

Interview

What is the regulatory science? Concept and history in United States and in Japan

— Interview with Professor Sheila Jasanoff —*

Sheila Jasanoff

Science and Technology Studies at the Harvard Kennedy School

Interview and translation :
Chieko Kurihara ¹⁾ Takeo Saio ²⁾
(August 25, 2010, Tokyo, Japan)

Abstract

Background : The term “regulatory science” was proposed in Japan by Uchiyama in 1987 and analytically reviewed in English literature in 1996. On the other hand, in the United States (US), one of the earliest uses of the term in analytical literature was by Jasanoff in 1990, in her book *The Fifth Branch*.

Objectives : The objective of this interview is to clarify the beginning, history, and meaning of the term “regulatory science” in the US as compared to Japan.

Findings : Through this interview we found the following: (1) In US, Jasanoff first proposed the concept of regulatory science in an analytical way, though there may be some isolated mentions before; (2) to say Weinberg is the founder of this concept is wrong, as he proposed the concept of “trans-science” to refer to the policy-relevant fields for which scientists have no answer, whereas the term “regulatory science” refers to science generated to give answer to political questions; (3) in US, regulatory science is discussed in relation to all policy areas requiring scientific knowledge for their resolution, whereas in Japan it is discussed mainly in the field of pharmaceutical development.; (4) in US, regulatory science is not considered the same as policy science, whereas in Japan policy studies, such as regulation or guideline development, is included in “regulatory science”; (5) science studies scholars in the US see regulatory science itself as including some subjectivity and hence as needing criticism in order to reveal the sources of possible bias, whereas Japanese opinion tends to regard scientific knowledge as generated objectively.

Key words

regulatory science, science and technology studies (STS), policy studies, pharmaceutical science, translational research

1) Molecular Imaging Center, National Institute of Radiological Sciences

2) Fuji Toranomon Health Promotion Center

* Japanese translation of this interview is published in printed version of Clinical Evaluation. 39(1) : 167-80.

1. Background of this interview

Interviewer Thank you so much for your acceptance of our interview request today. To begin, I would like to explain the background story of discussions in Japan concerning regulatory science. In Japanese society, Dr. Mitsuru Uchiyama, who was working the National Institutes of Health Sciences in Japan, is regarded as the first to propose the concept of regulatory science, in 1987¹⁾. After that, Dr. Uchiyama wrote many short articles on regulatory science in Japanese, and then in 1996, he wrote an analytic review article on regulatory science in English in an international journal²⁾. In this article he offered the definition that “regulatory science is the science of optimizing scientific and technological developments according to objectives geared toward human health”.

As for international historical comparisons, some scholars of science studies in Japan wrote that the real originator of the concept of regulatory science is Alvin Weinberg³⁾, however, we found that in this article there is no description about regulatory science⁴⁾. And also we found that your book “The Fifth Branch: Science Advisers as Policymakers⁵⁾.” This book includes an intensive description of regulatory science. Therefore, we wished to have an interview with you on the history of the concept of regulatory science in the Western world. We suppose that you would be the main founder of the concept.

The second point is that the Japanese scholars’ discussion has only focused on the good point of regulatory science, for example, its contribution to safety, to patient health, or to public value. But in your book there are some critical observations.

And another point I would like to discuss with you is the independence between science and policy-making or decision-making. It is very interest-

ing to hear your lecture on Monday⁶⁾ that sometimes scientific knowledge is generated in the process of a lawsuit or in relation to the context of regulation. It may be a mixture of debates in science and law. I would like to know the views of Western science studies on this point.

So first I would like to ask you about the history of this concept of regulatory science.

2. Trans-science vis-à-vis regulatory science – Is Alvin Weinberg the originator or not ?

Jasanoff First of all, I’ve never written the history of regulatory science. I’ve contributed to the discussion of it. I think that it’s completely wrong to say that Weinberg was talking about regulatory science. You have to put Weinberg into a historical context. He was a scientist. He was the director of Oak Ridge National Laboratory at a time when the U.S. government was trying to convert some of the military national laboratories to peacetime functions. And one of the prominent tasks that Oak Ridge National Laboratory took on was to develop methodologies for environmental impact assessment. In 1969, we enacted a law – the National Environmental Policy Act, or NEPA – which mandated that all federal agencies should prepare environmental impact assessments if they were contemplating any action with a significant impact on the environment. The law said these impacts should be assessed; but there were no methods yet in place for performing such assessments. Oak Ridge became quite important as the center where new methods were developed.

So 1972 was in this period of transition when government started demanding a lot of technical analysis for the purpose of carrying out policies. And Weinberg was trying to defend science itself from getting too implicated in areas of uncertainty



Prof. Jasanoff

Government of Austria. She holds AB, JD, and PhD degrees from Harvard, and an honorary doctorate from the University of Twente.

(Profile, Available from: <http://www.hks.harvard.edu/about/faculty-staff-directory/sheila-jasanoff>)

because he was worried that scientists would be pushed to say things that they could not support. In fact, they would be driven too far away from their main areas of competence, the strength of their conclusions, and their knowledge.

