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A recent article in *Nature* [1] asked provocatively*: Is China ready for GM rice?* The title reflects widely shared anxiety over genetic engineering in agriculture. The use of the term "GM" specifically conjures a politically charged object: "GMOs" or "genetically modified organisms." Is *anyone* ready for FrankenFoods? Strawberries with fish genes? Human cloning? The question has an ominous overtone, though both reporter and venue are identified with science. The question derives its energy from the decision of the Chinese Government to go full speed ahead with genetically engineered rice to confront what the state constructs as a gathering Malthusian crisis of hunger. What the article does not tell the reader is that the farmers are way ahead of the government: ready and able. Transgenic rice – officially unauthorized within China – has for several years been showing up in exports from China to Europe, to Japan, to New Zealand – and probably many other places that simply are not checking.

FrankenFoods

To ask if China is "ready" for "GM" rice is then doubly loaded. The necessity of getting ready implies threat; "GM" ties a specific cultivar to global anxiety about transgenic crops. The anxiety is multi-pronged: does the spread of transgenics entail threats of corporate dominance? Environmental risk? Food safety? The anxiety is heightened because these crops are spreading faster globally than perhaps any previous agricultural innovation, both through official channels of firm and state and underground, like films on DVDs or business software on CDs.[2] The transgenic genie is out of the bottle.

Then the question of who must be "ready" becomes especially curious. Farmers are clearly ready. As in many countries, cultivators in China risk prosecution to grow unauthorized

transgenic crops, including Bt rice. They do so because they are impatient with bureaucratic delays and unwilling to pay corporate technology fees. And in fact, though urban consumers of GM politics think otherwise, there is not a lot to get ready for on farm: all the technology is in the seed, typically with a few altered genes, often only one. There is no more preparation than in playing an illegal DVD of a Bollywood film, once you know how to operate a player.

GMO rice

But is the state ready? Here the construction of transgenic rice as a special category designated by "GM" indicates why the issue carries political freight. Being "ready" implies a state of preparation, alertness, and consequences of not being ready, all of which are bad. No one was ready for the financial meltdown of 2008, most especially pensioners and homeowners. Is China ready for democracy? Open internet? But no one has ever asked -- in Europe, or in China, or in India -- if nations were "ready" for transgenic pharmaceuticals – which have been with us, and thoroughly normalized, since successful production of human insulin via transgenic bacteria began in 1978. There are no FrankenPills on posters. Useful to urban consumers and endorsed by the authority of medical science, transgenic pharmaceuticals have not drawn protests. Agriculture is different. The category "GM" as site of risk has become so normalized in political discourse about agriculture that no one ever asks: what is especially risky about any particular cultivar? Is China ready for "GM rice" really means: is the state ready to confront the political and administrative complexities of seed surveillance contrary to farmer interests?

The answer is probably "no."We already know that stealth transgenic rice – and unauthorized Bt cotton as well – are being grown by Chinese farmers without permission of the state. What Jane Qiu's article highlights is why the state or farmers or anyone else should care.

The Government of China, like many governments in nations with large agricultural sectors – e.g. India, Brazil – officially promotes and invests in biotechnology as a means of responding to what are constructed as urgent crises on the land. Rice stands for the larger problematic of increasing food production. Much of the corporate propaganda for transgenic technologies evokes the Malthusian threat, but here the evocation of urgency is from the Chinese state. This is no small issue: regimes incapable of feeding their populations have not fared well historically. Nor have their citizens. Being dependent on the global economy for fuel and food runs counter to imperatives of statecraft itself, across many ideological gradients. The threat conjured in China is quite explicit: inadequate productive capacity projected into the future. Against this threat is posed a promise: technical change in plant breeding. Genetic engineering – the possibility of rearranging DNA in plants to produce traits that are not in the genome of the plant itself, such as insect resistance, virus resistance, enhanced nutrient content, and on the horizon drought and salinity resistance – has long been official policy of the Chinese government. The controversy implied by the *Nature* article rests on two changes in the context of biotechnology: first, rice would be

the first food crop authorized officially in China, and secondly, rice as a plant raises questions of agro-ecology not presented by cotton, China's first transgenic. But the same recombinant DNA technology that the state constructs as promise has been constructed as threat in a very powerful global discourse.[3]

