

## **Your case study**

You create a case to analyze and study, find one on web or in the newspapers, your own experience, or a situation from someone you know or read about

The case could also be totally made up or fictional, the better you make the case the more likely that a similar situation has really occurred somewhere

Highly flexible, could be on about anything that threatens any one of the canons

## **Air Force Engineer – Challenges with proprietary data**

Air Force engineers working in an acquisition program office will often be required to review the contractor's technical data and provide recommendations concerning whether the contractor's work is valid. As a result of these reviews and assessments, the engineers will usually provide input and recommendations to the program office leadership on whether the contractor's product is sufficient. With launch programs, this can be a recommendation of whether a rocket is safe to launch or not. Because of this responsibility it is essential that the engineers are objective and knowledgeable on the systems and subsystems that they are analyzing. Government engineers do not just want to rely on opinions of the contractor's engineers, since they work for their company and may not be completely looking out for the government. In addition, engineers working for the Government must be forthright on their level of knowledge when providing recommendations and assessments to what can lead to a critical decision.

There may be times where an Air Force engineer may feel that one contractor's launch service may be better if they designed or operated similar to the other contractor. If they then shared the other contractor's information then they would have committed a break of ethics. While we have an obligation to the public, we also have an obligation to the two contractors to protect their information. If we do not protect proprietary information adequately, the contractors may limit government access to their data thus preventing the government employees from doing their job effectively. It may also lead to improper disclosures during contract negotiations, which can result in skewed bid proposals. On the other hand, the goal is to build the best rockets possible so to protect our nation and carry out offensive missions accurately. Withholding knowledge or suggestions for improvements from the winning contractor prevents the best rockets from being made.

## **Big ego inspector**

I am a senior engineer with a major, global consulting firm. I was a co-lead project engineer on a \$350 million plant in China (not real location) for the government that took an intense 7 years to build. I was on location the entire time and I knew the plant aspects that I was responsible for inside and out, upside down and backwards. The local culture was such that it was tradition to grease the palms of government inspectors while they visited, it was an accepted practice in that culture. The inspector's pay took this into account, like tipping waiters in the USA. We studied what was standard and followed normal amounts for that area and what was being inspected. All the engineers I worked with could not stand the bribing traditions at all and felt sick to be involved with this corruption. While conducting the final and most important inspections of the plant we knew that bribes were expected to be the biggest. So, the lead government inspector along with his team of 8 people came to my aspects of the plant. It was near the end of his final inspection and it had gone very well so far. There were about 20 people in my group and several translators. The inspector accepted my gift and everything was going fine. He asked dozens of questions and my team had answers for all, we had been on site practically non-stop for 5 years and were highly skilled at our occupations. The lead inspector was very arrogant and decided to disagree on a technical decision we made because he had to show his authority and superior intellect in front of his junior inspectors. The issue was with a water treatment process we were using for a specific task. After 2 hours of trying to explain why the system was built the way it was he still insisted on changes that would just not work for the intended purpose. In fact, it made no sense how he wanted the treatment process changed. It would not produce the quality of water needed. My team of engineers and contractors knew far greater knowledge about that specific aspect than the inspector and his team. It got to the point that he was definitely not going to back down in front of his team, no matter what. He was the lead inspector and there was no one to visit with about his decision, he represented the national government of China. If he did not approve the entire plant on this official trip then great delays and expenses would start piling up. Plus, big strains in our relationships this late would likely make this a nightmare situation fast.

What should I do?

## **Changing the product testing procedure to meet requirements**

Recently, my main duty was to perform thermal performance tests. These test results are used for sizing up our product, so accuracy is very important to maintain a competitive edge. I had worked in this position for 11 years. During this time, I did my best to make sure the results were the best that they could be. One issue that I discovered was that the repeatability of the tests was about 0.5 – 3 percent, depending if it was a direct repeat test, or one that had been brought back into the system over a period of time. With time, the repeatability would get worse. This information was known to several in the company including my boss and his. The people who used the information to properly size our products also knew this. They would include a factor of safety to make sure the customer is receiving a good product.

Every once in a while, we would have a customer who wanted to witness the testing of the product in which they were purchasing (usually multi-million dollar contracts). There is one customer who had witnessed several of our tests. They are not ones to trust anyone, for they also have a testing facility to run their own tests. Each time they would come here for several days, witness the test, have some barbeque. Each time they would argue the fine details, but later they would go back happy and we would have a new contract.

On this last contract, again we were to set-up one of our products for them to come in and witness. As usual, we completed an early test on the product to see how it was performing. It tested at 98 percent, which is within the test accuracies of the system. However, this was not good enough for our new vice-president. This contract was important to him, for it would allow the company to reach its financial goal. Therefore, we re-tested it again, with no positive results. We checked out the system and verified that everything was functioning properly. Still, the test would only come out at 98 percent. The vice-president still demanded that the test come out at 100 percent.

Shortly after this, I walked in on my manager messing around with the testing program. I asked him what he was doing. He stated to me that we needed to have the test at 100 percent during the visit and he was going to make sure it was going to happen. He was changing the code of the program so one of the coefficients were changed just enough to make this happen. At this point, I told him what he was doing was wrong and that I did not want to have anything to do with test. He stated that he did not have any problem with that.

This began to trouble me. The fact that we were changing the test code in order to sell a job. I knew that we were not far off and this discrepancy could be explained. After days of contemplation, I confronted my boss about this. He informed me that this contract was important and he was informed to make the test come out. This contract stated that this test and the on-sight test each had to come out at 100 percent. Any deviation in this would result in financial penalties against us. I explained to him that changing the code to correct the test was wrong. He stated that he did not have any problem with this since it was within the error of our system. That we could use some of the previous test coefficients and come up with the correct results. This didn't ease my concerns, so he said that I could talk with his boss about.

At this point, I set up a meeting with his superior and discussed my concerns with him. He too stated the same things that I heard before. There was just too much money

on the line to allow these two percentage point to get in the way. I informed him that we should be able to negotiate our way out of this. At this point, he said we were to go on as plan and there was no way around this. This put me into a pinch. Our company has its own code of ethics in which we are obligated to report any unethical events. Knowing that pointing this out could jeopardize my career and the welfare of my family, I confronted him with our company's policy and stated that I would have to report this incident.

At this point, he was willing to sit down and go over the situation in more detail. I explained to him that changing the computer code in order to fix a test, no matter how small of change, was not right. We went over several other options that could be done before the customer would arrive. Still none of these would work. He stated that the right thing would be done.

