

The new Victorians

Anne Cutler discovers the joys of scientific correspondence

"MY dear Hooker," wrote Charles Darwin to Joseph Hooker on 6 March 1844. "I will not lose a post in guarding you against what I am afraid is... labour in vain." This urgent warning went by post, because Darwin had no option: he had no telephone.

What the Victorians did have, however, was a pretty efficient postal service, and they made good use of it. Look at the fat volumes of Darwin's correspondence. Hooker was only one of many fellow scientists with whom Darwin exchanged letters at a rate that seems to us prodigious. Victorian scientists bombarded one another with ideas, results and opinions, and all by mail.

By comparison, we write few such letters. But now, quietly, a new age of scientific correspondence is opening, and what has brought it about is a new kind of mail: electronic mail.

As we know, the telephone put paid to letter writing as the Victorians practised it. No point in writing it all down, finding an envelope and a stamp, entrusting the result to the uncertain mercies of who knows how many intermediaries and waiting—even if only a day—for an answer by the same route, when one can lift the telephone and get the answer now. The telephone surely revolutionised scientists' lives. In particular, it facilitated long-distance collaborations. You don't have to stop doing joint research with your colleague just because one of you moved from Aberdeen to Exeter. Or to Stanford or Sydney, for that matter.

With the spread of the telephone came a decline in the standards of the postal service; but that hardly seemed to matter when the telephone was so much more convenient.

Convenient though it certainly is, however, the telephone has its negative aspects. For example, it has a tendency to ring just when you're on the verge of finally cracking a problem, the distraction driving what would surely have been the solution right out of your mind. Or it allows a distant colleague to ring you up to discuss one project when you're in the middle of quite unrelated discussions with a colleague in the lab. Under such circumstances, it is possible to envy the Victorians their lack of phones.

Moreover, the telephone is hardly an everyday option for international collaborations. On the one hand, laboratory budgets in Britain don't stretch to in-depth interpretation of a series of experiments at international long-distance rates. On the other hand, when is the right time to call?



Man of letters. The art of communication could be about to make a comeback

The Californian's day is eight hours adrift of mine, while the Australians are almost maximally out of phase with a difference of up to 11 hours. Admittedly, it's probably possible to call Stanford at tea time and find your colleague in the lab at 8 am local time.

Oh for the ills of the rich

Sue Birchmore reckons it's worth joining the professionals

A COLLEAGUE of mine discovered recently that I am, like him, married to a nurse. "Ah," he remarked gloomily. "Another engineer married to a nurse. Passport to a life of poverty, that is." "Poverty" is perhaps putting it rather strongly—engineers' pay isn't quite as low as nurses'—but there's no doubt that we who deal in pounds force and pounds mass will never be as rich as those who deal in pounds money, and it sometimes rankles.

This is why I have to admit to a certain malicious satisfaction over some of the recent health scares. For example, in my innocence I had always vaguely imagined that those clinical-looking, plastic-wrapped "convenience" meals and pre-packed salads were, if anything, rather more hygienic than the scratch-built products of my tatty kitchen—but I had always eschewed them on grounds of cost. Now I discover that my economical (or mean) attitude may actually have saved me from a dose of the dreaded salmonella or listeria.

Then there's this "sick building syndrome". Workers develop mysterious maladies—headaches, tiredness, stuffy noses and so on—which attack them as they walk into reception, relenting only at 5 o'clock

Americans are like that. But the Sydneysider is fast asleep at our tea time, and doesn't get to the office until late in the evening in Britain when you're dropping off to sleep yourself!

That's why electronic mail has led us into a new, more gracious age of communication. Last week, for example, I sent the results of an experiment to a colleague in Melbourne. Detailed comments were waiting for me when I got to work the next morning. I also found the latest message from a Los Angeles contact with whom I have been gently arguing a point for what is now some months.

Similarly, the other day, an agonised search for a reference elicited a reply from the Netherlands in half an hour. My colleague in Scotland, who is terse and dismissive when telephoned unexpectedly, produces witty and helpful responses to electronic requests because he can deal with them at his leisure. All this is so much more congenial than the telephone, and so much quicker than what we electronic-sophisticates now call "snail mail", that one can properly talk of a new age.