So his 1972 article is not about regulatory science. It didn't use that language. It's about "trans-science." As he says, trans-science consists of that area where questions are asked of science but science cannot answer them. Regulatory science is totally different. Regulatory science seeks to give answers to those questions in an effort to advance policymaking. So it's intellectually wrong, I think, to say that the 1972 article was about regulatory science. I think Weinberg was responding to a particular historical moment in which public policy was beginning to make huge demands on science. Just to take one issue, environmental protection, the decade from '69 to '80 was the time that the U.S. government enacted every major environmental law, with each one imposing new demands on science, because each one required standard set-

ting based on scientific knowledge. That knowledge is what we term regulatory science.

Interviewer I understand the context. By the way, during the World War Two, Weinberg was engaged in the Manhattan project to develop the atomic bomb. Is it possible to find some relationship between such historical role of him and his opinion on science after the War?

Jasanoff I think to focus the discussion on Weinberg is really a confusion. You know, Weinberg is historically a very important figure. As you say he was a physicist involved in the Manhattan project. But I think his historical significance to the issues that we're talking about is that he was Director of the a national laboratory whose functions became somewhat transformed. During the war, Oak Ridge was making the nuclear materials for the bomb. But after the war, many of the national labs changed their focus to regulatory science instead, and Oak Ridge in particular became the center for environmental analysis.

Now I'm not a historian, and I'm certainly not a

historian about Dr. Weinberg, so I can't tell you details about him. I think that is a red-herring, as we say in English, to confuse the discussion of regulatory science too much with the person of Alvin Weinberg. You know, he wrote this one article. The reason why it's so famous is partly because it's two pages long; so many people could read it. Partly also it proposed a taxonomy that scientists liked. Scientists liked the idea that policymakers were asking impossible questions because that reduced the responsibility of science and put the responsibility on policymakers.

But if you look at what scientists did, and not what they said, scientists rushed to provide new science for policymaking. And today you see the results on a global scale. The way we look at climate change, that's all driven by policy-relevant science. Scientists are *not* saying that to question what will happen to the earth's atmosphere in a hundred years is a question policymakers can ask but that science cannot answer. They are not saying, "Oh, this is trans-science." Instead, they are very much saying that, based on our data, we are in a position to give you the best answers to these kinds of questions which are very futuristic and very uncertain. So I think that in the 30 or 40

years since this Weinberg article, it will be difficult to find areas that scientists agree are trans-science. I think most of the time today, scientists are quite happy to provide answers to all the questions that policymakers are asking.

3. Origin of the term "Regulatory Science" Significant role of Sheila Jasanoff

Jasanoff Now coming to my own book, the historically important piece is the 1987 article that I wrote in *Social Studies of Science*. You will note that the title of that article was "*Contested Boundaries in Policy-Relevant Science*"⁷⁾. I, myself, had not come across the term regulatory science in 1987. I used "policy-relevant science." But that article was a sort of a trial run that led to what was written in the book. I was already working on the 1990 book, *The Fifth Branch*. And in the book, I actually created the term "regulatory science." Other people may have used it; but it was not being used by STS (Science and Technology Studies) scholars. For me it was an invention to try to find a label that was different from "normal" research science. I think it would be wrong to say that there was a tradition of



Prof. Jasanoff, confirming the literatures on regulatory science

writing about regulatory science before 1990. There was not. And to my knowledge, I was using this term for the first time, and a lot of STS scholars later picked it up from me. As I say, other people may have used it, you know, historically before. But no one had actually put forward an analysis of regulatory science from a sociology of knowledge perspective. That was totally new. It was about how a fact is made and produced in this domain of scientific activity that serves public policy. That was the new topic in science studies, and in policy analysis as well.

Interviewer So when you wrote it for the first time, it was your own idea?

Jasanoff That was my own idea. An important point is that in 1987 when I was writing on the same topic that later became the book, I used the term “policy-relevant science.” It was not until 3 years later that I used the term “regulatory science” to try to get a more economical expression for that idea. What I’m saying is other people may have been using it but no one used it analytically and rigorously to describe a particular area of scientific activity.

4. Regulatory science as discussed in pharmaceuticals and other fields of science

Interviewer So it’s very interesting, Dr. Uchiyama said that he himself generated this concept; that it’s the first time in the world. But we can find in Western literatures that there are some other literatures, including your book, talking about regulatory science.

Another characteristic in Japan is that regulatory science is discussed especially in the area of pharmaceuticals and food, especially pharmaceuticals. Some people say that it’s also discussed in the area of atomic science, radiation safety. How is it

in the U.S.? Is there any specific field where regulatory science is intensively discussed?

