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# Life after SuperBabe

In the 30 years since the birth of the world's first 'test tube' baby, *in vitro* fertilization has become commonplace. The next three decades could bring equally transformative technologies.

She arrives in the delivery room of a British hospital just before midnight, weighing 3.4 kilograms — a routine birth for a baby who is anything but. Her parents keep a copy of the newspaper to mark her birthday: 25 July 2038.

She is just what they dreamed of, of course, because they did everything medically possible to make sure of it. They had her genome sequenced by plucking off a cell or two when she was an embryo, just as they did for the cluster of other embryos produced by the *in vitro* fertilization (IVF) process. They chose her when the Baby's First Four Letters™ analysis at the clinic said that this particular embryo had the best odds of growing up to be thin, happy and cancer-free …

If this 30-year-hence scenario seems entirely plausible, it is because of what happened 30 years ago this month, when the first baby created by IVF was born on 25 July 1978. The papers called her SuperBabe. Her parents called her Louise Brown. Since then, what once seemed incredible and controversial has become commonplace. Some 4 million babies have already been born via IVF. So in this issue, *Nature* asks experts in reproductive medicine to speculate on what the next three decades might hold (see page 260). Some of the techniques promise to be equally transformative, if they come to pass.

Consider, for example, what would happen if researchers learn to grow artificial sperm and eggs from other body cells (see *Nature* **452,** 913; 2008). They would have abundant raw material for IVF, and could potentially bring about an end to infertility altogether. As that scenario would also lead to a bountiful supply of embryos, genetic screening could become a necessity — and the door would open wider to allow genetic enhancement and modification of germ cells and embryos.

Already, modern societies are entering an era of personalized genetics, in which anyone can pay for a read-out of known risk genes — or, soon, a complete personal genome sequence. These technologies will make their way into the fertility clinic. True, with thousands of genetic risk variants contributing to multiple different conditions, no embryo will have the perfect genetic future. But these techniques could allow parents to create a top-five wish-list of the characteristics they most want for their child — avoiding, for example, the Parkinson's disease that plagues the family — and choose the embryo most likely to meet those criteria. Or the parents may focus on non-health-related aspects such as intelligence and ambition; the ethical debate about genetic selection is likely to intensify over the next few years, as it should.

Meanwhile, safety concerns about IVF have still not evaporated, even after 30 years. Although it is unlikely that IVF does any major harm, more subtle problems may become apparent only when very large numbers of children are followed into middle age or beyond. Yet few such studies have been initiated. There are almost no large registries tracking children born via IVF, and even less information on children subjected to more recent techniques such as preimplantation genetic diagnosis. Such long-term studies are expensive and difficult because the privacy of parents and children must be maintained, and many will choose not to participate. Nonetheless, such registries should be a priority — even more so as the next generation of assisted reproduction techniques comes online. Yes, prospective parents may have to accept risks — but they should at least know what those risks are.

**"Already, modern societies are entering an era of personalized genetics."**

Also not resolved in the past 30 years is how to ensure that the appropriate safety and ethical requirements are satisfied. One model is Britain's widely admired Human Fertilisation and Embryology Authority, which has the legislative backing to set rules and enforce them (see page 280). In the absence of such regulation, as in the United States, the onus is on doctors to prove that they are committed to transparency, safety and the best outcome for both prospective parents and their children.

What is certain is that our future newborn on her birthday will be oblivious to these debates and to the method of her creation. Her existence will demonstrate that nothing is sacred in human biology — and researchers should ensure that nothing is diminished about human reproduction by starting it in the lab. ■

# Templeton's legacy

The Templeton Foundation's exploration of science and faith merits tolerance, not outright rejection.

When a wealthy individual seeks to leave a legacy through scientific philanthropy, researchers usually greet such generosity enthusiastically. But the death of investment mogul John Templeton marks an unusual, and notable, exception. At the time of his passing last week, Templeton had poured some US$1.5 billion into the John Templeton Foundation, which funds research at the intersection of science and spirituality. Critics have maintained that the foundation needlessly conflates science and faith, with some calling for an outright boycott of Templeton funding.

Templeton was a deeply spiritual, albeit unorthodox, individual (see page 290). He lived a life firmly rooted in the Christian traditions of modesty and charity. Yet he was also a great admirer of science, the undogmatic practice of which he believed led to intellectual humility. His love of science and his God led him to form his foundation in 1987 on the basis that a mutual dialogue might enrich the understanding of both.

