thought. In that bygone age, Aristotle proposed that the heavens of the gods and the spheres of the stars were made of something more sublime than the four elements of fire, earth, air and water. His fifth element--the quintessence--endured in the Christian age. Early universities in twelfth century Paris debated Aristotle as a release from austere theology. Perhaps, scholars proposed, quintessence even explained why angels shone so brightly: they were imbued with the fire-stuff of stars.

Some of those twelfth century theologians, particularly free-thinkers such as Abelard, would have felt comfortable at the Dark Matter 2000 conference held in the spring of that year at Marina del Rey, California. Dark Matter 2000 was called to discuss the nature of the substance which may account for ninety percent of the mass of the universe. Modern cosmologists attending Dark Matter 2000 attributed characteristics to this substance which appear as surreal as the quintessence of ancient Athens and medieval Paris.

Dark matter, it seems certain, forms a matrix in which hang frameworks of galaxies, dust clouds and stars. Dark matter imparts a deep purple hue to the cosmos as a whole; bends light; accounts for ninety percent of mass in the universe, and penetrates ordinary matter--namely, earth, air, fire and water.

To extend this supposition further, our brave new cosmos may be perfused by a companion to dark matter: "dark energy" manifests itself as a sort of anti-gravity which causes the components of the universe to accelerate away from each other. Far from slowing down, our universe flings itself out in every direction ever faster.

If dark matter exists, what is it? Nobody knows. It has been suggested that this hypothetical concept is a manifestation of ordinary matter known to us only by its gravitational force. If so, dark matter is the canvas supporting the starry painting that is our cosmos; and dark energy is the force, the stretcher, for that canvas.

Many Animist peoples share an axiom: "As in heaven, so below." Christianity prefers "On earth as it is in heaven." Some researchers at Dark Matter 2000 gave serious thought to the notion that dark matter and dark energy represent ordinary matter and energy revealing the existence of another cosmos. The thinking goes that perhaps we are part and parcel of a parallel cosmos, a mirror-universe. We perceive no starlight from this other cosmos, but we feel its gravity, and its energy is speeding the expansion of our universe.

Such are the forces of dark matter and dark energy. Perhaps. If this were true, then another cosmos might lurk beyond some unseen pale, tugging us as we are tugging it, into a cosmic fate just like our own.

At the start of the third millennium, the debate about dark matter begins to sound like the ages-old quest for another unseen and unknowable concept, the search for heaven.

Quantum mechanics tells us that Nature is an open system, delighting in ambiguity. An electrical filament emits light made up of particles called photons, but when a prism diffracts the very same light it behaves as a wave. All material particles have wavelike properties. Stranger still is the effect we have on an object by observing it. P.A.M. Dirac, the Lucasian Professor of Mathematics at the University of Cambridge, writes, “We can observe an object only by letting it interact with some outside influence.” Therefore we disturb an object by observing it; and the smaller the object, the more we disturb it. “If a system is small, we cannot observe it without producing a serious disturbance and hence we cannot expect to find any causal connexion between conditions at one time and conditions at a later time.” In short, Dirac is saying that if we are interacting with (observing) a natural system, cause need not be followed by a natural effect. Scientific determinism has been replaced by an elastic physics.

By demonstrating that a future is not a necessary outcome of a past, quantum mechanics upholds the theological concept of free will. Once we strip away determinism the future falls within our power to influence. Science, in this sense, becomes a set of new tools with which to understand a revised theology.

It is no coincidence that anthropologists began to take seriously the primal logic of Animists and their shamans at about the time the curious properties of quantum mechanics became more widely known. The observer affects what is observed. Or, as St. Francis put it: “What we are looking for is what is looking.” Energy is spirit; and the power of spirits is the central quest of shamans as the power of the Holy Spirit is a central quest for Christians. To this day, many Animists--Navajo and Aborigine among them--rise with the dawn and drum or pray their world into being. The writer Laurens van der Post sat on the edge of a salt-pan in the Kalahari desert with his Bushman guide and watched the evening fall. He was moved to comment, “I was convinced that, just as the evening was happening in us, so were we in it, and the music of our participation in a single overwhelming event was flowing through us." Thus the quantum physicist, the saint, and the hunter/soldier/traveler.

The Animist practice of drumming, chanting or praying the world into existence each day finds its analogue in cosmology. Theories of "eternal inflation" or "multiverses" make room for many universes to exist simultaneously--in different dimensions. Here, new universes come into being all the time, each with its own idiosyncratic laws of physics.

