The Never-Ending Myth: *An Analysis of the Sociopsychological Mechanism of Hwang Woo-Suk Syndrome*

Sugmin YOUN, Namjun KANG, and Heejin KIM

Abstract

Science is assumed to be located in the realm of objectivity. The Hwang Woo-Suk affair, however, showed that it could also be located within the realm of social pathology. The essence of Hwang syndrome was a hypnotic condition collaboratively created by patriotic fever, science, and the media. For scientific research, the attraction and risk incurred by public passion were too tempting to avoid. The media amplified the process of collective myth making by reporting scientific accomplishments truthfully at first, and then moving on to creating and delivering stories of heroic science and scientists. It was a kind of patriotism that was close to collective narcissism, which drove a majority of Korean population to blind faith in the fabricated scientific feats of Hwang. A survey analyzing the underlying mechanism of this mental chaos shows that before the Hwang affair broke out, people's patriotic fervor, science, and the media formed a robust positive triangular equilibrium. In the process of the Hwang affair, the public sentiment of giving priority to national interest over scientific ethics or trustworthiness of the press won widespread sympathy.

Keywords: Hwang Woo-Suk, Hwang affair, Hwangppa, *PD Notebook*, stem cell, cell cloning, scientific fraud, fabrication, Buck-Goudsmit affair, BRIC (Biological Research Information Center)

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> *I enjoyed this shocking event. Despite hectic routines, I couldn't avoid spending several hours everyday on this . . . as one of those who were captivated by the Hwang syndrome.*
>
> *I feel still quite uncomfortable whenever I hear anything about Hwang Woo-Suk, even though quite some time has passed since the affair broke out.*[1]

The Hwang Syndrome

The Hwang Woo-Suk affair[2] began when MBC-TV, a major South Korean broadcaster, aired a documentary on Hwang's unethical process of obtaining egg cells for research. Throughout this affair, the procedures of biotech research, or more broadly, of scientific research, the peer review system, academic integrity, and the media's coverage of science revealed a fundamental shakiness.

Before the affair, a majority of Korean people had been driven to blind faith in Hwang's fabricated scientific feats regardless of demographics, social strata, and political ideologies. It is hard to express how strong and pervasive this faith was among Korean people. This was a universal emotion found among almost all Korean people that went beyond the extreme and aggressive supporters of Hwang, the so-called Hwangppa. It seemed simply out of the question to hint any suspicion of Hwang's research before the Hwang affair. When MBC's *PD Notebook* (A major TV newsmagazine program, similar to *20/20* or *60 Minutes* in the United States) broadcast a program on the ethi-

1. Quotes from a seminar on "The Hwang Affair and Journalism" hosted by Korean Society for Journalism and Communication Studies in February 2006.
2. It is difficult to delineate the exact time span of the Hwang affair. Hwang has been a national media figure since late 1990s. Hwang's hardcore supporters (so-called Hwangppa) aggressively reacted to any criticisms of Hwang until the end of 2006. This study, however, defines "the Hwang affair" as the sequences of events initiated from the first broadcast of MBC's *PD Notebook* (November 22, 2005) program and terminated by the judicial conclusion of the fraudulence of Hwang's stem cell research (May 11, 2006).

cal problems of Hwang's research, for many Koreans, the nature of shock was based on the fact that MBC dared to attack Hwang, or more precisely people's aspiration to him.

> Most "common people" were perplexed. What is MBC's intention in attacking professor Hwang? Are they so displeased with our pride for professor Hwang? . . . Couldn't they be more generous in considering the minute procedural matters of his research? We, the common people, wondered about *PD Notebook*'s real intention in attacking Prof. Hwang, over the possibility of a conspiracy (Kim D. 2005).

The Hwang affair, as it came to be called after the *PD Notebook* broadcast, was a massive-scale thrilling drama with many twists and turns. Hwang's fall came when the academic and judicial investigations formally concluded that a large part of Hwang's research was false. In the process, however, Hwang was persistent in insisting that the increasing amount of evidence revealing the fraudulence and unethical practices of his research was untrue,[3] a charge Korean public seemed to agree with. Even after Hwang's fraudulence in the derivation of stem cells from cloned human embryos became undeniable, quite a portion of the Korean people were reluctant to accept the facts.

The purpose of this study is to investigate the nature of Hwang Woo-Suk syndrome. What made a majority of Korean public get so excited about and cling to Hwang? What was the nature of the perplexed emotions many Koreans went through after the unfolding of the Hwang affair? Why were the people, the scientific community, and the media so extremely divided and conflicted? Will there be more Hwangs to come?

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3. In this vein, Beardsley claims that Hwang should be criticized the most based on the fact that he had many chances to admit his data fabrication after the *PD Notebook* report, but he denied these accusations until he was confronted with the decisive evidence (Beardsley 2006).

The Hwang Affair

Development

The Hwang affair began in 2004, when an article authored by Hwang Woo-Suk was published in *Science*, claiming that an embryonic stem cell produced via nuclear transfer had been successfully cultivated under experimental conditions. The Hwang Lab, already famous for its animal cloning, had done the impossible by implanting a donor cell nuclear into an enucleated oocyte and devolving it to the blastocyst stage. In May of 2005, the Hwang Lab again surprised the world by publishing that they had successfully made 11 patient-specific stem cell lines (Hwang et al. 2005). In the paper of 2004, they used 242 oocytes to successfully cultivate one embryonic stem cell, but in just one year the success rate had increased by ten times, with the cultivation of one embryonic stem cell out of 20 oocytes. An accomplishment like this was unheard of and represented tremendous levels of progress (Snyder and Loring 2006).

Due to these two consecutive successes, Hwang was called the "Greatest Scientist" by the Korean government, and also became a stem-cell researcher of worldwide renown.[4] However, how he obtained the oocytes used in the experiments soon became an object of ethical dispute. MBC-TV, one of the largest and the most influential broadcast networks in Korea, investigated this issue, and with the help of a whistle-blower they even broached the possibility that the research data was fabricated.