Later, he stated that I would not have to perform the test and that in not performing this test would not go against me. My manager would perform the test. This told me what his "right thing" was. I do feel that the "fixed" program was used for the test. The challenges that I see are deciding when the bottom dollar over-ride common sense. Your instinct for doing what is right is disillusioned by the pressure of pulling in more revenue. Pressure from one's superiors can be overwhelming and have a negative influence on one's decisions. The National Society of Professional Engineers' code of ethics is an excellent reference to help one with their dilemmas. It is also a very good persuasion tool, since it is based on the fundamentals and ideas of one's peers.

I am trying to decide if I should report the situation to more individuals up the ladder (or to client), it is a hard decision. I had several long conversations with my wife, my parents and my brother. To each, I explained the situation, along with the policies at hand. One of the main reasons not to report is the fear of losing my job or having some of those around me lose theirs. I still have my wife and family to take care of, and I do not want to jeopardize their welfare.

What should I do?

**AAWRE Engineering Ethics Workshop**  
**Conducted by Steve Starrett, Ph.D., P.E., D.WRE**

**ASCE Fundamental Principles**

Engineers uphold and advance the integrity, honor and dignity of the engineering profession by:

1. using their knowledge and skill for the enhancement of human welfare and the environment;
2. being honest and impartial and serving with fidelity the public, their employers and clients;
3. striving to increase the competence and prestige of the engineering profession; and
4. supporting the professional and technical societies of their disciplines.

**Fundamental Canons**

1. Engineers shall hold paramount the safety, health and welfare of the public and shall strive to comply with the principles of sustainable development in the performance of their professional duties.
2. Engineers shall perform services only in areas of their competence.
3. Engineers shall issue public statements only in an objective and truthful manner.
4. Engineers shall act in professional matters for each employer or client as faithful agents or trustees, and shall avoid conflicts of interest.
5. Engineers shall build their professional reputation on the merit of their services and shall not compete unfairly with others.
6. Engineers shall act in such a manner as to uphold and enhance the honor, integrity, and dignity of the engineering profession and shall act with zero-tolerance for bribery, fraud, and corruption.
7. Engineers shall continue their professional development throughout their careers, and shall provide opportunities for the professional development of those engineers under their supervision.

**Summary of Case Background**

An experienced water resources engineer and partner in a small consulting firm (**Aqua Damp, P.E., D.WRE**) has worked with a lake community (**Sunrise Lake, City government owns lake**) for a few years on trying to reduce the amount of sediment that is being deposited into their lake. The lake experienced about 40 years of high quality surface water prior to extensive residential and commercial development started in the watershed about 20 years ago. Excessive sediment causes coves to be too shallow for home-side docks to be usable, which also reduces property value, high turbidity in water makes it unsightly, and dredging sediment is very expensive. As the years go by, Aqua creates a watershed model, has lots of interaction with attorneys about lawsuits filed by Sunrise Lake against developments (i.e., **High Dollar, Inc.**) on the excessive erosion issue (100 to 300 times when compared to previous grass cover), met with EPA officials,

regularly communicated with developer's engineers (**We Build Engineers**) to determine better erosion control solutions, performed an extensive design review of erosion control devices on numerous construction sites, and regularly inspected erosion control at sites. Also, the point person (i.e., project manager) from the community (**Micro, President of Homeowners Association (manages lake for City) and Silt Committee Chair**) has been in very close contact with Aqua and his activities. Micro is a sharp, retired telecommunications person that is totally committed to reducing silt coming into the lake. Micro has lived around the lake for over 30 yrs and has had several good ideas / background information that Aqua appreciated. After 9 months of working with We Build Engineers, Aqua believes much progress has been made, attempts to control erosion have been extensive, and certainly also knows improvements to erosion control are still possible. Micro and Aqua have had many lengthy discussions over the success of control devices implemented, the direction that should be taken by Sunrise Lake, and their differences of opinion.

Dilemma 1. Micro asks Aqua to **extensively review** sediment being transported by **Deer Creek** into the lake, and to present **solution ideas** to We Build Engineers. Aqua has determined a very small portion of the overall sediment reaching the lake is coming from bank erosion in the Deer Creek watershed. Aqua informs Micro his requested activities will cost about **\$15,000** and Micro **approves** activity. The **resources** from this additional activity (as well as the overall project) are **important** to Aqua's small firm, not critical, however certainly important. Aqua thinks improvements to Deer Creek will not significantly reduce silt coming into Sunrise Lake. What are the ethical issues for Aqua? What should Aqua do? What are consequences?

Dilemma 2. Dilemma 1 works itself through. Aqua had **extensively reviewed** erosion control plans created by We Build Engineers, **offered dozens of suggestions**, We Build has incorporated almost all the suggestions, Aqua told Micro he was prepared to **seal** a letter to the attorneys (this process established by attorneys of involved parties) stating the erosion control plans were **acceptable** to Sunrise Lake. Micro tells Aqua the plans are **not acceptable** and to not approve plans. Micro also tells Aqua if he sends the letter it will weaken Sunrise Lake's legal position, and that Aqua would be "**done**". What are the ethical issues for Aqua? What should Aqua do? What are consequences?

Dilemma 3. Dilemma 2 passes and time slowly heals the conflict between Aqua and Micro. Aqua explains many engineering technical aspects to Micro and Micro disagrees with Aqua on some of the items. **Micro sends a letter** to the developer (High Dollar), without having Aqua review the letter, stating a list of 12 **urgent** problems. The list appears to be supported, or even partially created by Aqua. **Aqua disagrees** with 9 of the points, and the other 3 are not well described. What are the ethical issues for Aqua? What should Aqua do? What are consequences?

Dilemma 4. Dilemma 3 passes and time slowly patches conflict. Aqua feels he must have much **more contact** with other leaders from Sunrise Lake because Micro is far too emotionally about this silt topic. So, he requests **numerous times** with Micro and other leaders to present an **update** to the community. Micro is an excellent **politician** and

convinces other leaders he can work with Aqua and things are **fine**, no one else needs to get involved. Other leaders are working professionals, swamped with work and family, and honestly don't want to spend time on this silt topic. So, it is conveyed to Aqua again that Micro is the community representative. Micro tells Aqua don't call others again, the situation is far **too complex** for them to understand all the work that has been done. What are the ethical issues for Aqua? What should Aqua do? What are consequences?

