

This response was submitted to the evidence call held by the Nuffield Council on Bioethics on Donor conception: ethical aspects of information sharing between 21 March 2012 and 15 May 2012. The views expressed are solely those of the respondent(s) and not those of the Council.

Donor Sibling Registry (DSR)

“What’s in the best interest of the child to be born?”

“Is it fair to bring a child into the world who will have no access to one half of their ancestry, medical history and genetic background?”

The Donor Sibling Registry, in collaboration with researchers at California State University at East Bay, published the [largest, peer-reviewed study to date of donor-conceived people in the summer of 2011](#). The findings show that donor-conceived people overwhelmingly want to know specific details about their origins. Even when children grow up with loving parents, it doesn’t negate their longing to “own” their heritage and to know about their biological heritage and medical history. (It should be noted that approximately half of the respondents were not DSR members).

The study showed the need to address two distinct aspects of the donor system. First, when should children find out that their parents used donor sperm or eggs? And second, should children ever find out the identity of their donors? The majority of the **751 respondents** believed that early disclosure was important. More than three-quarters recommended that only known or willing to be known donors should be used. Study participants who grew up in single parent households or households with parents who were lesbian, gay, bisexual or transgender (LGBT) were more likely to learn of their origins at an earlier age than those of heterosexual couples. The participants, in turn, had a more positive view of their means of conception. Offspring of heterosexual parents were more likely to be confused about their means of conception. Around one quarter of respondents from heterosexual families reported an inability to discuss their origins with their social father. In many cases the fathers were not aware of the children’s knowledge, or that the children were actively searching for their donors.

Regardless of family type, most donor-conceived participants were interested in learning more about the donor and any half-siblings who were conceived through use of the same donor. Most frequently, the participants explained that they simply wanted to see what the donor looked like, followed closely by a desire to learn more about their ancestry and family medical history.

There needs to be education and counseling for both donors and future parents about the impact of using donor eggs and sperm. This needs to come from a third party, not one provided by the clinic or sperm bank. Donors need to understand that they are helping to create babies, not consumer products. They need to understand that many donor children long to know where they come from, that they desire to know about their ancestry and their genetic backgrounds. Donors need to also know that in this day and age of DNA testing and internet search engines, no one can be promised anonymity. Many families and offspring locate their donors long before children turn 18. Donors need to know that they can end up with 50, 75 or more than 150 donor offspring.

Parents should be encouraged to tell their children that they are donor- conceived, and also learn about the importance of honoring and acknowledging any curiosities their child might have about

their unknown genetic relatives. As one of our study participants explained, “I would say please, please, please be honest with your child about their origins from day one... I can't tell you how big a shock it was to discover at the age of 25, that the man I think of as my dad isn't my biological father.”

The DSR draws upon the information it has gained from its involvement with its large membership and also from the extensive and rigorous research it carries out amongst its members in order to formulate its views. And we have more than 1600 egg and sperm donors on the site, so have a very good idea of the curiosities that they also bring with them, when searching for offspring on the DSR.

In addition to a medical page where all genetic relatives can share and update medical information with each other, we also include a questionnaire for donors on the DSR that includes the 18 questions that hundreds of donor offspring told us they'd most want to know from their donors:

Do you think about me?	Yes - but it only happens when you think of me first
Who have you told?	Well...pretty much the whole world
How did your ancestors come to this country?	Some out of desperation-French Huguenots fleeing the inquisition, a Some came chasing hairy mammoths over the Bering Sea land bridge
Are you married?	:(I was, but I am not now. I hope that you are different from me, in th
What is your profession?	I am a the CEO and President of a medical biotech company.
Do you have children? If so, will you tell a bit about them?	I have had 4 - three boys and a little girl, who is now 6.

How did you meet your wife/husband/significant other?

She was an artist who painted a book cover for me

What's your favorite joke?

It's not a joke, but a saying: Time flies like an arrow, Fruit flies like a l

What is the saddest thing that ever happened to you?

Getting divorced

What's the funniest thing that ever happened to you?

It is a long story - about a pet rabbit that my dog dug up after it had there...

What generation do you feel a part of?

The Simon and Garfunkel generation

What great cause do you feel strongly about?

Ending donor anonymity

Which ancestor do you admire most?

My great great great grandfather - who was emigrating to Texas from hurricane and almost everyone drowned, including his parents. He an old, but were among the few survivors who made

What's your family's "brush with history"?