Bt 63 rice

What exactly is the threat that China may or may not be ready for? "GM" is a political label, but it is one that sticks: it has political effects. All plants in agriculture are genetically modified. We no longer live in the world of Gregor Mendel puttering with peas: rather, plant genomes have been for decades radically altered and re-assembled in order to get phenotypic variation that plant breeders and farmers want. Transgenic techniques came later, and may indeed cause less disruption of gene networks than alternative [non "GM"] techniques [Batista et al 2008], but are socially constructed as something one must be ready for. No other kind of plant is subjected to the level of scrutiny of a plant bred by recombinant DNA techniques. Nor do transgenic pharmaceuticals constitute a special object of regulation, surveillance and control. Recombinant DNA techniques are constructed as threats only in agriculture.

The thing China may or may not be "ready" for is the global governance regime that sets transgenic plants apart. "GM" rice constitutes a plant that must be plugged into international norms of bio-safety as laid out in the Cartagena Protocol. The Protocol itself is the product of transnational advocacy networks and EU politics; it was resisted by major transgenic crop exporters such as the United States and Argentina. The protocol reflects the fact that half the globe holds "GMOs" to require special surveillance, monitoring, and governance.[4] To be ready is to have institutions that can promise effective rural governmentality ; in this sense the question is rhetorical: China lacks that kind of state, as do most nations.

A global rift divides the planet into places that see special needs for bio-safety regulation of "GMOs" – except pharmaceuticals – and those that express no more concern with transgenic plants than with agricultural plants in general. The world is divided between an American construction of "GM" plants as "substantially equivalent" to their non-"GM" equivalents – because no difference can be found by scientific measurement – and a European view privileging the "precautionary principle" – that something truly terrible may be lurking in the new gene networks created by DNA splicing. Prince Charles refers to rDNA work on plants – but not pharmaceuticals – as "playing God," entering "realms that belong to God and God alone." Hubris is the culprit; genetic engineering, in this view, involves a "gigantic experiment I think with nature and the whole of humanity which has gone seriously wrong. Why else are we facing all these challenges, climate change and everything?" An empty vessel has been created into which multiple anxieties may be bundled, and its name is GM.

The European discourse of playing God does not play well in Asia; it presupposes the God of Genesis, a creator with a plan, a garden,

absolute control and a stable equilibrium of species. And in general the Apocalyptic vision of European political activism has not penetrated beyond small numbers of urban professionals in Asia, where grounds of objection of transgenics have to do with consumer preference and resistance to corporate globalization. China is the case that confounds the discourse; not MNCs, but Chinese scientists have been the drivers of transgenic research and development. China showed how public sector investments in transgenics could traget specific problems in agriculture without signing away the farm.

China was the leader among non-OECD nations in responding to biotechnology as a potential growth sector. Recombinant DNA techniques first became viable in laboratories in 1973; by 1980, patents on transgenic organisms became possible in the United States, as always the first-mover in creating and strengthening property in novel fields. With potential property to be made, and valuable discoveries in medicine and pharmaceuticals, a *de facto* global race began. In India, which established a Department of Biotechnology early, one heard the refrain "we missed the industrial revolution, we cannot afford to miss out on the information revolution." Much of Asia responded in similar ways, with grand plans for state backing of biotechnology in the mode of developmental statism, but China was the clear leader and only success story. Though much of the political discourse is about MNCs and patents, China represents a now-common alternative dynamic: public funding of transgenic crops by developmental states.[5]

China's early efforts in biotechnology began with strong state backing in the 1970s, focused on both food crops and cotton. Standard techniques of tissue culture and cell fusion were involved to modify plants before the advent of advanced recombinant DNA techniques in the early 1980s. The so-called 863 plan for advancing biotechnology research started in 1986.[6] The Ministry of Agriculture reported in 1996 that more than 190 genes had been transferred to more than 100 organisms, including plants, micro-organisms and animals. Investment levels were high, and addressed an indigenous sense of the most serious agricultural problems. The Bt cotton developed in China enables insect resistance from within the plant. It was a priority not only because of the massive land investment China had in cotton, but also because of the widely recognized externalities of heavy pesticide use: deleterious environmental and health consequences. China's Bt cotton is now growing both legally and illegally in far-flung Asian locations.