Dilemma 5. Dilemma 4 just goes away with no changes, Micro is still the **only contact person** for Aqua. All of Aqua's interactions with the rest of the 2,000 person Sunrise Lake community has been very positive. So, Aqua reinforces his perspective that he is helping the community, and tries to not let conflicts with Micro interfere with his engineering responsibility to **Sunrise Lake residents**. Another 9 months go by and **Micro is arguing with Aqua** about: erosion control progress, water sample results, quantity of silt in a sedimentation pond, details on engineering plans, detention pond outlet structure characteristics, what Micro believes is a crack in an earthen dam when Aqua knows it is a gully caused by surface water running down the uncovered backside of dam, and stating his displeasure with the overall progress. Through a couple of years now, Aqua knows Micro has **unrealistic expectation**, no formal education on related subjects, a lot of stress to produce lawsuit results because he has spent a lot of the community's resources, and a big ego that has been hit by many long ago and recent insults from High Dollar and We Build Engineers. Micro states to Aqua, "This **cooperation** between the **engineers** that the attorneys setup is not working, we need to start the **lawsuit** again to get results". Micro is also starting to spread his **displeasure with Aqua**, claiming that Aqua is part of the engineering brotherhood and is not willing to push We Build Engineers into doing what needs done. What are the ethical issues for Aqua? What should Aqua do? What are consequences?

### **Applying 8 step process to solving dilemmas**

1. State the problem.
2. Get the facts.
3. Identify and defend competing moral viewpoints.
4. Describe and discuss with colleague that would understand situation, listen well, and not be too close to situation to feel they need to act on something or do something.
5. Formulate an opinion.
6. Test opinion. If I decide this way, what would my family think of my action or lack of action? Would I want my kids or nieces and nephews to act this way? How would I feel if my actions were published on the front page of the paper?
7. Qualify the opinion or recommendation.
8. Time for decision. Do something, or nothing if that is your decision.

## **Environmental engineer asked to disregard some negative sampling data**

This last dilemma is prevalent in the environmental consulting industry: what happens when you find data that would condemn your client, but your employer ignores the results or asks you to not report them so that they can keep the client's business.

The former happens quite a bit more than you would think since most private companies that hire a consultant to investigate a site have some motive in mind for the site (either to develop it or try and make sure they did not have anything to do with it.) This can create a dilemma for the engineer that is responsible for the investigation since these contracts are usually quite lucrative, and most clients will keep using your company if they get results that are favorable. This can lead to some serious pressure on the consultants to get the result that makes the client the most happy, whether it is the right answer or not. Getting and keeping business contracts in the environmental work is a cutthroat place and set of circumstances. Some clients seed a contract with language guaranteeing further work only if the findings favor them, and a lot of those types of contracts become VERY lucrative. This pressure can take the form of engineers being asked to either disregard unfavorable/results from analyses to flat out falsifying the data to make the results happen. This sort of situation has occurred many times and usually it is found out later when the remediation system is found to have failed, sometimes to the detriment of people's lives. This sort of behavior does not restrain itself to the private side of industry, regulators are just as likely to ask for certain results, or blatantly tell you what should be the answers to the questions that they ask. Such regulators have asked consultants to pass sites that are not clean as such so that they would appear to be doing their jobs and continue to be funded as well. This is at heart a serious ethical dilemma.

## Experts decry virus course

Students recreate existing viruses, not inventing new ones

Ben Li

News Editor

Gauntlet, student newspaper at the University of Calgary

<http://gauntlet.ucalgary.ca/story/9496>

[May 29, 2003](#)

A new computer science course at the U of C drew international headlines this week, and international condemnation.

The course, entitled "Computer Viruses and Malware," will focus on "developing malicious software such as computer viruses, worms and Trojan horses," according to the university, and will be taught by Dr. John Aycock.

Computer security experts have stated that teaching students how to write malicious software--malware--is unnecessary.

"Should we teach kids how to break into cars if they're interested in becoming a policeman one day?" said senior technology consultant for Sophos Anti-Virus Graham Cluley in a statement.

Dr. Ken Barker, Head of the Department of Computer Science, explains that students will not be creating virus de novo, but will examine viruses already in the wild.

"That's exactly the kind of misinformation that concerns us," he said. "Nobody here says that we will create new viruses. Some media have reported that students will create new viruses, that is not correct. They're recreating viruses, not creating new viruses."

Aycock has previously stated that in order to develop more secure software and countermeasures against malware, software developers must first understand how the malware works.

"It's a case of being proactive rather than reactive," stated the U of C's May 15 press release. "This attitude is similar to what medical researchers do to combat the latest biological viruses such as SARS. Before you can develop a cure, you have to understand what the virus is and how it spreads--why should combating computer viruses be any different?"

Cluley disagrees.

"It is simply not necessary to write new viruses to understand how they work and how they can be prevented," Cluley said, in reference to the U of C's comparison of malware research to SARS research. "Instead [biologists] do what we do: careful examination of

new threats and a thorough understanding and analysis of the many threats which already exist. Creating new viruses is of no benefit at all, but could lead to greater danger."

Barker asserts that the course presents no additional risk of students unleashing new viruses.

"They can do it now anyway," he said. "If their goal is to be able to wreak havoc on computers, they're not going to invest three years at a university before doing so."

Cluley was also concerned with possible legal implications with the course.

"One wonders if the university will be held legally and financially responsible if any of the viruses written on their course break out and infect innocent computer users," he said.

U of C Vice-President External Relations Roman Cooney stated that the university would not be responsible.

"Any reasonably bright individual can get on the Internet all the information they need to create malware," he said. "Anybody can do this. Why would we be held liable?"

"We have taken measures to prevent students from using information to create viruses," added Barker. "This is a fourth-year course, and it's a closed system, so there's no way the work they're doing can enter into another person's computer."

Dan Seneker, speaking for the Faculty of Science, stated that teaching students about malicious software now helps them to write software to defend against malware in the future.

"It's just an extension of what the U of C is doing already, with the e-security course from Continuing Education and applied cryptography in the [Department of] Mathematics," said Seneker, who added that the virus-writing component of the course is just one assignment worth 20 to 30 per cent of students' grade.

Dr. Jan Hruska, CEO of Sophos, disagrees. On Wed., May 28, he issued a statement with language Senekar characterized as "strong," warning students to avoid the malware course.

"Don't bother applying for a job at Sophos if you have written viruses because you will be turned away," said Hruska. "You are of no use to us. The skills required to write good anti-virus software are far removed from those needed to write a virus."