To compare aspects of cosmology with shamanic traditions in this context comes naturally. Cosmology gropes into so many unknown frontiers and ponders so many questions that data are capable of as many interpretations as the responses given long ago by the Delphic Oracle. And, just as oracular and shamanic pronouncements may be less than lucid, philosopher David Hume commented as early as 1779 that earlier universes than our own might have been "botched and bungled throughout an eternity ere this system."

The sense of mystery introduced by modern physics and cosmology has had the effect of opening channels of communication across the void to that other enduring mystery, religion.

The concept of the Big Bang is at least as implausible as any tenet of western religion. And yet the Big Bang has become key to the thinking of some of the most brilliant minds working in modern science. In that sense modern society reflects precisely the state of affairs pertaining many centuries ago, when the best minds trained to become leaders and administrators of the Church.

The intellectual migration from religion to science is in some ways seamless. The physicists' notion that one set of laws applies through all time/space derives from that of a unitary, all-powerful god; and the notion that God is everywhere but occupies no single point translates well to the cosmological principle, which states that the universe is the same everywhere and has no center.

Given that these overlaps derive from ancient religious tradition, science and theology no longer appear far apart. On the contrary, each may draw strength from the realm of the other.

Many of us have come full circle, returning to Abelard's exhortation to the faithful to think. Science and religion are closer than ever before to forming a continuum between those two, formerly separate towers of human thought.

We saw earlier that biological and chemical systems have a profound capacity for self-organization and self-regulation--I called it the "falling together of appropriateness." This quality reaches its zenith in the means by which living systems manage themselves. It is surely time that the dominant living species learned to harness those very powers of self-organization and self-regulation in order to harmonize our activities with those of the world in which we live. The earth-stress in our time demands no less.

If we are to heal the biosphere of which we are a part, the human species must pool all its resources. Together, religion and science have much to offer. The patient in our care needs treatment, as much by our right spirit as by the healing touch of human technology. Above all, the power of that spirit must assert that our material values have to change. Let no one doubt that a new intellectual approach will merge the canopies of two great trees, science and spiritual thought. When that is done, we shall be well placed to offer remedy.

From the book “Let There Be Life”

by Robert Fripp

Published in Britain as “The Becoming” in 1998, I made substantial revisions before Paulist Press released the U.S. and Canadian edition at “Let There Be Life” in September 2001. ISBN: 1-58768-004-1 The following passage starts on page 70, passim:

From "Let There Be Life" pp. 92-3

"There is nothing unusual about this ability of algae and sponges to order themselves into different forms and phases of existence. Some viruses appear as inorganic crystals under a microscope; and slime-moulds can function either as separate animal-like cells that move around freely to forage, or they can come together as a single body to reproduce, like fungi.

We see how simple chemicals combine into organic compounds which then give birth to life; and how life itself has a tendency to organize and advance from simple forms to living things of great complexity. Even the most primitive organisms are often subject to a greater collective will. Some attribute such a tendency to biochemistry. Others call it God."

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From "Let There Be Life" pp. 172-3

"We take for granted the slow miracle of nature whereby a vineyard is irrigated and the water eventually becomes wine. It is only when Christ turns water instantly to wine that we are so utterly astonished." [Augustine of Hippo]

So saying, Augustine recognized the larger miracle; that Nature’s processes are miraculous at any speed. We live in a miraculous world, but the miracle is lost to us because we live within it, as an integral part of it, and so it appears mundane.

In fact, the nature of the things about us has become so mundane that science can discover a rational explanation for almost anything in physical, in chemical, and ultimately in mathematical terms. Scarcely a process in the living world escapes explanation by material, rational science. Its thrust in the modern age has explained our life, our origins, our diseases, even the stirrings of our planet and our universe, in terms that are coldly and piously rational, and numerically sane.

Thus the sense of poetry and mystery by which a new leaf unwraps itself and grows, or the intricate development by which an egg becomes an embryo and then its creature… All this we can explain, and rationally, for life's secrets have been rendered into a biochemical and electrochemical belief in the processes of DNA.

At this stage in our development we have learned to manufacture the genetic codes of life synthetically, inserting them into the deoxyribosenucleic acid rings of lower organisms such as bacteria, changing them, creating in effect man-made life forms specifically designed to produce chemicals and pharmaceuticals at our bidding.