Jasanoff I think that in the U.S. the major debates around science and regulation have centered more on the environment. But the “environment” is quite broad so it includes chemicals and also radiation; and in the late 1960s, there were debates about drugs and food, and in the 1970s some of the big debates were about nuclear power plants and their impacts on environment and health. Those impacts concerned not just radiation and health but also, importantly, the effects of the cooling towers, the seeping of heat into the waterways. And so I think that there were clusters of very important discussions in the U.S. There was one particular dominant center of debates around chemical exposures. Americans are worried about the impact of the chemicals and not only the location of the chemicals. So cancer was the main worry. People worried about chemicals in food, chemicals in the workplace, chemicals in the environment, chemicals in water, but with a particular focus on cancer. So throughout the 1970s, there was a lot of discussion on regulatory science about chemicals suspected of causing cancer.

Interviewer Yes, you wrote in your article about some debate on the threshold of the toxicological effects of chemicals.

Jasanoff Yes, the critical thing about chemical-related cancer was that according to theories of cancer causation, cancer was a non-threshold effect. People didn’t yet understand DNA repair and stuff like that, and it was assumed that any mutation has a potential to become uncontrolled, depending on the type of cancer. But there’s a public health principle that’s involved as well: if you don’t know for sure what the threshold is, then you should act as if there is no threshold. So this actually became an area where the U.S. philosophy of regulatory science was quite precautionary, that is,

when in doubt, assume the worst and act accordingly. Interestingly, today the U.S. denies the precautionary principle and says this is a European invention. But in fact if you look at American policy in the late 1960s, there was this period when people were quite influenced by public health considerations and their treatment of uncertainty was very precautionary.

5. Regulators conducting science for regulation

Interviewer It is also very interesting that you created the table to compare players in regulatory science and research science. You describe the players in regulatory science as regulators and industry, and the players in research science as academics.

Jasanoff It's not the regulators who are actually doing the regulatory science. They do this with the help of the academic scientific community. In the U.S. a lot of work in regulatory science is contracted out to academic scientists, and that causes conflict depending on the implications of the research. But that's related to the discussion on independence which is something else you want to talk about.

Interviewer In Japan there's a difference from the U.S. in that the regulator, I'm talking mainly about pharmaceutical development, the Japanese regulator doesn't have the function of itself conducting research. I think that FDA itself conducts some experimental research. In Japan, the Japanese regulator doesn't have such a function. And outside of the ministry, there is a research center such as the National Institutes of Health.

Jasanoff No, I don't think that that's a correct feature of the U.S. The U.S. situation is very complicated because there are many different agencies. The areas differ from one another. But there are

government research centers that are not directly controlled by the regulatory agencies. So, for instance, with occupational safety and health, there's a National Institute of Occupational Safety and Health which does research. It is not under the direct control of the OSHA, which is the regulatory agency, that's the Occupational Safety and Health Administration. EPA does some of its own research but it also funds a lot of research; it follows that it's not the EPA itself that's producing all environmental regulatory science.

There are numerous NIH institutes which both fund (extramural) research and do their own (intramural) research. One example is the National Institute of Environmental Health Sciences, an independent center that both does and supports research on the connections between environment and disease. FDA does not have an independent center. FDA does not do its own research. For pharmaceutical development, we have the same system that you have, that is, it's up to the pharmaceutical companies to produce the information on the safety and efficacy of their drugs. Of course, to produce that information they have to work with the regulatory agency, because the regulatory agency specifies what kind of information they need to produce, when it's adequate, whether the information meets the correct standards, and so on. This is also true of the environmental area, because in general the information used for standard setting, the primary data, are produced by the private sector. The assessment is done in the regulatory agencies.

The different regulatory agencies differ enormously in the way that the research function is organized relative to the regulatory function. In some cases, like OSHA, there is not one but two paired institutions. In the case of the EPA, it's much more complicated because EPA funds environmental research at universities for particular

purposes, relies on the NIEHS (National Institute of Environmental Health Sciences) for some functions, and conducts some of its own research at Research Triangle Park. FDA does not do its own research but reviews research done by others.

Interviewer By the way, science study scholars in Japan ⁸⁾ have also said that the article by Martin and Richards ⁹⁾ is the first review on the debate on regulatory science, and also that in the report by Committee on Science, US House of Representative, titled “Unlocking our future ¹⁰⁾” there is a very important discussion on regulatory science. But when we read these pieces we could not find any description of regulatory science.

Jasanoff Well, the Richards and Martin review (which, by the way, I commissioned as one of the editors of the 1995 Handbook of Science and Technology Studies) really deals with scientific controversy of all kinds. It surveys the different explanations that people have offered for scientific disputes, including those involving regulatory science – but that is not its focus. The House Committee report is not an academic analysis at all, not does it focus on regulatory science.

It lays out an overall strategic vision for U.S. science and technology policy that is quite uninformed by decades of scholarship on the nature of science and its relationship to politics. In particu-

lar, this report assumes that independent, objective and sound science is always available and that it is the duty of regulatory agencies and other decision-makers to identify such science. This misses the actual complexity of the science-society-politics relationship.

6. Conflict of interest

Is science independent from policy-making?

Interviewer And so how do you think about the independence of science from policymaking or decision making. I think that there are possibility of bias if the scientists have a very clear view of the decision or desired policy endpoint. This kind of objective may cause some bias that may be a conflict of interest. What do you think about this?