Cooney disagreed.

"If Sophos doesn't think the best people they can hire are the people who understand how these guys think and work, our students should be going elsewhere," he said. "They should work for a company that would value their education and training."

Barker questioned Sophos' intentions in criticizing the university's new offering.

"They're the third-largest antivirus company in North America, and arguably the second largest in Europe. Are they afraid of something? Competition?" asked Barker.

But Hruska's comments echoed those of the Anti-Virus Information Exchange Network, an organization claiming to represent the majority of anti-virus software developers, security professionals from industry and other educational institutions. Their statement, endorsed by members on Mon., May 26, read in part:

"We call upon the University of Calgary to review its decision to include the instruction of programming of malware as part of its curriculum. There are numerous ways to instruct students in the subject of malware without resorting to the creation of more viruses.

"The creation of new viruses and other types of malware is completely unnecessary. Medical doctors do not create new viruses to understand how existing viruses function and neither do anti-virus professionals. It is simply not necessary to write new viruses to understand how they work and how they can be prevented. There are also enough viruses on the Internet already that can be dissected and analyzed without creating new threats."

The AVIEN statement also offered to help the U of C develop the course and suggested that the university focus on tools and techniques to study malware, including viruses that already exist, teach students to defend and mitigate damage caused by malware, and study virus hoaxes, chain letters, and frauds.

"We're willing to work with all of these companies on this, Sophos has not done anything to help us on it," said Barker.

Seneker said that the U of C will seek input from law enforcement, philosophers, lawyers and the anti-virus community before the curriculum is finalized for fall 2003. He added that this type of course is available elsewhere.

"Others like Portland State University and [University of] New Haven in Connecticut offer courses on viruses and malware," he said. "Ours differs in that we offer it at the undergraduate level."

According to Seneker, the Department of Computer Science has received media calls from the Globe and Mail, the New York Times, and the Reuters news agency. Articles on the subject have been published in Africa, Asia and South America.

Reader Comments:

Add your comment or send a letter to the editor

Posted: 2003-05-30 17:11:21

#1 - It is possible to interpret the University of Calgary actions on this matter a potential security threat to both Canada and the United States. Since many of the recent terrorist entered our continent through Canada, it is quite reasonable to suppose that some of them are students in our Universities as well. It is believed by many, particularly in positions of authority and responsibly, that the next major attack or war will be preceded by a blitz attack on our critical communications and computer network infrastructure. The use of malware in this context would classify it as a weapon. The weaponization of malware is not a far fetched concept. Since most universities are not geared up to perform background checks on their students, they cannot control the potential threat that might be created by, or emanated from their institution.

Academia license is not in a vacuum outside the realm of ethics. The implied argument by the U of Calgary that we are not responsible for how our students may use their new gained knowledge/skills is akin to the argument many scientists have offered in the past. They have often claimed we just developed/invented the item we are not responsible for how it is used; i.e. moral neutrality.

That is, always has been, and always will be a bunch of bull pucky!

The university does have an ethical obligation for what it teaches. In fact, the U of Calgary might be leaving itself open to a plethora of lawsuits if one of their students creates and releases a virus that causes harm. I can see the headlines now; "University of Calgary student releases new computer virus shutting down emergency services in several cities. Several people die because they cannot contact 911." If I were the Dean or President of this school, I would be quickly re-thinking this decision.

As for P.C. Safe Devices, Inc., we will not consider job applicants who have received this type of training. As for AVIEN's analysis of this situation, "You are right on target as usual!"

It's time folks to get our heads out of the clouds, and get back down to earth!!

–Joseph A. Broyles, CEO of P.C. Safe Devices, Inc.

## **Case Study**

M.C. McFarland, "Urgency of Ethical Standards Intensifies in Computer Community," *Computer*, vol.23, no.3, pp. 77-81, Mar., 1990

Evaluate ethical issues using 4 methods: utilitarianism, deontological approaches, virtues, and a combination of any parts of these approaches that make the most sense to you.

## **Huge waste-water pumps stuck on dock in Europe**

I am a consulting engineer that has been working with a county government to expand the greatly over worked waste-water treatment plant and collection system. The area's population has exploded and is expected to continue. The overall project was about \$50 million and required a number of large specialty pumps. We selected an excellent pump manufacturer in Europe because of excellent reputation, quality, low maintenance needs, reliability, short time to obtain (only 1 year), and cost. The manufacturer completed the pumps on time, delivered them to the nearest dock (by railroad cars) where we were to negotiate with a shipping company the freight across the big pond. A ship captain calls my firm informing them the cost to ship, how long it would take, etc. Then he proceeded to state what his fee was, this was a surprise because he told us what the freighting was going to cost and now there was another substantial cost. We said thanks and started shopping around and inquiring about this captain's fee. Turns out it is a bribe to the captain, he is in-charge of the ship and nothing gets on without his permission, so it seems common in that region that captains take advantage of the situation. The amount of the bribe depends on weight, size, how many pieces, how the captain feels that day, how his other bribes have been going, etc. As we called around we could tell the word was out about our freight because the captain's fee had increased substantially. We called the pump company and they said, "sure there is a captain's fee, what is your problem". We thought about trucking or railing our equipment to another dock, however costs were huge, plus we would have to pay a number of bribes to get the freight out of the country and then we may face the same problem again at another dock. My engineering firm does not participate in bribes or other unethical behavior. Bribes are clearly unethical and it is stated directly in the NSPE Code of Ethics not to participate with any sort of bribery. We are also spending local government money so "bribing" the captain may have further legal implications. The waste-water treatment plant needs to turn on the expansion as soon as possible because inadequate treatment is causing substantial environmental problems downstream (water quality at a nearby city's drinking water intact is starting to be impacted negatively) and high EPA fines are mounting. These are very custom pumps and are not available elsewhere.

What should we do?

## **Engineer determines client greatly undercharged for electricity used**

I recently faced an unusual situation in Jamaica (not actual location).

The players and their relationships were a water/waste water (W/WW) management company that had a contract to manage the W/WW day-to-day operations for the whole island. The government owned all the W/WW equipment but contracted to pay a certain amount of revenue to the W/WW management company per the kilowatt-hour (kWH) used. The electric company charged for kWH only. They did not charge a demand charge like most utilities charge in the United States.

