FOOD SECURITY, SAFE FOOD:
Biotechnology and sustainable development in anthropological perspective

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Mijnheer de Rector Magnificus, dames, heren,

In deze voordracht zal ik betogen dat de voortgang van de bio-wetenschap, ondanks de recente protesten, niet is te stoppen. Biotechnologie is en blijft. Waar echter meer duidelijkheid over moet komen, zijn de oorzaken en achtergronden van de protesten. En we zullen een onderscheid moet maken tussen de behoeften en belangen van rijke en arme landen. Aan de protesten tegen biotechnologie in westerse landen kunnen diepere gevoelens van sociaal en politiek onbehagen ten grondslag liggen, vermomd als angsten over voedselveiligheid. Bij het zoeken naar een uitweg in de conflicten zullen deze sociale en politieke achtergronden, naast de vraag naar de risico's van biotechnologie, in beschouwing genomen moeten worden. Voedselzekerheid is een groot probleem in ontwikkelingslanden en technologie is onmisbaar in het vinden van een oplossing. Het is onjuist om hierbij technologie en democratie te zien als tegenpolen in het vinden van oplossingen voor honger en onrecht. Lokale betrokkenheid bij het ontwikkelen van agro-technologie is een manier om voedselzekerheid en naleving van mensenrechten onder één noemer te brengen. Hieraan levert de leerstoelgroep Technologie en Agrarische Ontwikkeling (TAO) een bijdrage door onderzoek te doen naar de functies (taakomschrijving) en de sociale organisatie (groepsvorming) van technologie binnen de agro-industriële keten. De aandacht voor de organisatie van taken en groepen stelt ons in staat op een vernieuwende en inzichtelijke manier het verband te leggen tussen technologie en sociale context, met als toepassing het creëren van een gezonde organisatorische basis voor nieuwe mogelijkheden in ontwikkeling en gebruik van biotechnologie. Dit is onlangs toegepast in

onderzoek naar rijst, gericht op de voedselzekerheid van groepen mensen in de armste landen ter wereld en met gebruik van biotechnologie. Een uitbreiding van dit soort onderzoek is uitermate belangrijk. Wageningen UR heeft de mogelijkheid hierin een voortrekkersrol te spelen en daarmee een krachtig geheel te smeden van de toegepaste sociale en agro-biologische wetenschap.

Biotechnology will not go away

Let me place my cards on the table: I believe knowledge gains in the life sciences are real and will not be abandoned, un-learnt or forgotten. I agree with the assessment that the new century is a Biotechnology Century (Rifkin 1999). A key question is "how will global society, politics and economy make use of this knowledge?" In this talk I intend to focus on food. Consumer reactions to genetically modified food (GM) have grabbed headlines, especially in Europe. Suspicion of authority can be a fine thing - a basic element in democracy. But popular enthusiasms are driven as much by feelings and fears as by scepticism. So what are we facing - a well-merited challenge to careless technologist and cunning business executive, or the outpouring of groundless fears that in an earlier age might have ended with the burning of a witch?

To state the problem in stark terms: Western suspicion of the life sciences applied to food threatens to put a brake on global biotechnology developments, but to the detriment of the interests of a majority of the world's population. How could such a situation arise?

Food purity is a perfect dinner-table topic of conversation. Hosts and hostesses outdo each other to provide guests

with ever more natural, organic and healthful food and drink. But in an advanced industrial consumer society few people have much idea about how food is produced, or the complex food chains required to deliver that food safely to table. What, in any case, is "natural" about an organic strawberry that has flown half way round the world at 10,000 metres in an altogether un-seasonal state of freshness?

Food is also a great topic among the poor. But here the conversation takes a different turn. Only mad or desperate people take risks with obviously rotten or dangerous food - but the refinements of food safety take second place to issues of food security. Is there enough to feed the family today? With what can meagre stocks be eked out? Who gets the small portion? Will there be enough in the granary at the end of the season? Can we afford guests? Food is also the raw language of the politics of survival. In African countries politicians win elections, or fend off riots, on their ability to distribute sacks of grain. Clearly, then, food debates will vary as we move across the globe.

Some work has attempted to discover what farmers in the South think about genetically-modified crops. But so far, southern consumers remain largely unheard in the debate about the application of life sciences to food issues. One of the obligations of the chair group Technology & Agrarian Development - a reason for its existence in an internationally-oriented life sciences university focusing on food and environment - is to amplify the conversation. Poor consumers are a key group far too little heard when it comes to assessing the merits and demerits of major technological interventions such as the Green Revolution (Lipton with Longhurst 1989, Richards & Ruivenkamp 1996).

But it would not be enough simply to switch from the dinner tables of the rich to the cooking pots of the poor. More thorough debate is needed about all aspects of life sciences and food security, adequately reflecting producers, consumers, rich and poor, the different genders and age groups, scientist, politician, merchant and citizen, alike. We hear much about economic "globalization", and some commentators even look forward to a politics based on global citizenship. Food issues - food safety, food security, food aid - are among the basic media through which a global consciousness is taking shape. Food - its production, supply and consumption - is an issue articulating not only concerns for economy and technology but also for environmentalism, taste and social justice. De Waal (1997) suggests (in relation to famine in Africa) that a government incapable of protecting its citizens from famine has forfeited the right to call itself a government. If we cannot organise a thoroughly inclusive global debate about food safety and food security then we have probably failed the first political test of a new just and sustainable world order.