And as the minutiae of our knowledge increases, so the study of life passes down through scientific disciplines that deal with ever smaller fractions of the whole. Biologists give way to biochemists, biochemists to physical chemists, then to physical mathematicians and so on, until, at last, at the level of sub-atomic particles, life's study passes into the realm of pure mathematics. Ultimately the quest for life's secrets becomes as much the property of unified field theorists as those other considerations of theirs, gravity and the electromagnetic energy of light beams. Which still doesn't explain the miracle of life: it proves only that we have mastered the physical manifestations, the linkages, by which it chooses its wonders to perform.

There is danger here. It is that science runs on alone, indulged to operate within the closed circle of its self-important self-concern. In many fields the quest has become its own servant, enslaved to numbers and facts, seizing on the instant chaff of knowledge and leaving the real stuff of wisdom far behind. An intuitive understanding of the world and of its living things cannot easily be measured, and too often it is cast aside.

But still the search goes on; for the ultimate sub-atomic particle, and for the ultimate theory to explain the existence or the absence of that same particle. So once again we are dealing with Creation's ultimates and opposites; with forces and energies and particles that cancel each other out but refuse to disappear into nothingness and the void. Small wonder that the quest for the greatest secrets of life and the universe centers on the least of all natural things.

Put like that, the message and its meaning are an unfamiliar philosophical abstraction, but we can change the words a little, turning them into parable instead of physics. "The kingdom of heaven is like to a grain of mustard seed… which indeed is the least of all seeds… but when it is sown, it groweth up, and becometh greater than all herbs, and shooteth out great branches."

We recognize only the first, the intended meaning of the parable, which represents the sense of mission and success. The second sense is literal, and so it goes unrecognized for what it is. A part of the kingdom of heaven is bound up in every grain of mustard seed per se--and in every other sort of seed--for the biblical expression reflects the life-given force for fertility, development and growth.

So much is bound up in a single seed, or in a sub-atomic particle, for that matter. Proof, surely, that the potential for Creation--for the Becoming--is greater by far than the mere germ of its physical and numerical manifestations. As with the mustard seed, so too with all of its coeval living partners in this world, up to and including ourselves. If that lends all of us some measure of divinity, so be it. And if not, so be that too."

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From "Let There Be Life" pp. 172-3

"Evolutionary biologists have puzzled over the processes by which new species originate ever since Darwin and Wallace suggested the mechanism of natural selection. Until recently, researchers preferred to believe that a new species evolved gradually from the old, that the transformation took place over extended time, countless generations, and resulted from many genetic mutations, each having a tiny effect. That view is shifting. It has become clear that, in certain cases, species division has resulted from a small number of genetic changes producing large effects.

In 1995, Toby Bradshaw and colleagues at the University of Washington (Seattle) analyzed DNA from two species of monkey flowers growing in the Pacific Northwest. Mimulus lewisii is pollinated by bumblebees, Mimulus cardinalis by hummingbirds. Both species are perfectly adapted to their visitors. M. lewisii has pink flowers, visible to bees, with yellow streaks which guide them to a concentrated bead of nectar. M. cardinalis is red, a color attractive to birds but not insects, and its petals form a tube leading to a pool of diluted nectar. In both cases the flowers' sexual organs are adjusted to brush the appropriate creature. Bradshaw and his colleagues concluded that just three distinct genetic changes had separated the two species, moving M. cardinalis to pollination by birds instead of bees.

Speciation, it seems, need not be slow, only thoughtful."

I, Eleanor

Chapter 22 from "I, Eleanor," the memoirs of Eleanor of Aquitaine. *Her "autobiography" tells the life-story of one of the most powerful women in European history, and surely one of the most complex. I wrote* "I, Eleanor" *in 2002-03.*

22. A brief digression on Fair Rosamond

1165-1176

I am tired beyond measure of Becket. The man still has some years to live in our account, but I cannot bring myself to speak of them. Not yet.

Furthermore, in those same years I drank my fill of Henry, too.

I hope, Aline, that your husband will cherish you, and you alone. Keep him by you in your bed, child; keep him gratified; keep him drained. If you keep his seed in you and not in him, you will discover that the feral humours of his sex won't reach for other women.

You wince. Tush, tush, I do not mean to shock you, but I hope that you can learn from what I have to say. Listen, and life may spare you from trial by the all-too-ready lance.

What I say is true. Too many men behave like rams in rut, but surely there were few as hot as Henry. He was insatiable. He sired eight—nine—living children on me as well as more bastards than I choose to count. He lured women to his bed-lust by the score.