After the airing, MBC's *PD Notebook* met with heated opposition. To make matters worse, *PD Notebook* was discovered to have used unethical journalistic practices, including threatening an inside informer to get a confession. *PD Notebook* and MBC itself had to face massive anti-MBC protests and criticism from other media. Even-

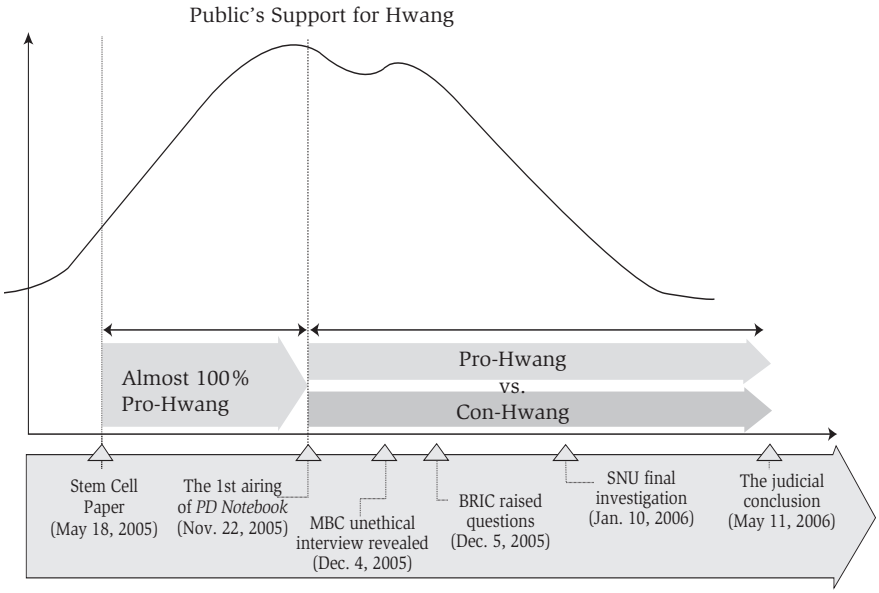
4. In 2006, the Ministry of Science and Technology began a program funding up to two scientists who made international contributions with three billion won a year per person for five years. Dr. Hwang Woo-Suk was the first of its recipients.

tually, *PD Notebook* was forced to publicly apologize. MBC even seriously considered terminating the show entirely.

Nevertheless, after the airing of *PD Notebook*, the suspicion of data fabrication in Hwang's research increased. In particular, young Korean biologists and genetic scientists raised the possibility of the manipulation of the cloning cell photos used in the *Science* article through the internet website of BRIC (Biological Research Information Center).

Seoul National University, where Hwang worked, launched a special investigation commission to look into the possibility of data fabrication. On December 23, 2005, the Commission announced that the research data (DNA finger printing, microscopic photos, confirmation of teratomas, etc.) of the 11 embryonic stem cells of the 2005 paper were from actually two identical stem cells. This meant that

Figure 1. Roller-coasting of Hwang's Stem Cell Controversy



the data had been fabricated. After the final report of the Investigation Commission of Seoul National University was submitted on January 10, *Science* decided to issue a full retraction of Hwang's 2004 and 2005 papers on January 20 (Kennedy 2006a, 2006b). The prosecutor also released almost the same investigation result (May 11, 2006). Figure 1 summarizes the major stages in the Hwang affair.

Fraud Cases in Science and the Hwang Affair

Scientific frauds are usually categorized into three classes: fabrication, falsification, and plagiarism (Judson 2004). Fabrication means that the data and/or research results have been completely invented. Falsification indicates the data were trimmed and adjusted to fit the hypothesis of the researcher. Plagiarism is copying parts of other works without references.

Hwang's case falls into the category of data fabrication, the worst of three. At the final press conference, Hwang admitted that he had expanded two stem cells to 11 in the 2005 paper. However, he argued that the two stem cells were authentic. This contradicted the final verdict of the Investigation Commission, which concluded, "There are no embryonic stem cells." If Hwang's argument had been true, his fraud case would have fallen under the category of heavy falsification, or an adjustment of data to inflate research results.

The judgment of falsification is often very difficult. In general, producing a firm conclusion using ad hoc based data is not a rare practice. Judson (2004) argues even famous scientists such as Newton, Mendel, Pasteur, Millikan, and Freud engaged in some amount of falsification in their research.

Falsification of experimental data is hard to detect. Data falsification can be judged by such criteria as to what level of observation was measured, how the aberrant data outside the theoretically predicted range was handled, and to what extent the range of replication was limited, etc. Yet, it is not easy to determine a widely accepted demarcation for data falsification since these criteria can vary case by case. Also, without the original data, detecting falsification through

peer review is hardly possible.[5]

Therefore, most scientific fraud cases begins with the outcry of an inside figure or whistle-blower. *Science*, which was directly involved in the Hwang affair, admits in its special issue of April 2006 "New Focus" that without an inside report, there virtually no chances of detecting falsification (Couzin and Unger 2006).

Buck-Goudsmit Affair vs. the Hwang Affair

The Buck-Goudsmit affair is a similar and famous case of scientific fraud. In the April 13th issue of *Science*, Henk Buck, an organic chemist at the University of Technology in Eindhoven, and Jaap Goudsmit, a virologist at the Academic Medical Center of Amsterdam University, claimed that they could effectively stop the penetration of the HIV-1 virus, which causes AIDS, using phosphate-methylated DNA (Buck et al. 1990). On April 12, 1990, on the eve of the publication, the University of Eindhoven made the news public. It resulted in excited media attention, and the main researcher, Buck, became a national science hero (Hagendijik and Meeus 1993). He publicly stated that AIDS would be a thing of the past within a few years.

Doubts were raised after the article appeared in *Science*. The biggest blow came from Van Boeckel, a fellow organic chemist at Eindhoven University who was involved in an internal fight over the rights of the phosphate-methylated process patent with Buck. He had a press conference on April 20th, claiming that Buck's research published in *Science* was utter nonsense. Buck criticized Van Boeckel, saying that scientific differences should be deliberated in science publications, not through press conferences. The major co-author, Goudsmit, stated that he had no doubt of the veracity of research

5. Greco, the editor-in-chief of *Journal of Science Communication*, mentions through the "Letter of Editor" that the Hwang incident shows the peer review system is not properly functioning even in the most prestigious journals such as *Science*. He claims that there is a need to introduce a new review system to enhance the reliability and integrity of the scientific research paper (Greco 2006).

data Buck had sent to him, and fully supported Buck's integrity.

The doubts and criticism led to a heated public debate in several Dutch newspapers and science magazines. The university eventually acknowledged that the purity of the phosphate-methylated DNA remained yet to be investigated. The media coverage of this affair heated up again on July 4th, when an investigative commission was formed by Eindhoven University to re-evaluate Buck's findings. On August 30, Eindhoven University announced that they had discovered errors in Buck's research and asked *Science* to retract the paper.