The TAO research programme

An inclusive global debate on food safety and food security requires comprehensive preparation. The playing field is not level. Even so, we need to identify the main issues. Let me do this by posing some questions:

- Are radical biotechnologies necessary to overcome potential massive hunger in poor countries, or is there still untapped potential in older more conventional techniques?
- How should we understand Western consumer concerns over biotechnologies - as well-merited suspicion of "big

science" and "big business" or as moral panic? And will indulging such concerns damage the interests of the poor?

- What does the increasing privatization of life sciences research and genetic resources imply, for rich and for poor countries, and for the 2 billion people only partly incorporated in the market sector (or not at all)? And how does the life sciences sector of the business world actually work?
- What is the potential scope of crop biotechnology, and how can the full range of that potential be tapped, as distinct from cherry-picking the immediately attractive commercial options?
- What food safety and environmental risks do we run through too precipitate (or too delayed) an introduction of new biological technologies? (Have we jumped clear of evolution, as a newspaper headline on biotechnology once claimed, or will nature have the last laugh?)
- Are the world's supplies of genetic resources adequate to the demands we are likely to put on them in our new century, and are they well conserved?
- Will the bioinformatic revolution lead us to new heights, or might we drown in a deluge of randomly acquired genetic resources and meaningless genomic sequences? And how are we to regard gene pools, in any case - as strictly biological phenomena, and shrinking fast, or as shaped for millennia by social action and correspondingly more present and robust than we sometimes realise?
- What eventually will be the settlement between a gene-poor North and a gene-rich South, as life sciences companies advance property claims over more and more of the genomic landscape?

- And last - but to me as important as any of the above - how can the poorest and most disadvantaged young women farmers from HIV/AIDS afflicted households (Rugalema 1999) or socially-ostracised under-age ex-combatants from African civil wars (Peters and Richards 1998) seeking land no one else can use gain access to new biologically-smart technologies that might just, through their robustness and flexibility, make their lives manageable again?

The list is long enough, and hardly includes any questions on European consumer reactions to genetically modified foods, or the campaigning activities of environmental groups. One reason to leave such questions to one side, for the moment, is that they may not be questions about technology at all. If concerns with the safety of genetically modified food reflect social concerns - dissatisfaction with the arrogance of remote government or big business, or worries about the fate of the family - then hundreds of generations of experimental rats will consume thousands of tonnes of trans-genic potatoes in vain; the fear will still remain.

I say more about this issue below, but for the moment I want to focus on biotechnology - how it works, whose interests it serves, and how it might be re-shaped to meet new and wider social interests, especially in the South. These are central questions in our chair group. The job of contributing to the international debate about new agricultural technologies, and how they might best be developed in the broadest societal interest, means first of all taking biotechnology seriously - seeking to discover how it is shaped in the laboratory, in the field, in food chains, in

firms, in marketing, in consumption. It means also looking at impacts, and the wider nexus within which food production and consumption take place. In trying to bring this wider setting into focus we have to consider technological contexts, such as the developing field of bioinformatics, institutional dynamics (the changing character of public and private sector research), and socioeconomic and socio-cultural issues (debates about genetic resources as property and user perspectives in technological development).

This is a very broad agenda, and perhaps a foolhardy one, especially for the Wageningen Technology & Agrarian Development (TAO) group, resting as it does on a chair with only two legs. Other groups in Wageningen handle some issues in specialist perspective - e.g. the ethics of novel foods, or the economics of innovation and institutions. But still someone needs to attempt to put the entire range of issues into general perspective. If (as they say) the devil is in the detail it may be in the interconnectedness of such a large range of socio-economic, cultural and technological issues that the global debate about food will make best sense. The chair group's principal asset, apart from the enthusiasm of youth, is inter-disciplinary and international capacity, with as many bioengineers as social scientists, and a team of researchers from South as well as North.

Let me say something about the range of our current research. The group's projects fall into five main categories:

- food biotechnologies as business phenomena, especially in the South. Examples include characterizing the

concrete and varied technology strategies of international food companies, and how these are translated into field realities, through contract farming.

- food biotechnologies as task and practice (based on laboratory and field ethnographies).
- Concerns to extend biotechnological knowledge (and other technologies) to meet the needs of new constituencies of users (this is sometimes referred to as reshaping the technology agenda, or as a politics of technology). Examples include work on the seed needs of Dutch organic farmers and the innovation needs of young African farmers affected by war and HIV/AIDS.
- development of new technology practices, e.g. farmer participatory breeding, sustainable pest management, user-oriented post-harvest technologies, GIS and genetic resource conservation, agrarian technology in post-war reconstruction and disaster relief.
- policy-oriented comparative historical and sociological work on the institutional cultures of plant sciences, with focus on seed systems and food security, genetic resources, genomics and bioinformatics.

