



Six Reasons We're No Longer Cloning Dogs

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It is with frustration and disappointment that we announce that we will no longer be offering dog cloning services, effective immediately.

I personally began investigating dog cloning in 1997, initially with the goal of cloning our family dog, Missy, who died in 2002 at the age of 15. Missy was the subject of the widely-publicized *Missyplivity Project*, originally based at Texas A&M University, later taken over by our predecessor, Genetic Savings & Clone (GSC), and finally by BioArts International. We ultimately succeeded in cloning Missy – with the help of our cloning vendor, the Sooam Biotech Research Foundation of Seoul, South Korea – with the birth of Mira in December, 2007, and her three sisters MissyToo, Mani and Kahless in the Spring of 2008.

Our initial experiences with dog cloning were quite positive (partly luck in retrospect). The technology seemed to work well enough at first that we decided to offer the service commercially through BioArts, with a trial auction of five dog cloning slots in the Summer of 2008 – the world's first commercial dog cloning service.

On September 5th of this year, we delivered the fifth and final set of clones to our commercial auction winners. While some of our clients have chosen to remain anonymous, all of them – like the recipients of the Missy clones – are very happy with the clones they have received. Mira, my clone of Missy, is my constant companion and a major source of pleasure in my life.

A lot has changed over the last year however, and we've now decided that it no longer makes sense for us to be in this market, for the following six reasons:

1) **Tiny Market –**

Cloning is controversial, which makes it an attractive media subject, and its resulting high profile leads some to conclude there is an equally significant commercial opportunity. However, after studying this market for more than a decade – and offering both cat and dog cloning services – we now believe the market is actually *extremely* small.

In order to collect more data on demand for dog cloning – and to promote our initial auction of cloning services – on May 30th, 2008 we announced the “Golden Clone Giveaway” – a contest with a grand prize of a free clone of the winner's dog. The media and blogosphere covered this announcement very thoroughly; we expected tens if not hundreds of thousands of contest submissions. We were astonished when just 237 people signed up for the giveaway.

For what it's worth, even if we had received a million submissions, I strongly suspect that the ultimate winner would still have been James Symington and his dog Trakr, who located the last human survivor at Ground Zero following the 9/11 attacks; they clearly deserve all of the attention and acclaim they have received. Regardless, the paucity of submissions to our giveaway confirmed our belief that the market for dog cloning is a highly specialized niche.

Of course, even a niche market can be worth pursuing if the product or service is correctly priced, and the premium price we set could have enabled a profitable cloning business in the absence of extreme lowball pricing from black market cloning competition from South Korea, as described in the next section.

Conclusion: Given how few people want to clone a dog when priced at zero, the market for dog cloning is at best a specialized niche. In a niche market, if one cannot capture a reasonably high price for each order, that market is not worth pursuing.

2) **Unethical, Black Market Competition –**

Our plans to provide dog cloning services to a small but high-end niche market were interrupted in February, 2008 when a South Korean biotech company named RNL Bio announced plans to clone a dog named “Booger” for \$150,000 (actual price paid seems to have been far less, if anything), implying their intent to engage in the black market cloning of dogs. We view RNL as a black market cloning company because we possess a license to clone dogs from the owners of the “Dolly” patents, whereas RNL does not.

Competition – even black market competition – is not necessarily a bad thing for consumers, though RNL's marketing was especially confusing. Every time RNL offered dog cloning services for \$150,000, they also announced that the price would fall to \$30,000 or so in the near future. Who in their right mind markets a luxury service by announcing that the price will soon fall by 80%? Imagine if Ferrari used the same strategy: “Our new sports car lists for \$200,000, but will soon be available for \$40,000.” Obviously customers would all wait for the cheaper product and the company would soon run out of cash.

RNL may actually believe that commodifying dog cloning at very low price points is the right way to maximize revenue, given the successful

application of this strategy in other industries like consumer electronics. However, if the dog cloning market is as small as the data suggest then it makes much more sense to keep the price high. With flat screen TVs, it's logical to drive the price as low as possible because just about everyone will purchase one at the right price, but what would the right price be for a flat-screen TV if only a few hundred people worldwide wanted one, as may be the case with cloned dogs? To put it another way, why sell 10-20 clones at \$30,000 when you can make far more profit by selling a single clone at \$150,000, especially considering that bioethical problems mount in proportion to the quantity of clones you produce, as discussed later?

In response to RNL's impossibly low price projections, our prospective customers all began to inquire as to when we planned to drop *our* prices, and most of these prospects chose to defer cloning their dogs, in hopes of an all-out price war. Of course, there is no technical way that RNL can deliver clones for \$30,000 unless they completely abandon all bioethical safeguards for surrogate mothers who carry the clones to term – and even then it's unclear how they could make a profit.

It's possible that RNL's grand strategy is to take over the dog cloning market by first eliminating all profit, rather like the Air Force Major in Vietnam who deemed it necessary to destroy a certain village "in order to save it". This is not as crazy as it sounds; from deep in the Korean psyche comes the phrase, *Nuh Jook Go Nah Jook Jah*, loosely translated as, "If I die, I am taking you with me." All Koreans know this phrase, which arguably lies at the heart of the 56-year stand-off between North and South Korea.

