

# THE CANDIDATES RESPOND

France's presidential elections are taking place at a time of deep debate over the French research community's standing and prospects. To further the debate, *Nature's* **Declan Butler** submitted a list of questions on research issues to the three leading candidates.

## **Is French science in decline and, if so, why? How much will you invest in science, when and on what priorities?**

**Nicolas Sarkozy:** It's true that we've had various warning signs over the past few years that the relative position of French science in the world is being eroded. France nonetheless maintains expertise of the highest international level in many disciplines, in particular in mathematics, physics and engineering. I note too that France exports its scientific expertise abroad, even if I regret the fact that many of our young scientists increasingly choose to leave the country because they no longer feel they can succeed at home.

It is time to put in place the indispensable reforms needed to reinvigorate our research, and to massively increase investment in priority fields. For me these are the life sciences, nanotechnology and environmental and energy technologies. It is also essential to reinforce the excellence of our fundamental research, which influences our innovation potential in the medium and long term.

Research and higher education will be at the forefront of my priorities. Although this will be realized in the shape of more resources — €4 billion [US\$5.4 billion] extra for research, and €5 billion for higher education — it will also involve deep reforms in the way the system works. Reform without resources would be as fruitless as resources without reform.

I want to favour powerful and autonomous universities, which will be reinstated at the core of our research effort, and to reinforce a culture of scientific evaluation by promoting competitive grants. I would also note that the reshaping and restructuring of the Saclay plateau will be a major presidential initiative. This site is unique in Europe in its enormous concentration of centres of education and research, but there is scope for it to be exploited yet further.

**Ségolène Royal:** I don't think it's fair to speak of a decline, because France still has great assets and renowned university researchers, for example in mathematics. But for years, France has not really made research or the universities a top priority. The recruitment drive launched by Lionel Jospin was stopped when the conservatives returned to power; budgets have stagnated, PhD students and young scientists have been neglected, and the research system has been made more complex. France has fallen from 5th to 11th place among OECD countries in terms of science spending. I want

to turn that situation around by making higher education, research and innovation top spending priorities, with a 10% budget increase each year for five years.

**François Bayrou:** It's not so much that French science is in decline, but rather that other countries, including the United States, Japan, the nations of northern Europe and, more recently, China, have constantly increased investment in research over the years. For too long, research budgets in France have stagnated. Despite this situation, French scientists still rank among the best in many disciplines, in particular in mathematics, and in certain fields in physics, chemistry, biology, social sciences and the environment. It is now urgent to invest in emerging disciplines. I propose that France reinvest in research, with a 5% budget increase in real terms every year for ten years.

## **The street protests of 2004 reflected disillusionment among young researchers. How would you make science careers more attractive? Should scientists be functionaries with jobs for life? What role is there in France for the sort of postdoc system that exists in other countries?**

**Mme Royal:** During Monsieur Sarkozy's five years in power, there were four successive science ministers. His government made commitments to the scientific community in 2004 after pressure from the community, but it reneged on them in its 2006 law on research. Our young people accept that their work has to be judged, but they demand that the PhD be recognized as a professional qualification, that there be long-term planning and a way of making the system work, and that they should have ways to get involved in research organizations at universities or in the private sector after their doctorates. I will encourage risk-taking original research while at the same time favouring stable employment, as other countries do.

**M. Bayrou:** The researchers' movement of 2004 was much broader than just a simple protest; it revealed to the public the extent of the research system's deterioration and the need for investment. Science is at the heart of our society's future — from primary school onwards.

As for young scientists, their pay is currently

much too low. A postdoc system is needed, as in every other country it would provide extra training before a more permanent position in industry or public research. Steps will be taken to make it easier for French postdocs abroad to return, and to promote their integration into the research system or innovative companies. Career structures must also make it easier for staff to switch between teaching, research and the private sector.