Wives learn to turn their face the other way—I did for fourteen years. But there came a season when I could no longer wear a tranquil mask in my husband's hall.

Does the name Rosamond Clifford mean anything to you, Aline? No? You are too young. It will when you have been a wife in England for some years. Bards and jongleurs will beg meat and a night at your manor in exchange for a song and a poem or two. And you will then be surprised to learn how, out of spite and jealousy, your former mistress, the old Queen Aleänor, killed sweet Rosamond.

Hah! I thought that slander might stir you. It startled me the first time I heard it.

I speak of the summer after Becket fled to Louis, the year I governed our lands from Angers while Henry went warring—or should I say whoring?—in Wales [1165]. Over time I gleaned news of Henry and this woman.

Among the Welsh knights was Walter de Clifford, a Norman who held an estate in the borders, near Bredelais. Perhaps in his remote and rustic world this fool had not learned to lock up his women at Henry's approach, although, God knows, my husband's reputation galloped before him along every road. No wife or daughter, no female ward or hostage, was presented to Henry unless the lord of a place where he stopped had either malice or ambition in his heart.

It may be that de Clifford, seeking some advantage, steered his daughter in harm's way, but that I cannot say. Or Henry may have come on her near Oxford, for she was schooled there, at Godstow, by nuns.

This Rosamond Clifford smote Henry as no paramour had possessed him before. I'm sure he thought only to bed her, perhaps for a night, perhaps for a week; but she possessed him till she died. Here was an attachment without precedent in its intensity. I gather this naughtiness was all a-buzz for a season or two before word reached me. The fool confused the hurt in his loins for love! Love, mark me! Henry in his lust was so confused that he squandered his love—the quality by which men attach each other—on a woman! In the world of noble liaisons this affair was passing strange.

Until this Rosamond bewitched his senses, Henry summoned enough discretion to manage trysts and conquests in dark corners of a hall. But Rosamond! With her he must be seen. With her he must display affection. On her he must lavish gifts. Her he must install within a short ride of our palace at Woodstock! You may believe me when I say that Henry was quicker to give the kiss of peace to Rosamond than to Thomas Becket.

I spent my first decade with Henry believing that a bull in March must yield in time to November chills, becoming a sober, wiser soul. For the longest while I thought I might one day check his bridle. But it was not to be. Years spent apart, on opposite sides of the Channel, did not help me command him, although they eased the tensions between us. Then the first blasts of the Becket affair taught me what I should have learned, that Henry would not be ruled.

Not even in the matter of discretion. He had stabbed his blade in women by the score—I see I have inured you to the coarser world, Aline—while retaining the decency to greet them next morning as if they were nuns. But his whore Rosamond left him drunk to possess her, again and again. Would that she but sapped his seed. However, she also sapped his brains. I heard constant whispers of their dealings, of course. If a noble lady does not equip herself with ears she will be as innocent of news as any village idiot. But this infamous liaison was a fire; the closer one got to the source, the hotter the whispers became. Here was one woman whom the late Saint Bernard might hate with a blameless conscience *and* [ITALIC] my blessing—for in truth she was a fallen angel.

But in the matter of her death the Almighty knows me innocent. When I had power to send her dead, I did not; and when God wisely chose to take her from this world I was under constant watch by Henry's spies.

Henry himself spent the winter [1165-6] wearing out horses on the frosty road between Rosamond at Woodstock, and Clarendon, where he rewrote the laws of England. For that I cannot mock him. We landed in a kingdom where it seemed that every manor and shire had its own ancient laws and punishments. So I grant the devil his due: Henry imposed on the backward English a common "law and custom of the land." It was there, at Clarendon, that Henry's conclave of nobles and prelates approved his idea of swearing twelve just men to report malefactors. It was there, too, that Henry slipped his lance past Becket's shield: the Assize forbade religious communities inducting a person from the lower classes unless he could prove good repute.

That done, Henry took ship to preside at our Easter court in Angers. No doubt he came hot from Rosamond's bed to mine, where he conceived John on me. That October I resumed my role as regent of England. I travelled in Oxfordshire—Woodstock was always a favourite palace—where it seemed the very birds clamoured "Rosamond, sweet Rosamond." I spoke just now of approaching a fire. I knew soon enough that our seat at Woodstock was the burning hearth: Henry's hussy lodged mere miles away. In that season I experienced something that never befell me before or since. Whenever I moved through a crowd, people fell silent.

No matter. I lodged at Oxford castle, giving birth to John the day after Christmas. He is named for the saint on whose day he was born.