Southeast Asian states feared that that China would become hegemonic in this new information-intensive sector, and ramped up plans for autonomous development defensively [Barboza 2003]. But plans in Southeast Asia were cut back after a profound European U-turn on genetic engineering in agriculture. Like commercial firms in the United States, European states initially saw the genomics revolution in biology as a potential source of profit and national development; European firms were early leaders; they were backed, especially in France, by governments. The turn away from biotechnology came as a result of transnational social movements joining hands across the Atlantic in opposing corporate

environmental irresponsibility. By the end of the 1990s, Europe had crossed over, from support for genetic engineering to attempts to protect its economy from American transgenic imports.[7] Whereas American policy moved to the USFDA conclusion of "substantial equivalence" and society followed in train, Europe moved to a "precautionary principle," led by social activists.

But not all opposition targeted all biotechnology: food was the crux of the anti-GM campaign in Europe. "White" biotechnologies, such as biodegradable plastics and other industrial applications, as well as "red" biotechnologies in medicine and pharmaceuticals remained strongly supported in Europe [EB 64.3 2006]. In these applications of rDNA technologies, there are large human utilities, such as avoiding death. Food is different. There being no benefit to consumers in GM-food – with a few caveats about reduction of pesticide residues and externalities – European consumers were free to support campaigns to restrict agricultural biotechnology not only in Europe, but all over the world. The most successful efforts were in Africa, as Robert Paarlberg's new book *Starved for Science* documents. The WTO has ruled that the European standards are contradicted by EU science, but the EU U-turn remains both politically sticky in Europe and consequential internationally. The EU declaration on "GMOs" structurally segregated world markets: GM or GM-free. It became quite clear in the late 1990s where the smart money would go in poor countries hoping to export to Europe.

China's current interest in regulation of transgenic rice derives directly from this global regulatory rift. An early leader in state-led biotechnology development, China slowed its approach after the EU U-turn. Cotton is one thing, food another. Bt cotton from China's public sector not only performed well, and reduced pesticide poisoning of farmers and farm workers, but was smuggled out of China and thrives as stealth seeds in other parts of Asia.[8] Bt cotton is of no concern to powerful players in the international system; national governments such as Vietnam and Pakistan prefer to look the other way in order to avoid a confrontation with both farmers as political agents and their own incapacity to build viable Cartagena-friendly bio-safety regimes. Rice is food, and thus another kettle of fish.

What China is not ready for is another assault on the integrity of its export products; that assault derives from EU regulations as to what food is acceptable and what is not. Spot checks carried out by several EU countries, including Germany, the UK, and France, have, since 2006, found Chinese shipments of rice and rice products to contain evidence of a genetically-engineered rice, specifically Bt 63. Bt63 is not authorized for commercial cultivation either in China or in the EU; its import into the EU is banned. The formal resolution of the China-EU conflict was to require all rice and rice products from China to have a certificate that there is no transgenic Bt 63 content; one predicts a strong market for certificates over time. Japan and New Zealand, which have similar EU-like restrictions, reported similar findings.[9]

The Cartagena Protocol requires that "Living Modified Organisms" be clearly identified in international trade; the criterion for an LMO is essentially the same as the GMO. This is not surprising: EU support of transnational opponents of biotechnology succeeded in crafting soft law stigmatizing transgenics and their downstream products, whether or not any DNA or trans-gene protein survives processing. Surveillance is to be "from farm to fork." Though the reality of food systems would seem to make this level of control a dream only bureaucrats could conjure, the consequences are serious. Failure of the Chinese government to enforce the protocol indicates not only non-compliance with international soft law, but inability of the state to control transgenic

organisms within its own boundaries or in its exports. China is hardly alone in failure to regulate crops -- – seed police are hard to find – but China does face strong international pressure for tighter regulation of safety in exports in general. Bt proteins have not been shown to kill pets or people, but the net effect is to undermine confidence in Chinese exports to nations with strict regulations.