**M. Sarkozy:** The 2004 social movement, and the research-community summit that followed, showed that scientists, far from fearing change, are crying out for it. They are not just worried about salaries — although salaries are obviously an essential recognition of their contribution to society and a key to making scientific and technological careers attractive. Reaffirming the value of research careers is therefore an imperative for me.

I want to end the undignified situation facing young scientists and research students, and set up a genuine postdoctoral policy in France. When this is done, I envisage increases in remuneration that would better take into account individual merit, the scientific quality of the work and the results obtained. I want to tear down the archaic barriers that separate full-time researchers and those who also teach. During the course of their careers, all should be free to devote themselves to both research and teaching in whatever measure they choose, as in most other developed countries.

## **The leadership of France's industries and government is dominated by graduates not from universities, but from the Grandes Ecoles, which specialize in business, public administration or engineering. How would you reconcile the parts of this dual higher-education system in such a way as to recognize the value of PhD scientists and their research skills?**

**M. Bayrou:** Every country's higher-education system is a product of its own history. Must we reconceive the entire system? I prefer strongly encouraging the existing one in its evolution. The first step is for the PhD to be recognized as a professional qualification in the context of employment, and for its status to be integrated into labour laws, as is the case elsewhere. This would make those with doctorates a fully fledged part of the professional cadres of our country in business, in public administration,

in politics and in the media.

Rather than pitting the different educational routes against each other, I prefer policies that diminish the differences between them. For example, we might extend the existing bridges between universities and the *Grandes Ecoles*, such as reorientation classes, to deserving students in all courses at the master's or PhD level; or it might be possible for the *Grandes Ecoles* and universities to set up common curricula. Higher-education and research policy would oversee progress on these objectives, in particular when allocating public support.

**M. Sarkozy:** Research students will come into their own when French universities finally have available the finances and the autonomy they need to be centres of excellence — something that is already the case for courses in law, medicine and economics.

The *Grandes Ecoles* and universities are complementary, and we should reinforce that. Decent salaries for graduate students should encourage more students from the *Grandes Ecoles* to choose PhDs in research. Research needs to play a bigger role at the *Grandes Ecoles*, and the best university students should be able to switch to those courses. Universities and *Grandes Ecoles* that are close to each other should have joint campuses with shared services. Universities could benefit from the *Grandes Ecoles'* business know-how, and the access their students enjoy to highly responsible jobs. I want PhD students to be able to access opportunities beyond the areas of research and education. The experience of a professional further degree should open the way to senior positions in business or public service.

**Mme Royal:** I have pledged to have the PhD recognized both in the civil service and in the private sector. It is also necessary to bring the various parts of the higher-education system closer together, and to establish routes for moving between the *Grandes Ecoles* and the universities. That will be a role for the PRES, which will stimulate interaction and synergy between universities, *Grandes Ecoles* and research organizations.

**Is French science beyond reform? Are the recently created National Research Agency and presidential High Council for Science and Technology a sound basis for further reforms?**

**M. Sarkozy:** No, French science is not unreformable! I think it has never been more ripe for reform. Growing awareness of the state of research is spurring demand for change. Lecturers and researchers are faced with globalization and international competition, just as everyone else is. Travelling a lot in their jobs, they are able to make comparisons.

Don't forget that as well as playing a role in the foundation of the ANR and the High Council

for Science and Technology [in my roles as finance minister and minister of the interior], I also encouraged the creation of 'competitiveness clusters' — clusters of companies, laboratories and universities that cooperate closely on common projects. I want to reinforce the ANR's role, as well as the quality of its evaluation procedures, and to triple the funding of research projects.

**M. Bayrou:** That's not fair to French research. I am very conscious of its willingness to get beyond the deadlock in which it finds itself. Research must first be reinstated as a priority on the political agenda; leading French politicians must make that their personal duty.

An agreement will be proposed on a non-partisan basis, bringing together the big political players who are aware that major investment is necessary. The more detailed questions — such as the organization of the executive, the role of parliament, university autonomy and evaluation — could then find simple and transparent solutions, because it will be easy to verify how the organization meets a need and facilitates the contribution of French scientists to the common questions facing France and humanity. It is urgent that we act.