Granted Rosamond was three-and-thirty. I was forty-four, old enough that I no longer roused passion in the husband whose children I bore. To Henry, my body was as well rehearsed as a hasty mass before breakfast.

But kill her? No, I would not dignify his harlot in that way. No plot of mine would stoop to canonise her beauty by sealing it in death. Unless perhaps my prayers condemned her.

The Venus in the Vault

by Robert Fripp

Barbara Brescia admits her visitor, turns and leads the way to the back of the house. Tall and thin, she favors dark clothes. Her hair, swept up in a sophisticated bun, complements a tranquil persona. The ensemble suggests a dowager lady transposed to small town Connecticut from first century Rome.

Beyond the picture window, the waters of Long Island Sound throw a changing play of reflected light across the ceiling. Nature's display of chiaroscuro is prophetic: the subject comes up as we talk.

The niceties concluded, Brescia speaks with restrained passion about a painting that dominated much of her life's work and her mother's before her. She is attempting to prove that a painting locked in a New York City vault is an original by the sixteenth century master, Correggio. Brescia's mother bought Venus Disarming Cupid at an auction in Manhattan in 1943. For mother and daughter, tracing its history and proving its provenance became a mission.

Tea is served, and Brescia begins to press her case. A woman in her eighties who knows that time is running out, she addresses her jury of one with the rehearsed competence of a trial lawyer making an opening statement in a major case.

In 1531, Federigo II Gonzaga, Duke of Mantua, commissioned the artist Antonio Allegri—Correggio—to paint a series of eight canvases known to the art world as "The Loves of Jupiter." The supreme god of the Greek pantheon had an insatiable appetite for sex; Duke Federigo's commission gave Correggio a free hand to adorn many square feet of canvas with exquisite, naked female flesh.

The eight resulting beauties were probably intended to adorn opposing walls of a gallery in Federigo's palace at Mantua (Mantova, in Italian). They may indeed have adorned those walls, briefly. But Duke Federigo was not destined to ogle his "Loves" for long. His sense of self-preservation got the better of him, and "The Loves" became the premium he paid for insurance against the realpolitik of troubled times. Many other minor potentates in northern Italy also had reason to feel ill at ease. The source of their worry was Emperor Charles.

In 1519, Charles I, king of Spain, had been crowned Holy Roman Emperor Charles V, a title which gave this assertive nineteen-year-old a steel grip on large parts of Western Europe. From his father he inherited the Netherlands, Luxembourg, Artois, and much of Burgundy. Then there was Aragon, Navarre, Granada, Naples, Sicily, Sardinia, the fabled wealth from ongoing conquests in the Spanish Americas, and a half share with his mother in Castile. Not content with these, Charles used his wealth and the first half of the 1520s to wrest much of northern Italy away from King Francis I of France. He did this ruthlessly and efficiently, capturing Francis himself after the battle for Padua, in 1525. A year later, humiliated, Francis renounced France's claim to the Italian lands: Charles became master of large swathes in northern Italy. By the time he was thirty, Emperor Charles was the regional superpower, a man to be feared.

When he cast his admiring eye on Federigo's newly-painted beauties, the duke felt it politic to present them to the emperor as a gift. Charles promptly ordered the collection carted north to his palace in Prague. However, the "Loves" were not to hang in Prague much longer than in Mantua. A reversal of fortune carried Correggio's naked ladies off as spoils of war to Sweden, and into the collection of Queen Christina.

Later in her life, this firebrand of a woman broke Swedish law in order to convert to Catholicism. She then abdicated her throne and removed herself lock, stock and picture collection to Rome. The Vatican thus won a royal convert at a time when religious strife was tearing Europe apart, but although Christina's conversion gave the Roman Church a major propaganda coup, she herself brought the Curia no joy. Pope Alexander VII described the former queen as "a woman born of a barbarian, barbarously brought up and living with barbarous thoughts."

Christina's behavior in Rome became more bohemian than barbarian. She leased a palace from Monsignore Farnese, who was soon appalled to learn that his tenant was hanging a number of "revealing" pictures on the Farnese family's ancestral walls. The former queen also ordered their modesty drapes removed from the Farnese marbles. One wonders if the paintings which caused Farnese to protest—a protest Christina curtly rebuffed—included Correggio's "Loves."