Jasanoff I think that science studies would want to treat this issue in a much more theoretical way. Conflict of interest is a legal concept which says that there are forms of entanglement between science and interested parties that we do not wish to encourage as a society. But this is a social idea. It’s not a natural idea. If you study the conflict of interest guidelines throughout the world, you will find that they differ because societies have different ideas about how much pairing and entanglement



Prof. Jasanoff and interviewers (left: Saio, right: Kurihara)

they think is okay and how much they think is not okay.

As you perhaps know, since 1980 the U.S. policy has been to encourage people who receive federal grants actively to seek patents so as to commercialize their results. So that has led to very close ties between academic researchers and pharmaceutical companies, in particular, and biotech companies as well. And it's a constant debate, you know, how to balance two things. One is that if you are funding research with public funds you want to produce benefits for people, benefits that are developed by the private sector through commerce, so you want a pipeline from basic research to commerce. The other is that you don't want the research to simply tell the private sector what it wants to hear and not be critical and so forth. At my university, at Harvard, it's a constant push and pull. How much connection to business is desirable, because without business you don't get public benefits? It tries to wrestle with this question of when is it too much and when is it adequate or enough.

I think that this issue is different from questions about bias. The STS theoretical position is that there is no science that is not biased. The moment an experimental scientist decides that he or she is going to undertake an experiment, there is bias. There is bias because a path has been chosen which the scientist wishes to follow. They wouldn't be following this particular path if they didn't have a desire to follow it or if they didn't have a commitment to reaching particular kinds of results.

Interviewer You mean they're doing science subjectively.

Jasanoff At every point where one chooses there's subjectivity; but there are other more subtle kinds of subjectivity as well, in the sense that, for example, positive results get treated very differently from negative results. In the pharmaceutical industry recently there has been a real set of

scandals because, after some adverse effects were detected, it turned out that the companies had systematically not reported the negative results but had reported only the ones that showed a positive benefit. So now people said that this was the wrong way to go, and not reporting negative studies is an example of bias. But at the same time no journal will accept a negative experiment.

With policy-relevant work or regulatory work, you can require that when people undertake a study, they should record it. You know: 20 efforts were made, one succeeded and 19 failed. To say that one succeeded is a distortion in this case. You also need to know about the 19 that failed. If you're publishing in scientific journals, maybe the 19 that failed, they're not interesting. But if you're presenting science for policy, then the percentage of successes and failures is highly significant. So, you know, in the pharmaceutical sector, we've now moved to say that all clinical trials have to be recorded, not just the ones that produce good results. So this is a step forward.

But it's a mistake to say that pure science has no biases and that policy introduces biases into science. It's more that science always has room for subjectivity and judgment. It would not be science unless there was room for subjectivity and judgment. And it has institutional biases of all kinds.

7. Science and the generation of subjective/objective knowledge Does science generate or introduce bias?

Interviewer I agree with you. I was also thinking the same thing when I was listening to your Monday's lecture ⁶⁾, many of the people attending that symposium think that science is very objective and that science can find the truth. But I agree with you that not only policy-making but also sci-

ence itself has some mechanisms to generate bias. I am also working inside the scientist's world, and I feel that they always want to produce some good result to prove their theory, to prove some estimates. Also, another important point is getting grants. They have to write many kinds of proposals – that this kind of science is very good; that it will very much contribute to society. These days, scientists have to write many of these kinds of things in their proposal to get a grant. I think this is biggest reason for bias in scientific results.

Jasanoff Well, I would just avoid the language of bias. It's a difficult term and I think it introduces a lot of confusion. I don't think that the grant application process itself introduces bias. Obviously, it requires you to present your results in the most positive way you can, because otherwise you will not be getting the grant. But I think that every time you publish an article, you're in effect presenting your results in the most positive way. Anyway, I think this is probably applicable to science in general. In fact it's not a question specifically about regulatory science.

Interviewer I understand you very well. By the way, the journal *Clinical Evaluation*, on which this interview is to be published, started in 1972 and its editorial policy is to publish negative result of clinical trials ^{11, 12}). So it pays a fee for manuscripts with negative results and get some money from manuscripts with positive results.

At the time of the journal's establishment, a small number of people are interested in the kind of matter that negative results should be published. These days, as you said, ICMJE (International Committee of Medical Journal Editors) published a statement in 2004 that they don't publish clinical trial reports without prior registration in public database. After this statement was published, many Japanese researchers became interested in this kind of publication matter.

8. Regulatory science vis-à-vis serviceable truth

Jasanoff You know, if you're speaking to a science studies scholar, the question has always been what do you mean by these terms? It's well established in STS that objectivity is a name that we apply to a state or position that is socially created and socially justified. So we choose to call something objective if it corresponds to certain criteria. To think that objectivity exists in nature, like air, that is not an intellectually correct position in my view.