**Mme Royal:** The real question is: which reforms does French science need? It's our misfortune that successive right-wing governments have failed to make research a priority. It was opposition to the impoverishment of the university and its decline that brought students out on to the streets in 1986 and 1995, and scientists in 2004.

French research needs simplification, coherence and transparency. It is necessary to rebuild the confidence of young people so that they take science degrees. French research needs multi-year contracts between the universities and the research organizations that set out planning for funding, personnel and management. The ANR should act to complement this, as similar organizations do in other countries, by funding multidisciplinary, encouraging partnerships between public and private research, and promoting international cooperation.

**Research funds are mainly given to labs within research organizations such as the CNRS, whereas most countries distribute funds to projects based on scientific excellence. How would you strike the balance between the two approaches? What is the future for the CNRS?**

**M. Bayrou:** The question doesn't reflect the reality. The research funded by the institutions and those treated on a project basis are the same. They are carried out by the same researchers. They are complementary, and quality should be the criterion in every instance, whether the calls for proposals are French or European. The lack of an a priori partitioning makes science policy vibrant and

flexible. At the same time, we need to keep an eye on the proliferation of funding structures. As for the CNRS, its contribution to research is undeniable; its labs play a role throughout most of French research and people are jostling to join it (including the 20% of foreign researchers it has recruited).

**Mme Royal:** The founding principle of our research organizations, such as the CNRS, is to evaluate scientific projects on the basis of excellence and to integrate these projects within whole teams working in synergy in their laboratories. So it is necessary to give research establishments the resources with which to support the best teams, as assessed by rigorous scientific evaluation. A European dimension needs to be built in to that process.

**M. Sarkozy:** I want the university to be at the core of the research system, not stuck on its edge. I don't have any problem with the large research agencies, such as the CNRS, INRA or INSERM, keeping networks of their own laboratories — to manage 'big science' projects, for example, or to carry out the latest research on specific themes. But they should be clearly repositioned as funding councils whose main role is to support the best university research teams. Scientific excellence should be financed massively and as a priority.

**Germany has recently launched a multibillion-euro 'excellence initiative' to boost the international standing of its universities. How would you modernize France's universities? Should they become the backbone of public research, as in most developed countries?**

**Mme Royal:** We must respect our own history and at the same time advance with our partners towards better European integration. One thing is sure: we must lift French universities out of their destitution, and raise the quality of research within the PRES to the highest international level. Regrouping the universities will make their strengths more visible, and improve their position in international rankings.

I favour a rational, optimal use of resources based on evaluation; this means we must provide favourable working conditions for all researchers. If we supported only a small proportion of researchers it would mean that we would be paying the others without benefiting from their potential. That would be absurd.

**M. Sarkozy:** As of the day after the elections, I will be ready to launch a major reform of French universities designed to give them much more autonomy. This will include powers to recruit, to fix salaries, to decide how they organize themselves, to build endowments and to diversify their funding sources. I will also rebuild the way that they are governed, restructuring their executive boards and the ways they choose their presidents.

These indispensable reforms will come with costs, if only because we need to redress a backlog in investment that has built up over the years. So the higher-education budget will be increased by half. An unprecedented effort will also be made to improve the living and working conditions of students and lecturers.

**M. Bayrou:** The role of the university must be strongly reasserted. After a massive increase in student numbers over the past two decades, enrolment has now stabilized, and this makes it possible to envisage a new phase of long-term development. The universities suffer three ills: the absence of recognition of the PhD, lack of funding and a poorly adapted governance structure.

We need to reach spending-per-student levels equal to or more than the average of OECD countries, continue the rapprochement with the *Grandes Ecoles* that has now begun, and make changes in the ways the universities are run. Initiatives such as the merger of Strasbourg's universities, scheduled for 2009, are to be commended and encouraged. Such moves can only boost France's international visibility and improve its research.

