The Cheeses, the Owls, the Synchrotron and the Chartreuse
(Some Thoughts from France on Science and Taste)

In the 1930's M.B. Foster, an Oxford philosopher, published three articles (in the prestigious philosophical journal *Mind*) on "the Christian Doctrine of Creation and the Rise of Modern Science." In those days the scholarly and popular consensus on that subject was largely unanimous: if there had been any influence of Christianity on the development of science it had been negative. Bertrand Russell's words at the beginning of his *History of Western Philosophy* are typical of the mood. Whereas science gives us genuine knowledge, says Russell, theology "induces a dogmatic belief that we have knowledge where in fact we have ignorance, and by doing so generates a kind of impertinent insolence towards the universe." The supposed effect of this conjectured "insolence towards the universe" had been catalogued a few decades earlier in an influential (and typical) book by John Wilson Draper provocatively titled *History of the Conflict Between Science and Religion*. Draper's conclusion was that through its disparagement of science Christianity had become "a stumbling block in the intellectual advancement of Europe for more than a thousand years."

Foster's meticulously reasoned articles—written not as Christian theology or apologetics, but simply as a careful exercise in the history of thought—were the beginning of a slow but thorough change in this image of "warfare". Though many people (including many Christians, who should know better) still use such language of conflict, it is now widely acknowledged that some aspects of medieval Christianity were not only a fertile seedbed for modern science, but quite likely a necessary condition for its eventual development.

The main point of Foster's exhaustive (and largely irrefutable) argument was that Greek science had never moved beyond its embryonic stage because it assumed that genuine knowledge was (as in a mathematical proof) always a matter of abstract reasoning from certain first principles. Though the physical world could provide examples and illustration of these ideal truths, it was never their starting point. In contrasting modern empirical science with ancient Greek attempts at science, concludes Foster, "In each case the modern procedure will be found to differ from its ancient counterpart by the part which sensuous experience plays in it."

"Sensuous experience" of course, is nothing new; it was certainly not new to the Greeks. But the Christian experience of the Creator-God of love who invented physical reality, and who in Jesus, became a part of it, changed forever how we *value* that knowledge. We cannot know the world God has made simply by thinking about it. What God does, like who God is, is inexhaustible, surprising and gracious. Knowledge comes through engaged experience, not detached contemplation. The Psalmist said it well: "*Taste* and see that the Lord is good." This recognition that sensuous experience is the source of knowledge is basic to Hebrew understanding. And it is here, rather than in Greek ideas of the superiority of the knowledge abstracted from the senses , that the tradition of empirical science took root.

Of all the senses, "taste" provides the best metaphor for this sensuous engagement with a creation of gratuitous goodness. Unlike vision and hearing, it does not operate passively, or at a distance; it combines the immediacy of touch with the infinite complexity of scent. And more than any of the other senses it seems mainly pure gift. It would be easy to argue, on the basis of "survival value" for the practical nature of the other senses. But the complexities of taste (beyond the simplicities of "sour", "sweet" and "salty") are all extras. Why *should* the world taste so good?

Which brings me, finally, to France. Through the generosity of friends, my wife and I had the privilege recently of living, for a few months in the winter and spring, in their old stone house in a village in Provence, in the south of France. France--particularly this rural part of southern France—is a small island of resistance to the waves of fast food and artificial flavours which have spread like a flood around the world from North America. No house in the old village is more than a five-minute walk from a bakery. Every morning, beginning before dawn, the people converge on the warmly lit doors of the *banette's* and go out again with croissants, baguettes, brioches, usually still comfortably warm from the brick oven.

And twice a week, again beginning before dawn, even in the sleety days of January, panel trucks converge on the village square, farmers get out, open doors, raise awnings, set up tables, and begin to sell an astonishing range of olives, fish, vegetables, sausage, and cheese. Ah, the cheeses! from hard, Savoyard monsters weighing 20 kilograms, to soft, palm-sized patties of fragrant goat cheese wrapped in chestnut leaves and tied with a bit of grass. One could sample one a day and a year would still not be enough to taste them all (Charles deGaulle is said to have grumbled that it was impossible to try to govern a country with 200 kinds of cheese, but he underestimated the number by at least half).