The ups-and-downs of the Buck-Goudsmit affair are similar to those of Hwang's in several aspects. Once the press embargo over the *Science* on-line edition was lifted on May 19, 2005,[6] major media in Korea delivered news of Hwang's feat, just as Dutch television did in 1990. The news of the economic benefits of patient-specific stem cells, the possibility of organ transfer, and the cure of patients paralyzed by spinal cord injuries immediately brought about a national sensation in the same way that the news of a possible cure for AIDS did.

The relationship between Hwang and Schatten, a world famous stem cell researcher at University of Pittsburg, was also similar to that between Buck and Goudsmit, who had solid reputation in the field of AIDS virology research. The Goudsmit team at the University of Amsterdam Medical School took part in the virological testing process, and verified that DNA inhibited the reverse transcription mechanism of the HIV-1 RNA (Hagendijk and Meeus 1993). At the beginning stage of the Buck-Goudsmit affair, Goudsmit firmly supported Buck. However, after the possibility of data fabrication emerged, Goudsmit argued that he had only checked the inhibition process of the AIDS virus, and thus was not responsible for the fabrication charge (Hagendijik and Meeus 1993; Moody et al. 1990). When questions on Hwang's paper arose, Schatten firmly took Hwang's side. However, once questions over the research became

6. The print version of *Science* was published about a month later, on June 17, 2005.

more evident, he asserted that he did not participate in the stem cell experiment and knew nothing about the data fabrication. He was the first to ask *Science* to remove his name from the list of co-authors. Both Buck and Hwang resigned after the scientific fraud was officially confirmed, but Goudsmit and Schatten returned to their original jobs after receiving a light reprimand.

Hwang's actions as a main researcher closely resembled Buck's. Buck was portrayed as a self-sacrificing and hard-working researcher by the media (Hagendijik and Meeus 1993). Korean media portrayed Hwang's unbelievable hard work by introducing his week as "Monday, Tuesday, Wednesday, Thursday, Friday, Friday, Friday (no weekends)."

Hwang's behaviors during the controversy were also similar to Buck's. When Buck was asked in an interview with a Dutch tele-vision station, "Could AIDS be conquered in a few years?" he answered, "This is what I actually assume, yes" (Hagendijik and Meeus 1993, 392). Hwang met a famous Korean pop musician who was paralyzed in a motorcycle accident and proclaimed, "I will make you walk again." Through these public statements, biological researchers became the conveyors of false hope (Gorke and Ruhrmann 2003).

The fall of Buck and Hwang also closely resemble each other. After *PD Notebook* went on air with their accusations, Hwang claimed that a scientifically ignorant media should not raise questions about scientific results that had been acknowledged in a prestigious journal like *Science*, just as Buck did. When cloning experts and the media requested the stem cell evidence, he continued to give excuses and asked for time to release more concrete outcomes. As more pressure was built against him, Hwang cut off all contact and entered a hospital, feigning illness. When everything was revealed to be a fraud, both of them claimed that some other party had been responsible for the data fabrication and they had been trapped in a conspiracy.

Mechanisms of Hwang Woo-Suk Syndrome

The Buck-Goudsmit and the Hwang affairs reveal notable differences, particularly in terms of media coverage and the reaction of the public. Right after the publication of Buck-Goudsmit's research in *Science*, Dutch media worried that their claims of complete cure for AIDS were too hasty (Hagendijik and Meeus 1993, 400). As Dutch chemical and biological academic journals continued to question Buck's research, the media reduced news coverage and the public started to lose interest (Hagendijik and Meeus 1993, 403). On August 30, 1990, when Buck-Goudsmit's research was concluded to be fraudulent, there was no sympathy from either the media or public (Hagendijik and Meeus 1993, 405).

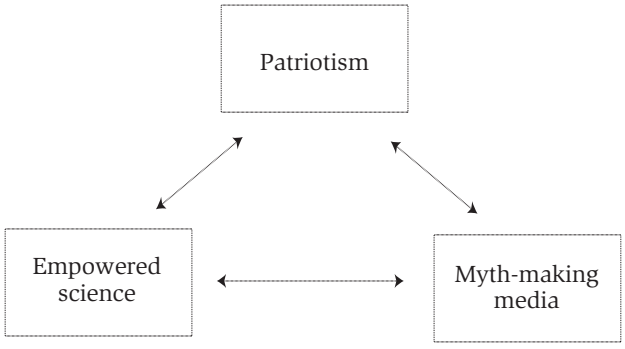
On the contrary, in Hwang's case, until *PD Notebook* questioned Hwang's research, few criticisms had been raised by either the scientific community or media. After the airing of *PD Notebook*, the criticisms of scientific community, people, and media were directed against *PD Notebook*. While the Dutch people and media regained their composure soon after the facts were revealed, a majority of the Korean people and media fell into pathological adhesion to a heroic scientist, persistently refusing to recognize the facts.

It is unrealistic to try to pinpoint a single critical factor that resulted in the materialization of this pathological state. It seems rather that multiple interacting factors mutually reinforced one another.

According to Kang Myung-Koo and other researchers (Kang et al. 2007), three factors were critical: people's fervor, an empowered scientific institution, and a myth-propagating media. Before *PD Notebook* raised questions, people, scientific institutions, and media mutually reinforced each other in a swirling pattern, and formed a vicious cycle of supporting Hwang, ending in the creation of a "truth suppression system."

After the broadcast, however, the mutually-reinforcing interconnected system started to malfunction. As the media no longer supported science with a single voice, the belief in science began to

Figure 2. The Sociopsychological System of Hwang Syndrome



shake. A majority of the population experienced confusion of belief systems. Opinions were split between those who remained obsessed with Hwang's innocence, and those who turned to the facts. This in turn led to the breakups in people, media, and the scientific community, with the entire nation eventually being swept into the Hwang controversy.

People

The patriotic fervor shared among the Korean people deserves to be mentioned as the first and the central factor of this whole mechanism. The craze for Hwang was a near-universal phenomenon, regardless of the political and demographic features of people.

> The public was wildly enthusiastic over Hwang and started talking collectively about the "national" hero and the "national interest" that he could realize in the future. There was irritable rejection of any attempt at intellectual criticism or media verification of his claims. *PD Notebook* was denounced as diabolical, treacherous, and unpatriotic. It was a totalitarian madness that would not tolerate one percent of differing opinion (Chun 2006).

Throughout the 1990s and 2000s, the patriotic fervor of the Korean

people was well illustrated on many occasions: the gold-collection movement during the late 1990s' foreign currency crisis and the nationwide street mass cheering during the 2002 FIFA World Cup are just a few of the many possible examples (Han and Shin 1999; Hwang and Yang 2002; Hwang, Yang, and Kang 2003; Rheingold 2003).