Probably me

What did your ancestors do for a living?

Mostly doctors – at least 3 generations of them in a row on my paternal side

What was your childhood like?

I lived in the National Parks – places like Yellowstone

What is your favorite comfort food?

Mint chip ice cream

What subject in school were you best at?

Chemistry and Biology.

We know that connecting with one's half siblings and one's biological parents can be profound, and an important part of nurturing one's self-identity. We have too many donor conceived children that are growing up feeling disoriented and disconnected because they have been cut off from their ancestry and their genetic backgrounds. Many feel a great sense of betrayal, as they were not told the truth until later in life, or found out by accident. Many who are under 18 greatly desire to connect with their half siblings and their biological parents. And we know that there are many former egg and sperm donors who wish to connect with their genetic children, many who feel that they were not adequately counseled before donating.

Language

In our surveyed group of 751 donor offspring about the language they used for their "donor" we found that many offspring used the terms "father" or "dad" to describe him:

42% used the term donor

30% used the term sperm donor

28% used the term biological father

11.5% used the term donor dad

8.5% used the term father

2% used the term genetic father

(More than one term could be chosen, as many offspring use more than one term).

Parents need to be very, very careful about their own bias, and to let the language be child driven. It should be them that define the relationship between them and their genetic relatives, not us, the parents. To many parents, the donor is just a "piece of genetic material" or a "donated cell", but to our children, the donor is often viewed much differently. If we are not careful, our children will pick

up on our language, (and on our fears) and they will silently understand that any interest in the donor may be hurtful to the parent, and then they will feel guilty about any curiosities they are having about the "invisible" half of them (my son's words). We have talked to many offspring who do not feel that they can talk to their parents about their longing to connect with their genetic relatives. Many are searching behind their parent's backs because they feel it's somehow a betrayal to wonder about and desire to know their biological parent and/or half siblings.

Accidental Incest

Despite the fact that the larger sperm banks ship sperm across the US and to many other countries, we hear of many random meetings on the DSR. These meetings take place at summer camp, at school functions, at parks, on cruises, at parties- just about anywhere. And offspring can be any age when these meetings occur.

In one group, of 75 half-siblings, there were actually two separate random meetings. Here's one of the stories:

"we went on a cruise last week with our son. On the 2nd day of the cruise (he was stir crazy by this point) we visited the play room on the ship to keep him occupied. While we were in there playing we met a single mom with her son. We were on our way to lunch and invited them to join us. After spending about 30 minutes together, she asked which cryobank we used -we told her Fairfax -she did as well. As the conversation went on she asked us what drew us to our donor. A few things we said... his audio, education, height, religion but most of all, his childhood photo -you were called 'the painter' from the first time we laid eyes on you! Well, her face went pale and she said, "that's funny, mine was painting too..." As we all sat there astonished at what was happening, we asked her the donor's number and of course she replied, 214x! We were floored that fate would bring us together and 2 half brothers were sitting beside each other."

And a few more:

1. "I had a similar experience with UNC Andrology. I have a 12 year old donor-conceived son. I know of one donor sibling (another 12 year old boy) whom we discovered at a potluck when the boys were 2-3 years old. "
2. "A single mom that I know from our temple has a daughter in the preschool there. Last year, for some reason, after school started, they switched her daughter from one preschool class to another. In the second class, the teachers observed that my friend's daughter promptly bonded with one of the other little girls in class. They were frequently observed playing together, holding hands for extended periods, etc. At the parent-teacher conferences, the teachers suggested to the parents of both little girls that they arrange a playdate for the girls, as they obviously enjoyed each other's company. During the course of the playdate, as one of moms is a single mom and the other moms are a lesbian couple, the manner in which the women became pregnant was an obvious topic of conversation. As the two mothers compared notes, they discovered that, in fact, the two little girls who had become such close friends so promptly were in fact half-sisters, having used the same sperm donor from the same sperm bank."
3. "I also want to share how I found one more sibling. I was on a bowling league this past fall and winter. I knew another woman had her daughter using a donor but we had never had much discussion about the issue. When our teams were bowling each other, we talked more. A

few things she said caught my interest and after a bit I asked if she knew her donor number. She told me and it turns out her daughter and my son are siblings. What a small world.”