Frameworks to draw these interests together will be discussed in a moment, after saying something - as is appropriate on these occasions - about the chair holder's background and academic debts.

Some personal background

As a student in London University in 1963 my tutor, David Harris, introduced me to the work of his great Berkeley mentor - Carl Sauer, who had written about crop origins and dispersals. A particular reason to mention

Sauer here is that when the Rockefeller Foundation first contemplated the post-war venture in food security for the South later to become the Green Revolution Sauer was consulted. He advocated first understanding the best practices of small scale farmers, as opposed to the "big science" framework advocated by Norman Borlaug and others, influenced by the war-time problem-solving success of the "military-industrial complex" (Marglin 1996). My own critique of the Green Revolution approach (a book, *Indigenous Agricultural Revolution*, 1985) was thus a tribute to Sauer (via Harris) and to the unsung colonial (and post-colonial) agricultural officers already implementing an alternative swept aside by larger international forces in the 1960s. But more of this below.

As a student my enthusiasms lay with landscape, geomorphology, soils, and vegetation and the sociology of small groups. I went to Nigeria in 1968 to do work on farming systems, took a job in the University of Ibadan during the Biafran war, and stayed seven years, as part of a bracingly argumentative group of geographers led by Michael Barbour and the inspirational Akin Mabogunje. I carried out fieldwork on the western edge of the Niger Delta and in the savanna Ibarapa District. I learnt a lot about regional landscapes and changing cropping systems over 100 years of colonial transformation, and became especially interested in documenting farmer knowledge. In 1974 I returned to London, took a lectureship at London University's School of Oriental & African Studies, and began to write about African farmers.

But I lacked comparative field experience. So I jumped at a chance to move to the anthropology department at

University College, where David Harris had been instrumental in establishing a new joint degree in anthropology and geography. The anthropologists wanted to appoint a tutor. I was offered the job if I agreed to move fully into an anthropological "mode". This gave me an opportunity to return to West Africa as a field anthropologist. Based at Njala, in 1982-3, I undertook fieldwork in a rather isolated rice-farming village, Mogbuama. Starting late on a difficult language I never learnt Mende well enough to ask questions about God, or even relatively abstract matters like kinship. My work necessarily concentrated on the concrete, resulting in two books (*Indigenous Agricultural Revolution*, 1985 and *Coping With Hunger*, 1986). A reviewer accused me of blatant repetition. The truth is the books were written in reverse order to their publication. I found difficulty in getting a detailed farming systems fieldwork study published. Anthropology was not yet interested in environmentalism, and the ecological approach was old-hat. Jane Guyer advised that I prepare a condensed version in a broader framework, and this resulted in *Indigenous Agricultural Revolution*, where I argued (following Sauer) there could be a grass-roots alternative to the Green Revolution based on the best of what farmers actually did.

Joining the West Africa research group of anthropologists at UCL brought me closer to the "ancestral" geographer-anthropologist and pioneer of farming systems studies, Daryll Forde, who founded the department, and whose spirit informed my work (sadly I never met him in person). But I did have the pleasure of associating with another leading light of UCL anthropology, Mary Douglas, whose ideas have also deeply influenced my

work. While documenting debts, it is also appropriate to mention two colleagues outside UCL, Keith Hart and Jane Guyer. Arguing with Keith Hart's ideas on agricultural revolution was an education in itself. Keith came from the position of classical political economy. I espoused an openly populist, farmer-oriented, perspective. We shared knowledge of West Africa but had different views on what was needed to transform the agrarian sector. I agreed with Keith about the need for an accelerated technology-intensive agricultural revolution in Africa, but not about the means (which I think will be provided more by genes than machines). Jane Guyer, meanwhile, has for years kept me instructed on gender and households. Her innovative long-term tracking of the twists and turns of food farming in Nigeria has been an inspiration.

Anthropology, food safety and food security

As you have heard, I come to Wageningen as an anthropologist, albeit one committed to interdisciplinary studies (and interested in linking the social sciences to the biological/environmental sciences). Why do I think anthropology is relevant to the broad international debate about food safety and food security? And what is its relevance to the technological aspects of that debate?

i. Food safety.

Food biotechnologists often ask how I understand the current storm over safety of GM food. One answer is that it may be a passing phase. Much public response is led by environmental campaigning groups. Not all such groups have very secure democratic bases. Aynsley Kellow (1999) has even characterised some as media-oriented image

producing multinationals. Mass media enthusiasms are fashion-prone - the fashion may quickly change. There is some evidence (from plant biotechnology consensus conferences in Britain and Germany) that representative members of the general public quickly develop views broadly convergent with the main scientific consensus on molecular technologies once a full range of options and explanations is debated. Openness and consumer choice are persistently demanded, the business strategies of the life-science multinationals generate suspicion, but there is also ready recognition that alternatives - chemical intensive or organic agriculture - have drawbacks, and that a blanket rejection of biotechnology might well harm the interests of the food-insecure in the South. To arrive at such a position is not to approve the life-sciences strategies (including intellectual property claims) of some multi-nationals, endorse the current emphases in application towards what might rudely be termed the "junk food" end of the food chain, or to deny that caution is essential with a "living" technology that might have possible enduring negative biological consequences. As is well known, the Deutsche Bank changed its advice on the desirability of investing in life sciences companies because of the swelling public concern over GM foods. The headlines in the financial press were "sell, sell, sell", but the small print of the Deutsche Bank assessment advised holding on to such stocks made good sense for those who could wait. Our latter-day British King Knut may hope to hold back the tides, but probably not for long. Genomics is not going to go away.