It is hard to explicate how this patriotic mentality has historically been formed. This phenomenon, however, is assumed to bear a close relationship with the compressed modernization process Korean society experienced during the 1960s, 1970s, and 1980s. During this period, the authoritarian military regimes pushed for rapid economic growth, putting the development and maturation of civic virtues on the back burner (Iwabuchi 2007; Park 2003, 2005; Lee et al. 1999). The outburst of passion for patriotic symbols, which is distinguished from a healthy and rational civic attitude, is a typical social mentality under such circumstances.

Scientific Community

The second factor in the Hwang syndrome is a scientific community lacking ethical and critical integrity. Life sciences, and more generally science itself, are considered a neutral sector that is the furthermost apart from politics and power. In reality, however, the Hwang affair revealed the existence of an overly empowered and authoritarian science institution fueled by both people and political power, and finally demonstrated the dire consequences such power can lead to.

Kang and others (2007) offer an interesting analysis of the establishment of an authoritarian scientific institution in Korean society in the late 1990s and early 2000s. In this interpretation, the creation of Hwang was a national project systematically led by the Kim Dae-jung and Roh Moo-hyun administrations as part of a political scheme to legitimize their governance. Faced with intense global competition, the left-wing Kim and Roh administrations, which had promised an anti-*jaebeol* (highly concentrated large conglomerates) socioeconomic policy, needed an alternative development model from that of the

previous authoritative governments. The answer was found in science.

Hwang's research team was one such case. They received special attention when they succeeded in cloning cows by dividing fertilized eggs in 1995. After Dolly was reported as the world's first animal born through differentiated cell cloning in February 1997, Hwang was introduced as an aspiring cloning expert capable of following up on Western cloning technology.

Soon after the Roh administration came to power, high-profile members of the government such as Blue House Secretary-in-Chief of Science and Technology Bak Gi-yeong, and assemblymen Jeong Dong-yeong and Yi Hae-chan voiced political support for Hwang, and finally President Roh himself helped stir public enthusiasm. Hwang was the perfect symbol, an ideal embodiment of the administration's rallying call for an advanced civil society based on science and technology (Kang et al. 2007).

Media

The third factor in the Hwang syndrome is the media. It has been much discussed (Hagendijik and Meeus 1993; Nisbet et al. 2003; Palfreman 2002; Paul 2004) that the media coverage of science accommodates popular interest in scientific knowledge rather than delivering objectives and accurate scientific facts in an attempt to pick news value out of complicated scientific research. Through this process, media changes normal science into a conjurer's field (Toumey 1996) or the pursuit of maverick science (Dearing 1995).

To become a story that appeals to the media, science research needs to satisfy the following conditions (Felt 1993). Hwang's stem cell research possessed elements that were suitable for the media or at least Hwang's adroit media skills made his research appear this way.

a) Economically and politically relevant science: In the case of HTS or cold-fusion, the economic value of energy substitution is infi-

nite. Hwang's stem cell research was also considered having enormous business and medical potential.

b) Good, old, and little science: No matter how grand the scientific discovery is, it cannot appeal to the media if it is not understandable to the public. Superconductivity can be easily shown with a magnet and liquid nitrogen, and cold fusion's process can be reconstructed with common experiment utensils. In Hwang's case, the method used in cloning stem cells and implanting nucleus was portrayed to the public with the familiar hand dexterity of using chopsticks.

c) Hero scientist: To become a media-appealing story, there has to be a hero. If not, media often create one. Buck-Goudsmit and the Hwang affairs all had hero scientists.

d) Staging race: For science to become news, it has to be as exciting as a day at the races. HTS and cold-fusion are both directly related to the solution of future energy problems. They are research areas that developed countries fiercely compete in to take the lead. Hwang's stem-cell research is also an area where researchers devote all their time to making a "scoop" with the outcome.

e) Science without risk: The public has enthusiasm towards science that has a low possibility of harm while at the same time providing great benefit. Hwang wrapped the stem-cell research up with its humanitarian application to eradicate incurable diseases, and thus effectively derailed or diluted the controversy over human cloning.

Before the broadcast of the fateful episode of MBC's *PD Notebook*, the majority of Korean media functioned as faithful agents promoting Hwang. Even after *PD Notebook* stirred up doubt, a majority of Korean media outlets stuck to Hwang and abandoned the journalistic mission of verifying and delivering facts. MBC itself was not entirely free from this tendency, as the board considered terminating the *PD Notebook* show entirely.

Supplementary Survey

A survey was conducted to supplement the research. Data were collected from March 15 to 20, 2006, when the Hwang affair was nearing its end. To maximize the representativeness of the sample, particularly in terms of gender and age, the quota sampling method was adopted. First, researchers sampled a number of classes in various grades and majors in two universities located in Seoul (Seoul National University and Yonsei University). Then, with the permission of the instructors, survey questionnaires were given out to the students of those classes. On each questionnaire was the designated gender and age category of the targeted respondent (e.g., 40-49 year-old woman). Each student was asked to work as a survey agent, whose main role was to find a respondent (subject) of the pre-designated category, and assist him/her to complete the questionnaire, and return it to the researchers.

The questionnaire included questions measuring the attitudes toward Hwang Woo-Suk, trust in stem cell cloning research and science in general, attitudes toward *PD Notebook*, trust in newspapers and the internet, and the shock from the initial breakout and the subsequent turns in the Hwang affair. There were also questions about the respondent, such as gender, age, political opinions, and other pertinent demographic data. By asking the respondents to answer the questions over the course of the different stages presented in Figure 1, this survey tried to trace the changes in the attitude as the Hwang affair unfolded.

A total of 600 questionnaires were given out and 420 returned. Among them, 398 were included in the analysis through validity screening. The final sample represented the original gender and age quotas quite well. Among 398, male was 50.5% (original quota 50%) and female was 49.5% (50%). The age distribution was ① 10-19 group 9.5% (10%), ② 20-29 group 20.4% (20%), ③ 30-39 group 22.1% (20%), ④ 40-49 group 22.9% (20%), ⑤ 50-59 group 18.3% (20%), and ⑥ 60+group 6.8% (10%).