So I'm a bit worried when people say that regulatory science is not objective because it's biased; that's not the point. The point is that in regulatory science the problem of deciding what will count as adequately objective is a real issue that one has to grapple with it and think about: what's adequate for the purposes that we strive to serve. I'd say that the point for regulatory science is not to get at the truth per se. The goal is to achieve a "serviceable truth." I've long thought that I should write an article which resurrects that concept, to try to say what serviceable truth is. But it's an important point: serviceable means that it does the job; it serves the purpose. That's what serviceable truth is. A truth that is adequate for us to go forward with does not need to be absolute. It does not need to be eternal. It does not need to be a natural law. It's still adequate to make policy. And I think that in the policy world, we're usually dealing with serviceable truths, you know, what's enough to serve the purpose.

On Monday we talked about this in the context of legal proceedings. So what is adequate knowledge on which to condemn a person to death, or for somebody to pay 20 million dollars to enforce a recall of a product or a service. You know, it's a

sliding, shifting scale. It's not predetermined. It's a result of the process through which we're getting to a conclusion and it has social values built-in. I mean there are values involved in making the decision this is an adequate set of facts to act on.

So take climate change. Do we have enough knowledge about what will happen in 50 years that we should impose severe taxes on people now? Well, it depends. Obviously in America, people have said, "No." But of course, that's a very debatable point. In other countries, people have said that the most negative consequences would be so bad, and they would be so bad especially for the poorest and most vulnerable people, that even if we are uncertain, we should take precautionary steps now. So is that objective or subjective? I mean it's obviously informed by knowledge. But it's also informed by ethics and morality about what is right. What is the right thing to do? The point that I'm constantly making nowadays is that two meanings of the word "right" are often mixed up together. One is "right" in the sense of correct. Two plus two equals four – not five, not three. So it's the right answer to say four. The other is "right" in the sense of normatively right. If I say two plus two, it's right for you to tell me that it's four. You know, you would be inappropriate playing games with me if you told me five or three. That's a different sort of right.

9. Regulatory science and normativity Incorporating values in the production of knowledge

Interviewer Such consideration seems to be related to the things you said about justice.

Jasanoff The basic points are fairly simple, I said, that regulatory science is not science that is known in advance. Regulatory science emerges out of a particular set of discussions, context depen-

dent because they happen in a particular context, which is quite different from research science. So when I presented that table in Chapter 4 of *The Fifth Branch*, I was simply arguing that regulatory science is produced—it's a kind of knowledge production, for sure—but it's produced in a context that differs in fundamental ways from research science. This doesn't mean that you can't get good regulatory science or better regulatory science. It's just that if you think of it contextually then what's good and what's better depends in part on the endpoint that you are trying to achieve.

The second important point I made was that regulatory science communities and researchers end up producing what we think is good science for policy. But then this involves a form of boundary work: what belongs on the science side of the boundary is not known in advance. It is the result of negotiations carried out in a politicized context, and the results are controversial because of that context. So some people say it's accurate; others say it's not accurate; some say it's going too far; others say it's not going too far. What they're fighting about is that boundary between science that is good enough for decisions and science that is not yet good enough. Opponents will always say "Oh, this is not real science. You've mixed politics into it?" When they're saying that, they're saying something value-laden. They're saying – "You have drawn a boundary saying that this is science, but we don't accept the validity of that boundary you've drawn. You only took some of the available positions into consideration in drawing that boundary. So the conclusion is not representative enough. Or you didn't give the other side enough time to research their position. You know, it is a value question whether the boundary around the regulatory science is going to gain public approval or not.

Again, let's come back to the climate change case

because it's been so controversial lately. The people who support the idea that climate change is happening, they say, look at the strength of the consensus among climate scientists. It's so strong; all the scientists agree, and we trust them. But the people who disagree, say, consensus among whom? You know, if 1,200 people who are getting huge grants to do their research come together and say, this is what we've discovered, okay, all 1,200 of them made the same finding, but why should we believe them? When the scientists themselves are an interested party—they're getting money and fame, and invitations to presidential offices and premier's offices, and jetting around the world, and having nice meetings—why should we believe them? So there, in the case of climate skepticism, you see the stand-off between science and different sets of ethics and values. They're very closely linked up together.

10. The concept of regulatory science

Relation to policy studies

Interviewer We understand very well about your view on regulatory science and it's characteristics of the process of knowledge production. So I would like to ask another question on different point. In Japan not only natural experimental science, but also the policy making process, including guideline or regulation development and decision making, these kinds of studies are also included in the concept of regulatory science. How is it in the U.S.? Are these kinds of studies are included in the concept of regulatory science?

Jasanoff Regulatory science is a term that's used to describe a particular domain of scientific activity: that domain of science which serves regulation in the same way that you can talk about medical science (science that serves medicine) or you

can talk about environmental science (science that helps us understand the environment). Regulatory science describes a social zone in which a particular kind of knowledge is produced. To understand or to make sound judgments about regulatory science, one has to answer questions which I think are socially important. When is regulatory science good? When is it bad? When can we trust it? When can we not? How do we know that one conclusion is better than another? How do we know that knowledge has improved over a period of time? If we want to draw on a newer scientific theory, what should we do to test its reliability? These are all very important social questions.