Farnese surely took no comfort from the fact that Correggio combined a superb eye for anatomy with the skill to execute exactly what he saw. The artist remains, almost five hundred years later, among the consummate masters of the human form. The late Claude Marks, a lecturer at the Metropolitan Museum in New York, wrote to Brescia in 1989, commenting that Correggio has no peer when it comes to foreshortening—that is to say, rendering limbs that point out of the canvas, towards, or away from, the artist. This observation becomes a tagged piece of evidence in a thread that leads, possibly, to the resurrection of one of Jupiter's "Loves" on a canvas that may be a work by the master.

After Christina's death, the "Loves" show a well-established chain of title. No taint attaches to <u>Mercury Instructing Cupid before Venus</u> in London's National Gallery, for example, or to <u>Antiope</u>, hanging in the Louvre. But <u>Venus Disarming Cupid</u> is the unfortunate exception: her trail goes dark in the 1790s and disappears after 1803. As far as the art world is concerned, <u>Venus Disarming Cupid</u> has been lost.

Barbara Brescia pauses at this point, wondering how much her visitor is taking in. She rises to search stacks of books and files until she finds what she is looking for, a color print of Venus Disarming Cupid, a photograph she commissioned from photographer Joshua McClure. “Isn’t she beautiful?” she asks, in a rhetorical tone that admits little scope for dissent.

Brescia and her mother spent much of the past sixty-one years making a strong case that Correggio’s truant canvas is alive and well in its vault beneath Manhattan. If the world accepts their evidence, Venus Disarming Cupid would be the only Correggio in private hands. Apart from his “Loves,” the master is almost entirely known for his frescoes on church walls that are neither portable nor saleable—the cupolo in the Duomo, for example. His few surviving paintings are priceless in the literal sense, because many a year has passed since one came up for sale.

Brescia’s mother was the late Evalina (Lyna) Russell, born in 1896, the eleventh of thirteen children in the family of a schooner skipper turned station master, Joseph Buckley Russell of Bridgewater, Nova Scotia. Lyna fled Bridgewater for the brighter lights of Boston, where she studied fine art before marrying her professor, Andreas Randel. Together they began to build “The Randel Collection.” By the 1920s they were holding soirées for musicians and artists, first in Boston, later in New York. Lyna rose in New York society, serving twenty-seven years as the president of the New York Aquarium Society. The couple’s only child, Barbara Randel Brescia, trained in fine art and in art education. By the 1940s Lyna had divorced Randel and married again, to financier William McClenan. McClenan died, leaving his widow sufficiently well off to allow Lyna and her daughter to keep their collection.

In April, 1943, Lyna chanced into the Lawner Gallery on University Place (long since closed) where she fell in love at first sight with a dusty, partly-concealed painting, Venus Disarming Cupid. Lyna visited the picture several times before the day of an auction that was scheduled to decide its fate. When the auctioneer’s hammer concluded the matter, she was astonished to discover that she had made the successful bid. She tried to take her Venus home in a cab: it was too big. The gallery provided the best that wartime austerity could offer, an open truck. Lyna climbed onto the tail of the truck, wrapping the naked lady in her new fur coat for the ride to the painting’s new home, an eleventh floor apartment at Ninety-second Street and Broadway.

Before she bid for, and won, her Venus, Lyna had studied the brass label attached to its gilt frame. It read: “Rondani—favourite pupil of Correggio—1494-1534.” The spelling of “favourite” suggested that the plaque was engraved in London. More to the point, those dates belong, not to Rondani, but to Correggio. Her early discoveries prompted Lyna's thirst for more, plunging her into years of study at the Forty-second Street Library and the Frick Art Library.

Her researches revealed that, after Queen Christina died at Rome in 1689, Jupiter's "Loves" passed to Cardinal Dezio Azzolino, the queen's platonic lover, a churchman with fewer scruples about naked flesh than Monsignore Farnese before him. From Azzolino, the paintings eventually passed to the Duke of Lorenzano. Their provenance to this point remains unchallenged.

In the 1770s, Lorenzano sold Venus Disarming Cupid to the British ambassador at the Court of Naples. Sir William Hamilton was an early exemplar of a time-honored tradition in the British Foreign Service; he "went native," serving his government at the Court of Naples for thirty-seven years, from 1764 until advancing French troops forced his hasty departure in 1801. His long sojourn made Sir William a well-informed and respected collector of objets d'art.