And then, outside town, there are the various farms and estates, large and small, set in their acres of olive orchards and vineyards, inviting us to come in for *degustation*. Economic pressures are threatening all this local gustatorial variety. Economists argue that the ancient tradition of small farms in which it is rooted are artificially subsidized by the French government and the European Union. Factory farms, mass production, long shelf-life, plastic wrappers and factory-produced flavours are on the horizon here, as in most of the world. But for a while yet the ancient legacy of the tastes of creation, modified by human love and labour, will not be neglected in Provence. "Taste and see. . . ."

This all is rather predictable, you say. France is famous for its food. But what does the taste of 400 kinds of cheese have to do with old arguments about the origin and nature of science?

I will tell you.

The friends in Provence whose house we stayed at are Peter and Miranda Harris, founders of *A Rocha*, a Christian Conservation organization. A few miles away from their house in the village, on the edge of a rare natural wetland, is *Les Tourades,* the big

house which has become one of several Arocha Field Centres now dotted around the world in such places as Lebanon, Kenya, England, Canada , and the Czech Republic. Arocha centres are small communities of people (some permanent, some transient) who work together to provide support for the study and preservation of the surrounding environment . They all grew out of the kind of community that took shape at the original A Rocha, in Portugal (Arocha is Portuguese for "the rock"). Peter Harris has told that story very well in his book *Under the Bright Wings*.

The Harrises and their young family arrived in Portugal with the unusual goal of facilitating a nature study centre as part of Christian mission. As is clear from his book, this goal was shaped by two things: one was a deep call to Christian mission (Peter is also an Anglican priest); the other was an irrepressible interest in birds: seeing them, naming them, learning more about them. For a long time he has been the sort of person described by that slightly archaic word "the naturalist". The word is archaic in the same way as "natural philosophy" is archaic as a synonym for science. But it is superior to "science" (which means simply "knowledge") in one important respect: it contains (through the Greek root *philo-*) the implicit recognition that love is basic to both knowledge and wisdom.

The naturalist is a person who loves, delights in, and wants to experience and learn more about the great diversity of things in the natural world, whether they be birds, flowers, stones or butterflies. The naturalist tradition has nourished science immeasurably. Whether or not all naturalists are scientists, there is little doubt that all scientists are (or at least began as naturalists). It is out of the naturalist's passion to experience, enjoy and understand—in short to "taste"--the flavours of creation—that all true science is born. We humans are here to "taste and see" all the variety of Creation's gifts. Birds are vastly more varied and important than cheeses, yet delight in the two sorts of creatures reflects this same unique human calling and privilege.

It is no surprise that bird banding, or "ringing" has become an important part of the science done at some Arocha centres. Placing small, light metal bands on the legs of birds enables study of their migratory patterns. Among the smallest of warm-blooded creatures, birds yearly travel the greatest distances, mileages matched only (in a few cases) by the oceanic journeys of whales. As we gradually piece together a picture of these immense annual journeys, our appreciation both for the creatures themselves, and for the inter-knittedness of creation, can only grow.

The night we arrive in France, in January, there is general excitement at Le Tourades because a number of long-eared owls have been seen—and heard—in the grove of Cypresses behind the house. They are not usually seen here. The next night the nets are up, and we are invited to participate in the banding. Our flashlights show two gray forms immobilized in the nets suspended above the garden. Working by flashlights, those with the training to do so carefully, slowly, extricate the birds (with only a few bloody fingers from razor-sharp beaks and claws). The indignant owls are placed in loose cloth bags and taken to a table on the terrace. How much does it weigh? Suspend the bag from a scale. Remove the owl, hold it carefully by its talons. Male or female? One year old?

two? three? Subtle marks on the black, gray and tan feathers carry this information. All is recorded, along with the number of the ring that is carefully crimped onto its foreleg. I am invited to feel the wing-feathers; they are indescribably soft, merging on the leading edge into a microscopically small fringe that makes the owl's nighttime flight absolutely soundless. This, together with huge ears (not the feather-tufts which give the long-eared owl its name, but large, sound-amplifying indentations in the skull) along with the owl's enormous, light-catching eyes enable it to catch at night the voles and lemmings on which it lives.

I am given the bird to release. As I hold it by its two legs it is warm and soft against my hand, motionless, but quivering ever so slightly with fear and energy. I open my hands, and the owl is gone, soundlessly, into the chilly night.