So to answer those questions well, I think, one needs a theoretically well-informed appreciation of what regulatory science is and how it works. And to get that understanding—how regulatory science works, how it's produced, how it's validated—of course one has to understand the connections between the science and the policy. For one thing, regulatory science is often produced under very specific legal requirements, probably in Japan, certainly in the U.S. So we have, for example, a law governing the behavior of advisory committees. If the regulatory agency appoints an advisory committee it can't simply rely on those whom it regards as the best scientists. It has to observe the law, and one of the things the law says is that the committee must be "balanced." So no part of regulatory science is independent of law, politics and values. It's important when one says "this is good science" or "this is bad science" to keep in mind that there is a whole infrastructure for regulatory science which is quite different from the science done in laboratory for the purpose of curiosity.

Interviewer According to Uchiyama's proposal, natural science to serve regulation is one very important area of regulatory science. And another important area is guidance development for

scientific activity. Guidance development is not natural science but based on natural science to serve regulatory science, people discuss and conduct some research and make some guidance for, for example, pharmaceutical clinical trial.

Jasanoff Well, guidance development as I understand it is preceded by assessment, which is a little different. There is first the primary experimental science that produces results; then there is synthesis and assessment that puts these results together, and tries to say what this knowledge means for policy; and then there's guidance which says, finally, we should act in this way or that. It's important again to remember that the boundaries among these phases—knowledge making, assessment, guidance development—are not clear. They can be quite fuzzy.

11. Regulatory science and decision-making in new drug approvals

Interviewer Another point is that the decision making process for new drug authorization is regarded as a very important area of regulatory science, as Japanese people understand this concept. What do you think?

Jasanoff I don't think decision making is the same as regulatory science. That's a question of how one is defining these terms. Regulatory science, as I've said, a few times, is that body of scientific and technical knowledge which serves regulatory decision making. To say that it's the same as regulatory decision-making wouldn't make any sense, and I don't know why one would say that. If you want to draw a model of regulatory decision-making, you might say the production of regulatory science is one component, and then assessment of regulatory science could be another component; developing policy guidelines could be another com-

ponent. And you know, to some extent they're all being stacked together; you have the same people doing it; you have the same meetings; you have the same discussions. If an advisory committee is telling FDA, yes, you should approve this drug with the following label, well that's guidance. But in order to provide that guidance the advisory committee has to study the chemical product. It has to see whether the clinical trials favor the approval or not. It also has to see whether the clinical trials point to some possible dangers or not. So knowing that the guidance is needed will affect how they read the clinical trials in the first place.

Let me give you a concrete example. Recently, in the last 5 to 10 years, there's been a lot of controversy about active suicidal ideations which were linked to a generation of antidepressant drugs called SSRIs (selective serotonin reuptake inhibitors). The claim was that they may increase suicidal tendencies instead of curing the depression. When FDA first approved these drugs, there were no warnings and that these were considered to be enormously beneficial and favorable. And then in America, some people started suing the drug companies, saying that some of the patients who were under treatment had committed suicide. In England, regulators reviewed that evidence and decided to withdraw most of those drugs from prescription to adolescents. They took a much tougher view of the evidence of suicidality. In the US, the FDA did a re-analysis of the clinical trials. The first analysis of the clinical trials had produced a positive result for the drug companies. They were widely prescribed. Then after these lawsuits began the FDA convened a special committee to re-review the same results – the same results, not different studies – and they decided that, after they looked at the statistics differently, there was a slight elevated risk in a particular age group, adolescents. Then the FDA asked for a warning to be put on the drugs.

There's still controversy because some people say that as a result of the new restrictions on the drug, the suicide rate has actually increased. But it's a very interesting case because it illustrates how inadequate it is to use binary distinctions of true and false, biased and unbiased, in this area. The questions are more subtle: good for whom, in what circumstances, subject to what warnings or precautions?

It also illustrates how values enter into the process of assessing and using regulatory science all the time. If there had been no lawsuits, FDA would not have asked for a re-analysis. The data would have been the same data. But you see, one day they're being read in this way, another day they're being read differently. So why is that? You can call it bias. You can call it distortion. I think it's much more theoretically honest to call it "co-production." At every moment of assessing complex information about the world, for the purpose of making policy, our values enter into that assessment. Questions of why we are doing this; for what purpose; how much deviation can we tolerate when we say result A is the same as result B; when we are forced to say that result A is *not* the same as result B; who is doing this assessment; for what purpose? These issues are all inevitably relevant to the discussion of regulatory science. And I think it's more honest to admit that values are there, and then say, "Okay, we knew that values are there, how should we (in a democratic society where values are democratically controlled), how do we want people to exercise these values?" And this is when many of the conclusions in my book come into play. How much transparency should we have; how much representative data should we have; and so on?