The Impact of the Hwang Affair

The controversy, first brought to the fore by MBC's investigation of ethical issues over donations of human oocytes for the stem cell research, had made headlines for several months, followed by a number of dramatic twists and turns. Figure 3 shows the first moment when each respondent started to pay attention to the scandal. Despite the complicated topic such as biotechnology, almost a half of the respondents showed a deep interest in Hwang's controversy from the beginning of the news coverage (168 out of 398, 42.2%). After the disclosure of the "unethical" interview MBC *PD Notebook* had conducted, up to 78.6% of respondents answered that they had started to pay attention to the scandal. At the stage of BRIC(Biological Research Information Center)'s refutation, almost all respondents devoted themselves to this controversy in one way or another. There was no gender difference in the amount of attention paid to this series of news.

Figure 3. Number of People Who Started to Pay Attention to Hwang's Affair by the Stage

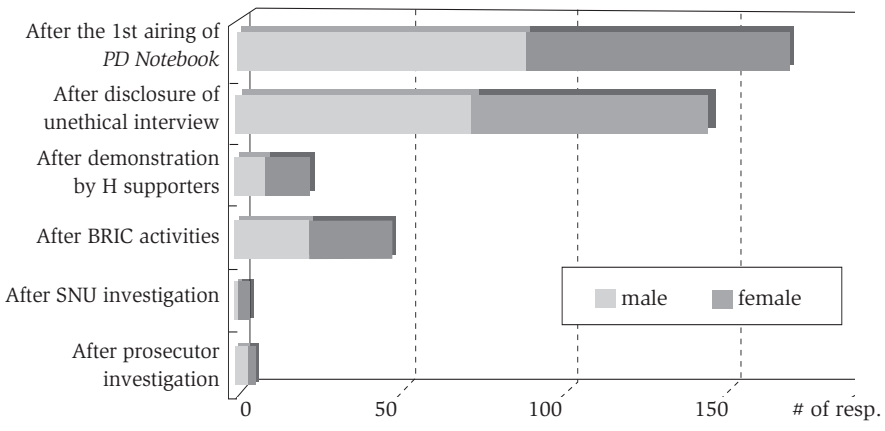


Table 1. Degree of Attention and Impact by Age and Stage

	10's		20's		30's		40's		50's		60 +		Avg. by time	
	att.	impact	att.	impact	att.	impact	att.	impact	att.	impact	att.	impact	att.	impact
After 1st airing of *PD Notebook* (n=)	55.3 12	69.6 12	64.3 31	62.9 31	65.4 38	65.1 39	71.5 42	66.5 43	67.7 31	66.7 32	70.4 13	73.1 13	66.8 168	66.3 170
After disclosure of unethical interview	43.7 11	57.5 11	49.4 30	63.5 30	60.0 33	60.1 33	60.4 35	66.6 34	59.7 29	66.7 29	70.0 7	66.4 7	57.1 145	63.8 144
After demonstration by Hwang supporters	33.5 4	40.3 4	40.0 4	56.3 4	58.0 5	70.0 5	55.0 4	52.5 4	65.0 2	60.0 2	50.0 3	63.3 4	49.3 23	57.1 22
After BRIC activities	45.4 7	60.0 7	50.0 14	60.3 15	52.3 11	59.4 11	62.9 7	77.9 7	70.0 5	78.0 5	60.0 3	73.3 3	54.4 48	65.3 48
After SNU investigation	8.5 2	28.5 2	– –	– –	– –	– –	– –	– –	50.0 2	100 2	– –	– –	29.3 4	64.3 4
After prosecutor investigation	60.0 2	75.0 2	3.0 1	10.0 1	– –	– –	30.0 1	70.0 1	10.0 1	10.0 1	– –	– –	32.6 5	48.0 5
Avg. by age	45.6 38	59.3 38	54.2 80	61.7 81	61.3 87	62.8 88	65.3 89	66.8 90	63.1 70	67.5 71	66.1 27	70.2 26	59.9 392	64.5 393

To examine the intensity of their attention and impact throughout the different stages of news releases, respondents were asked to measure them with a scale from 0 to 100—for "attention" scale, from "not at all" (0) to "devoted myself to Hwang's controversy" (100); for "impact" scale, from "not at all" (0) to "cannot repress their astonishment" (100). Represented in Table 1 are the degrees of attention and impact by age and stage.

In terms of the attention scale, the average intensity was 59.9. By stage, attention was the highest right after the airing of the episode of *PD Notebook* (66.8), and it went up again after BRIC's online refutation had been made (65.3). There was an age difference observed in attention intensity: the average of the teens was 45.6, whereas that of the sixties was 66.1. It is clear from the table that age was positively correlated with attention.

For the impact scale, the average intensity was 64.5. By stage, the pattern was similar to that for the attention scale: the first broadcast release and BRIC's refutation. While there is an age difference, the gap is not as large as that of attention (11 vs. 20). Although it seems true that the Hwang controversy put the entire generation into a shock, the positive correlation between these two variables was observed in the same manner of attention.

The results of Pearson's correlation analysis of age, attention-getting-stage (stage, hereafter), and intensities of attention and impact are presented in Table 2.[7] The correlation in Table 2 provides the evidence for the positive relationship between stage and attention intensity, but not for the relationship between stage and impact intensity. This result suggests that the earlier the person started to pay attention to Hwang's scandal, the more they devoted themselves to it. No matter when they started to be attracted to the controversy, however,

7. In a strict sense, the variable of "attention-getting-stage" in Figure 1 is a nominal scale. It violates the statistical assumption to estimate Pearson's correlation coefficients with interval scales of intensities of attention and shock. However, it can be compared with other variables if the stage variable is treated as the cumulative serial variable of those who started to pay attention to the scandal.

Table 2. Pearson Correlation Analysis of Age, Stage, and Intensities of Attention and Impact

		Stage	Attention	Impact
Age	Pearson corr. coefficients	**−.143**(**)	**.235**(**)	**.128**(*)
	sig. (two-tale)	0.01	0.00	0.01
	N	395	394	396
Stage	Pearson corr. coefficients		**−.292**(**)	**−.073**
	sig. (two-tale)		0.00	0.15
	N		392	393
Attention	Pearson corr. coefficients			**.473**(**)
	sig. (two-tale)			0.00
	N			392

(*): $p < .05$, (**): $p < .01$.
Stage: the moment when the people started to pay attention to the scandal.
Attention, Impact: the intensity of respondent's attention and impact respectively.

they were all deeply impacted. In summary, the Hwang scandal captivated almost every Korean's attention, and shocked them from the very beginning of the controversy, regardless of their age or gender.