This publication would turn away from religion in seeking explanations for how the world works, and believes that science is



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likely to go further in explaining human moral impulses than some religious people will welcome. Thus it shares a degree of suspicion with many in the scientific community at any attempt by religiously driven organizations to fund science. A chief concern is that the influential Templeton Foundation might be seeking to inject religion into the scientific world. And it is easy to understand that concern given the political activism of many American fundamentalists and their efforts to promote ideas such as intelligent design, which posits a divine hand in evolution. The foundation's most vigorous critics accuse it of attempting to lace science with spiritualism.

That claim is somewhat ironic, as Templeton himself seemed to have just the opposite in mind. He believed institutional religion to be antiquated, and hoped a dialogue with researchers might bring about advances in theological thinking. The foundation's substantial funding of science and religion departments around the world is directed towards those ends. Theologians have also used foundation money to develop and promote arguments that reconcile some of the apparent contradictions between science and religion. For those many scientists with a faith, promoting the compatibility of science with faith is a prudent and even necessary goal. Strict atheists may deplore such activities, but they can happily ignore them too.

The foundation's scientific agenda addresses 'big questions', which has sometimes resulted in work that many researchers regard as scientifically marginal. One field popular with the foundation is positive psychology, which seeks to gauge the effects of positive thinking on patients, and which critics argue has yielded little. Also heavily supported are cosmological studies into the existence of multiple universes — a notion frequently criticized for lying at the edge of falsifiability. The concern is that such research has been unduly elevated by the foundation's backing. But whatever one thinks of positive psychology and the like, the foundation's support has not taken anything away from conventional funding. And in the field of cosmology at least, it has arguably yielded some new and interesting ideas.

**"Templeton believed institutional religion to be antiquated, and hoped a dialogue with researchers might bring about advances in theological thinking."**

The foundation's management now falls chiefly to Templeton's son, John M. Templeton Jr, whose Christian beliefs are reportedly much more conventional than his father's. A critical scrutiny of the foundation's scientific influence continues to be warranted, and no scientific organization should accept sums of money so large that its mission could be perceived as being swayed by religious or spiritual considerations. But critics' total opposition to the Templeton Foundation's unusual mix of science and spirituality is unwarranted. ■

# An uneasy peace

## Britain's 'big science' funding agency is now in a position to regain much-needed credibility.

Last week, an official opened a meeting between scientists and the UK Science and Technology Facilities Council (STFC) by asking that those present leave their weapons at the front desk.

The joke, which met with anaemic laughter, shows how bad things have been between the council, whose responsibilities include high-energy physics and astronomy, and the scientists it serves. In December, the council announced that it had an £80-million (US$160-million) spending shortfall in its latest budget, which runs until 2011. Council officials laid out preliminary plans to withdraw from such key projects as the International Linear Collider, a next-generation particle accelerator, and the Gemini Observatory, a pair of 8-metre telescopes located in Hawaii and Chile. Many were furious over the cuts, which came with no consultation.

Gallows humour aside, last week's meeting showed that the STFC has gone some considerable way towards repairing its relationship with the community. Resentment remains, especially towards Keith Mason, the council's sometimes truculent chief executive. But by and large, the researchers who depend on the STFC to back their work seem ready to accept a programme that includes some cuts. This transformation is thanks to the rapid formation of ten specialist advisory committees to help inform the final version of the STFC's budget.

Although the plan looks similar to the original package, important concessions have been made and priorities shifted in a way that has ameliorated the community's initial rage. The final plan sets aside around £1 million for 'advanced detector work', similar to that being done in preparation for the linear collider. It also continues participation in the Gemini telescopes, although it will seek to sell half of Britain's observing time in the project. The plan also promises support to projects in other fields, such as nuclear and neutrino physics.

The truce between community and council comes just in time. Already the UK government is gearing up for its next budget review, and the STFC and its constituent physicists must be able to work in concert if they are to win a bigger slice of the cake in the next round. They must speak with a single voice to policy-makers about the broader value of their work, and they must be coherent about the consequences of lower funding levels.

Coming up with a consistent message will not be easy. The STFC supports many disciplines. Yet at last week's meeting there was a sense of common purpose. The message from both the crowd and the STFC was that their work and especially the people who do it provide an intellectual foundation on which the knowledge economy is built. That message should resonate reasonably well with the Treasury, which is seeking economic returns on its investment in science, and will ring more true to scientists than promises of spin-off technologies and business–government partnerships.

It is up to both sides to develop last week's germ of an idea into a full-blown campaign. The STFC can work with the community to communicate effectively to policy-makers, while researchers, through the newly formed advisory committees, must tell the council how their work fits with the broader goals of the STFC. A dialogue of this sort, sorely absent this past eight months, is essential if the funding shortfalls seen last winter are not to be repeated in the next spending cycle. ■



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