In the early 1790s, Sir William put Venus Disarming Cupid up for sale. Hoping to fetch a higher price in London, he shipped the canvas from Naples to England with a letter of instruction to his nephew, Charles Greville. Sir William asked Greville to have his painting relined and its nose and ankle touched up with watercolor. For this task Sir William recommended an artist whose work he knew: Patoun. Sir William's surviving correspondence with Greville is instructive: the ambassador refers several times to his painting as "my Correggio." He had no doubt about its origin. Nor did notable contemporaries, among them the society painter Joshua Reynolds and Horace Walpole. Both accepted the Venus as Correggio's work. Walpole himself was a major collector: Strawberry Hill, his castle of a house near Twickenham, housed his large and eclectic collection.

Brescia pauses in her tale and sighs, as if marking the years when the trail goes cold. Without Greville's permission, the artist Patoun made two copies of the original Venus Disarming Cupid. The Earl of Radnor then purchased what he—and no doubt Greville—thought was the original Venus. However, when Radnor unveiled his new purchase at his country seat, Longford Castle near Salisbury (where it still hangs), whispers circulated that Radnor's Venus looked like a copy. That may be, but, despite subsequent correspondence between Greville and Hamilton referring to the existence of the two illicit copies made by Patoun, some modern experts credit the Longford painting to Luca Cambiaso.

Had Sir William been in London at the time, the outcome might have been different. Patoun would not have dared to reproduce the original. Sir William was an educated connoisseur, an authority on Italian art and antiquities: he was no dilettante. In the 1780s he bought the Portland Vase, the thrice-restored pot that anchors the British Museum's collection of Grecian vases, several of which came from him.

If Sir William has slipped quietly into history, his second wife, Lady Emma, has not. In 1801, the Hamiltons, husband and wife, were evacuated from Naples and the clutches of advancing French troops by no less a captain and commander than Horatio Nelson. Nelson had met Emma eight years earlier, in 1793, when HMS Agamemnon docked at Naples. On that occasion, Nelson stayed at the Hamiltons' palazzo. That visit left no whiff of scandal: the proprieties were observed. But eventually Lady Emma became Nelson's mistress, a favor she retained after his death at the battle of Trafalgar, in 1805. A grateful British government granted the admiral's mistress a generous pension.

Lady Emma was a widow by then, Sir William having died in 1803, and his estate disbursed. Lyna Randel's researches showed that, after his death, the real Correggio—whichever of the three it may have been—goes missing, its tracks confused among the copies. Here, the accepted provenance moves into the "lost years" which have proved a stumbling block for art historians. From a modern perspective, the provenance of the Venus in the vault is not proven. The lady is considered a bastard, if not an orphan.

But Lyna's painting continues to give affirmative evidence on its own behalf. Sir William had asked that his Venus—"my Correggio"—should be relined, its nose and an ankle being restored with watercolor. Lyna had her painting examined. It had indeed been relined. And infrared photos of its nose and ankle reveal the restoration that Sir William had requested.

Unable to trace her painting forward after 1803, she began to tackle the problem from the other end, trailing its history backwards from 1943, the year she bought it.

Lyna's painting—which has come to be called "The Randel Venus"—has two labels or affidavits affixed to the back of its canvas. One reads: "From the Thomas Thompson collection, 1869-70, Geo. P. Rowell."

Thomas Thompson was the first known American owner of the Randel Venus. A millionaire Bostonian, Thompson seems to have imported works of fine art by the ship-load. He lost thirteen hundred items to a fire at Boston's Tremont Temple in March 1852. (The damage to the building was repaired, and it came to national attention on the eve of the Civil War when "Negroes and Abolitionists" were expelled, to quote Harper's Weekly of December 15, 1860.)

The Randel Venus escaped the blaze at the Tremont Temple. Perhaps it was housed in one of Thompson's several residences, or he may have "acquired" it later. We know Thompson did not take his loss lightly. Writing to the chief of the Boston fire service, his letter mentions in passing that he sometimes acquired his objets d'art in unusual ways. It is not know by which "unusual way" he acquired the Randel Venus. A cache of four hundred letters dealing with Thompson's collection might have shed light on the matter.

This cache was cited as a reference source in compiling the catalogue for an auction held in 1870, after the millionaire's death. First Lyna, then her daughter, Barbara Brescia, spent a total of 49 years looking for this correspondence, without success. Lyna's researches ended with her death, in 1972.

A forensic specialist has examined the Randel Venus, concluding that the majority of its pigments are consistent with a painting limned between 450 and 500 years ago—an origin around 1530 would fit perfectly. However, the canvas does yield traces of a more recent pigment, Prussian Blue. Discovered in 1704 by a Berlin dye-maker, Diesbach, the color was chosen for Prussian army uniforms, hence the name.