4. “I got the confirmation from the clinic today. I'm not surprised. The personalities are way too much alike for them not to be from the same donor. The 14 year old girl lives WALKING distance to my parent's home. That was scary for me. I don't mean the girl or the distance, but what would happen if a parent didn't tell their children about this and it was a boy/girl relationship. Truth is always better. I'd hate for two children to end up married only to discover that they are half brothers/sisters.”

And here's one case where a donor donated at more than one clinic (we have donors donating at up to 17 clinics on the DSR). Between 22-27% of surveyed sperm donors (this is published research) say that they donated to more than one clinic. This is extremely problematic when medical issues arise, as families and sperm banks have a hard time finding families because of a lack of accurate record keeping (sperm banks do not know how many children are born from any one donor) as well as because the donor has a different donor number at each clinic, as there is no central registry where this is tracked or recorded:

“When our son was one, a new couple joined the mothers group with a six month old baby boy [L] . A few weeks later, someone else in the group remarked to my partner how alike S and L looked - when I heard about that remark, I simply dismissed it from my mind as I didn't agree. The week after that, the mother of L remarked to me how beautiful she thought our son was. I was a bit surprised that someone would go out of their way to say that about someone else's baby. [In retrospect, I don't think she had any conscious idea about the connection but I think their similarity must have triggered something unconsciously.]

A couple of months later, our group held a party attended by about twenty couples. At some point, a small-group conversation started about donors and the mother of L was talking about how they made their choice of donor, based on his particular interest in music. I was listening in and I immediately knew, as the information was so specific, that it was the same donor. I didn't say anything at the time but later I telephoned L's mothers and told them I was pretty sure it was the same donor. We had our donor's code. They had gone to a different clinic and didn't have the code - but they were able to contact their clinic to get it – and it was the same.”

It should be noted that these random meetings do not only occur in the US. And we have to wonder, how many of these meetings have occurred amongst donor offspring who are unaware of the methodology of their conception?

Medical Issues

Over the years, the DSR has brought intense joy through connecting to very many people. In addition, it has helped eliminate much of the stigma associated with being a gamete donor or a donor conceived person. Behind the scenes, but very actively, the DSR's research, education, and

counseling services have been instrumental in creating momentum towards establishing positive reforms in the egg donor and sperm banking industries.

Before the DSR came along, the reproductive industry almost invariably told recipients never to tell their offspring how they had been conceived. The whole topic of donor conception was a toxic secret, burning holes in many families, and surrounded by stigma and shame. The notion of maintaining permanent and accurate records was largely considered irrelevant by the industry. Some sperm banks even had policies not to maintain records. Because sperm donors are not patients and sperm banks were not treating recipients directly, sperm banks generally did not consider the acts of sperm donation or supply as medical treatment, and therefore considered there to be no mandated requirements for records. This changed to some extent with legislation passed in 2005 when requirements to perform STD and HIV testing were federally imposed.

But even till the present, sperm banks are often reluctant to accept or collate reports of genetic disease. Even when they do so, they generally do not notify other recipients of the same donor's sperm. In pre-DSR days they frequently did not even withdraw a notified affected donor's sperm. Before the DSR the sperm banks believed there was no way for recipients to know of other children with problems by the same donor, hence likely causing the sperm banks to feel insulated from liability. This situation was not aided by decisions in legal cases where sperm banks were shown to be deliberately excluding information about hereditary illness, or falsely proclaiming negative results in genetic testing. See the case of *Johnson v. Superior Court (California Cryobank, Inc.)* (2002), where despite the sperm bank substituting a clear family medical record instead of the donor's own handwritten health profile in which he reports polycystic kidney disease, the court still finds no liability against the sperm bank. Also see the case of *D.D. v. Idant Laboratories* that was finally decided on appeal on 6 April 2010 wherein the court ruled that genetic defects in sperm from a sperm bank can not form the basis for a products liability suit, stating that allowing such a claim would be tantamount to recognizing a claim of "wrongful life." As yet, there has never been a single recorded successful case pinning liability for unscreened or un-notified genetic illness on a sperm bank.

This state of affairs has led to some sperm banks resolutely refusing to test donors for genetic illness. It is in their economic vested interest to have as many donors as possible, and the law seems not to require any genetic screening. Hence, from the sperm banks' perspective it is best for them not to screen for genetic disorders, since otherwise they would have to exclude affected prospective donors that legally they appear to have no obligation to screen out.