But it doesn't take a training in anthropology to arrive at this summary assessment. Where anthropology is seriously

useful, it seems to me, is in offering some insight into why there are food scares in the first place. Some (of course) reflect poor regulation and corrupt practices (the public has every right to be alarmed about anti-freeze in wine, dioxin in chicken feed, or BSE-infected meat). But not all food scares are so real. I still ritually bite off and spit out the tips of bananas (my mother so instructed me when I was a child, and when I asked why, she explained the Ministry of Food had advised people to do so during wartime, but she never knew why). I have never eaten a peanut butter and jelly sandwich, not because I am anti-American, but because (again) my mother forbade it, because of a 1940s aflatoxin scare affecting West African groundnuts.

Anthropologists are brought up to understand that many foods are "unclean" not because there is anything wrong with the food but because food avoidance is a way of maintaining important social distinctions (including maternal authority). Avoidances are acquired as part of social training, in which the meal, and how to behave at table, are often central elements. Mende villagers in the Gola Forest of eastern Sierra Leone still fitfully follow an old "clan" food taboo system - if your lineage taboo is Monitor Lizard, say, then folk believe you will get scaly skin by breaking the taboo. Nobody today remembers very clearly why this is so, but it was probably once part of a system of clan exogamy. Being scared of acquiring a scaly skin from eating Monitor Lizard was more a question of who you could and could not marry than anything to do with the animal itself. This is obvious to informants - because they see plenty of people around (from other lineage groups) enjoying the meat and living perfectly healthily.

Mary Douglas has for many years patiently explained that if taboos are about maintaining social group boundaries then the converse also applies - many of our ideas about risk associated with food (and transactions between the environment and our bodies) are, in reality, fears that group solidarities are being threatened (Douglas 1996; Douglas & Wildavsky 1982). Our social worlds are kept in place by our natural categories (an insight derived from Emil Durkheim). None of us can agree what "nature" is - humans are part of nature, where culture regularly posits a society/nature distinction - but why should we agree, if (as is the case) our social circumstances vary. What is clear, however, is that we can surely expect a reaction when technologists start to "tamper" with nature, since such developments are liable to threaten who we think we are.

The English social philosopher Perri 6 (1999) has noted that artificial intelligence and biotechnology are symmetrically reversed cases - in one case the machine assumes "life", in the other "life" becomes a tool. Both modes of boundary-crossing are likely to present challenges to the social categories everywhere. However (and this is a major research challenge for anthropologists) if Douglas is right, we may be able to "match" reactions to artificial intelligence or genetically modified foods with recurrent features of social organization and culture.

Douglas does not downplay bio-safety issues. But one of her main messages for technologists is that engineering yet more safety may not deal with the problem of the public acceptance of risk. One element in risk is in fact fear, and fear is a social fact. Maybe the answer (in terms of genetic engineering) is to try not to trip over such social facts.

Perhaps it was not wise to launch genetically-modified foods largely through "filler" foodstuffs such as soya and maize. Parents have enough moral uneasiness concerning "junk" food as it is. We fear maybe the family is falling apart, since the kids no longer seem to sit down to a meal. The precautionary principle (deployed against genetically modified food - i.e. restrict use until absence of any risk can be proven) may be no more than a plea to be released from some of our social anxieties. Indeed, we live, as Ulrich Beck argues, in a "risk society" (Beck 1994). But in talking to biotechnologists I find that the major lesson has already been taken on board. They now know that new biotechnology strategies will have to focus on products and processes that ameliorate rather than exacerbate social fears - e.g. innovations with clear health or environmental advantages.

ii. Food security

In many ways the debates over food security aspects of new agricultural technologies are much more complex, if perhaps less heated, than the debates over food safety. It is here that anthropology (in my estimation) has most to contribute. I see two somewhat distinct levels of debate. First, there are questions of global policy - the macro issues. And second, there are arguments about how food security actually works (and how it breaks down, and how its functionality can be restored or enhanced) - in short, the micro issues.

Let me say something about the macro-policy questions first. Perhaps 10 per cent of the world lives in absolute poverty, with insufficient command over food or other basic resources, and a third of the world's population is

somehow involved in the so-called "peasant" (or partially self-provisioning farming sector). As the anthropologist Robert Netting (1993) pointed out in a major comparative assess-ment, there have been many premature announcements of the death of the peasantry, but small family farming has proven a stubbornly durable, and viable, mode of livelihood across the globe. A big issue is how to maintain a lively, innovative knowledge base in the "peasant" sector in a world in which life science advances in agriculture are predominantly market-driven. Global policy debate also encompasses major arguments about the maximum world population, when it will be reached, and whether and how such population levels will be environmentally sustainable. A review suggests cautious optimism is not unreasonable. But responsible assessments include technological advance in agriculture in some shape or form (Mitchell et al., 1997). Perhaps it is a built-in bias of the genre, but optimistic world food security projections that exclude the new knowledge gains in the life sciences in some shape or form are so rare as to be non-existent. It is currently the greatest challenge to the anti-GM protest movement to open its alternative global food security projections to the widest scrutiny, to avoid the charge that its protest is a variant on the old argument that the world would be a safer place for the rich if the poor did not exist (Richards & Ruivenkamp 1996).