The government contracted the W/WW management company to \$0.10 a kWH for 6 million kWH per year. The 6 million kWH (existing electrical usage) was an agreed upon number by both the government and the W/WW management company. The government would pay the actual cost of electricity (kWH) to the electric company. The contract then stated that if the W/WW management company used more than 6 million kWH in a one year period, the W/WW management company would have to pay the difference to the government. If, however, the W/WW management company used less than 6 million kWH in a one year period, the W/WW management company would get a refund of the difference from the government minus 50%.

This was a 10 year contract. After the first year, the 6 million kWH figure would be reduced by 4.5% and stay that way throughout the remaining years of the contract. We were hired by the W/WW management company to (a) go to all the W/WW plants and high energy use facilities to measure the kWH at these facilities to verify that the electric company was billing the correct amount; (b) perform an energy audit on these facilities to help reduce their electric bill by 4.5%.

I was given electric bills for the previous 22 months which had about 2,100 individual sites with the kWH usage and the associated amount charged for that site. After collecting the kWH data at the W/WW plants and high energy use facilities, I started comparing the actual kWH data to the kWH data from the electric company. I determined that the W/WW management company was being undercharged by the electric company by about 1.5 million kWH a month! That was 18 million kWH a year that was not billed! One site was responsible for about 70% of the discrepancy. At 0.10/kWH, this came out to \$1.8 million a year that was not being collected by the electric company. On top of that the 6 million kWH was agreed upon and set by both parties without knowledge of this error. So the actual kWH value should have been 24 million kWH and not 6 million kWH.

When discussing the numbers to the W/WW management company, they admitted knowing about the discrepancy and instructed us not to divulge this information to the electric company. To me this was dishonest and unethical. Although I read the IEEE code of ethics at the time I passed my PE exam, I did not know how to approach this situation. I did not even think about the IEEE code. My supervisor at the time told me to hold off and not make any immediate decisions. We agreed to wait until after we

presented the information in a formal presentation to the “#3 man in charge” and the “#5 man in charge” of the W/WW management company. The # 5 man in charge is a well known engineer in the W/WW profession with patents in water treatment processes that have been used in third world countries. Both of them flew in from Europe for this presentation. The electric company was not present at this meeting.

The discrepancy was presented and many questions were asked. I did not bring up the subject of informing the electric company about the discrepancy in the meeting, as my supervisor and I had agreed. Afterwards, we discussed how to handle this dilemma on the plane when headed back to the U.S. I stated that this was really bothering me.

What should I do?

## **Kansas City Hyatt Regency Walkway Disaster (wikipedia)**

[http://en.wikipedia.org/wiki/Hyatt\\_Regency\\_walkway\\_collapse](http://en.wikipedia.org/wiki/Hyatt_Regency_walkway_collapse)

Construction on the 40-story Hyatt Regency Hotel began in 1978, and the hotel opened in July 1980 after some construction delays. One of the defining features of the hotel was its lobby, which featured a multistory atrium crossed by suspended concrete walkways on the second, third, and fourth levels, with the fourth level walkway directly above the second level walkway.

### The disaster

On July 17, 1981, approximately 2,000 people had gathered in the atrium to participate in and watch a dance contest. Dozens stood on the walkways. At 7:05 PM, the walkways on the second, third, and fourth floor were packed with visitors as they watched over the active lobby, which was also full of people. The fourth floor bridge was suspended directly over the second floor bridge, with the third floor walkway set off to the side several meters away from the other two. Construction issues led to a subtle but flawed design change that doubled the load on the connection between the fourth floor walkway support beams and the tie rods carrying the weight of the second floor walkway. This new design could barely handle the dead load weight of the structure itself, much less the weight of the spectators standing on it. The connection failed and both walkways crashed onto the lobby, killing 114 people and injuring more than 200 others.

There are lots of pages on the web about this disaster. Review the material available.

## **PE sealed plans not familiar with**

I am an EIT that works in California. One of my recent projects was located in Utah. We received a request from our client for a preliminary set of drawings that were to be used as a permit set to be sent to the county. Normally a permit set would not require a stamp and signature but for this particular county a PE seal was required. We finished the drawings and necessary specs in time to send the project out but were unaware of the PE seal needed until right before the set had to be sent out via Fed-Ex. A delay on our part would cause a lot of problems for our client. The experienced engineer I worked closely with on this project was a PE in numerous states, however he was not licensed in Utah. Our problem was that the only engineer in my main office that was licensed in Utah was out of the office, and to my understanding not even familiar with the current state of the project. Another Utah licensed PE happened to be one of the company's principles (worked in a different office) that only really gets projects started and never really works directly on a design project. Our office manager had duplicates of his PE stamps in her desk so that he did not need to bring the correct one anytime he visited our office and needed his PE stamp.

What should we do?

## **Recent UMKC plagiarism scandal highlights issue of academic dishonesty**

**Ben Swofford**

**Issue date: 7/11/05 The Current online.com (UM-St. Louis student newspaper)**

UM-Kansas City Dean of Arts and Sciences Bryan LeBeau was suspended for allegedly plagiarizing portions of a commencement speech he gave in December 2003.

LeBeau was accused of copying certain portions of his speech from one that Cornell West, professor at Princeton and leading African-American academic, gave at a Wesleyan University commencement in 1993.

LeBeau's speech had large portions copied from West's speech almost word for word.

"A tragic sense of history will give you a view of the world in which no culture and no civilization and no society has a monopoly on wisdom and virtue. It would allow you to see ambiguous legacies in the past, to accent hybrid culture, because every culture that we know is based in part on fragments of antecedent cultures," West said in 1993, according to a transcript of the speech.

"A realistic sense of history will give you a view of the world in which no culture and no civilization and no society has ever had a monopoly on wisdom and virtue. It will allow you to see ambiguous legacies in the past, to accent hybrid cultures, because every culture that we know - including our own - is base in part on fragments of antecedent cultures," LeBeau said, according to the speech as it was published in the Dean's Newsletter No. 7 of UM-Kansas City.

Different portions of the speech were similar, and at one point, LeBeau uses the same quotes from the same authors in the same order as West.

The incident of plagiarism would have gone unnoticed except for Sally Greene, professor at North Carolina-Chapel Hill, who Googled a Hegel quote that both West and LeBeau used. She found the comparisons between both speeches.

Raleigh Muns, UM-St. Louis reference librarian and author of an Internet page examining plagiarism said the Internet has become a great tool in detecting plagiarized material.

"You can look in databases. Do some phrase searching. You can look on the Internet as a whole. The backside of being able to plagiarize from the Internet is being able to catch it so much easier with the Internet," Muns said.