So in an era where Tay Sachs has almost been completely eradicated from the Jewish population through premarital genetic testing, there are still children being born via gamete donation with the illness. In March 2006 a child was born from egg donation with Tay Sachs and in 2011 the DSR was notified that a four-month-old child born from the sperm of an Ashkenazi donor had died from Tay Sachs. Donor gamete children are also being born with cystic fibrosis despite the ASRM recommending this as one of only three genetic tests a sperm bank should carry out. Currently litigation is being pursued in Oklahoma regarding a donor child born with the most common CF mutation from a donor ostensibly tested for that mutation. (See CBS news 2/17/2012). The DSR is hoping this will be a break through test case, but the sperm bank are vigorously defending the case, since all case law is on their side. (The other two tests the ASRM recommend are for sickle cell and thalassemia. However, the DSR has been notified about children being born carrying the mutations for such, so testing is obviously being skipped.)

From its members, the DSR has had reports of children (and donors) with the following genetic linked illnesses or potentially genetically linked.

Acute Lymphoblastic Leukemia, ADD, ADHD, Agenesis of the Corpus Callosum, Albinism, Alcoholism, Alpha 1 Deficiency, Alpha Thalassemia, Amniotic Band Syndrome, Apraxia, Arnold-Chiari malformation, Asperger's, Asthma, Atrial Septal Defect (ASD), Autism, Auto Immune Thyroiditis, Bi-cuspid Aortic Valve Disease, Bi-Polar, Borderline Personality Disorder, Branched-chain Ketoaciduria, Breast Cancer, Cardiac (ASD PDA) and Pulmonary Hypertension, Brain Aneurysm, Canavan Disease, Cavemous Angioma, Cerebral Palsy, Chromosome abnormality:5p minus or Cri-du-chat, Coarctation of Aorta, Colon Cancer, Congenital Heart Disease, Congenital Hypothyroidism, Congenital Lobar Emphysema, Cornelia de Lange Syndrome, Craniosynostosis, Cystic Fibrosis, Cystic Hygroma, Dandy Walker Variant, Depression, Down Syndrome, Dwayne Syndrome, Dysgraphia, Ebsteins Anomaly, Ectodermal Dysplasia, Eosinophilic Esophagitis, Epilepsy, Febrile Seizures, Femoral Antiversion, Fragile X, Galactosemia, Genetic High Cholesterol, Goldenhar Syndrome, Graves Disease, Hashimoto's disease (chronic lymphocytic thyroiditis), Hemochromatosis, Hemoglobin D, Hemophagocytic Lymphohistiocytosis, Hole in Heart, Horseshoe Kidney, Hypertrophic Cardiomyopathy, Hypophosphatasia, Hypospadias, Hypoplastic left heart syndrome (recessive disorder-death reported), Hydrocephalus, Hypotonia, Ileal Atresia, Imperforated Anus, Juvenile Dermatomyositis, Juvenile Arthritis, Keratosis Pilaris, Kidney Reflux Stage 3, Klinefelter's Syndrome, Langerhans Cell Histiocytosis, Lethal Dwarfing Syndrome, Leukemia, Lung Cancer, Maple Syrup Disease, Marcus Gunn Syndrome, Marfan's, Medium Chain Acyl CoA Dehydrogenase Deficiency (MCAD), Medulloblastoma Brain Tumor, MTHFR C677T gene mutation, Melanoma, Mitral Valve Prolapse, Multiple Hereditary Exostoses, Multiple Sclerosis, Myelomeningocele (Spina bifida), Myotonic Muscular Dystrophy (MMD), Neblastoma Stage 3, Neurofibromatosis Type 1, NUT Midline Carcinoma, PANDAS, PCOS, PDD-NOS, PHACES Syndrome, Pectus Excavatum, Plagiocephaly, Polycystic Kidney Disease, Prader-Willi, Primary Sclerosing Cholangitis, Prostate Cancer, Pyloric Stenosis, Radioulnar Synostosis, Rasmussen's Encephalitis, Renal Disease, Retinoblastoma, Rett Syndrome, Rheumatoid Arthritis, Robertsonian Translocation Chromosome, Rotary Nystagmus, Reitters Syndrome, SVT-Supraventricular Tachycardia, Sagittal Craniosynostosis, Scoliosis, Sensory Integration Dysfunction, Severe Congenital Neutropenia, Sickle Cell Carrier, Seizure Disorders, Sieves Disease, Spastic Quad Cerebral Palsy, Spinal Muscular Atrophy, Strabismus, Sub-Aortic Membrane, Tay Sachs, Tethered Spinal Cord Syndrome, Third Degree Heart Block, Thyroid Cancer, Torticollis, Tourettes, Trachea Esophageal Fistula, Truncus Arteriosis, Type I and Type II Diabetes, Ulcerative Colitis, Vacteral Association, Van Der Woude Syndrome, Vasovagal Syncope, Vesico-Uretal Reflux, Von Willebrand Disease, Williams -Beuren Syndrome, Wilm's Tumor (Kidney Cancer), Wolff-Parkinson-White Syndrome, and Zellweger Syndrome.