Though this threat to export products is the main objective risk of growing transgenics in China – the Bt itself has not been shown to be unsafe for humans or animals, and many Bt crops are regularly consumed – the *Nature* article is more concerned about environmental effects. Given China's disturbing record on environmental protection, how serious a risk is transgenic rice? In general, Bt crops present a difficult question for environmental policy: if we compare the Bt plants to traditional cultivars, cultivated in traditional ways, the transgenics reduce pesticide use and therefore seem environmentally friendly. Nevertheless, one seldom finds transgenic crops discussed in the frame of biodiversity preservation or sustainability. Rather, the environmental risk assessment of transgenic crops typically poses questions about the potential for gene flow in the environment.

Bt cotton in India

Here the Chinese official caution regarding Bt rice raises the importance of disaggregating transgenic crops. Bt rice raises more and more serious questions of agro-ecology than does Bt cotton, China's most successful biotechnology venture. Gene flow from Bt cotton presents little if any potential risk; like many cultivated crops, cotton is highly specialized, with no evidence of crossing with wild relatives. Without crossing, there is no gene flow. If genes flow, there is a question of fitness: will the wild and weedy relatives of the cultivated plant now gain an advantage in fitness in the environment from addition of the trait from the transgene [eg insect resistance]? Will this fitness advantage be such that they begin to dominate, thus upsetting agro-ecologies in new ways? This is the "super-weed" scenario stressed by opponents of rDNA technology: FrankenPlants. With cotton, the answer to

these questions is almost certainly not; with rice, there is a much greater possibility of agro-ecological risk. Rice is first of all a grass – a more promiscuous kind of plant than cotton – and secondly has wild and weedy relatives in and around cultivated fields.

The bureaucratically sensible resolution would seem to be to test the crops under Chinese conditions. But testing itself comes under attack when the object is "GM." Uncertainties abound: how long a testing period is long enough to determine safety? For proponents of the precautionary principle, the answer is "forever." For the US FDA, the answer is "not much": if composition tests show the same range of variation in transgenic plants as in comparable non-transgenic cultivars [i.e. comparing apples to apples, rather than to oranges], there is no reason for special regulation or labels. The American position risks riding on the side of hubris: we know what we know. The European position imposes nearly impossible[10] standards: how can you prove that something will not happen? Do you check your brakes every time you take your car out to drive? Do you avoid any airplane that could conceivably crash and burn? Do you demand demonstration that your cell phone safe cannot cause cancer?

Of course we all – Europeans and middle-class activists of transnational advocacy networks in poorer countries – dismiss as alarmist "risks" from cell phones. But there has been a recent upsurge in caution concerning cell phones in regard to brain damage from a presumably authoritative source: the Director of the University of Pittsburgh's University Medical Center Cancer Center.[11] Why do we disregard such warnings – and seldom check our car's brakes or inquire into the maintenance record of our next flight's plane? Because the disutility of ascertaining certainty far outweighs a subjective assessment of risk. Moreover, negatives are impossible to prove: how could there be even in principle decisive proof that no critical system on any given 747 will fail? No one can live with the precautionary principle; not only are there innumerable known unknowns, but – and here Donald Rumsfeld for once got something right – the sheer number of unknown unknowns is everywhere daunting. Farmers in China, like those in India, Pakistan, Brazil, Vietnam and much of the world grow Bt transgenics because they make life marginally easier, slightly more profitable, and slightly less destructive of their very local environments. If there are distal and uncertain risks, they pale by comparison to the real risks of pesticide poisoning and crop failure. Farmers make this calculation whether governments approve or not, just as desperate Americans try remedies not yet approved by the Food and Drug Administration.