This is all "science": but it is done with an undertone of excitement, delight and love. Will another human ever touch it? Probably not. But perhaps so—maybe here again—maybe in Finland, or even Northern Africa: all are possibilities. If so, the number of the band will be recorded, the information shared, and the web of knowledge that we weave around mystery will be a bit more complete. But it is a knowledge that grows first of all from a delight in creation's surprises. "Taste and see. . . ."

A few weeks later Mary Ruth and I had a chance—through a friend who works there—to visit the synchrotron (more precisely: the European Synchrotron Radiation Facility) in Grenoble France. Grenoble is an ancient city in a spectacular location. It was founded by the Gauls, fortified by the Romans, and lies at the confluence of the Drac and Isere rivers, where they flow out of the high Alps that tower above the city. Downriver, the Isere flows on toward the Rhone through rich farms which make up Europe's premier walnut-growing region.)

Grenoble—the site of several universities—has also become a European centre of high-tech research. Near the point where the two rivers come together is the half-mile-round circle of the synchrotron. (It is placed on its narrowing beak of land precisely like the vast eye of a giant heron) . With an annual budget of 60 million Euros, the synchrotron is supported by 17 nations, from Israel to Finland, and the conversations in the halls and laboratories is a collage of languages. At any given time at least dozens of research projects are going on there. Competition for the privilege of using the facility is intense.

Inside the 844-metere storage ring of the synchrotron, electrons (first boosted to an energy-level of 6 billion electron volts) circle in a vacuum at just under the speed of light. The beams are bent around the circle (actually a 40-sided polygon) by huge magnets, and at every bend they change direction and lose energy in the form of x-rays. These "leaking" x-rays are the whole reason for the synchrotron. They are focused into some 40 "beam-lines", tangent to the circle. Each of the lines of x-rays is directed into a lead-lined room, filled with very precise robotic arms, cameras, and other recording devices, where the work of the synchrotron takes place.

That work is a vastly enhanced kind of exploration by the senses: it allows human beings to see fine detail inside of solid matter. The synchrotron is, in effect, an enormous x-ray microscope—or rather a whole set of such microscopes, using the x-rays given off by the rapidly circling electrons in the storage ring These are not the kind of x-rays we are exposed to when we go to the dentist or have a broken arm: they are (roughly) a trillion times more powerful: "brighter," as the scientists put it, with considerable understatement. (It would be fatal to be in the lead-lined laboratories when the beam is unshuttered and the focused x-rays scatter off their target). Unlike normal medical x-rays—which only cast a vague shadow—the synchrotron's x-rays can be finely focused to reveal microscopic detail.

The object being analyzed is moved in the beam precisely so that its structure is revealed in a series of very fine slices; each "slice" photographed, stored by a computer, and the whole solid object, digitally reassembled so that its fine three-dimensional structure is revealed. Shortly before our visit one of the uses of the beam-lines synchrotron was by a paleontologist examining a fossilized egg. It was, of course, impossible to explore the contents of the egg by ordinary means. The synchrotron however precisely showed the hundreds of tiny bones and fragments inside (the egg had been broken before fossilization), and allowed reconstruction into an image of the unhatched creature from the past. Perhaps it was a small dinosaur; perhaps a very early bird, a distant ancestor of the owl I had held in Provence a few weeks earlier.

On our visit, a French woman was sitting in the observation room outside one lab watching a series of slightly changing images on computer screens. The specimen in the beam-line was a small cube of limestone. The purpose of the experiment was to determine the inner structure of the cube's cracks and cavities. Afterward the limestone would be subjected to CO_2 under pressure, and the cube again would be examined by the synchrotron's x-rays. How would the CO_2 penetrate the limestone? How would it change the limestone? Those were the questions--interesting questions in themselves—but also deeply relevant for schemes to sequester CO_2 out of the atmosphere by pumping it back underground.

About 80% of the use of the synchrotron's 40 beam-lines is academic—the acquisition of "pure knowledge." As the glossy booklet describing the facility explains (evoking the opening of Aristotle's *Physics*: "All men by nature desire knowledge"):

> The thirst for knowledge drives us to explore the world around us. What is our planet made of? What are the processes that sustain life? How can we explain the properties of matter and develop new materials? Will it one day be possible to conquer viruses, predict natural catastrophes, or eliminate pollution?
>
> Most of these questions cannot be answered without a profound knowledge of the intimate details of the structure of matter. To help in this quest, scientists have developed ever more powerful instruments. . . .