The DSR views the lack of genetic testing as immoral and indefensible. All children procreated through donor conception are as a consequence of deliberate conception through the unification of gametes from two individuals who have never knowingly met. The procreators did not fall in love; they did not have sex. The recipients' only interest is in the conception of the healthiest, fittest offspring possible. Hence, there is a major conflict with the sperm banks whose main motive is maximization of profits and avoidance of liability. The donor gamete industry is worth about half a billion dollars annually. Because of the state of current US legislation and case law, perversely the least genetic testing results in the least liability for sperm banks, but maximizes the risk for recipients and offspring.

This is a situation that we cannot tolerate and on behalf of its membership, the DSR is speaking up against it. We are currently pushing for federal regulation to require adequate record keeping, updating and sharing of medical information amongst families and significant consistent genetic

testing of would-be donors. We are also pushing for the rights of donor offspring to know their genetic parentage at, or even before they turn 18.

Who we are:

The Donor Sibling Registry (DSR) is a recognized 501(c)(3) non-profit organization. Our mission is to educate, connect and support all people affected by gamete donation, whether they be donors, parents-to-be, recipients or offspring.

We have 36,000 registered people on our site; all of whom are either donors, recipients or offspring. Besides our members, we have on average, 10,000 unique visitors visit the site each month with more than ten-million hits in 2011 alone.

The DSR has been operative since 2000. Since that time we have successfully facilitated the contact of more than 9,200 people who are genetic first degree relatives including donors with offspring and half-siblings with each other. We are a global organization, with members in many countries around the world. We have approximately 400 UK families on the DSR and have matched many of them with half siblings and/or donors both from local clinics, as well as from international sperm banks in both Denmark and the US.

Besides providing a forum for meeting blood relatives, the DSR provides several other services.

We provide counseling and consultation services for donors, offspring and parents.

The DSR runs two very active discussion groups to which around twenty thousand messages have been posted since 2000. Many issues relating to donor conception have been extensively discussed and debated over the years with contributions from the full range of our members.

The DSR regularly performs research in collaboration with premier academic institutes and other researchers to ascertain the views, feelings and needs of donors, those who are conceived through donated gametes and also the recipient parents.

The DSR has partnered with The Family Centre at Cambridge University, California State University at East Bay, University of California at San Francisco, University of Canterbury, NZ, and the University of Liverpool. The DSR, in collaboration with these institutions, has published more than a half dozen academic papers in journals such as Human Reproduction and Reproductive Bio-Medicine, with several more papers currently in progress.

The DSR has brought intense joy through connecting many people. In addition, it has helped to eliminate much of the stigma associated with being a gamete donor or a donor conceived person, mostly as a result of the DSR's many media appearances. Starting with local Denver media in November of 2002, and then to Good Morning America the very next month. In 2003 there was an appearance on Oprah, and the same year the John Walsh show. The DSR has also participated and appeared in discussions about donor conception in other media including NBC's Today Show, CBS Evening News, ABC World News, MTV, Fox News, CBS Early Show, Geraldo at Large, The Anderson Cooper Show, CNN, ABC's Primetime, the Doctors, Good Morning America (several times since 2002), CNN, PBS, BBC, NPR, and a host of local television and radio shows across the United States and worldwide. Broadcasts have aired in France, UK, Australia, Germany, Canada,

Japan, China, South Korea, and Switzerland.