Do farmers then worry about biodiversity, as the *Nature* article clearly thinks they should? Yes and no: they worry about destruction of helpful predators on the pests of their crops, but they recognize that spraying poisons across the fields kills friends and foes alike, including some farmers and farm workers. Bt plants, in contrast, are targeted to a class of pests, and contained in the plant tissues. Bt plants represent a kind of poetic justice: if a pest leaves the plant alone, it will not be harmed; if it attacks the plant, it will die. The advantage to the farmer is that the pro-toxin stays in plant

tissues, instead of rivers, soils, lungs, birds, toads, ladybugs.

In this one incidence of conflicting pressures on the state in China is contained the global cognitive rift around transgenic organisms, much as the history of imperialism can be drawn from a single cup of tea. The discourse is one of threat and promise, of state responsibilities and international norms. The dichotomous—threat/promise—construction of technical change in agriculture resonates with previous attempts to promote or stop technical change; the "green revolution" of nitrogen-responsive grain varieties still launches many pages of paper. Agriculture is symbolic terrain on which much larger conflicts are joined.

The lessons from China's consideration of Bt rice then illustrate larger points about transnational politics of "GMOs."First, disaggregation is necessary to make sense. China's development and deployment of an indigenous Bt cotton raised no real controversy; rice is a food crop, and the politics around food differ fundamentally from those around purely utilitarian technologies, whether cotton or insulin. Second, rice is not cotton in terms of gene flow: careful science is necessary to sort out risks and benefits to farmers; risks to farmers and agro-ecological systems are much greater in rice than cotton. Third, there is no reason to assume, as is often done instrumentally, that biotechnology entails corporate dominance of either farmers or national governments. China is the giant exception, but not the only one. Finally, nothing in the battle for the formal-legal high ground makes much difference on the real ground. Though the EU battles the US and WTO over whether or not transgenic crops should be allowed, the decision will ultimately be made by farmers.[12] It is the agency of people close to the seeds that will settle the question; in China, that decision leans toward transgenic rice, just as it previously did to transgenic cotton. It is hard to conjure the kind of state that could regulate the seed choices of millions of farmers across dozens of crops; but even if such surveillance and control could be imagined, it is hard not to think that there are better things to do.

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Notes

[1] Jane Qiu, Agriculture: Is China ready for GM rice? Published online 15 October 2008 | Nature 455, 850-852 (2008) | doi:10.1038/455850a

[2] See Herring, 2008 *Nature Reviews*

Genetics in the reference list for data and sources. For aggregate comparative data, see Clive James's annual *Global status of commercialized transgenic crops*; for reference see James 2002.

[3] In the reference section, see Winston 2002 "Travels…" ; Herring 2007 "The Genomics Revolution…" Herring 2008 "Opposition…" Paarlberg 2008 "Starved for Science…"

[4] See Paarlberg 2008; Herring 2008 on the global cognitive rift on transgenics and its reflections in soft law and national regulation.

[5] See Cohen 2005 for the scope of efforts in relatively poor countries. On nutritional, as opposed to production-oriented values and international non-corporate cooperation, see Bouis 2007. On the developmental state logic, Herring 2008c.

[6] For a time-line of biotechnology research and development, see Huang J. and Wang Q 2002: 124, table 1.

[7] For references, see Herring ms "Cognitive Blockages…" or Herring 2008.

[8] See James 2002. I myself came upon an illegal version of the Chinese Bt cotton in Andhra Pradesh in South India; it was subsequently legalized in alliance with Rath Seeds as Fusion Bt through the bio-safety protocols in Delhi.

[9] Japan Finds Unauthorised GM Rice in China Products. Reuters 01/08/2008; Food Safety Authority of Ireland, Control measures regarding the unauthorised genetically modified organism 'Bt 63' in rice and rice products from China. Alert Notification: 2008.01. 30 April 2008; The New Europe Health commissioner takes Chinese rice to task 25 February 2008 Issue 770

[10] See Weighardt 2006 on the complexity of what look to be simple bureaucratic standards for transgenic content.

[11] Here.

[12] For a sustained argument concerning the mechanisms of farmer evasion of both firm and state in global biotechnology dynamics, see Herring 2007b.