Changes in Trust towards Science and Media

As the Hwang affair went through different stages, public trust in stem cell research also changed. Figure 4 shows that public trust in stem cell research overall—and in Hwang's research specifically—changed little either after the first disclosure by *PD Notebook* or after the revelation of the unethical investigation practice of *PD Notebook*. This shows that from the start, *PD Notebook* could not exercise any influence on public trust in Hwang's research. After the formal questioning of BRIC, the website of biological information cluster and discussion forum for biologists, however, the level of public trust started to dramatically fall and continuously dropped throughout the remaining stages.

The robustness of earlier trust demonstrates that Korean society paid a great deal of blind loyalty to Hwang. The *PD Notebook*, as one of the most famous "whistle-blower" program on TV and with a focus on correcting injustice in Korean society, still could not overcome the Korean people's blind faith in Hwang. In contrast, this "irrational" trust began to fall after BRIC—and known only to a few biologists—raised questions by providing the manipulated photos and other supporting data. This observation shows the importance of expertise in science reporting. In other words, a general in-depth investigation program like *PD Notebook* can influence general issues of our society, but in terms of possessing the level of scientific expertise needed to evaluate Hwang's research, the sophisticated knowledge of expert groups is more influential than that of journalists.

Table 3 shows the results of correlation analysis between the political attitudes of the public and trust in science. Political attitudes were divided into authoritarianism and liberalism (Altymeyer 1981;

Figure 4. Trust Changes in Stem Cell Research and Hwang by the Stage

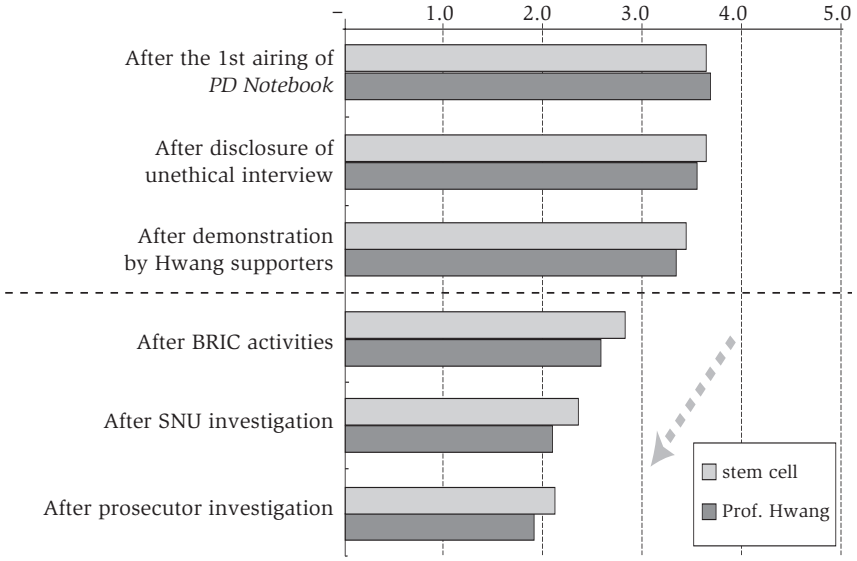


Table 3. Relationship between Political Attitude and Trust in Science: Before and After the Hwang Affair

Political attitude / Time / Trust in science	Authoritarianism		Liberalism	
	Before	After	Before	After
Science journal	– 0	+ 0	+ 0	+ 0
Stem cell research	++	++++	– 0	– 0
Bio-science	++	++	+ 0	+ 0

+ 0, – 0 : not significant, but retaining the sign of direction? (+ or –)

+ :	0.10 ~ 0.199	– :	– 0.10 ~ – 0.199
++:	0.20 ~ 0.29	– – :	– 0.20 ~ – 0.29
+++:	0.30 ~ 0.39	– – – :	– 0.30 ~ – 0.39
++++:	0.40 ~ 0.49	– – – – :	– 0.40 ~ – 0.49

Theiss-Morse et al. 1992).[8] After analyzing the relationship between political attitudes, the trust of science and the media, an interesting result emerged.

First, the relation between political attitudes and trust in science deserves special attention. As shown in Table 3, authoritarian attitude and trust in stem cell research and biological science have positive correlations, while liberal attitudes do not display any meaningful correlations with the two factors. Yet, the two groups have little

8. This study constructed the measures of liberalism and authoritarianism based on the patriotism scale proposed by Theiss-Morse, Sullivan, and Dietz (1992) and right-wing authoritarianism' scale by Altymeyer's (1981). Some original items are as follows:

   – When I see the National Flag flying on Independence Day, or watch our Armed Forces march in, or sing national Anthem with thousands of other Koreans, I know the true meaning of patriotism.
   – If someone think what they did was good for the country, we can call them a "patriot" even though they trampled over the law and the Constitution.
   – What we need is not more civil freedoms, but the virtue of strict law enforcement.

   Out of 17 items, a total of three factors were extracted using principal component

significant difference prior to the Hwang affair. After the affair, the correlations between authoritarian attitudes and science were emphasized (especially trust in stem cell research) and the difference between the political groups intensified.

The relationship between political attitude and trust in journalism is shown in Table 4. Similar patterns with Table 3 occur. As for trust in journalism prior to the affair, there are clear differences between authoritarian groups and liberal groups. Before the Hwang scandal, authoritarianism showed negative correlations with *PD Notebook* and MBC, while liberalism had a positive correlation with MBC.

Table 4. Relationship between Political Attitude and Trust in Media: Before and After the Hwang Affair

Political attitude / Time / Trust in media	Authoritarianism		Liberalism	
	Before	After	Before	After
PD Notebook	--	---	++	++++
MBC	-	--	+	+++
YTN	+0	+0	-0	-
Newspaper	++	+	-0	-0
Internet	+	+0	-0	+0

analysis with Varimax Rotation and Kaiser criterion of eigenvalue ≥ 1.0. These three factors accounted for 63 percent of the total variance. After an analysis of the items with a dominant factor loading pattern, it was concluded that the first factor represented patriotism, the second factor, liberalism, and the third factor, authoritarianism. The construct validity of the factors were inferred from an examination of the factor scores correlations between F1 and F2, F1 and F3, and F2 and F3. The correlation between F1(patriotism scale) and F3(authoritarianism scale) was positive and high(r = .43) as predicted. Also, the correlation between F2(liberalism scale) and F3(authoritarianism scale) showed the high negative correlation(r = -.40). Finally, the correlation between F2(liberalism) and F3(authoritarianism) was not significant(r = -.056) as predicted theoretically.

After the Hwang affair, the gap between these two groups became wider. Those who belonged to the authoritarian group weakened their trust in *PD Notebook*, which had sparked the Hwang controversy from the beginning, whereas those who were more liberal strengthened their trust in the program. The authoritarian group put more blame on *PD Notebook* and MBC, while the liberal group expressed support for them.