Articles about the DSR and it's families have appeared in hundreds of newspapers and periodicals, including: The New York Times, Time, Newsweek, Chicago Tribune, SELF Magazine, O Magazine, New York Post, London Times, Boston Globe, Los Angeles Times, New Scientist Magazine, GQ Magazine, LA Times, Toronto Globe and Mail, and many more around the world.

The DSR has been invited to speak at, and present research findings at many conferences: July of 2006 at the Association of Managers of Gynecology & Obstetrics, in Denver; March 2007 at the Association of Health Care Journalists, L.A., CA; in March 2008 at the DePaul University College of Law, Symposium: Tracking Change, Chicago, IL; in June 2009 at the European Society of Human Reproduction and Embryology (ESHRE) in Amsterdam; in January 2010 at the British Fertility Society, Bristol, UK; in February 2010 at the L.A. Gay and Lesbian Center, L.A. California; in March of 2010 at the Sturm College of Law; in April, 2010, Asia Pacific Initiative on Reproduction (ASPIRE) Meeting, Bangkok, Thailand; in July 2010 at Genetics and Society Meeting, Tarrytown, NY; in October 2010 at the ASRM Meeting, Denver Colorado; in November 2010 at the National Council on Family Relations, Minn., MN; in December 2011 at the 14th World Conference on Human Reproduction: Plenary Speaker, Merck Serono Symposia and Donor Linking Symposium, Melbourne Australia. And more recently, the DSR presented a talk to law students at the University of Colorado Law School in March of 2012.

DSR Research

Current Research

Non-Biological Parents of Sperm Donor Children: A Survey. Wendy Kramer and Lucy Frith.**** January 2012: Our paper "FORMING A FAMILY WITH SPERM DONATION - A SURVEY OF 244 NON-BIOLOGICAL PARENTS" has been accepted for publication in Reproductive BioMedicine Online. They say, "As the subject matter of your article fits exactly with the inclusion criteria for our Ethics, Bioscience and Life issue 7, we intend to include it in the next printed issue which is to be published in June this year, although it will appear online much earlier."

2010-2011 Collaboration with the University of California San Francisco's Human Genetics Institute:

A study is currently underway that will investigate the hereditary and environmental factors that influence physical, behavioral and medical traits among relatives in the DSR. Look for papers in 2012/2013.

2012: With the Department of Sociology and Women's and Gender Studies, Wellesley College, a study on donor siblings and their sense of relationships with each other.

Summary of Donor Sibling Registry Publications:

[Offspring searching for their sperm donors: how family type shapes the process.](#) Human Reproduction. Sep;26(9):2415-24. **Diane Beeson, Wendy Kramer, Patricia K. Jennings******

Sperm and egg donors' experiences of donating and of being contacted by their donor offspring. Human Reproduction, Vol.26, No.3 pp. 638–645, 2011, (2011). **Tabitha Freeman, Vasanti Jadva, Wendy Kramer and Susan Golombok***

Offsprings' experiences of searching for and contacting their donor siblings and donor. **Vasanti Jadva, Tabitha Freeman, Wendy Kramer, and Susan Golombok*** RBM (Reproductive Bio Medicine) online, (2010) March 2010* November 2011, this paper has been nominated for the [Robert G. Edwards Prize Paper Award!](#)

The experiences of adolescents and adults conceived by sperm donation: comparisons by age of disclosure and family type. **Vasanti Jadva, Tabitha Freeman, Wendy Kramer, and Susan Golombok*** (2009) Human Reproduction doi:10.1093/humrep/dep110.*

Gamete donation: parents' experiences of searching for their child's donor siblings and donor. **Tabitha Freeman, Vasanti Jadva, Wendy Kramer and Susan Golombok*.** (2009) Human Reproduction, volume 24, issue 3, pages 505-516;doi:10.1093/humrep/den469*

US oocyte donors: a retrospective study of medical and psychosocial issues **Wendy Kramer; Jennifer Schneider and Natalie Schultz.** (2009) Human Reproduction; doi: 10.1093/humrep/dep309

Papers In Progress:

Semen donors who are open to contact with their offspring. Ken Daniels, Maria Perez-y-Perez, Wendy Kramer**

* Collaboration with University of Cambridge, UK

** Collaboration with University of Canterbury, NZ. Presented at ASRM 2010 and British Fertility Society 2011 meetings.

*** Collaboration with California State University, East Bay. Presented at ASRM 2010 and British Fertility Society 2011 meetings.

**** Collaboration with University of Liverpool.