Those who fear the new technologies are rather prone to assert that food security is more a matter of distribution than production. This brings us down to the micro-level - to join debates about how food security systems actually function, how they can be reinforced, and how they might function better. The important arguments of Amartya Sen

about famine as a product of collapse in entitlements (Sen 1981) free us to think about imaginative emergency entitlement schemes (those of us advising Bob Geldof about the use of the BandAid money once envisaged flying a transport plane over famine districts in Africa scattering dollar bills rather than sacks of food). But we should also recognise that technology, of the right kind, and in the right hands - in the hands of women household providers, for example - can itself be a mode of empowerment, and therefore a form of entitlement.

The anthropologist Alex de Waal (1997), following Sen, has mounted an important critique of food aid to Africa, claiming that promotion of democracy and human rights is a better long-term way of ensuring the long-term self-reliant food security of African populations. There is general agreement among experts in global food security that Africa - beset by war and the HIV/AIDS pandemic - is a special case, and de Waal is almost certainly right to argue that state incompetence is a major element in the problem. But if food-security-reinforcing grass-roots democracy is to gain ground it has to be rooted. Rather than the democracy-defeating politics of food aid it would be a better for local democracy if, through technological adaptation to difficult circumstances, communities were able to produce food themselves. At village level in Africa people see "democratic" freedoms as speaking without deference to the views of the patrons who rescue them from hunger in times of difficulty. Democracy is not only freedom to elect popular leaders but also the "freedom from hunger"without which truth cannot speak to power.

From my field work on Sierra Leonean farming systems (Richards 1986) I conclude that on-farm adaptation (mainly experimenting with locally-circulated land-race materials) is about a third of the "coping" equation (interestingly this is about the same amount to which seed technology has contributed to Chinese food security since the great famine of 1958, according to the thesis of TAO researcher Song Yiching, 1999). Human rights lobbyists aim to bring about local debate in support of democratic freedoms, but it is equally possible to think in terms of engineering features of seed systems supportive of the rights of local actors to speak and act. Single seeds - dense packages of information valuable only to the user - get everywhere, even in war zones (Richards & Ruivenkamp 1997). Women captives - stripped of all their possessions, even their clothes - managed to carry African Rice across the Atlantic, hidden in their hair. Seed technologies well-designed for diffusion in war-zone conditions (a design concept I have labelled "smart relief", Richards 1996) might support the emergence of new civil islands of tranquillity even in the midst of war - a notion rural Mende people in central Sierra Leone acknowledge in the term "sokoihun" ("corners", in the war zone where people have not fled but decided to stay and farm). Smart relief might support the right of corner dwellers to act to reinforce peace, where food aid sometimes spreads only a mad scramble and confusion. There is no choice as between technology and democracy in Africa. The right use of genetic knowledge is one of the pillars of democracy and peace.

"Technography"

This brings me to the heart of my talk - hands-on concern for the details of the new biotechnological knowledge, how it works, and how it can be engineered in various ways to support a range of social outcomes. The TAO group is especially concerned with research on this level. The beginning of wisdom, we believe, is to take biotechnology - or indeed any technology - seriously. No anthropologist plays fast and loose with the central concepts of informants, however strange to an outsider they may seem. Thus much of our effort is invested in an ethnography of biotechnology. How do breeders and molecular engineers think, work and organise? How do multinationals and contract farmers get it together at field level? What do we really know about how farmers select planting materials (and with what consequences for population genetics and conservation of the raw material of biotechnology)? How do research teams and farmers align around common problematics?

This is a little different in emphasis from the social-called "constructivist" paradigm in social studies of science and technology, where a desire to demonstrate the significance of social agency is so strong that concern with the hard intractability of material transformations sometimes seems to fly out of the window. I have more to say about this in a moment, but here it is sufficient to note that our approach is closer to that of the anthropologist Tim Ingold , who has long advocated treating the tool, action and agent as a complex package of embodied performative behaviours (Ingold 1993). What is sometimes missing from this second approach, however, is an explicit focus on the social

organization of the task group, and this is something our research group tries to remedy. If a term is needed then I borrow "technography", coined by our colleague Dominique Hounkonnou (the francophone tradition is perhaps a little less afraid of such neologisms than the Anglo-Saxon). Technography seems to capture the essential task-focused (or "applied") aspect of what it is we seek to understand, namely the "engine room"of biotechnology (not to mention its navigational process).