In summary, before the Hwang affair, political attitudes had little effect on trust in science and media. This indicates that regardless of people's political inclinations, liberal or authoritarian, most people trusted in stem cell research. After the Hwang affair, however, among the groups with different political inclinations, the discrepancy between trust in science and the media became wider. In other words, those who were inclined towards authoritarianism strengthened their trust in stem cell research while intensifying a negative attitude towards the broadcast (*PD Notebook*) that had sparked off the controversy. On the other hand, the liberal group displayed the direct opposite. This result matches the division and conflict in Korean public opinion concerning Hwang and stem cell research after the affair.

Discussion

The purpose of this study was to analyze the Hwang Woo-Suk syndrome, the blind faith and enthusiasm for the fabricated scientific feats of Hwang, and its perplexity and resistance after the Hwang affair. This research suggests that this syndrome is in large part the outcome of the circular mechanism of three major factors: an overly patriotic people, an empowered scientific establishment, and a myth-making media.

Before the Hwang affair, the Korean people, scientific circles, and the media established a robust, mutually reinforcing, interconnected system in support of Hwang. A patriotic passion that came to resemble a pseudo-fascism among the Korean people was a central part of

this mechanism. It was this passion, brought in by political science, that was symbolized by Hwang and the blind media at the beginning. After the affair, this system started to collapse. A majority of Koreans experienced dissonance in belief systems. This in turn led to breakups in people's beliefs, the media, and the scientific community. This marked the beginning of the Hwang Woo-Suk syndrome.

The supplementary survey of this study shows that before the Hwang affair broke out, the people's patriotic fervor, science, and the media formed a robust positive triangular equilibrium. After the affair, a breakup from the collective hypnotism was observed. Most Korean people experienced great shock and dissonance throughout the Hwang affair. The survey found that liberal-minded people freed themselves from the syndrome state relatively easily, while authoritarian-minded people tended to regress to their original beliefs in Hwang by ignoring the anti-Hwang evidence.

Science is assumed to be located in the realm of objectivity. The Hwang affair, however, showed that it can also fall into the realm of politics and propaganda. The Hwang affair showed the amount of adhesion existing among science, public desire, and politicians. Science became an empowered institution by catering to the people's desire for patriotic science. Hwang led this process to the point of engaging in symbolic manipulation in close relations with the mass media and even in the fabrication of the hard facts.

The media amplified the process of collective myth making by reporting science accomplishments truthfully at first, and then moved on to creating and delivering the stories of heroic science and scientists. The media eventually changed their stances as evidence against Hwang piled up, but this was only after quite some time had passed after the Hwang affair.

According to the supplementary survey, the predominant way Korean people resolve the psychological dissonance caused by the Hwang affair was to blame Hwang the person, and his research. In the same vein, they criticized the media, even though it was in large part the overly passionate patriots themselves who had blinded the media. Meanwhile, what remained relatively intact was the peo-

ple's passion. This coincides with the widespread public sentiment throughout the Hwang affair, that is giving priority to national interests over scientific ethics or trustworthiness of the press.

This implies that the risks of the second and the third comings of the Hwang affair are still present. For scientific research, the attraction and risk that public passion incurs seem too fatal to avoid. Research that meets this passion will get the attention, support, and the power. On the contrary, research that sticks to strict academic principles apart from this passion will remain relatively deprived. Under these circumstances, the risk of scientists being driven into the temptation of becoming another Hwang is ever present.

The same warning can be given regarding the media's journalistic practices. The media may overcome political power, and even the danger of the media themselves becoming a power. Can the media, however, overcome the ultimate barrier set by the people's beliefs and desires? Or, will it continue to cater to this power? These are the ultimate questions the experience of the Hwang affair has left us to answer.

REFERENCES

Altymeyer, B. 1981. *Right-wing Authoritarianism*. Manitoba: University of Manitoba Press.

Beardsley, S. 2006. "Down in Flames." *Scientific American* 294.3: 20-22.

Buck, H., et al. 1990. "Phosphate-methylated DNA Aimed at HIV-1 RNA Loops and Integrated DNA Inhibits Viral Infectivity." *Science* 248: 208-212.

Cha, Jae-Ho. 1985. "70 nyeondaemal-eseoui gachi, taedo mit sinnyeom-euro bon hangugin-ui sedaecha" (Generational Differences in Values, Attitudes, and Beliefs among Korean Adults in the Late 1970s). *Sahoe simni yeongu* (Studies in Social Psychology) 2.2: 129-168.

Choi, Jang-Jip. 2006. "Hanguk minjujuui-ui byeonhyeong-gwa hegemoni" (The Transformation of Korean Democracy and Hegemony). Paper presented at conference titled "Is Democracy Still a Hopeful Discourse?" Institute of Democracy and Social Movements, SungKongHoe University,

January 12.

Chun, Kyu-Chan. 2006. "Hwang Woo-Suk satae-reul tonghaebon hanguk jeoneollijeum yangsik-ui bipan-gwa jeonmang" (Critics and Prospects of Korean Journalism Reviewed through the Hwang Woo-Suk Affair). In *Sinhwa-ui churak, gugik-ui yuryeong* (Myth and Falling Down: The Phantom of National Interest), edited by Won Yong-Jin and Chun Kyu-Chan, 341-376. Seoul: Hannarae.

Couzin, J., and K. Unger. 2006. "Cleaning Up the Paper Trial." *Science* 312: 38-42.

Cunningham, A. 2005. "Research Leader of the Year, Woo Suk Hwang." *Scientific American* 6: 48.

Dearing, J. 1995. "Newspaper Coverage of Maverick Science: Creating Controversy through Balancing." *Public Understanding of Science* 4: 341-361.

Felt, U. 1993. "Fabricating Science Success Stories." *Public Understanding of Science* 2: 375-390.

Gorke, A., and G. Ruhrmann. 2003. "Public Communication between Facts and Fictions: On the Construction of Genetic Risk." *Public Understanding of Science* 12: 229-241.

Greco, P. 2006. "New Scandals—Time to Rethink the Rules?" *Journal of Science Communication* 5.1: 7.

Han, Gyu-Seog, and Soo-Jin Shin. 1999. "Hangugin-ui seonho gachi—sujikjeok jipdanjuui-eseo supyeongjeok gaeinjuui-ro" (A Cultural Profile of Korean Society: From Vertical Collectivism to Horizontal Individualism). *Hanguk simni hakhoeji: sahoe mit seonggyeok* (Korean Journal of Social and Personality Psychology) 13.2: 293-310.