**Private-sector research spending has stagnated since 1990, despite a plethora of state interventions such as tax credits, innovation hubs and regional networks. State planning produced France's powerful aerospace, nuclear and transport industries, but is 'innovation by decree' possible for fast-moving sectors such as biotechnology and information technology?**

**M. Sarkozy:** The competitiveness clusters that I established in my different positions in government are still very young. But an initial appraisal is rather encouraging. I would emphasize that they represent a relatively innovative approach, at least by French standards. These clusters are not decided on from on high, but are defined on the basis of sectoral and territorial strategies defined by players on the ground. The state has lent a fundamental impetus, and financial support; that is all. As you say in Great Britain it is a bottom-up, and not top-down, approach.

It is, above all, the quality of research and the dynamism of the ways in which it is disseminated that determine our potential for innovation — not just financial incentives. The creation of powerful and autonomous research-university campuses will contribute to these factors. But let's be pragmatic; everywhere in the world, from emerging economies to developed and ostensibly free-market countries, the state intervenes to encourage innovation, and to build and reinforce the industrial and technological sectors of the future.

**Mme Royal:** The frame of reference in which this happens has been subject to ceaseless

change. We must bring that to an end and simplify things. The effect of measures such as tax credits for research must be better evaluated, and access to capital markets for second- and third-round financing must be improved by recourse to part of the defiscalized savings capital (life-insurance funds). Today, most economic aid benefits large companies; it would be better to help the SMEs.

Innovation has stagnated because fundamental research has not been supported. The proactive policies of the 1960s led to the development of the space, aeronautics and nuclear-power industries. The 'breakdown' in biotechnology — despite the fact that French labs were at the forefront of sequencing the human genome in the early 1990s — stems from a glaring lack of support for the life sciences a decade ago. Conservative politicians have a short-term view; to prepare for the future one needs to plan long term. That can develop only if enterprises employ PhDs, who are best placed to seize innovation opportunities by following trends in research. I will help companies that recruit PhDs.

**M. Bayrou:** I want to support all parts of the 'French innovation ecosystem' as it holds the seeds of many of tomorrow's industries. Certain technologies (including biotechnology, telecommunications, electronics, nanotechnology and software) marshal a wide range of the players in this ecosystem (such as researchers, technology-transfer agencies, entrepreneurs, private and institutional investors, and specialist consultancies). I propose supporting and adding value to the ecosystem as a whole.

Research is not in itself innovation, but it can and should contribute to it. There are several ways of promoting this. Researchers contribute to our growth and our competitiveness by taking interest in their work's potential for wealth creation. To attract talent, I propose that for researchers living in France, royalties from patents should be exempt from income tax. I want to reinforce technology-transfer departments in our research institutes — a few hundred million euros could have a substantial impact — to help the birth and development of innovative enterprises.

To liberate industry, we must treat entrepreneurs who dare to take risks with a 'principle of confidence'. I will establish major legislation for innovative SMEs (such as a small-business act, extending the existing 'innovative young company' status and establishing a 'young listed company' status). Finally, I would increase investment in a substantial but simplified fashion, in particular by facilitating investment by individuals, and by promoting venture capital.

**What are your ambitions for building the European Research Area, and how should this affect national research and innovation choices?**

**Mme Royal:** Making research a budget priority will recognize its driving role in the construction of Europe. We therefore affirm France's commitment to the construction of the European Research and Innovation Area.

By devoting only 1.85% of GDP to research, the European effort is half that of the United States or Japan. We will act to ensure that the revised EU budget of 2008–09 gives a new priority to research, by arguing for a readjustment in favour of spending that benefits the future. I will also ask that public spending on research and development be excluded from the criteria of the stability and growth pact [which limits government deficits in countries within the eurozone].