So when I say I want to get away from binary distinction between true or false, biased or unbiased, pure and impure, and so on, I'm not so interested in how regulators will deal with knowledge,

but also how they will deal with uncertainty. So what do we mean by independence; independence from what; how do we secure it? If things go wrong, what kinds opportunities are there to seek redress? And you know in many societies these questions haven't been asked openly. So if a drug is released in some market, and a mistake was made and many people suffer, like the recent case mentioned in the American newspapers in which an anti-Alzheimer's drug increased the Alzheimer's symptoms among people, then what should we do? The victims have Alzheimer's. They're not in a position to do anything. So what mechanisms of redress do we have as a society and who is asking that question? As a scholar I regard it as my role to be asking those kinds of questions.

12. Compensating injuries as a social responsibility Tort law, insurance

Interviewer In Monday's discussion you said that it is the function of justice to contribute to people who are injured. From my understanding it is important to develop some social mechanism to compensate these kinds of injured people. It is very important, more important than to find or investigate the cause and result of the things that injured them.

Jasanoff Well, I think that compensating people who are hurt, taking care of people who are hurt, is a prime social responsibility. I think that sometimes, not *all* the time, it is more important than finding out who was to blame. Compensation involves what in America we call "tort law." Tort law is a major branch of the law. It's about private parties who may have injured other private parties and sorting out the resulting claims by deciding who is to blame. But the basic idea has not changed. I think we should have a reasonable insurance

scheme that takes care of people regardless of how they were hurt. And then we should have legal remedies for cases of serious carelessness, willful misconduct, and so forth.

There are times when it is important for a society to penalize somebody because something so bad was done that they should be held responsible. “No fault” judgments are efficient and appropriate in a lot of areas, but sometimes it’s important to find who was at fault. It is an ongoing discussion in major journals when we switch from a fault-based to a no fault system. It’s a philosophically and morally interesting question. Since the financial crisis, we have had this discussion in the US, and I think we’ve decided that probably too much finance was being done in a no fault way. Not enough blame attached to the people who toppled the financial pyramid. But it’s still an ongoing debate.

I think that it’s a danger to push everything on to science in that sense, and this is where Weinberg’s article comes back. It’s still a relevant article because in enlightened societies we have a myth in our minds that the scientifically right solution is always the correct one. If we could find out whether this drug really injured people, then of course it’s correct to blame the drug company. Well, but sometimes it may not be the correct thing to blame the drug company. We should instead say, we as a society should be insured regardless, you know, in order to preserve the benefits for everyone. We do that with unemployment. We say it’s not your fault that you were thrown out of work so we will cushion you for a period. So I think that compensation always goes hand in hand with social responsibility and social insurance questions: how much of a floor do we provide to everybody so some compensation can be offered without fault, and when do we think the fault is so great that just compensation is not enough?

Take the Toyota case that is developing now. If

it’s really unknown why the engines suddenly speeded out of control, that’s one thing. But if the executives were receiving information over a couple of years and they said “Oh let’s not bother fixing that condition”, that’s a different matter. So as a society, we may want to have different answers in these different situations. I don’t think scientific controversies are going to be decided only by the courts, but to talk about scientific controversies in the courts without talking about the total system of social responsibility is a problem.

Look at a country like New Zealand, which is a tiny country, and they’ve adopted an insurance system which is different from big countries. They said that, no matter how you are injured, you will be compensated out of general revenues, the tax fund. It is managed by the New Zealand government. It doesn’t matter if you are injured at work, it doesn’t matter if you are injured in a car accident. You are compensated anyway. But of course you don’t get huge benefits. So that system creates equality in the sense of a floor below which you cannot go below, rather than peaks and valleys. The US system creates peaks and valleys. If you don’t go to court you get nothing. If you do go to court, you might fail, in which case you also get nothing. But if you succeed you can get very much. I’ve never liked that system. You need to have a well-calibrated system where the majority of cases are handled through insurance but cases of grave misconduct can still be litigated in court.

Interviewer So it is very interesting this difference among the cultures. In Japan, the compensation system is very bureaucratic and divided into many areas. And we have an experience of comparing of compensation for injury to healthy volunteers caused by participation in research and employees’ compensation under the labor law. Healthy volunteers’ participation in research is in some points similar to working as an employee.

There are some differences of grade of compensation between for the research participants and workers. And I asked this question to a person in Sweden and the Swedish person said there is no difference between a healthy volunteer and an employee. All kinds of people are equally compensated by the government if they are injured. That is their idea. This idea of social security and public insurance derives from the concept of “solidarity”, which comes from socialism.

Jasanoff That is a very interesting example. At a more philosophical level it suggests that causality and responsibility, and how those ideas relate to citizenship, are treated differently between Japan and Sweden, and also between Japan and the U.S. In my comparative research, those are the kinds of issues I’m interested in. At the surface there’s the descriptive difference, you know, that the healthy volunteer in Japan gets less than in Sweden. But below the surface it relates to how we look at a body in a society. In Sweden, which is a small and highly egalitarian society, the human person and the human body is the same regardless of context; whereas in Japan, causality, context and social role are tied up together in a different sort of packaging. Obviously the purpose of critical scholarship like what you’re doing is to show these differences. Often people are not even aware that other ways of thinking exist, or they don’t want to know what the truth is about their own societies because it’s too complex. But if you take your debate into a public forum, where we see that the healthy volunteer and the willing worker are really similar human beings, then we can ask they should we have unequal compensation.