Hanada, T. 2006. "The Domination of Populistic Culture over Science and Journalism." Paper presented at an international conference on "Trust and Ethics in the Investigative TV Journalism," Institute of Communication Research, Seoul National University, March 29.

Hagendijik, R., and J. Meeus. 1993. "Blind Faith: Fact, Fiction and Fraud in Public Controversy over Science." *Public Understanding of Science* 2: 391-415.

Hwang, Sang-Min, Jin-Young Yang, and Young-Ju Kang. 2003. "Sedae jipdan-ui gachi-ro gubundoen raipeu seutail-gwa geu-e ttareun gwonwijuui yuhyeong-gwa seonghyang-ui bigyo" (Types of Lifestyles Differentiated by Values in Korean Cohort Groups Reflecting Their Authoritarian Personality). *Hanguk simni hakhoeji: sahoe mit seonggyeok* (Korean Journal of Social and Personality Psychology) 17.2: 17-33.

Hwang, Sang-Min, and Jin-Young Yang. 2002. "Hanguk sahoe-ui sedae jipdan-e daehan simnihakjeok tamsaek: jeonijeok gongjon gwanjeom-eul tonghan daehaksaeng jipdan-ui sedae imiji bunseok" (The Image of Generations in Korean Society with Transferable Coexistence Perspective). *Hanguk simni hakhoeji: sahoe mit seonggyeok* (Korean Journal of Social and Personality Psychology) 16.3: 75-93.

Hwang, W. S., et al. 2004. "Evidence of Pluripotent Human Embryonic Stem Cell Lines Derived from a Cloned Blastocyst." *Science* 303: 1669.

_____. 2005. "Patient-Specific Embryonic Stem Cells Derived from Human SCNT Blastocysts." *Science* 308: 1777.

Inglehart, R. 1997. *Modernization and Post Modernization: Cultural, Economic, and Political Change in 43 Societies.* Princeton: Princeton University Press.

Iwabuchi, K. 2007. "What Is So Cultural about the Study of Media Culture Now?: Beyond Brand Nationalism into Media Citizenship." Paper presented at an international conference on "New Perspectives of Media Studies of the BK21 Digital Media and Communication in Korea and Institute of Communication Research," Seoul National University, October 6.

Judson, H. 2004. *Fraud in Science.* Orlando: Harcourt.

Kang, Myung-Koo, et al. 2007. "Aegukjeok yeolmang-gwa sunggohan gwahak" (Patriotic Passion and Sublime Science). *Hanguk eollon hakbo* (Korean Journal of Communication) 51.1: 59-90.

Kennedy, D. 2006a. "Editorial Expression of Concern." *Science* 311: 36.

_____. 2006b. "Editorial Retraction." *Science* 311: 335.

Kevles, D. 1998. *The Baltimore Case: A Trial of Politics, Science, and Character*. New York: W. W. Norton.

Kim, Daejung. 2005. "Witch Hunting for the Common People." *Chosun Ilbo*, December 5.

Kim, Myeong-eon, Kim Ui-cheol, and Bak Yeong-sin. 2000. "Cheongsonyeon-gwa seongin gan-ui sedae chai-wa yusaseong" (Intergenerational Differences and Similarities between Adolescents and Adults). *Hanguk simni hakhoeji: sahoe munje* (Korean Journal of Psychological and Social Issues) 6.1: 181-204.

Lee, Seung-Hwan, et al. 1999. *Asiajeok gachi* (The Asian Values). Seoul: Tradition and Modernity.

Lewontin, R. 2004. "Dishonesty in Science." *New York Review of Books* 51.18: 38-40.

Moody, H., et al. 1990. "Inhibition of HIV-1 Infectivity Phosphate-methylated DNA: Retraction." *Science* 250: 125-126.

Na, Eun-Yeong, and Jae-Ho Cha. 1999. "1970 nyeondae-wa 1990 nyeondae gan hangugin-ui gachigwan byeonhwa-wa sedaecha jeunggam" (Changes of Values and Generational Gaps Between 1970s and 1990s in Korea). *Hanguk simni hakhoeji: sahoe mit seonggyeok* (Korean Journal of Social and Personality Psychology) 13.2: 37-60.

Na, Eun-Yeong, and Kyung-Hwan Min. 1998. "Hanguk munhwa-ui ijungseong-e gwanhan sogo" (A Study on the Dualism of Korean Culture). *Sahoe gwahak yeongu* (Social Science Studies) 24: 3-16.

Nisbet, M., D. Brossard, and A. Jroepsch. 2003. "Framing Science: The Stem Cell Controversy in the Age of Press/Politics." *Harvard International Journal of Press/Politics* 8.2: 36-70.

Palfreman, J. 2002. "Bringing Science to the Television Audience." *Nieman Reports* 56.3: 32-34.

Park, Sung-Gwan. 2003. "Process of Modernization in Korea Society and Changes in Social Communication Circles." Paper presented at annual symposium on "Digital Civil Society and Social Informatics," Seoul National University and University of Tokyo, October 24.

_____. 2005. "Gullon-ui chulhyeon-gwa hanguk minjujuui" (The Emergence of Mass opinion and Democracy in Korea). Paper presented at conference on Change of Korea society and the Role of Journalism in 21century, Institute of Communication Research, Seoul National University, June 3.

Paul, D. 2004. "Spreading Chaos: The Role of Popularizations in the Diffusion of Scientific Ideas." *Written Communication* 21.1: 32-68.

Rheingold, H. 2003. *Chamyeo gunjung: hyudaepon-gwa inteonet-euro mujanghan saeroun gunjung* (Participating Crowd: New Crowd Equipped with Mobile Phones and Internet). Translated by Yi Wongyeong. Seoul: Hwangkumgazi. Originally published as *Participating Crowd* (2002).

Snyder, E., and J. Loring. 2006. "Beyond Fraud—Stem-Cell Research Continues." *New England Journal of Medicine* 354.4: 321-324.

Theiss-Morse, E., et al. 1992. "Mixing Methods: A Multistage Strategy for Studying Patriotism and Citizen Participation." *Political Analysis* 39.1: 89-121.

Toumey, C. 1996. "Conjuring Science in the Case of Cold Fusion." *Public Understanding of Science* 5: 121-133.

Weaver, D., et al. 1986. "Altered Repertoire of Endogenous Immunoglobulin Gene Expression in Transgenic Mice Containing a Rearranged Mu Heavy Chain Gene." *Cell* 45: 247-259.