Conclusion: Jeong-Chan Ra, President of RNL Bio, either drove us out of the dog cloning market by ignoring international patents and promising price points he knows he can't fulfill – in which case he's as devious as he is unethical – or he has singlehandedly destroyed a high-end niche market by grossly overestimating its size and grossly underestimating the optimal price, in which case he has died and taken us with him. Only time will tell!

3) Weak IP –

One of the most frustrating aspects of our experience cloning dogs is that we might have been able to prosper within this market despite its small size and black market competition IF we had had a strong licensing partner, instead of a timid and unsupportive one.

By way of background, the dozens of patents and other intellectual property (IP) derived from the cloning of Dolly the Sheep back in 1996 were eventually acquired by an Austin, Texas company called Start Licensing. When BioArts decided in 2007 to offer dog cloning commercially, we sought to obtain an exclusive license to clone dogs from Start. Given that we have no independent cloning capacity ourselves – GSC closed its U.S. cloning lab in 2006 –controlling the IP for cloning dogs is essential to our business model.

We expected no trouble acquiring a license to clone dogs, given that Start's entire *raison d'être* was to acquire and maintain all cloning IP for the benefit of a small group of companies – including ours. However, after a lengthy and expensive negotiation, it became apparent that Start was unwilling either to commit to defend their cloning patents against infringers or to grant to BioArts the right to do so on their behalf. Start was afraid to defend their patents against challengers in the dog cloning space because if they lost, they might also lose the ability to control markets they actually cared about – mainly agricultural cloning. Start's strong preference was to do nothing to defend the dog cloning market against patent infringers.

Our response to Start was fairly orthodox: patents are of little value unless and until defended successfully, and Start should welcome the opportunity to prove the value of their patent estate. Privately, we were appalled by what we perceived as the gutlessness of our licensor, a critical partner without whose support our success was essentially impossible.

In February 2008, when RNL Bio announced plans to clone Booger, we begged Start to respond strongly in the dual arenas of law and media. However, Start's public statements were late, weak and poorly promoted, and their legal response was comparably anemic. This created a strong public perception that RNL was a legitimate competitor of BioArts, which did considerable damage to our brand. It also encouraged RNL to become more brazen in their infringement and more defiant in their public dismissal of both BioArts and Start Licensing.

Conclusion: Although RNL Bio is clearly a black market cloning company without respect for international patent law, Start Licensing is, in our experience, a paper kitten, and without meaningful IP we can't function in the dog cloning market.

4) Unscalable Bioethics –

If RNL seriously intends to reduce the price of dog cloning to a fraction of current levels as announced, there is no doubt that they will have to compromise one of the most expensive aspects of the process, which is animal welfare. At BioArts, we don't believe that the Western market – the largest for dog cloning – will (or should) purchase cloning services in the absence of strong welfare protocols, which is why we've decided not to compete at such low price points.

To understand the relationship between price point and animal welfare, it helps to begin with a question: Why were South Korean scientists the first to clone dogs? Is it because they are so much more talented than cloning scientists from other countries? If so, then why is it that *all* of the dozen-plus mammalian species that have been cloned *except* dog/wolf were first produced *outside* of South Korea?

The answer is that cloning dogs has far less to do with scientific acumen and far more to do with the availability of dogs as ova donors and embryo recipients (surrogate mothers). At current cloning efficiencies, an average of twelve dogs are needed as donors and recipients to produce a singled cloned puppy. It is only possible to master canine cloning in a country where dogs are very plentiful, as they are in South Korea. But why exactly are dogs so plentiful in Korea?

The majority of South Korean people are either indifferent to dogs or relate to them as pets, just as in the West. However, a small minority in

South Korea – as in North Korea, Taiwan, East Timor, China and Japan – also eat dogs occasionally. According to the BBC, 8,500 tons of dog meat is consumed per year in South Korea, with another 93,600 tons used to produce a medicinal tonic called *gaesaju*. As of 2003, approximately 4,000-6,000 restaurants still served dog meat in Korea. In order to meet this demand, South Korea has an industry that raises a certain breed of dog as food, resulting in large numbers of these dogs also being available for use in cloning.

Obviously the idea of eating dogs is quite shocking to Westerners (just as U.S. consumption of 34 million cows per year is shocking to most East Indians). *At BioArts, we felt we could operate within South Korea in an ethically defensible manner by contractually requiring that our Korean cloning vendor safeguard the wellbeing of surrogates used to produce our clones, which is exactly what we did.* Our contracts with our cloning vendor guaranteed a certain standard of animal welfare, including that surrogates used to carry embryos for BioArts were *never* to be returned to the farms that produced them – where their destiny would surely be slaughter, and ultimately meat or tonic.

As long as the price for cloning a dog stays reasonably high, profit margins are sufficient to cover the cost of these ethical safeguards, which require that the surrogates either be adopted or maintained in perpetuity in relative comfort. However, as RNL moves aggressively to commoditize dog cloning at low price points, it cannot possibly maintain even marginally acceptable bioethical standards.