Bio-science, like farming, is small-group team work. In one of the most interesting recent studies of a high-technology task environment the cognitive anthropologist Hutchins steps on board a US Navy warship to try and understand how on the navigation bridge teams and machines are linked in moving through turbulent and dangerous waters (Hutchins 1995). TAO researchers are somewhat similarly interested in how biotechnology research teams manage cognitively "distributed" tasks when venturing into new terrain. This we view as a vital step in trying to understand how to "navigate" towards new social uses of life sciences knowledge. It is fundamental to our thinking that the "market" environment is by itself not enough to meet the needs of the food-insecure. Studies of the behaviour of firms from an evolutionary perspective suggest that market signals are not enough for the business world either. The market selects rather than makes successes. Something has to happen internally first. This is what makes a focus on the task group, and task-group cultures, such an important aspect of what we seek to do.

Small-group social organizational studies have been somewhat unfashionable in anthropology of late, the revi-

val of interest by Hutchins and others in cognitive anthropology notwithstanding. Where students still groan about kinship studies, task-group studies seem to have been lost without trace from the curriculum. They were central to the introduction to anthropology I received in the early 1960s. Barbara Ward, in particular, was especially open to the task group, being as happy to let us spend as much time with social pyschologists such as Sprott as with anthropologists like Leach.

I was deep in the field in Nigeria when Tom McFeat's brilliant short book *Small Group Cultures* was published in 1972. McFeat explores the literature on experimental and natural small task groups. North American Indian ethnography provides a rich store of examples of the latter. Many Indian trappers lived their political, kinship and household lives in summer camp, and then split off for winter work undertaken in small trapping groups. These groups were working parties, focused on the task in hand, without complication of family or political commitments. Ritual, political and expressive group activities were matters for the summer vacation (somewhat the opposite of the Wageningen pattern). And yet task groups have more than a momentary, casual construction. Members develop skilled routines, and cooperative procedures, and these had to be handed on to team replacements. The group has to be formed and re-formed from year to year (from a larger pool of potential members, all with broadly the skills required to trap). Thus it develops a distinct culture (cf. Douglas 1987), but clearly differentiated from the cultures associated with other essential, but larger-scale or longer-term aspects of life (we all have to come to terms with wider groups in society and so develop political commit-

ments, and we all have to come into life, reproduce, and exit - hopefully in good order - for which reason we form family/household groups).
McFeat implies anthropologists embrace the complexities of kinship at the expense of other kinds of small-scale social groupings. His express aim was for task groups to be taken more seriously. The importance of the issue came into focus - literally - when as a young Canadian soldier on the banks of the Ems seeking to cross from the Netherlands into Germany in 1945 McFeat observed a twirling, out-of-control section of a pontoon-mounted Bailey bridge swing round a bend in the turbulent river, to run aground on the near side, fortunately before attracting enemy fire. The thing had been designed like a parade ground - with four squaddies controlling outboards at the four corners of the raft and a hapless corporal shouting against the breeze in the middle. This was a marine contraption designed by the army, McFeat quickly realised. Parade grounds are places without much to distract from the sergeant's fog-horn voice. The four corner men on the turbulent, windy Ems couldn't hear the corporal even if they had wanted. But also they had too much local information tempting them to react unilaterally, looking beneath their feat at swirling currents, and outwards at fast shifting perspectives of possible landing spots. The Navy, McFeat points out, would have enclosed the engine men, and linked them to a well-positioned navigator via a system of bells or other unambiguous signals, and that way the contraption might have stood a chance of arriving at its intended destination.

Matters were very differently arranged, McFeat tells us, on the Nootka whaling canoe, where the paddlers must

approach the whale, the harpoon man strike, and the helmsman turn away from the animals's thrashing tail, all in one marvellously coordinated movement, without hesitation, ambiguity or any shouted commands. The task culture of the Nootka whalers is developed and handed on in relation to, but distinct from, other social aspects of Nootka life. Family quarrels - or whatever - must be left strictly on shore. The task is all-absorbing, and has its own rules and coordinative and communicative logic. This leads McFeat to explore, via the experimental literature on communication in small groups, and small-group open-ended problem solving, how task cultures arise. He ends by devising his own anthropological experiments in task-group cultural formation, showing how, by having to transmit information to a regular intake of new members about the task in hand, the task group develops its own distinctive traditions and problem orientation. McFeat is able to link back to the literature on ritual, myth and games, to show that these are all areas of "redundancy" involved in helping task-groups to achieve sufficient " "on-going-ness" to allow adaptation to new or changing tasks, even while teams are being reformed or changed.

I missed McFeat's book first time round. By the time I returned from Nigeria, and then took up a job in an anthropology department, task-group studies in anthropology were dominated by Marxist debates about pre-capitalist agrarian relations of production.