13. Regulatory science and translational research

Interviewer This would be the last question,

what do you think about recent FDA-NIH activity on regulatory science and translational research? There is so much funding for regulatory science and translational research¹³⁾.

Jasanoff In Japan there may be a very different understanding of what falls under the category of regulatory science than for us in the States. How science studies define our understanding of regulatory science is quite different from what you’re describing. Maybe one way to put it is that, regulatory science is not the same as science policy, and that is a big difference. Regulatory science is the input into making public policy. STS scholars are interested in knowledge making. So they’re interested in different types of knowledge, and regulatory science is a type of knowledge. And that’s what STS scholars are interested in.

There’s a much broader issue of science and technology policy – health policy, medical policy – that is different from regulatory science and maybe that’s what explains the confusion. Science policy itself is an ambiguous term. Science and technology policy have been used to mean the policies for encouraging, fostering, and promoting science. If the federal government says we will double the NIH budget over the next ten years, that’s a science policy statement. It has nothing to do with regulatory science. That is just a totally different thing. Then the term science and technology policy is also used to cover the use of scientific information in public policy.

It’s possible that in Japan the term regulatory science is much broader and it covers this question of what we should do in terms of promoting and fostering science. In America it’s narrower. It’s about what kind of knowledge are we using in policy. Translational medicine is part of NIH policy for science and technology; but the government is interested in translational research as a general matter, so the government can do get more public,

economic and employment benefits from its investments in science. NIH is supposed to be a basic science institution, but it's always been clear that you don't get congressional support unless you show benefits to health. Basic science is not something Congress is interested in by itself. So translational research actively tries to take the basic science and translate it into usable applications. It's part of science policy and that's the sort of motivation for it.

Interviewer Thank you very much to have dedicated your precious time so long to this discussion, your analytical view point on regulatory science is very interesting and gives meaningful suggestions to Japanese people who are interested in this subject. In Japan, the Society of Regulatory Science is just going to be established. This is especially in the area of pharmaceutical development. So from now on, discussion on regulatory science would become more and more intensive in Japan, and there would be many things to learn from you. Thank you very much.

REFERENCES

- 1) Uchiyama M. [Regulatory science]. *Eisei Shibu Nyusu (The branch news of the National institute of Health Sciences)*. 1987 Oct 28 ; (272). Japanese.
- 2) Uchiyama M. Prospect for drug product quality: Regulatory Consideration. *Pharmaceutical Technology*. 1996 ; 20(10) : 44-52.
- 3) Weinberg AM. Science and trans-science. *Minerva*. 1972 ; 10 : 209-22.
- 4) Saio T, Kurihara C. Regulatory Science Wars: Confused concepts and incompetence of academics on science studies. *Rinsho Hyoka (Clinical Evaluation)*. 2010 ; 38(1) : 177-88. Japanese.
- 5) Jasanoff S. *The Fifth Branch: science advisers as policymaker*. Cambridge and London: Harvard University Press ; 1990.
- 6) Jasanoff S. Perspectives on Scientific Disputes in Court-15 years after Science at the Bar. Symposium on "Scientific Controversy in the Courts" ; 2010 Aug 23 ; Tokyo, Japan.
- 7) Jasanoff S. Contested boundaries in policy-relevant science. *Social Studies of Science*. 1987 ; 17(2) : 195-230.
- 8) Nakajima T. [Debate in the Science : Focused on the debate on regulatory science]. In : Kanamori O, Nakajima H, editors. *Kagakuron no Genzai (The present of science studies)*. Tokyo : Keiso Shobo ; 2002. p. 183-201. Japanese.
- 9) Martin B, Richards E. Scientific knowledge, controversy, and public decision-making. In : Jasanoff S, Markle GE, Petersen JC, Pinch T, editors. *Handbook of Science and Technology Studies*. Newbury Park : Sage ; 1995. p. 506-26.
- 10) Committee on Science, U.S. House of Representatives. Unlocking our Future: Toward a new national science policy. 1998 Sep.
- 11) Yorio Sato. On the Inauguration of *Rinsho Hyoka (Clinical Evaluation)*. 1972 ; 1(1) : 1-2. [Nakajima A, Trans. *Rinsho Hyoka (Clinical Evaluation)*. 2006 ; 32(1) : 138. Available from : http://homepage3.nifty.com/cont/inauguration_e.pdf]
- 12) The Editorial Board of *Rinsho Hyoka (Clinical Evaluation)*. Editorials. *Rinsho Hyoka (Clinical Evaluation)*. 1999 ; 27(1) : 5-11. Available from : http://homepage3.nifty.com/cont/27_1/EditorialsEng.htm
- 13) After this interview, FDA issued the report titled "Advancing regulatory Science for public health" (October 2010), IOM (Institute of Medicine) issued the workshop summary "Building a national framework for the establishment of Regulatory science for drug development" (2011, The National Academies Press), and various concepts and definitions of regulatory science have been proposed in the context of drug development.