In this new age of communication, scientists swap ideas as Darwin and Hooker did: reasonably quickly but not intrusively. Urgent matters can be dealt with at once; responses arrive before questions have faded from memory; correspondence can take on some of the aspects of conversation. But no jangling bells pre-empt our attention; we read and respond to e-mail as it pleases us, not at our correspondent's convenience. E-mail has made of us new Victorians.

Of course, it also means that we can now ignore deadlines even longer than we used to: not just till the collection of the last appropriate post, but literally right up to the last minute. But that's another story. □

when they head off home. The syndrome principally affects workers in air-conditioned offices, and there seems to be a suggestion that plush furnishing and carpets make matters worse by shedding irritating fibres into the atmosphere. Very few engineers are in any danger from that. No, the health hazards in our working environments tend to be rather different, as I realised when I walked into my office at a previous employer and was confronted by a mouse. Well, "confronted" is hardly the right word; it was dead on its back with its paws in the air. What really worried me at the time was the question of what it died from—and would I be next?

Another of the great health worries of our time: heart disease. While marketing executives cruise around in Sierras, engineers pedal pushbikes, thus reducing their risk of heart failure (but vastly increasing their chances of coming to a squeaky end under the wheels of a juggernaut). And while the marketing people are forced to indulge in cholesterol-laden business lunches (the sacrifices demanded by high office!), we

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engineers generally subsist on sandwiches.

No wonder companies offer their highest-paid employees free medical insurance! They obviously need it. Which of us care-free engineers and scientists, unencumbered by the weight of riches, would swap our drawing boards and lab benches for unhealthy air-conditioned offices, clogged arteries and executive stress?

Well, this engineer for one, given the chance. The nasty truth remains that the up-market ills may make the news, but the

diseases of poverty kill many more people. In 1978, if my book of statistics is to be believed, the death rate among British professional men was 77 per cent of the national average for those aged between 15 and 64, while that among unskilled manual workers was 137 per cent. Their children fare better, too. In 1980, infant mortality for the professionals was 8.9 per thousand live births; for the manual workers, it was 16 per thousand. Being poor can seriously damage your health. □

All the fun of the fair

John and Ben Gribbin assess the first Edinburgh Science Festival

SCIENCE may at last be penetrating into the consciousness of the great British public—and not just because of scare stories about London being 8 metres under water in a few years from now. In 1988, a modest, but significant, scientific book prize was established, alongside all the Booker-type awards that fiction writers have to share; this year, the great city of Edinburgh saw the light, and last month introduced a science festival as a counterpart to its famous festival of the arts. If you missed it, too bad: the festival attracted less publicity than it deserved south of the border. But the good news is that it is coming back for at least two more years, and almost certainly will become a permanent feature of the Scottish cultural heritage.

The wonder is that nobody thought to do it before. However, it is appropriate that the idea should surface in Scotland, home of James Clerk Maxwell, and a country where education is still taken seriously. Education is, in fact, only part of the story. The thinking behind the festival is that science is a part of daily life, and ought to be celebrated in the same way that we celebrate good books or theatre.

We wouldn't want you to run away with the impression that it was all fun and games. There were plenty of serious talks, discussions and presentations on topics such as (you've guessed) the greenhouse effect and genetic engineering. But we visited Edinburgh for a long weekend simply to enjoy the science, and, while we studiously avoided anything too serious, we still found it impossible to cram in everything we wanted to see and do.

This was the most important achievement of the festival and the one which points the way ahead for science festivals in Edinburgh and elsewhere. People do not, by and large, go to the other Edinburgh Festival to be educated. They go to have a good time. Science has for too long been stuck with the image of being good for you, but not much fun. If science festivals can shatter that myth, they will be doing more to ensure the future of science in Britain than any number of serious lectures on the ozone hole.