Asking questions about how task groups function is still worthwhile. It is an aspect missing from Karin Knorr-Cetina's otherwise highly impressive recent study of the "laboratory cultures" of high-energy physics and molecular

biology (Knorr-Cetina 1999). She discovers that the worlds of "big science" are culturally distinct. High-energy physicists service giant machines and work in large teams. Much of their work is done away from the experiment. Molecular biologists work in small groups, in a kind of kitchen sink environment, more or less (like cooks) constantly fiddling with the materials until something comes out right. This is a valuable insight. Where perhaps the analysis falters is finding any useful analytical role for the notion of "laboratory culture". Culture is defined "as...the aggregate patterns and dynamics that are *on display* in expert practice..."(p. 8, my emphasis). There is plenty of lovingly observed detail of (apparently rather junior) researchers at work, but rather too little sense of agents' social roles, how they have been formed into teams, and how the teams articulate the cultural resources they create (whether through training, rituals, games, or myths) in order to reproduce the group and propagate the task in hand. The stress on "symbols and meaning" at the expense of organizational data reflects the influence of Clifford Geertz, who treats culture as something to soak in rather than use.

So our own work aspires to a more organizational emphasis. Science is above all the work of agents formed into teams. Wageningen has long researched the agency aspect, in laboratory and field (at the "interface", as Norman Long would put it). But in science teamwork is as much a social fact as contestation. Thus we need a sociology of teamwork at all levels of the food production chain, from laboratory to farmers' fields, to understand how task cultures shape (but also potentially squander) technological opportunities. For this the analytically precise approach of

Tom McFeat or Mary Douglas is more useful than luxuriant documentation. In the jargon of cultural studies, this is to prefer "thin" description over "thick".

Aligning life sciences & food-security concerns: task group analysis

My own introduction to task group cultures came the practical way, through field work. Mende rice farmers in Mogbuama, central Sierra Leone, form seasonal working groups around farm sites. A key moment in the farming year is the construction of the farm shelter. Once this is roofed, the women in the task group transfer their cooking and other domestic activities to the farm on a full-time daily basis. The on-farm task group resembles a nuclear family - a man, a woman, two or three older children. Often it is, indeed, a nuclear family in the kinship sense. But at times it is simply a seasonal task group - a team in which the man, woman and children all have their specialised roles - formed for no other purpose than food security. I was surprised the man and woman went separate ways when we reached the edge of the village one evening. Both were recent divorcees, and the children were "fostered" from elsewhere for the purpose of constituting a functional farming group. The form the group takes is to a degree dictated by the nature of the tasks, and the skills required (time consuming bird scaring with mud pellets and a sling almost demands children - even if they neglect their task, the noise they make romping on the tall bird-scaring platform achieves the required purpose by other means).

There is in effect an ecology of task groups, i.e. only so many ways, in relation to crop types, soils, climate, seaso-

nality and so forth, that small task groups can organise effectively. This, in turn, establishes a group envelope within which individuals try to solve problems, including playing with innovations and experimenting with seeds. My book on rice farming in Mogbuama (Richards 1986) followed these farm tasks groups across a farming season, including attempting to understand where it was possible for the group to "push its envelope". The anthropologist of technology Bruno Latour started his career in a similar part of West Africa. There he discovered the mystery of the African village, and departed to study a life sciences laboratory as if it were a mysterious African village (Latour and Woolgar 1986). By contrast, I discovered in the African village goal-directed task groups operating with much the same suck-it-and-see practicality professor Knorr Cetina finds in the molecular biology research laboratory environment. When the task group is split out from larger multi-purpose groups such as the household, kin group or secret association, and when the environmental constraints are correctly figured in, much of the mystery disappears. A clear, practical, "thin" account is possible. This then raises the possibility of what kind of alignment exists between lab-based technology and the "envelope-pushing" activities of food-security task groups on the ground. The demand for a user emphasis in food security research (as increasingly heard in the international crop research centres) is a demand in effect to increase the synergy between the two kinds of task groups.

The ecology of task groups is certainly a central issue. There are reasons to suspect that, entranced by genome mapping and radical gene shifting possibilities, task groups in agricultural biotechnology may be operating too far

from "natural" environments, and that adverse genotype x environment interactions may undermine current approaches. As a colleague in London once told me, with a raised eyebrow, none of his colleagues would be capable of recognising on farm the plants on which his laboratory worked. Biotechnology research may have to be reintroduced to its environment (both social and biological) if it is to resolve food security problems more effectively. There are as yet few studies that seek to relate the organizational efficiency of the biotechnology task group to this wider task environment.

An interesting exception is the thesis of Theo van Hintum, a researcher at the Wageningen Centre for Genetic Resources (van Hintum 1994). Claiming "The structure of the gene-pool, and likewise that of the Barley Core Collection, is...hierarchical and...described by a dendrogram." (Abstract, article II) van Hintum goes on to outline the setting up of an international barley genetic resources management network that reflects the nature of the resource, and the demands likely to be place upon it. We could argue, I suppose, about the evidence for the hierarchical organization of gene pools. In an age of radical gene shifting technology and biodiversity depletion some might see a clear, featureless genetic ocean, where others see a random scatter of disconnected puddles in a drying river bed. Or is gene pool organization merely an artefact of the cladistic methods used by geneticists? What is interesting about van Hintum's approach, however, is that he so clearly appreciates that the social organization of the scientific task group and an unfolding debate about the nature and organization of the material it seeks to manage must proceed hand-in-hand. Conventional sociology of science adopts an outsider perspective. What van Hintum appears

to imply is that science itself must develop a sociology, from within, to ensure task group culture is indeed well aligned with the task.