The three ways faculty search for plagiarized material are proprietary sites owned by the university, search engines and commercial sites, Muns said.

The most popular commercial site on the web is Turnitin.com, a subscription based site that certain colleges use, including St. Louis Community College. With Turnitin.com teachers submit students' papers to the site, creating a huge database of papers and ensuring students' papers do not get passed around.

"There's a large bunch of commercial software for plagiarism," Muns said.

The UM-St. Louis Student Conduct Code has a three-part definition of plagiarism, including use of quotes without crediting the source, unacknowledged buying of material produced by others and unacknowledged collaboration.

When plagiarism is discovered by teachers, they are obliged to report the incident to Academic Affairs within 14 days, the Academic Dishonesty Guidelines states. Students accused of plagiarism are then supposed to attend an informal disciplinary hearing.

"The University has a person who does investigate and make recommendations on outcomes of cases. Every case has different outcomes and sanctions. It depends on the case," Lori Morgan, executive assistant in the office of the vice chancellor for academic affairs, said.

Tanisha Smith, assistant to the dean of the graduate school, is that person. Smith investigates every case of plagiarism on campus and takes part in the disciplinary hearings. She said it is possible to see 10 to 15 cases of plagiarism per semester and that it is a problem on all of the UM campuses.

"Disciplinary action ranges from a warning for the first offense to expulsion for extreme cases," Smith said, adding that "most expulsions are repeat offenders."

UM-St. Louis also uses Discretionary Sanctions, which usually involve volunteer work for the offending student.

The vice chancellor for Academic Affairs makes the final verdict in all plagiarism cases. "[The UM-St. Louis plagiarism policy] is pretty standard. Basically, don't do it, and if you do, we are going to hit you real hard," Muns said.

Students can appeal decisions to the Student Conduct Committee Review and to the chancellor as a last resort.

"In a sense, good plagiarism takes as much effort as thinking and writing on your own, anyway. [For] bad plagiarism, you're going to get caught and busted," Muns said.

## NEWS

<http://www.nature.com/news/2005/051219/full/051219-3.html>

Published online: 19 December 2005; | doi:10.1038/news051219-3

Timeline of a controversy

### **A chronology of Woo Suk Hwang's stem-cell research.**

Concerns about ethics, errors (accidental or intentional) and possible fraud have dogged the stem-cell researcher Woo Suk Hwang, from Seoul National University in South Korea, since his landmark 2004 Science paper on stem cells from a cloned human embryo. Here [news@nature.com](mailto:news@nature.com) describes how events have unfolded from that initial paper - with the most recent events presented first (you may want to read from the bottom-up the first time you read this). Keep checking back for updates over the coming weeks.

October 2006

A confident and defiant Hwang takes the stand for the first time in court. The defence denies allegations of fraud and embezzlement, and has prepared a case against the charge of violating the bioethics law for the next hearing. A verdict may be handed down by the end of the year.

12 May 2006

Hwang is indicted today on three charges. The Seoul Central District prosecutor's office charges him with:

- 1) Embezzling KRW2.8 billion (US\$3 million).
- 2) Committing fraud by knowingly using fabricated data to apply for research funds.
- 3) Violating a bioethics law that outlaws the purchase of eggs for research.

21 April 2006

Two women who donated eggs to the South Korean effort to produce cloned human embryos for research file a lawsuit against the state and the two hospitals that collected the eggs. They claim they were not made aware of the potential risks of donation. They are seeking 32 million won (\$35,000) in compensation.

Woo Suk Hwang of Seoul National University used more than 2,200 eggs from 119 donors in his failed attempts to clone human embryos. Many women were not told of the risks and a large number have since reported side effects.

20 March 2006

Woo Suk Hwang of Seoul National University in South Korea lost his licence to conduct embryonic stem-cell research on 16 March, and was fired by the university on 20 March. There are now no groups licensed to carry out such research for therapeutic cloning in South Korea, although several are licensed for in vitro fertilization-based human embryonic stem-cell research. The retractions of Hwang's papers in Science meant that he no longer met the legal requirement for a licence of having at least one publication in embryonic stem-cell science in the past three years.

06 March 2006

Hwang admits ordering researchers to fake data for his 2005 Science paper.

10 February 2006

Schatten is cleared of scientific misconduct by the University of Pittsburgh, but chided for taking so much credit for research in which he was barely involved.

February 2006

A truck driver torched himself to death in Seoul after distributing leaflets calling for disgraced cloning expert Hwang to continue his research.

Hwang is being investigated over a variety of legal matters, including misuse of state funds, fraud in applying for funding based on knowingly faked results, and breaching the country's bioethics law.

08 February 2006

Nature looks at how biologists are regrouping after the Hwang debacle, with features investigating the limited supply of eggs for research and the question of whether we will need therapeutic cloning at all. A main contender in the cloning race, Advanced Cell Technology, says it plans to tread cautiously on the ground left vacant by the collapse of Hwang's claims.

02 February 2006

Korea's National Bioethics Committee confirmed rumours about the way Hwang procured eggs. It found that Hwang had forced junior members of his lab to donate eggs, and that he used more than 2,221 eggs in his research rather than the 400 or so he acknowledged using. Thirty-five women's groups plan to sue the government for supporting Hwang's research and neglecting issues related to egg procurement. About one-fifth of the donors, many of whom weren't told of the risks, are now suffering side effects.

31 January 2006

Two bioethicists retracted a paper in which they outlined the informed-consent procedures for egg donation that they had devised in collaboration with Hwang (K. W. Jung and I. Hyun Am. J. Bioeth. 6, W19-W22; 2006).

12 January 2006

Science issues an editorial retraction of Hwang's 2004 and 2005 papers, saying: "Because the final report of the SNU investigation indicated that a significant amount of the data presented in both papers is fabricated, the editors of Science feel that an immediate and unconditional retraction of both papers is needed. We therefore retract these two papers and advise the scientific community that the results reported in them are deemed to be invalid.... Science regrets the time that the peer reviewers and others spent evaluating these papers as well as the time and resources that the scientific community may have spent trying to replicate these results."

The full retraction can be found on Science's website [here](#).