Europe must also support the fundamental research on which the cutting-edge technologies our economy needs will be based. The structures of research and development in France should be developed with our European partners — for example, by applying the EU's European Charter for Researchers and by supporting the European research-funding agency, the European Research Council.

I want to encourage European science from the bottom up by reinforcing cooperation, by constructing networks of labs and institutions, and by developing cross-border collaborations.

**M. Bayrou:** This should be the first question, given that Europe is the appropriate arena in which to address many scientific questions. I propose, if elected President of the Republic, an initiative to make research a 'shared competence' between the EU and the member states. It is obvious that the European research budgets are not fit for their purpose. In the European parliament my party supported a doubling of the budget for the next (7th) Framework programme, as proposed by the European Commission, but alas the Council of Ministers of the European governments vetoed the doubling.

The problem obviously stems from the refusal of the majority of European governments (including France) to increase the overall budget of the EU — which is barely greater than 1% of its GDP. Without an increase, it is impossible to meet our international obligations, to support the new members of the EU, to maintain existing policies and to give research the impetus it deserves. If we do it, Europe will become the welcoming scientific environment we want — the sort of promised land CERN already is.

**M. Sarkozy:** The European Research Area and the Lisbon objectives are fundamental contexts for the EU. But research budgets allocated by the EU itself amount to barely 5% of total European research spending. And the excessively bureaucratic management of these resources sometimes discourages even the most willing would-be participants.

But the European Research Area is essential

for two reasons: for large projects that need a critical mass that no single country could muster, and for evaluating excellence at the continental level rather than within the narrow confines of each country.

I therefore want the creation of a European Agency of Research and Innovation that would allocate funding for fundamental research on the basis of excellence, without the bloated bureaucracy of the current programmes, and that would also finance the major innovative industrial projects — twenty-first-century equivalents of Airbus and Ariane. In both cases, such an agency must exercise free choice, and not be saddled with the obsessional search for national ‘juste retour’ payback that plagues EADS and the Galileo programme.

**Britain looks set to target 60% cuts in greenhouse-gas emissions by 2050. What cuts would you commit France to and how would you attain them? What international treaty obligations should be agreed post-Kyoto?**

**M. Bayrou:** France signed Kyoto, and emission quotas from industry on French territory have been stabilized. I will fulfil the European commitment to a target of generating 20% of our energy from renewable sources.

But we need to do even more, through saving energy and new technologies — for example, the construction sector already has the know-how to erect zero-emission buildings. That will create local jobs. Finally we need more research to improve our understanding of the climate, and to develop a vigorous programme of technologies that can deal with the greenhouse effect.

**M. Sarkozy:** I am proud to be able to say that France made a visionary choice in committing itself several decades ago to developing its nuclear-power programme. Today this gives France greater security in energy supplies, and allows it to reduce its greenhouse-gas emissions. Just think, the carbon emissions saved by France using nuclear-power stations rather than fossil fuels are equivalent to those of all Europe’s cars.

As a way of combating the greenhouse effect, nuclear power undoubtedly remains the energy of the future. Of course, we have also made scientific and technological priorities of research on renewable energy and more energy-efficient means of production and transport. As for international treaties, the pragmatic approach is to make sure countries stick to the commitments made under existing treaties, in particular the Kyoto Protocol.

As a market of 500 million people, Europe should make greater efforts to encourage its large commercial partners — in particular the United States, China and Canada — to play according to the planet’s own rules. Countries that behave like stowaways hitching a free ride, making no effort to reduce their emissions,

should not continue to benefit from the competitive industrial advantage this gives them. To compensate for this we must tax products from countries that make no effort to reduce emissions after 2012, even if this means modifying World Trade Organization rules.

**Mme Royal:** I am committed to a 75% reduction in our greenhouse-gas emissions by 2050. I’m setting out an ambitious policy because I’m convinced that climate change is the major challenge of the twenty-first century. So I advocate saving energy in the building and transport sectors, developing renewable energy (solar, wind, biomass and geothermal) and promoting research into carbon capture and storage, electricity storage, hydrogen, intelligent electricity grids and new fuels created through hydrolysis of biomass.

