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## **A Conversation With Jean Golding**

Tim J Peters

This interview was conducted on 5 October 2012 at the University of Bristol, Bristol, UK. Jean Golding has approved the transcript for publication.

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## A Conversation With Jean Golding

Tim J Peters

Jean Golding was born in Cornwall, UK on 22 September 1939. She read mathematics as her first degree, but then came across epidemiology as the result of a series of accidents. She fell in love with what she saw as a series of detective stories, and has continued in the discipline ever since, initially publishing under the name Jean Fedrick. She has concentrated on maternal and child health, but is interested in the whole gamut of environmental influences on physical, psychological and intellectual outcomes. She has been involved in designing studies in Jamaica and other areas around the world, but has devoted most of her research career to large UK birth cohort studies, including both the 1958 and 1970 national birth cohort studies. She started the journal 'Paediatric and Perinatal Epidemiology' in 1987, continuing as Editor-in-Chief until 2012. In the early 1990s she initiated the Avon Longitudinal Study of Parents and Children (ALSPAC), an in-depth study starting in early pregnancy and following the parents and their offspring throughout infancy, childhood and adolescence (n~14000 children). She retired as Scientific and Executive Director of the study at the end of 2005, but continues to work on various aspects of the survey.

TP: Few people start off intending to become an epidemiologist – what is the path that led you into your career?

JG: I'm not alone in that it was totally by accident. Until the age of 18 I was particularly interested in zoology and chemistry. My polio made laboratory practice difficult in those days (it would be fine now with all the equipment) so I went into mathematics, which I was reasonably good at but it wasn't a passion. I read mathematics at Oxford and although I considered changing course, every other subject involved essays and I felt I wasn't good enough at writing them, so I stuck to mathematics. And what have I done ever since? Naturally, I've been writing! After getting a not very good degree, I went into school teaching. I then got married, had two children, all of that very rapidly, and then divorced, very rapidly.

TP: So you were well into life events at that stage?

JG: If you're going to do all of these then why not pack them into a short time-frame. I was then in London with two young children to support, ex-husband having gone to America and paying no maintenance. I was doing anything to bring money in, such as editing and writing manuals for teaching children in Malawi, when suddenly there was an advert to join a research team. It was a bit unclear what was wanted, but I got the post and could work at home. I was calculating percentages, nothing mathematically detailed.

TP: In London?

JG: Yes, and it was the 1958 British Perinatal Mortality Survey – ultimately under Neville Butler, although I hardly ever met him at that time. The person in charge was Eva

Alberman, a pediatrician who'd had four children and then gone into epidemiology, the way quite a few women do. I became fascinated by differences in patterns of diseases across the country, and we had the job of putting together what turned out to be the Second Report.<sup>1</sup>

By then I'd completely fallen in love with questions about malformations: why did they change in prevalence across the country so much, and across different social groups? Next I got a Research Fellowship studying anencephaly, in the Department of Human Genetics and Biometry at University College London where, by osmosis, I picked up a lot of genetics. At the end of the fellowship I got an epidemiologist post in Richard Doll's department in Oxford, and so that's how I got into the subject.

TP: Had you done your PhD thesis by then, or you were doing it?

JG: I was doing it ... actually I finished it 13 years after starting it when Cedric Smith, my supervisor in London, said, "I cannot find another excuse to keep you going any longer." I kept thinking of new things that needed to be done, which was very dangerous.

TP: It sounds like you started with something you were very good at, mathematics, and despite it not being your passion, persisted with it, and ultimately found something you could apply it to that kindled the passion that had been missing.

JG: Absolutely.

TP: And your interests and skills in writing predated your move into epidemiology?

JG: To some extent. Writing was part of the 1958 cohort post, but you have to be pushed hard to write your first paper. It wasn't until I was at UCL that I showed Cedric Smith a paper I'd written. Since he'd taken me on just on the say-so of other people, I'll never forget that look of relief when he came back having read it!

TP: It's interesting that you've mentioned a connection with genetics even back then. How would you say that epidemiology has changed, particularly the way you practice it?

JG: In the very early days we were still playing with cards in card sorters. I did most of my research with relatively small numbers, albeit 1,000 at a time, using punched cards, which many have never heard about. They were cards with little holes around the edges, and by punching out these holes you could represent the data for an individual – that is, whether or not something was present. To conduct an analysis, you collected all your cards together, put a knitting needle through the hole you were interested in and you shook. The relevant cards came out, and you knew what was there and what wasn't. You could then take the selected cards and sort them by something else, and so on. You could *feel* the data, count it, and see what was missing. All that tends to be hidden in a black box nowadays, and the benefits then were that you really knew your data.

TP: Search engines have clearly moved on, although I understand that if they find something not related to the search it is still termed ‘a false drop’ in resonance with such times.<sup>2</sup> Anyway, how do you think these early experiences influence your current work?

JG: They have stayed with me in that I want to see all the details of the data. If I’m looking at a disorder or I want to quantify a particular trait, I like to see how that relates to all sorts of things before starting any complex analyses. So I am very resistant to commencing an analysis saying, “I’m going to focus on this”, because I feel that you don’t know enough about what the biases might be. I want to explore the data fully first.

TP: You’ve already mentioned some people who were around when you started on this journey, but who influenced you most?