Conclusion: For every dog cloned by RNL in the future, it's likely that a dozen or more will be slaughtered for food as a direct result.

5) Unpredictable Results –

Bioethical concerns pertain not just to the treatment of surrogates but also to clones that are born with physical anomalies that render them undeliverable. Fortunately, when dog cloning works, it seems to work well. The four clones of my family dog – the first dog clones commercially produced – are all healthy, as are the five sets of clones delivered to the winners of our auction. All of these clones received detailed veterinary examinations before leaving the cloning lab, plus the clients were free to conduct additional examinations using their own veterinarians before formally accepting their clones.

Unfortunately, in addition to producing and delivering numerous perfectly healthy dog clones, we've also seen several strange anomalies in cloned offspring. One clone – which was supposed to be black and white – was born greenish-yellow where it should have been white. Others have had skeletal malformations, generally not crippling though sometimes serious and always worrisome. One clone of a male donor was actually born *female* (we still have no good explanation for how that happened). These problems are all the more worrisome given that cloning is supposedly a mature technology in general – Dolly was born in 1996 after all – and dog cloning in particular is supposedly the most advanced application of cloning.

Equally maddening, our cloning vendor's kennels have been repeatedly stricken by assorted canine diseases and parasites. Several Missy clones died in an outbreak of *Parvo* – a highly infectious though also generally preventable disease. In addition, numerous clones were delivered with parasites including *Giardia*, *Coccidia* and *Demodex* – all treatable, but again also preventable. The scientists and technicians at Sooam all seem to be highly competent and conscientious, but that just highlights a larger concern: if our high-tech cloning vendor can't manage the disease/parasite problem while fulfilling just seven orders in two years (including the Missy and Trakr clones), how can we possibly expect to avoid such problems while scaling up to the hundreds or thousands of orders *per year* required for profitability at low price points? Again, with higher margins it might be manageable, but those margins won't exist at RNL's proposed price points.

In addition to problems with abnormalities and diseases, our cloning vendor has also been unable to predict cloning efficiencies with sufficient precision for commercial operations, again despite what we believe to be their sincere and earnest efforts. On more than one occasion, no clone was born for many months, only to have multiple clones of the same donor born in rapid succession (five in one case). Multiple births of cloned dogs are both common and unwelcome, given that most clients only want one or two clones at most. What are we supposed to do with the rest?

RNL Bio will no doubt argue that there's something wrong with the methods used by Sooam, our cloning vendor, but the teams at both Sooam and Seoul National University (SNU) – which performs all cloning for RNL, which has no cloning facilities or staff – were trained by the same scientist, Dr. Woo-suk Hwang, and according to recent scientific publications, both teams use almost identical methods and have almost identical efficiencies. Furthermore, many of the same anomalies we've observed in cloned offspring – such as the unexplained sex-change – have also been reported by the cloning team at SNU, suggesting that these occasional problems are inherent with the technology, not either team's specific method.

Despite curtailing our cloning service, we're continuing to work with Sooam to find homes for all unwanted dogs of whatever type. However, given that there is no tradition or infrastructure for pet adoption in Korea, we'll probably have to ship unwanted dogs to other countries for adoption – yet another expensive and unscalable solution.

Conclusion: Cloning is still an experimental technology and consumers would be well-advised to proceed cautiously.

6) Distraction Factor –

As mentioned in Point 1, the controversial nature of pet cloning makes it enormously popular with the media. If the market were larger, this media attention would be most welcome, but when it consistently fails to result in sales, it's just a distraction.

In addition, while some of the smartest people I've had the privilege to meet are journalists on the cloning beat, there is also a seemingly endless supply of hacks asking the same inane questions over and over, such as, "How dare you clone pets when so many are homeless?" It takes a huge amount of staff time and energy to answer these questions – which is time/energy that could be going into better things. (For the record, one last time, blaming cloners for pet overpopulation is like blaming Ferrari for the traffic on the nation's highways.)

Among the many “better things” we plan to focus on now are several powerful new technologies we’ve invented in the decade we spent developing commercial cat and dog cloning services – technologies with far greater value outside the cloning industry than within it. To give just one example, it turns out that the technology used to transport biopsy samples from veterinary lab to gene bank or cloning facility actually makes a huge difference in the cloneability of the resulting cell line – as well as the health of the resulting clones. We produced six clones of one genetic donor using two cell lines – one shipped using an ice chest (sadly, the industry standard) and the other shipped using the “GoldiLox”, an advanced shipper developed by BioArts subsidiary RoBio Systems of London. The patent-pending GoldiLox is so named because it provides very precise over *and* under-temperature protection for the biological payload, keeping the temperature “just right.”

The four clones we produced from the cell line shipped in the GoldiLox were all completely normal. Both of the other two clones produced from the cell line shipped in the ice chest were abnormal.

The GoldiLox shippers and various other technologies we developed for cloning are going to be particularly useful to the burgeoning regenerative medicine industry – which offers both dramatically greater ROI and humanitarian benefit than does pet cloning. Why waste time applying our new technologies to a small and problematic industry like pet cloning when they’re worth so much more in other fields?

Conclusion: At this point, pet cloning represents more distraction than opportunity for BioArts.

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