References

Barboza, D. 2003, "Development of Biotech Crops is Booming in Asia," New York Times, February 21. p A3.

Batista, Rita, Nelson Saibo, Tiago Lourenc¸ and Maria Margarida Oliveira. 2008 "Microarray analyses reveal that plant mutagenesis may induce more transcriptomic changes than transgene insertion." Proceedings of the National Academy of Science March 4. 2008 vol. 105 no. 9

Bouis, H. 2007. "The Potential of Genetically Modified Food Crops to Improve Human Nutrition in Developing Countries." Journal of Development Studies Vol 43 No 1.

Cohen J. I. 2005. "Poor nations turn to publicly developed GM crops." Nature Biotechnology, 23(1), pp. 27-33.

EB64.3 2006 "Europeans and Biotechnology in 2005: Patterns and Trends," A report to the European Commission's Directorate-General for Research. Final report on Eurobarometer 64.3. EU Commission. Brussels.

Government of India, 2001 Ministry of Science and Technology,

Department of Biotechnology, *Biotechnology: A Vision*. New Delhi.

Herring, RJ 2007a. "The Genomics Revolution and Development Studies: Science, Politics and

Poverty," *Journal of Development Studies* Vol 43 No 1.

Herring, RJ 2007b. Stealth Seeds: Biosafety, Bioproperty, Biopolitics." *Journal of*

Development Studies. Vol 43 No 1.

Herring, RJ 2007c Suicide Seeds? Biotechnology Meets the Developmental State. India in Transition. Center for the Advanced Study of India University of Pennsylvania.

Herring RJ 2008 "Opposition to Transgenic Technologies: Ideology, Interests, and Collective Action Frames," Nature Reviews Genetics London. Nature Publishing Group Vol 9 June 2008.

Herring, RJ ms *Cognitive Blockages, Politics, and Adaptability: Fallout from the Great EU U-Turn,* For the workshop "Politics of Adaptation to Environmental Challenges in South Asia in the 21st Century" Oslo, Norway. November 6-9.

Huang, J. and Hu, R. 2008. Genetically modified rice, yields, and pesticides: Assessing Farm Level productivity effects in china. Economic Development and Cultural Change, 56(2), 247-262.

Huang, J., Pray, C. and Rozell, S. 2002. Enhancing the crops to feed the poor. Nature 418: 678-684.

Huang, J., S. Roselle, C.E. Pray, and Q. Wang 2002. "Plant Biotechnology in China" *Science* 295: pp 674-677.

Haung, J., Ruifa Hu, Cuihui Fan, Carl E. Pray, and Scott Rozelle. "Bt Cotton Benefits, Costs, and Impacts in China," *Agbioforum*, Vol. 5, No. 4 (2002), pp. 153-166.

Huang J. and Wang Q. 2002. Agricultural Biotechnology Development and Policy in China. AgBioForum*, 5(4): 122-135.*

James, C. 2002. Global Review of Commercialized Transgenic Crops: 2001 Feature: Bt Cotton. *ISAAA Briefs* No. 26. ISAAA: Ithaca, NY.

Pray, C.E., J. Huang, R. Hu, and S. Rozelle. 2002. *Five Years of Bt Cotton in China – the*

Benefits Continue. The Plant Journal 31 (4).

Naim, Moises. 2005. Illicit : How Smugglers, Traffickers and Copycats are

Hijacking the Global Economy. New York: Doubleday.

Paarlberg, R. L. 2008. Starved for Science: How Biotechnology is

Being Kept Out of Africa. Cambridge: Harvard University Press.

Pinstrup-Anderson, Per and Ebbe Schioler. 2000. Seeds of Contention: World Hunger and the

Global Controversy over GM Crops. Baltimore: Johns Hopkins University Press.

Weighardt, F. 2006. European GMO labeling thresholds impractical and unscientific *Nature*

Biotechnology **24**, 23 - 25 (2006) doi:10.1038/nbt0106-23b

Winston, M. 2002. *Travels in Genetically Modified Zone*. (Cambridge, MA: Harvard University Press).