Our entertainment came from comfortably familiar sources and from new and unexpected directions. The Discovery Dome, perched in the Botanic Gardens, was a bit of both. It is a travelling version of the kind of "hands on" science exhibition familiar from Bristol's Exploratory and the

Science Museum's Launch Pad. "Mobile", we thought, must mean "inferior". If anything, it was better: the tents housing the exhibition made it more circusy; almost all the exhibits were in working order; and there were some new items (to us), including a hypnotically obsessive rotating disc filled with viscous fluid and revealing patterns of smooth and turbulent flow.

That wasn't the only surprise. We made what we thought would be a duty call on a primary science fair, prepared to look condescendingly at the work of our juniors. We found that 40 schools had constructed exhibits. Not only were the exhibits themselves impressive and interesting, for

or, at least, the one which satisfied the quizmaster. It is, they claimed, an anagram formed from the initial letters of New York and the first part of London, commemorating the joint development of nylon by researchers in the US and Britain.

Up popped a senior member of the audience to dispute this. According to his version, the original plan of the inventor was to christen the new fibre "nulon". When it was discovered that the name had already been registered, it was changed as little as possible, replacing the "u" with a "y".

After much debate, the "NY-LON" version was agreed to be correct for the purposes of the quiz, with a plea for further information from anyone who has it. We'd be as interested as the organisers to know the full story!

The perspicacity of the organisers was clearly demonstrated at our last "official" port of call, the Science Book Fair, held in the Albert Thompson Hall of Heriot-Watt University. Instead of simply filling the place with boring but worthy scientific tomes, the festival had found room for an exhibition on space and a section devoted to science fiction; "Space and science fiction" was, indeed, a theme for a series of talks and workshops linked to the book fair. And the appropriateness of Edinburgh as a venue for such a festival was confirmed by another surprise. Our highest highlight was a visit to



Science under canvas: children delight in the temporary Discovery Dome at Edinburgh.

example, a working model of a swing-bridge; but Linlithgow Primary School, several steps ahead of the national media, had produced a special edition of a newspaper, *Primary Press*, reporting the event. And, sitting in on a science quiz involving secondary schools, we were delighted to be plunged into the midst of a scientific controversy.

What, the teams were asked, is the origin of the word "nylon"? Two of the four competing schools in the final round of the competition (nail-biting stuff, with the scores nearly level) gave the right answer;

a "show" not officially part of the festival: the camera obscura at the top of the Royal Mile.

You can get the lectures anywhere; we get them every year at the BA. But a combination of interesting talks *plus* hands on science, science-fiction books and a camera obscura? Only in Edinburgh! Now that the idea is a proven success, we can hope that the Edinburgh Science Festival will go from strength to strength; and maybe that other cities might be encouraged to emulate it. After all, there are rumoured to be other festivals of the arts! □

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Experimenting with computers

The possibilities are endless, as Walter Benenson explains

YOU hear a lot about how personal computers are going to revolutionise teaching at all levels, but usually the claims are vague, and few real examples are given. After reading an article or hearing a talk on the subject, can you actually envision how to introduce computers into your classes? Well, you will find below a series of experiments in Newtonian physics which will make it clear how computers can be used in teaching. They represent, of course, just a sample of what can be done. I am sure that, after reading this, you will have many ideas of your own.

(1) Galileo's Tower of Pisa experiment

In this experiment you take a small portable computer (say, a Zenith SupersPort) and a large bulky older model (perhaps an IBM AT) to the top of a building. The students can either take part in this experiment or observe it from the street. The object is to show that both computers take the same time to fall from the building and hit the ground independent of their mass or memory size, as predicted by Newton's theory of gravitation.

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ENIGMA

No 511

Double, double. . .

by Susan Denham

I WROTE an odd number on the board and asked the class how many numbers (including the original number itself) could be made by writing exactly the same digits but in different orders. (For example, if the number had been 5051, the answer would have been nine, namely 5051, 5015, 5105, 5150, 5501, 5510, 1055, 1505 and 1550.)

Clever Dick got the right answer immediately, so to keep him busy I told him to repeat the exercise with exactly double my original number.

"That just doubles the number of ways, Miss," he reported.

I told him to double again and repeat the exercise, and again he reported "That doubles the number of ways yet again, Miss."