I think that it is important that those countries that produce the most carbon dioxide (the United States, Australia, Canada) come back to the negotiating table to prepare for the post-Kyoto regime, and that they commit to the path of restraint in the use of energy that is necessary for the development of emerging economies such as India and China.

**Would you maintain nuclear power’s current 75% share of French electricity generation? What are your plans for the EPR and next-generation reactors, and how will you tackle France’s accumulating nuclear waste?**

**M. Sarkozy:** The nuclear sector is of absolute strategic importance, as well as of industrial and technological excellence. France is one of the rare countries to have mastered the nuclear-fuel cycle in its entirety. France will continue to nurture its comparative advantage here by modernizing its nuclear fleet and know-how. That’s why we have committed to a series of third-generation reactors, the EPR, and a research programme into fourth-generation reactors. This will let us generate more nuclear energy while optimizing security and waste production.

**M. Bayrou:** Pursuit of the nuclear programme is not incompatible with the development of renewable energy; the overall need for energy is growing. Nuclear doesn’t contribute to the greenhouse effect, and that’s a good reason not to reduce it. The EPR project will therefore be maintained, and research carried out on a new generation of power plants. Nuclear power is one of our indispensable energy tools and one of our assets in the fight against the greenhouse effect.

But we need a scientific assessment of the EPR. The renewal of our existing fleet of reactors hinges on this project, and a decision this important for our energy policy cannot be taken on the sly. There must be as wide and democratic a debate as possible.

I will back the ITER project in Cadarache.

As it’s a matter of heavy investment with a global vocation, the European share of funding should increase.

Treatment of nuclear waste is a priority. A demonstration project should be launched rapidly to prove that after temporary storage, the volume and radioactivity of waste can be reduced to low levels. This is necessary to reassure the many men and women in France, and worldwide, who have doubts about this form of energy because of the risks still associated with it.

**Mme Royal:** I have put environmental excellence at the heart of my programme. I pledge to increase the part renewables play in the energy budget by 20% by 2020. That effort, combined with an ambitious programme of energy saving, will allow us to reduce our dependence on fossil fuels. These policies must also allow us to reduce the proportion of our electricity generated by nuclear plants.

France’s law on nuclear waste is designed to keep all possible options open — deep storage, reversible storage, vitrification, immobilization and transmutation. I will pay particular attention to guaranteeing that the storage of nuclear waste is reversible. Parliament will decide in ten years time which options should be retained for long-term management of nuclear waste.

I think that the current government took the decision to go ahead with the EPR without adequate analysis or debate. No impact assessment was presented to parliament, and no effort was made to create real diversification in our energy mix. We cannot set our country’s energy future in stone without an in-depth debate, not just on the EPR but on the entire issue.

I pledge to shape this debate by encouraging citizens and economic stakeholders to concentrate on three different goals that have to be reconciled: reducing energy consumption (because the least polluting energy is the energy we don’t use), proactive development of renewable energy (which would include decentralizing energy generation to the point of use) and examining the future of nuclear energy. At the same time, we will pursue research on next-generation nuclear reactors.

**Should France continue to have an independent nuclear deterrent and the research apparatus that goes along with such a commitment? Could you foresee a day in which Europe has a common deterrent?**

**M. Bayrou:** This is, above all, a question about European politics and Europe’s role in the world. From the French point of view, and in order to escape from Europe’s current constitutional crisis, we first need to work out a new simplified treaty on the European constitution, understandable to everyone, and then put it to a referendum — because only the people can undo what they have done. I support the commitment made recently in Berlin to find

a solution before June 2009. In this case, the diplomacy and defence of Europe, and consequently the policy of deterrence, will have a place there, as well as the R&D that is necessarily associated with it.