Defenders of the Randel Venus argue that the presence of Prussian Blue does not argue against a Correggio pedigree for Venus Disarming Cupid. Within two decades of Diesbach's discovery, Prussian Blue was a popular medium: the Dutch painter, Simon Eikenlenberg, extolled its virtues in 1722. By 1724 it was being manufactured in England. It was readily available to Sir William's restorer, Patoun. Forensic tests have shown that, over the years, restorers used Prussian Blue to touch up two authenticated paintings in Correggio's "Loves" series, Leda and Io. Both display more Prussian Blue than the Randel Venus without raising doubts about their pedigree.

In spite of that pigment, Claude Marks had no doubts. Near the end of his lengthy, closely-reasoned letter to Brescia, he wrote in 1989:

> "Your 'Venus' is clearly the work of a master. The painting seems to me to be of museum quality, and one which on a purely subjective basis , and from what I know of the artist and his period, I would have no difficulty in accepting as being by Correggio himself."

Barbara Brescia's researches have taken her down many paths, including one that ends at Blair Atholl Castle, in Scotland. Sir William Hamilton was a younger brother of the then Duke of Atholl. The castle's picture gallery displays a portrait of Sir William and his first wife—not Emma—who face each other, sitting at ease in the ambassador's Neapolitan apartment. The portrait was painted by a fellow Scot, David Allan, and dates from 1768, just four years into Sir William's long tenure as ambassador. Allan, no doubt acting on his patron's instructions, painted Venus Disarming Cupid into the backdrop, above the seated couple. Sir William clearly thought so highly of "my Correggio" that he ordered this prize possession included in his, and his first wife's, portrait.

In the 1990s, the peripatetic British nun and fine art commentator Sister Wendy ventured her opinion. Brescia had sent her a copy of McClure's photograph, naming no names, just asking for an opinion. After a brief discursion on the style of Bronzino, Sister

Wendy names Correggio in her reply, stating: "I'm seeing a touch of his sweet gentleness here."

So why has it taken two professional lifetimes of struggle to attach Correggio's name to the Randel Venus?

"Well," Brescia suggests mildly, "I think the Longford Castle supporters may have something to do with it."

Francis Pakenham, Seventh Earl of Longford, died in 2001. For much of his life, Frank was a Labour peer, driven by his faith in socialism, the Catholic church, and penal and social reform.

Clearly, if the Randel Venus is by Correggio, the painting at Longford Castle is not: one of them may be a knock-off by Patoun. And one of them may be worth upwards of $30 million dollars—an estimate given to Brescia in 1985. Another question remains. Where is the second copy by Patoun?

In 1870, Dr. Julius Meyer, the director of the Royal Gallery in Berlin, visited known and likely Correggio paintings and wrote up his conclusions, published in German in 1870. The English version of Meyer's book (Macmillan, London 1876) is rare, but Brescia has a copy so worn that its leaves fit between its covers more like papers in a folder than pages in a book. Picking up her copy, she rapidly finds the well-thumbed passage describing Meyer's conclusion after visiting Longford Castle. In his opinion, the Longford Castle painting is "not by Correggio."

Meyer never saw the Randel Venus. Around the time his German edition was going to press in Leipzig, Thompson's painting was going to auction in Boston. But Meyer knew a Correggio smile when he saw one. He writes, on page 257:

> "[Correggio] paints his Madonnas with the same charm and grace of form and action as his women in Jupiter's love stories, and their smile, which expresses boundless maternal love, evinced the same depth of tenderness as in his Danae."

The smiles on Correggio's women were special, enigmatic, not unlike that of the Mona Lisa. To be blunt, sixteenth century models, even young beauties such as Correggio's wife, Girolama, were probably missing some teeth. Hence the closed-mouth smile, which Correggio captured so well.

Curiously, Meyer named the Longford Castle painting as Venus Arming Love. There seems no such ambiguity in the Randel Venus: the goddess appears to be taking away Cupid's bow, not giving it to him.

Whether Correggio painted her or not, Venus Disarming Cupid is a beauty to behold. She deserves a better fate than incarceration in a private vault. The smile on Mona Lisa offers an enigma; Venus Disarming Cupid presents an even greater one. Who painted her? Is the Randel Venus pedigreed, or plagiarized? The history of her early years is strange enough. Were the lady better known, the history of her past two centuries might emerge, like her, from the dark.