So I told him to double the number yet again and to repeat the exercise with the four-figure answer.

"It's doubled the number of ways again, Miss," he replied and, as always, he was quite right.

What number did I write on the board?

A £10 book token will be awarded to the sender of the first correct solution opened on Thursday 18 May. Please send entries to Enigma 511, New Scientist, King's Reach Tower, Stamford Street, London SE1 9LS. The Editor's decision is final. The winner of Enigma 508, 'A colourful deception', was J. H. Roughley of Windlesham in Surrey.

Answer to Enigma 508

A colourful deception

Miss Wheel took the route C, D, E, G, B, A, E. The tourists thought they were taking route E, A, B, G, F, D, C.

(2) Coefficient of static and sliding friction

This experiment takes no special equipment other than the standard computer work-room which can be found in most universities in the US. These rooms are filled with desks on which various computers are placed for the students to use. In the procedure for this experiment one needs students with strong backs because the idea is to tip the desk and measure the angle at which the computer slides off. This angle is related to the coefficient of friction for the computer-desk interface, μ_{cd} , by the relation $\mu_{cd} = \tan \theta$.

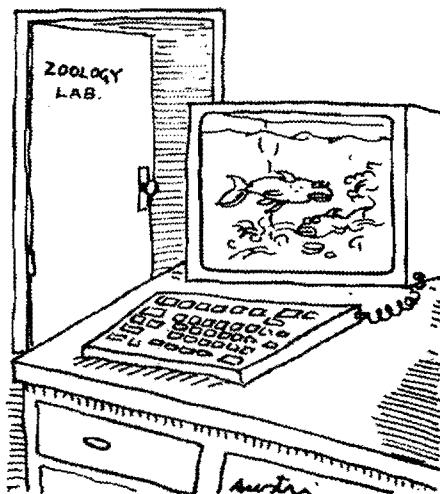
The students should experiment with all the computers in the room to see if the coefficient depends on the size of the computer or its model. Turning the hard discs on and off is another interesting exercise for students. Can they devise a way to find the coefficient of sliding friction?

(3) Spring constants and simple harmonic motion

The spiralled up cord which connects the keyboard to the computer makes an excellent spring. First the students should hang the keyboard from the side of the desk and determine the displacement of the spring. Look up the weight of the keyboard in the manual. The spring constant is given by $k=W/x$, where W is the weight and x is the displacement. Now the student should get the keyboard oscillating up and down like a yo-yo. The frequency of oscillation should be given by $f=2\pi/(k/m)^{1/2}$. The student can repeat the whole exercise with the computer itself rather than the keyboard.

(4) Circular motion

Once the spring constant of the cable has been determined, many experiments are



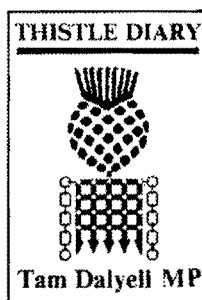
possible. For example, the keyboard can be whirled around the head of the student and the displacement measured. The object is to show that the displacement is enough to give the required centripetal force. Circular motion of this type is also useful to demonstrate the idea of elastic limits. For this purpose the computer can be whirled around the head of the student faster and faster until the cable breaks, and the elastic limit can be determined.

I believe that the reader will have by this time realised that there is an endless number of uses for the computer in the classroom. I would like to emphasise that student reaction to the experiments I have described has been enthusiastic. In my experience no set of experiments has ever motivated the students as these ones have. Many students voluntarily repeat the course and sometimes show up just to watch and help.

Next time, I shall go into the use of computers in experiments in biology and rocket science. □

UNESCO, energy and a plague of dormice

Another round-up from Westminster



MANY MPs, and from all parties, never approved of Margaret Thatcher's decision to follow the US and pull out of UNESCO. Now that the director-general of that organisation is the distinguished former vice-chancellor of the University of Granada, the Spanish minister Dr Federico Mayor, there is no excuse for not getting back in double-quick time.

Mayor recently addressed the Parliamentary and Scientific Committee with great success. His audience included Sir Walter Bodmer, Sir John Kingman, Sir David Phillips, and the director of the Royal Institution, John Thomas.