But in the long term, Europe must also offer the world the model of peace that it has itself managed to build over 50 years. Disarmament should become one of the world's underlying principles, so that the multipolar and multi-cultural world where our descendants will live is not a world of war at risk of worldwide conflagration.

**Mme Royal:** We will maintain our policy of nuclear deterrence. We will act with vigilance and firmness at the international level to prevent the proliferation of weapons of mass destruction. I should also note that I am very much in favour of the construction of a European defence policy.

**M. Sarkozy:** France must be vigilant in maintaining the independence of its national nuclear deterrent. It is the life-assurance policy of our nation, the ultimate guarantee against threats to our vital interests. In a world in which ballistic missiles are proliferating and weapons of mass destruction spreading, it is more important than ever. If I am elected, I will be careful to preserve the operational, technological, scientific and political credibility of our nuclear forces.

Our vital interests are not restricted to our own borders; and our deterrent capacity could benefit other European countries. For my part, I'm completely ready to consider opening discussions on this point with our neighbours and partners, for example, with a view to reinforcing Europe's space-based early-warning systems. Why couldn't the French and British also come together in the future to develop common industrial and technological programmes to modernize our nuclear weapons?

**What are your priorities for space, and in particular for the balance between science, applications and manned flights to the International Space Station and the Moon?**

**Mme Royal:** France is a major space power, having developed, with its European partners, the high-quality Ariane launchers. I think that the high costs of manned space flight mean that such ventures should be carried out in international programmes. The launch of Earth-observation satellites is, of course, a priority.

**M. Sarkozy:** Space is a strategic sector for Europe. It's central to scientific exploration, to defence and security, to economic development, to ecological surveillance and to monitoring commitments made by the international community, all of which are essential for our continent. Europe must do everything it can to maintain independent access to space,

and this includes preserving its ability to build and operate launch vehicles. It must increase its efforts to acquire greater expertise in space-based communication, observation and positioning technologies. The Galileo project has become bogged down in national quarrels that are petty compared with the stakes on the table, and breaking the current deadlock is a matter of urgency.

But not everything is going badly in Europe: far from it. We can be proud of the work accomplished by the European Space Agency in science and exploration. More broadly, I'm keen on greater European cooperation in space. France should be ready to make the extra effort to lead the way, if needs be, as it has done in the past. The main goal must be to maintain and reinforce our basic civil, military and scientific skills. If, after that, we can together develop more ambitious manned flight and planetary-exploration missions, then why not?

**M. Bayrou:** We must assure, within a European framework, our technological independence in launch vehicles, and in particular prepare for a successor to Ariane. The emphasis should also be on fundamental research and exploration of the Universe, a field in which France and Europe are proficient, and then on GMES and on the Galileo navigation system. For Europe to carry sufficient weight, should it aim for the Moon or even farther, perhaps going it alone? Should it support the International Space Station? This all demands reflection.

**France has long defended the common agricultural policy (CAP), yet this is a major obstacle to the economic growth of developing nations. How would you reconcile the need for international solidarity with the interests of France's agriculture?**

**M. Sarkozy:** The EU has agreed to discuss the future of the CAP again in 2013. Although I take the position that the current balance should not be changed before then, that mustn't stop us from starting to think about the future of the CAP. But let me state clearly that under no circumstances should Europe renounce its status as an agricultural power. This is in its own interest and that of other countries.

The coming global demographic explosion and the reduction of arable land in many regions arising from changes in climate that we can already foresee will frame the question of humanity's food supply in new terms that confer an even greater responsibility for food availability on temperate zones. How could we be sure that the price of agricultural goods would fall if we dismantle European agriculture and become dependent on powers such as the United States, Brazil or Australia for our food?

**Mme Royal:** France is a major agricultural

nation. And it certainly intends to defend the interests of its farmers. But I would like our agriculture to evolve into something that better respects the environment, and to promote agriculture in countries in the south. We can find a win-win compromise here.