Hwang makes his first public appearance since 16 December. In a press conference he says: "I, once again, offer a deep apology to the people and the government for having generated this big confusion and scandal... I ask for your forgiveness. I feel so miserable that it's difficult even to say sorry." He stands by his story that the stem cell lines in his study may have been switched by other researchers, and maintains that the "source technology" behind his studies is valid and can be proved. "I think we can create patient-specific stem cells in six months if sufficient eggs are available," he says. "My life will be spent undoing my wrongdoing." Prosecutors have begun searching Hwang's home and office for their fraud investigation.

10 January 2006

Verdict

The Seoul National University investigating committee delivers its verdict: both Hwang's 2004 and 2005 Science papers are based on fraudulent data. But his Afghan hound Snuppy is a real clone.

Verdict: Hwang's human stem cells were all fakes

04 January 2006

Science issues a statement saying all authors have indicated a willingness to retract the 2005 paper. They say the wording of the retraction will only be finalized after the SNU investigation is completed, which is expected next week.

PD Notebook, a Korean investigative news programme, airs a piece that levels further charges against Hwang. According to one of its producers, the programme claims that Hwang coerced a junior team member into donating eggs for research.

29 December 2005

The Seoul National University (SNU) team that has been investigating the South Korean researcher reports that there is no evidence that Woo Suk Hwang's stem cells came from patient-specific clones. Last week the investigators said that at least nine of eleven stem-cell lines in Hwang's 2005 Science paper were not what the paper claimed them to be (see 23 December entry below). Now they add that the remaining two lines also do not match the DNA of patients, as they were meant to. Instead they match cells from other, normal embryos created by in vitro fertilization. "Currently, we cannot find stem cells that have identical DNA fingerprint traces with patients and Hwang's team does not have scientific data to prove they did harvest patient-specific stem cells," says Jung-Hye Roe, director of research at SNU, in a press conference.

Science issues a statement saying: "There is no question in our minds that the stem-cell paper published 19 May 2005 by the journal Science needs to be retracted, and we are proceeding swiftly but appropriately in that direction." Science adds that they have not yet received official notification of the SNU investigation results, nor do they have all of the co-authors' signatures on a retraction agreement. They give the authors a deadline of 30 December, after which they say they will move towards an editorial retraction.

23 December 2005

A rapid investigation of Hwang's work at Seoul National University delivers a damning initial verdict: large amounts of the data in his 2005 landmark paper on patient-specific stem cells were fabricated. The university's investigating team announces in a televised press conference that the data in the 2005 Science paper came from just two cell lines, not 11 as claimed. This "cannot be some error from a simple mistake, but can only be seen as a deliberate fabrication", the panel says. Hwang says that these two stem cell lines, which are frozen in his lab, were derived from cloned embryos from specific patients. The university is doing tests to validate this. Investigation says Hwang lied Korean scandal will have global fallout.

16 December 2005

Science announces that Hwang and Schatten have written to request a retraction of their 2005 paper. Science editor Donald Kennedy says the journal received the letter hours before Hwang's press conference in South Korea (see entry below). Kennedy quoted from the letter during a press conference with reporters: "After analyzing the data, our team concludes the results...could not be trusted... Therefore we are requesting to withdraw the paper." Science says it must wait for the entire research team to consent to the retraction - a process that Kennedy says should take "days or weeks - not months."

Apology and defense

Hwang tells a press briefing that he and his team did create stem cells matched to individual patients, but that there were "mistakes made, human errors, in taking photographs and in the preservation of the stem cells". Hwang says he will seek agreement from his co-authors to retract the Science paper, and will investigate how the mistakes were made. He adds that his team is thawing some frozen stem-cell lines from the study to authenticate them.

15 December 2005

Scientific American removes Hwang from his position as a Research Leader of 2005.

Accusation of fake data

News stations across Korea report allegations from one of Hwang's collaborators that the work from May 2005 was based on fabricated data. Roh tells the MBC and two other television stations that Hwang had told him "there are no cloned embryonic stem cells".

13 December 2005

Schatten asks Hwang to retract their May 2005 Science paper. Schatten claims he has news of allegations from someone involved with the experiment that make him want his name removed from the paper. According to a release from the University of Pittsburgh, Schatten writes to Science and his co-authors: "My careful re-evaluations of published figures and tables, along with new problematic information, now casts substantial doubts about the paper's accuracy."

A letter from eight scientists, including Ian Wilmut, the cloner of Dolly the sheep, is published in Science calling for validation of Hwang's results: "We encourage Hwang's laboratory to cooperate with us to perform an independent test of his cell lines."

11 December 2005

Investigation opened

Seoul National University announces an investigation of Hwang's research, as requested by Hwang himself. The university hospital treats Hwang for stress and exhaustion

05 December 2005

Investigation opened

University of Pittsburgh officials say they have opened a preliminary inquiry into the 2005 paper.

04 December 2005

Media outlets report that the MBC has apologized for the reporting tactics used in their 22 November programme on Hwang.

#### Mistake in the 2005 paper

According to Science editors, Hwang contacts them to alert them to erroneous duplications in some images published as part of the Supporting Online Material for the 2005 paper. "We made some unintentional error by using about 4 pictures redundantly," he says. Science determines that the redundant images did not appear in the PDF version of the accepted paper, but were inserted later, and says the mistake does not affect the paper's scientific conclusions.

01 December 2005

#### Accusation of mis-matched DNA

The MBC challenges the credibility of Hwang's data. Pursuing a tip-off, MBC gets five samples of patient-specific cell lines from Hwang and sends them, together with corresponding tissue samples, to an independent lab for DNA analysis. The programme reports that the DNA in one cell line does not match the tissue sample as it should. There are many possible explanations for MBC's findings, such as contamination. But the mismatch also raises the possibility that the embryonic stem-cell lines were not cloned from the stated patients. Hwang stands by his science.

#### TV tests call into question cloner's stem-cell success

According to Science, Moon Il Park, Director and Chair of the Institutional Review Board (IRB) on Human Subjects Research and Ethics Committees at Hanyang University Hospital, reveals to them the results of an investigation by the hospital IRB and Seoul National University IRB. It finds that: "1) two researchers under Dr. Woo Suk Hwang's supervision donated oocytes voluntarily without any coercion and 2) approximately US\$1,445 was paid for direct expenses." This was not illegal or in violation of the Helsinki Guidelines of 1964, which prohibit coercion of research subjects. Park also told Science: "We strongly believe that the identified concerns have no impact on the validity of the scientific conclusions."

24 November 2005

#### Admission of payments for eggs

Hwang admits that his stem-cell research used eggs from paid donors and junior members of his team. He resigns from his official positions, saying he will continue his research.