UNESCO is currently carrying out four inter-governmental scientific programmes on the environment and natural resources. First, there is the International Geological

Correlation Programme, which seeks to investigate those aspects of the Earth's crust that have a direct bearing on the distribution of mineral and fuel resources. Secondly, there is an interdisciplinary ecological programme geared towards the rational management of terrestrial and aquatic ecosystems. Thirdly, the International Hydrological Programme seeks to identify the basis for the rational, long-term management of water resources. Finally, there is a range of activities under the Intergovernmental Oceanographic Commission, aimed at defining the mechanisms governing the oceans and their resources, their effect on the climate, assessment of marine pollution and so on.

Although Britain has continued to help in the oceanic programme, we should get back into the full flow of UNESCO activities. I believe that the MPs present at Mayor's speech will be urging the Cabinet to do so.

DAVID SHAW, the Conservative MP for Dover, has asked an interesting question of Michael Spicer, the energy minister: what would be the estimated size of a wind park

with an output capacity of 1200 MW? (An output of 1200 MW is comparable with that of a pressurised-water reactor of the type being built at Sizewell).

Spicer told him that the Department of Energy's estimate is that the land area required for a wind farm with an installed capacity of 1200 MW might be between 110 and 140 square miles (290 to 370 square kilometres), although "there is still considerable uncertainty about this".

At this very moment, within the Department of Energy's research and development programme on wind energy, Spicer and his colleagues are examining the implications and public acceptability of wind farms. They are also looking at constraints on Britain's total wind energy resource that would be imposed by such significant environmental factors as national parks, areas designated as being of outstanding natural beauty, and urban land. The sooner the results are published the better, if only to stop people suggesting that estimable wind projects could provide a soft option to nuclear power.

I RATHER thought that Robert MacLennan, the Social and Liberal Democrat representing Caithness and Sutherland, was on to good ground when he highlighted a curious omission from the Atomic Energy Bill going through parliament. He referred to the lack of any provision to make good a defect in the legislation under which the UK Atomic Energy Authority handles contracts and consultancy work, and the fruits of its research and development.

MacLennan was not only making a constituency point for Dounreay when he told the House that the staff of the AEA represents a unique national resource—comparable with our resources of coal, oil, and gas. It has increasingly expanded into non-nuclear research and development. I wonder what the very alert Public Affairs Department of the AEA will have to say about the bill—or are they constrained as public employees? They should be entitled to their say.

ARE WE about to suffer a plague of edible dormice? I doubt it. However, you ought to know that, in the Commons last month, Ron Davies, the Labour MP for Caerphilly, asked Richard Ryder, the agriculture minister, how often during the past three years he has issued licences to trap them.

Ryder told Davies that licences to trap edible dormice were issued on four occasions between 1986 and 1988, under section 16(3) of the 1981 Wildlife and Countryside Act. The licences were issued to occupiers of commercial forests where this non-indigenous animal—a foreigner, perish the thought—was causing "serious damage". It was a condition of each licence that the number of animals taken should be reported to the ministry.

Solemnly, Ryder gave details. In 1986, one licence was issued, and four of the brutes were taken. Nineteen-eighty-seven was *annus mirabilis*, when the first licence yielded 43 dormice—a real plague—and the second 14. In 1988, the danger seemed to have been averted, as one licence was issued and only six of the creatures were taken.

Forgive me asking, but do edible dormice really do "serious damage" to the realm? □

SPARE a thought for Christopher Harding, chairman of British Nuclear Fuels. Harding used to take

a certain amount of pleasure in recounting the fact that, were his company to replace Calder Hall, its ageing nuclear power station at Sellafield, with a coal-fired plant, it would run the risk of breaching the site's health and safety regulations in respect of airborne radioactivity.

Puzzled? Read on. Coal is hewn from the ground. It contains impurities. These include naturally occurring radioactive compounds. Combustion releases ash into the air which contains radioactivity. This is deposited on the ground and can get into the human food-chain via plants.