"The thirst for knowledge": It is a good phrase, taking us back again to the senses, but it is not quite accurate, for the thirst is not primarily for the abstraction "knowledge": it is first of all to touch, with expanded senses, things which have been hidden. It is a thirst to "taste and see."

Thus the synchrotron, of which there are now about 50 in the world. Universities—at least professors and their doctoral students (who are particularly useful for staffing the night shift on the 24-hour schedule which synchrotron research requires)—make up most of the use of the facility. But about 20% of the capacity is rented (at a fee of roughly 1000 Euros per hour) to business and industry, to answer questions like, "can this soap be made to fill its mold more efficiently?" "Can we achieve a tastier distribution of nuts and bubbles in this chocolate bar?" The answers of these questions are good for business, and good for the attempt to make more things available to more people, some of whom are hungry for any food at all. Yet ironically, inevitably, some of the new knowledge, when put to use, may threaten the very tastes and textures of creation in which it was born.

It's not easy to separate "pure knowledge" of creation from the use of that knowledge. And there is nothing sinister about this wedding of knowledge and use—of science and technology. Nor is that wedding—despite its vast acceleration over the past decade—a sinister thing, though all of us can think of technologies we regret. The use of knowledge for power and pleasure is an ancient, inseparable part of our humanity. This was reinforced on the afternoon of our synchrotron visit when we entered quite a different world.

When we left the synchrotron—having surrendered our visitor's badges and retrieved our driver's licenses at the security gate—we crossed the Isere river and drove up—and up, and up—a narrow road above Grenoble, into the regional park of the mountain massif known as the Grand Chartreuse. Soon there was deep snow on either side of the road. Just below the village of St. Pierre de Chartreuse we passed two white-robed monks with skis on their shoulder, tramping along the slushy verge of the road. (The lower part of their robes were no longer very white). They were headed towards the monastery of Grand Chartreuse, the mother-house of the Carthusian order, which has other monasteries throughout Europe and in North and South America. It is a contemplative order (no visitors are allowed at the monastery itself), and near the monastery (unseen above us in its snowy meadow) we passed a sign announcing that we were entering a "zone of silence". Above the road and the snowy forest the limestone peaks were silent indeed.

Several centuries ago, so the story goes, some of the monks of the order succeeded in translating a medieval *grimoire* containing a recipe for an "elixir of life." (It is worth noting in this context that a *grimoire* is a book of spells and potions, associated with the tradition of magic—an older, less successful, way of using knowledge to achieve power.) The elixir, based on 130 plants, was first distilled in 1605 by the apothecary of the order, a father Jerome Maubec.

The recipe—almost lost during the French revolution—is now held by only two Carthusian monks at a time. They oversee the gathering and blending of the carefully guarded variety of plants from the surrounding countryside (and perhaps from further afield). Soaked in alcohol, the mélange of plants is eventually distilled, aged, and produces a light green liqueur which eventually gave the name of the order (and the mountain) to a colour, *chartreuse*. It has also delighted the taste of millions of people. (As it had delighted us the night before when our host, the engineer from the synchrotron, had served some to us.).

Down the mountain we went on a tour of the vast cellar where today the liqueur is produced, aged (in hundreds of enormous oak barrels, and distributed around the world.

We bought a bottle and brought it home and served it a few days later to some of the Arocha interns with whom we had banded owls a month before. They too were delighted and intrigued by the tastes of Chartreuse, and we engaged in a sort of competition to name as many as we could. Pine? Rosemary? Cinnamon? Orange? Vanilla? Lavender? Perhaps all of these? Perhaps none. But whatever it contains Chartreuse (whose sale continues to support both the Carthusthian order and its various relief projects around the world) is a witness both to the flavours of creation, and the human delight in tasting and tinkering with them.