#### Clone star admits lies over eggs

22 November 2005

Seoul-based Munhwa Broadcasting Corporation (MBC) aired an investigative news programme showing further evidence that Hwang used eggs from junior members of his lab - the PD Diary program was called "The Myth of Hwang Woo-suk and Suspicions over Eggs."

21 November 2005

Sun Il Roh, a fertility expert at MizMedi Hospital in Seoul and a co-author of the landmark paper, admits that 20 eggs he procured and gave to Hwang for his 2004 study were paid for. Roh, a co-author on the 2005 paper, insists that Hwang did not know this.

12 November 2005

Schatten publicly cuts all ties to Hwang and his team at Seoul National University.

Mistake in the 2005 paper

The 2005 paper's authors provide Science with corrections to data in the paper's table 2, which are not thought to significantly alter the work's conclusions. The corrected table is published.

11 November 2005

According to Science, Schatten tells them he has stopped working with Hwang, because he believes Hwang misrepresented facts about consent issues related to the 2004 paper. Science asks Hwang to inform them of any concerns regarding his research. Hwang says he is looking into the matter.

10 November 2005

According to Science, Gerald Schatten, a biologist at the University of Pittsburgh and co-author of the May 2005 Science paper, alerts them to Korean press reports alleging that researcher Sun Il Roh has illegally traded ova. Schatten reassures Science that "none of the oocytes used in Professor Hwang's '04 or '05 Science papers were obtained from reimbursed women donors."

October 2005

Hwang resumes research, ending his voluntary suspension of activities.

19 October 2005

South Korea's government launches the World Stem Cell Hub, an international network for exchanging embryonic stem-cell lines and cloning technology. Hwang is to be its head.

Korea launches network to share cloning information

03 August 2005

Cloned dog

Hwang and colleagues announce the first cloned dog - Snuppy, an Afghan hound (Lee B. C. et al. *Nature* 436, 641; 2005). Some scientists hail his birth as a feat of ingenuity and perseverance, others question its value.

19 May 2005

Landmark paper

Hwang's team at the Seoul National University in South Korea reports it has established 11 embryonic stem-cell lines derived from the skin cells of individual patients (W. S. Hwang et al. *Science* 308, 1777-1783; 2005). The experiment is hailed as a huge step towards the medical use of person-specific cell lines. It also backs up the embryo-cloning claims in the team's February 2004 paper.

13 January 2005

The South Korean government approves Hwang's embryonic stem cell research. It is the first approval issued under the nation's new bioethics law.

01 January 2005

South Korean bioethics law comes into effect.

22 May 2004

The annual meeting of the Korean Bioethics Association calls on Hwang and a review board to answer questions about funding sources and the recruitment of egg donors. The association wants the National Human Rights Commission, an independent investigative body funded by the government, to pursue the case. But the commission's bioethics task force was not intended to investigate specific research projects.

Korean bioethicists call for inquiry into stem-cell work

May 2004

Ethical questions

Questions are raised about ethical practices in Hwang's work after investigations by Nature. It appears that some of the eggs may have come from junior members of the research team. This is potentially problematic because obtaining human eggs is painful and risky. Hwang denies any wrongdoing, but says that he will suspend his research until a new national bioethics law comes into effect in the new year.

Korea's stem-cell stars dogged by suspicion of ethical breach

February 2004

Biologists say that the South Korean breakthrough has alerted Western researchers to the pace of scientific and technological progress in East Asia. Hwang and colleagues attribute their success to a supportive cultural environment, well-funded laboratories, and legislation permitting human embryos to be cloned for research. Also critical to the researchers' success was their collection of 242 human eggs from 16 female volunteers.

Cloning success marks Asian nations as scientific tigers

12 February 2004

Landmark paper

Woo Suk Hwang from Seoul National University in South Korea and colleagues announced that they have cloned 30 human embryos and harvested stem cells from one of them (W. S. Hwang et al. *Science* 303, 1669-1674; 2004). The work makes headlines worldwide, as a step towards stem-cell therapies for diseases such as Parkinson's. Other groups have claimed to clone human embryos, but the supporting evidence has been sketchy. This success will also need further supporting evidence.

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<http://www.sciencemag.org/sciext/hwang2005/>

LETTERS

Retraction of Hwang et al., *Science* 308 (5729) 1777-1783. Retraction of Hwang et al., *Science* 303 (5664) 1669-1674.

Editorial Retraction

The final report from the investigation committee of Seoul National University (SNU) (1) has concluded that the authors of two papers published in *Science* (2, 3) have engaged in research misconduct and that the papers contain fabricated data. With regard to Hwang et al., 2004 (2), the Investigation Committee reported that the data showing that DNA from human embryonic stem cell line NT-1 is identical to that of the donor are invalid because they are the result of fabrication, as is the evidence that NT-1 is a bona fide stem cell line.

Further, the committee found that the claim in Hwang et al., 2005 (3) that 11 patient-specific embryonic stem cells line were derived from cloned blastocysts based on fabricated data. According to the report of the Investigation Committee, the laboratory "does not possess patient-specific stem cell lines or any scientific basis for claiming to have created one." Because the final report of the SNU investigation indicated that a significant amount of the data presented in both papers is fabricated, the editors of Science feel that an immediate and unconditional retraction of both papers is needed. We therefore retract these two papers and advise the scientific community that the results reported in them are deemed to be invalid.

As we post this retraction, seven of the 15 authors of Hwang et al., 2004 (2) have agreed to retract their paper. All of the authors of Hwang et al., 2005 (3) have agreed to retract their paper.

Science regrets the time that the peer reviewers and others spent evaluating these papers as well as the time and resources that the scientific community may have spent trying to replicate these results.

Donald Kennedy  
Editor-in-Chief

#### References

1. Investigation Committee Report, Seoul National University, 10 Jan. 2006. (Members: Chairman Myung-Hee Chung, SNU, Uhtaek Oh, SNU, Hong-Hee Kim, SNU, Un Jong Pak, SNU, Yong Sung Lee, Hanyang University, In Won Lee, SNU, In Kwon Chung, Yonsei University, Jin Ho Chung, SNU)
2. W. S. Hwang et al., Evidence of a Pluripotent Human Embryonic Stem Cell Line Derived from a Cloned Blastocyst, *Science* 303, 1669 (2004).
3. W. S. Hwang et al., Patient-Specific Embryonic Stem Cells Derived from Human SCNT Blastocysts, *Science* 308, 1777 (2005).