My work on rice farming systems in Sierra Leone traced the evolution and consequences of what seemed to me a wrong alignment between scientific task group culture and task. The colonial administration considered wet rice cultivation (associated with Asia) more "advanced" than (African) dry rice. When a rice research facility was established in Sierra Leone (in the 1930s) it was mandated to "switch" farmers from dryland to wetland rice. This introduced a category distinction that made more sense to the administrative mind than in farming reality. I documented how persistent attempts (from the 1930s to the 1980s) to get farmers to abandon rice on uplands for rice in swamps were firmly resisted. Local food security lay in being able to manage upland and lowland rice together. Where possible farmers cultivated topographic sequences, spreading out labour inputs and usefully lengthening the harvest period by adjusting activities up and down slope as the season unfolded. I encountered farmer experiments addressed to the opportunities and risks in the key intermediate zone (right on the border between presumed historical epochs) since it was here that the most effective rolling adjustments could be made. In particular, farmers experimented with their germplasm to find plastic material capable of coping with the very variable conditions encountered from year to year in mid-slope cultivation. Some farmers kept alive the tradition of selecting low-yield but early-ripening African Rices (*Oryza glaberrima*) suited to this niche, even though Asian Rice types had become more general elsewhere on their farms. It was one of the technological ways in which the poor could escape debt,

and political clientage. The experimenting farmer who kept clear of patronage politics - often the immigrant made good - was held up as the archetype of the food secure citizen, where better endowed but less single-minded farmers were often laid low by involvement in political intrigue (Richards 1986; 1993).

Peter Matlon, appointed research director of the newly reorganised West African Rice Development Association (WARDA) in 1988, had sufficient confidence in this analysis to organise his research strategy around the upland-lowland continuum, and to re-focus some of the upland breeding strategy on "mid-zone" adapted materials. For the first time in West Africa, rice research was organized in a way that reflected farmer task group orientations. One immediate result was that WARDA began to pay attention to the low-yielding and hitherto scientifically neglected African Rice (*O. glaberrima*) kept in play by farmers because it still had utility in mid-slope environments. Biotechology helped overcome an inter-specific sterility barrier, and WARDA now has several promising inter-specific hybrids for topo-sequence planting. Posing farmer-oriented questions about the upland-lowland continuum, and what happens to the rices in the middle, has led to new scientific knowledge. Dingkuhn & Asch (1999) recently outlined the basis, in terms of crop phenology, for recognising classes of drought avoidance mechanism in different groups of West African rice cultivars. The top and bottom land rices tend to be photoperiodic. The low-yield glaberrima rices tend to be short duration and a-photoperiodic, escaping drought and competing with weeds through vigorous early growth. This is why farmers find them useful in early cultivation in mid-slope locations (on

river terrace plots and water-retentive soils). A higher yielding rice that behaves like existing farmer *O.glaberrima* selections in the intermediate zone is now becoming established as a recognised ideotype among upland breeders in the region (Jusu 1999). Recent claims concerning WARDA inter-specific hybrids suggest that this may be a rice revolution in the making for food-insecure African farmers, and women farmers in particular. If so, then the lesson is that it pays to seek to align research with user problematics, accessible through what has here been termed a "technographic" focus.

Concluding remarks

Rector Magnificus, colleagues, friends, family, I have three concluding remarks. The first is to pay tribute to my colleagues in the chair group. Without them I could do nothing. I would especially like to mention Dr Guido Ruivenkamp, who has selflessly devoted time to establishing our infant "half group" at the expense of his own important work on the sociology of food chains. The second remark is to sum up in a sentence the approach advocated in my address. What I have termed "technography", with its joint focus on understanding technology and task group, could (I believe) be a major tool for the conversion of the new century's knowledge gains in life sciences into socially-productive fields of application not yet tapped by market forces. Third, as a father in an African family, I would like to take this opportunity publicly to acknowledge its support, in Zetten and in Sierra Leone, mentioning in particular Esther Richards-Mokuwa, the real authority on food safety and food security issues in our home. This leads me to say some-

thing about how this domestic background relates to the larger issues of food safety and food security central to this university's mission. My family responsibilities make me especially aware of the current hazards facing young people in Sierra Leone, and in Africa more widely. There have to be better and more secure options than early death as a child combatant or from HIV/AIDS, and I believe the new life sciences and biotechnology have a part to play in inventing sustainable ways of life for some of the world's poorest and most vulnerable young citizens. Locked into cycles of destruction they yearn for new ways of rebuilding shattered lives, and often express frustration at exclusion from a fast-moving world of science and technology (Peters & Richards 1998). If they are to be once again included - if their dream can be reignited - food technology may be the place to start. When women in Sierra Leone are asked how they will make peace they sometimes simply say "we will cook for the rebels". This is a timely reminder from the grass roots to think of "food safety" and "food security" as tools of social and economics rights and justice as well as of practical sustenance. I assure you that in the Technology & Agrarian Development chair group you will find a talented team dedicated to the integration of knowledge through which biotechnology may yet feed democracy and peace. I thank you for your attention.

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