* * * * *

In the twelfth century, about the time that the first Carthusian monks started building their wood huts in the forest below the peaks of the Grand Chartreuse, a boy, Francis (named, perhaps for the popular new style of song which troubadours were bringing south from Provence) was born in the Italian hill-town of Assisi. His capacity for delighting in the tastes of creation was unusual. Even more unusual was the clarity with which he was able to recognize these creatures as gifts from the creator, as he recorded towards the end of his life in the "Canticle of the Sun" (which we still sing as "All Creatures of Our God and King") Francis' unique combination of love for God, for Creation, for song and for his "Lady Poverty" attracted thousands of followers and led to the founding of the Franciscan order. The sensibility which they carried to the corners of Europe helped recover for Christendom the central Christian mystery: that in Jesus the Creator had entered his creation, shared our tastes, our hungers, our temptations and our death. (It was Francis who first brought animals into the church at Christmas, to help remind worshippers of the Creator's creatureliness.)

One of those early Franciscans (legend has it that he was healed as a child by the aging Francis) was the man we know as Bonaventure. Bonaventure was a contemporary of Thomas Aquinas, and he came to the cathedral school in Paris where Aquinas was forging and defending his great rational synthesis of Greek and Christian thought. Bonaventure combined a keen intellect with a passionate Franciscan love of Creator and Creation. And he was uneasy with the way that Thomas, like Aristotle before him, assumed a god-like perfection for the reason alone. We cannot anticipate or understand what the love of God will do: we can only ascend to that understand up the ladder of the senses; the senses, not the reason, are the foundation of knowledge.

Michael Foster argued, many centuries later, that the fundamental difference between Greek thought and Christian was this belief in the centrality of "sensuous experience." If we can point to any place (beyond the Gospel of the Incarnation itself) where this stream of thought begins to flow clearly, it is in the Franciscan Bonaventure's celebration of the tastes of creation as the first step on a ladder to knowledge of the Creator. In *The Mind's Road to God* he wrote:

> He, therefore, who is not illumined by such great splendor of created things is blind; he who is not awakened by such great clamor is deaf; he who does not praise God because of all these effects is dumb; he who does not note the First Principle from such great signs is foolish. Open your eyes therefore, prick up your spiritual ears, open your lips, and apply your heart, that you may see your God in all creatures, may hear Him, praise Him, love and adore Him, magnify and honor Him.

C. S. Lewis inadvertently provided an almost perfect commentary on Foster's important idea that science is rooted in sensuous experience, in a poem called "On Being Human". He begins by describing the sort of knowledge which an angel might have: a pure, disembodied intelligence. And the sort of knowledge he describes is knowledge of the idea of a thing, untroubled by the imperfections of the sensuous:

> Angelic minds, they say, by simple intelligence
> Behold the Forms of nature. They discern
> Unerringly the Archetypes, all the verities
> Which mortals lack or indirectly learn.
> Transparent in primordial truth, unvarying
> Oure Earthness and right Stonehood from their clear,
> High eminence are seen; unveiled, the seminal
> Huge Principles appear.

It is this lofty vision which Greek science sought to achieve—the sort of knowledge we have of a geometric theorem. But creation cannot be known this way, apart from the senses, and thus Greek never really developed beyond mathematics. Lewis proceeds to contrast a disembodied intellect's knowledge of a tree with a human knowledge:

> But never an angel knows the knife-edged severance
> Of sun from shadow where the trees begin,
> The blessed cool at every pore caressing us
> --An angel has no skin.

Lewis gets to food, and taste:

> The nourishing of life, and how it flourishes
> On death, and why, they utterly know; but not
> The hill-born, earth spring, the dark cold bilberries

The ripe peach from the southern wall still hot,
Full-bellied tankards foamy-topped, the delicate
Half-lyric lamb, a new loaf's billowy curves,
Nor porridge, nor the thingling taste of oranges,
An angel has no nerves.

It is only in the immediacy of this engagement with the sensuous mystery of creation that science is born. The "angelic knowledge" of mathematics has its place: but knowledge of creation is born here, in the senses. Nowhere else in human history has such a high value been placed on the particular, the specific, the sensual. Lewis concludes the poem by explaining why.

. . . here, within this tiny, charm'd interior,
This parlour of the brain, their Maker shares
With living men some secrets in a privacy
Forever ours, not theirs.

The taste of cheese, or chartreuse; the mystery of a bird's migration; the secrets locked in stone: *tasting* these things is at the core of our human-ness. And whether the love of these things goes further than sheer delight, into knowledge and usefulness, the arts and sciences begin here, in a recognition that the gracious Maker of all things shares and blesses our experience of them. Taste and see. . . .