**M. Bayrou:** I favour a reforging of the CAP in order to move towards sustainable production, to encourage the diversification of agriculture and to assure quality. But the arrival of new member states, where agriculture needs modernization, will necessarily impose burdens on the common agricultural budget.

One must evolve, taking into account farmers in the developing world whose yields are not supported like ours; co-development is the only method that can abate the emigration caused by poverty and can establish solidarity with the poorest countries. And we need to develop a strong agrofood industry, aimed at exports, that will create jobs.

**What will be your policy on genetically modified crops in France, Europe and at the World Trade Organization level? Would you change existing laws on embryo and embryonic stem-cell research?**

**Mme Royal:** I am in favour of a moratorium on open-field cultivation of GMOs and of having a public debate on this question, which is of interest to all citizens.

On embryonic stem cells, the compromise in the 2006 authorizing dispensations for research in this area contradicts the 2004 bioethics law. Research on human stem cells should be permitted provided that they are obtained after informed consent, they come from embryos that are no longer part of any fertility treatments and the proposed protocol has been rigorously examined. We must revise the legal framework to reconcile ethical principles and scientific progress.

**M. Bayrou:** What has happened with GMOs is symptomatic of the lack of democratic consultation on major topics in France. Such a debate would have helped to bring out the citizens' expectations, and to provide directions for research, so as to allow the downstream use of the technology in a way that was regulated and acceptable. We must therefore organize this now, with input from independent scientists. In the meantime, I am in favour of an immediate moratorium on GMOs. There should not be cultivation in open fields before we have sufficient perspective on their effects on the environment and human health.

Stem cells, plants that make therapeutic molecules, and other new questions thrown up by advances in research should be treated in the same way; if the legislative plan is adequate, ethics committees can play a complementary role, with an eye to authorizing things and following up on research that carries risks.

**M. Sarkozy:** I want research to continue on GMOs as, among other things, that is the only way to improve our knowledge of the potential risks to human health and biodiversity. Unless we can be highly certain that they are harmless, I am less enthusiastic about their industrialization and marketing.

As for research on embryonic stem cells, I'd first of all like to remind you that in 1994 France was the first country to equip itself with a body of bioethics laws. These were, from the outset, considered evolutionary and revisable; the next revision has been scheduled for 2009. It will therefore be up to the legislature to consider at that point possible modifications in line with progress in science and medicine. With the creation of the Agency of Biomedicine in 2005, researchers can now submit research projects for review. I'm delighted that projects that have been favourably reviewed can thus develop in our country within a clear and evolving framework. I think it's indispensable that research also continues to develop in this area.

Whether it is GMOs or stem cells we must

avoid both obscurantism and scientism, and have a transparent debate.

**If there is a question we didn't ask that you feel is important and close to your heart, please feel free to ask, and answer it, here.**

**M. Bayrou:** An emerging aspect of scientific policy that must not be left in the shadows: society's acceptance of science. Public opinion, better educated and informed, is more ready to question the beneficial or adverse effects research can have.

So patients, for example, know much about their illness thanks to the Internet, and can carry on informed conversations with their doctors. In a technologically developed society such conversations will become more frequent, and will touch all of science. So I want us to pay attention; the public must be well-informed by the media of scientific and technological progress. Then completely democratic debates will benefit the whole of our society.

**M. Sarkozy:** I want there to be French universities to rank alongside Cambridge and Oxford in the international top ten, and for French talent — starting with scientists — that has emigrated to Great Britain to decide that at last we have given it the reasons it needs to cross the Channel in the opposite direction.

**Mme Royal:** You forgot the essential role of democratic debate in a modern country. Science cannot develop outside of, or in opposition to, society. It is essential to develop a scientific culture and for society to debate scientific issues. All citizens should be associated with advances in science. This means that the overarching direction of research should be determined on the basis of parliamentary debate, the recommendations of the High Council for Science and Technology, and also of citizen conferences. I will do everything in my power to make sure that after my election we see a new generation of researchers enriching our lives with their talent and enthusiasm. ■