Times are a changin'. The National Radiological Protection Board recently published its latest review of the radiation exposure faced by Brits. It noted that earlier assessments of the radiation dose from "fly-ash" discharges had been "appreciably overestimated". The average dose from this source is now put at a tiny 0.1 microsieverts. To put that in perspective, the average radiation dose from all radioactive sources is 2.5 millisieverts.

As a result of the NRPB's reassessment, building a coal station to replace Calder Hall is no longer officially a health hazard—all of which seems rather hard on Harding. □

INCIDENTALLY, given that Harding has done much to encourage greater openness at British Nuclear Fuels, we were a little alarmed to see a recent full-page advertisement placed by BNF to promote its Sellafield Exhibition Centre. The advertisement states: "There's plenty to see and do for all the family and it's all completely undercover." What can this mean? □

FULL marks to PIG (UK), a company based in London, for being quick to latch onto the possibilities of concern about the ozone layer. The company has announced that it is launching the Dust Bunny, an electrostatic wiping mitt for use in the printing, photographic and computer industries. This, a press release says, "will reduce significantly the need for aerosols (and the release of CFCs into the atmosphere)" in those industries, though it doesn't quite explain how. Interestingly, the fabric from which the mitt is made was developed for PIG by the chemical company DuPont, the world's largest manufacturer of CFCs. □

A FEW years ago there was a joke circulating among secondhand car salesmen. What's the difference between herpes and a Russian car? Answer: you have a chance of getting rid of the car. Now, for some reason or other, there's a similar joke circulating among broadcasters. What's the difference between Sky TV and the Loch Ness monster? Some people claim to have seen the monster. □

TO BE fair, jokes often give an exaggerated picture of what is happening. Feedback is happy to report that, having described in some detail the problems our resident electronics expert encountered in installing a dish aerial (Feedback, 4 March), we now know of at least one person who has

FEEDBACK

managed to see Sky TV; after several weeks, and having brought in professional help, he has finally managed to get the system working.

Technically, he tells us, the pictures are excellent. Unfortunately, he adds, the programmes were pretty dire, apart from the news channel and a surprisingly good batch of films last Sunday.

The biggest surprise of all, however, was the discovery that the British government and taxpayer are helping to pay for Sky. The first commercial he saw had William Woollard in a long and obviously expensive filmlet extolling the virtues of the British Army's work in conserving the environment—by planting trees in the vast areas of countryside used to train people to kill and be killed. □

AFTER junk mail and junk fax, we now have to report a more insidious threat: junk telex. Like many others, we were disturbed to receive a telex last month informing us that a Russian nuclear submarine had sunk off the coast of Norway. Almost as disturbing was the message attached: "How will that special relationship fare? Follow the stars on Insight and see what the Insight astrologer foretells about your love life and the love lives of those near and dear to you . . ." □

CATS, we are sorry to say, come in for some rough treatment in France—at least when it comes to well-known phrases and sayings. Hence, "A frog in the throat" becomes "A cat in the throat" and, worse, "Another fish to fry" becomes "Another cat to whip".

But none of this Gallic wisdom can explain a problem that has been bothering particle physicists recently, that is, how did a cat end up in the French sector of LEP, the big accelerator being built at CERN near Geneva? The cat was 100 metres below ground, lurking beneath some apparatus. How did it get there? The only access is by lift (with controls 1.5 metres above the floor), by stairs (with heavy doors to open and close) or by the open shaft, 100 metres deep, down which equipment is lowered. Perhaps someone was testing the cat's ability to land on its feet. On the other hand, it could, of course, have been Schrödinger's, which would explain everything. □

MEANWHILE, at another part of the LEP ring, this time 150 metres below ground, researchers building an experiment known as ALEPH were rash enough to stage an open day last month. By mid-afternoon, people were queuing for 30 minutes or more to go down the "pit" to see some of the sophisticated equipment that physicists delight in.

So were they suitably awestruck by the hardware, costing several millions of Swiss francs and comprising some of the most sensitive detectors around? Apparently not. It seems that, for most people, the simple experiments in physics are still the best. The main attraction proved to be the impressive echo, with everyone clapping or shouting at the bottom of the shaft and waiting for the sound to bounce back from the cover at the top. □