JG: Eva Alberman was superb at being the first person to hold my hand and walk me through. The questions I was asking were about physiology, pediatrics and causes of death, and what to read. This was all completely new to me – especially since having spent so much time in hospital as a child I never wanted to go anywhere near anything medical! Eva gave me an informal one-to-one degree course, successfully reversing my early biases and always being there as an inspiration. She was particularly interested in malformations and was the key person for me. I then got to know Neville Butler, who had a quite different key – if you had a finding or had written a paper, he would go through it in great detail trying to tear it to bits. The only way I could get our papers submitted was by saying, “I shall assume that unless I hear from you by X that you’re happy for me to submit”, and that way we did get quite a lot published.

TP: You’ve already noted collaborations with two very different people, but what are the most important ingredients of a successful collaboration?

JG: They work particularly well if collaborators bring different things and are open to each other’s ideas. That’s rare, and it’s a death knell if it starts with “Let’s talk about authorship and get that settled”, rather than “What are the scientific questions and how can we answer them?”. I’ve had many collaborations, but the very best is with Marcus Pembrey, a clinical geneticist who was part of the inspiration behind the Avon Longitudinal Study of Parents and Children (ALSPAC).<sup>3</sup> Marcus would bring ideas, be very supportive, positive and proactive, while being diffident to authorship.

TP: Through your lifetime and on the international stage, who would you pinpoint as the two or three most important epidemiologists?

JG: This is difficult but I would start with Alice Stewart – she was my star in being ahead of her time in thinking that prenatal events might be important for childhood cancers. As a woman trying to succeed in academia she had a rough time, but she was extremely bright and forward-looking. There’s also Mervyn Susser and Zena Stein, and while I don’t want to distinguish between them, I thought Zena was particularly good. Again she’s a woman, and I think it was her idea to follow up the women who were pregnant

during the Dutch Hunger Winter, which was formative and is still producing fascinating information.

TP: Which is your most influential paper and which is your most under-appreciated one?

JG: It depends how you define “most influential”. Our Jamaican studies<sup>4</sup> were highly influential in Jamaica, though they’ve hardly been quoted in the international literature. They were instigated by their Department of Health, who wanted answers that they could put into practice. To have your research implemented straightaway is fantastic, though at times I had to hold people back, saying “Well, you’ve got to confirm this”.

Of these papers, I’d highlight the one emphasising the importance of treating pre-eclampsia properly, as many women and their babies were dying because that wasn’t happening.<sup>5</sup> We went out into the bush and interviewed families of women who’d had eclampsia and died, to discover what had and what hadn’t happened. From this we formulated a card to give to women, with pictures saying if any of these things occur, go to your health worker quickly. This empowered women to say, “Look, this is happening. You must do something.”, and the death rate dropped. This was really exciting and I am proud of this for many reasons, including that my daughter designed the card. This study hasn’t received as much appreciation in scientific circles as it should, partly perhaps because it was based in a developing country.

TP: Are there any other examples of papers you felt were better than they were received?

JG: There are various things that over time got buried and, suddenly, years later are now coming forward. My PhD thesis on anencephaly emphasised the importance of diet, including the possibility that tea drinking was involved.<sup>6</sup> This caused hilarity at the time because nobody thought this was feasible. In any case it got overtaken by the randomised trial of folate,<sup>7</sup> which I don’t deny is extremely important. When my paper was written up it got published very obscurely, with no publicity.<sup>8</sup> Now, much later, there are publications showing that tea drinking and CNS defects such as spina bifida and anencephalus may be linked.<sup>9,10</sup> Moreover, one study showed that tea-drinking reduces the bioavailability of folate,<sup>10</sup> so it could all tie together. When I wrote this up Richard Doll said “You can’t afford to be wrong again, Jean” – I can’t remember what the other instances were, perhaps they’re buried, or perhaps they’ve been justified!

TP: How have you chosen the research questions you want to address?

JG: This is basically dictated by curiosity, from reading around all sorts of topics, including psychology and teratology as well as pediatrics and mental health. Questions come up all the time – there’s never a shortage of issues to investigate, just a matter of whether you can get funding. So there are lots of things I’d like to pursue, but which one is a question of which week it is, what am I most interested in today? I’m enjoying going back to working on various questions with ALSPAC; even though we’ve got hundreds of collaborators, they’re not addressing all the questions I founded it for, so that’s a great opportunity for me!

TP: What are the contributions to the field for which you would most like to be remembered – in terms of studies in general and particular findings?

JG: The study has to be ALSPAC,<sup>3</sup> the birth cohort I founded of over 14,000 births in the south west of England in 1991-1992. It is different from the other British cohort studies in that it commenced in pregnancy, had genetics in mind, included biological samples and collected other data in considerable detail. It still continues, indeed into the next generation. Raising funding to conduct it was an enormous task, and I carried on directing and running it until the end of 2005, after which I gratefully handed over to George Davey Smith, who has great vision and excitement, and I am happy with this in most ways. It's inevitable that one sometimes wishes to influence things, but I've tried to keep out of that and in any case I am thoroughly enjoying the opportunity to write up more of the results.

Regarding particular findings, we've shown that diet, especially maternal diet in pregnancy, is crucial to children's development. Fish is very important, but generally I'm really proud of having made sure we were collecting dietary data from the outset. Having said that, I also think the most exciting things are what's to come from what we're working on now – but if you don't think that, you might as well retire!

TP: Turning to broader issues, how do you think epidemiology shapes matters around it – that is, what important contributions would see your subject making to society?

JG: It's enabled people to start questioning what's happening in the environment, and particularly the dangers of smoking. This is exemplified by Richard Doll's work, but also the research on smoking in pregnancy and exposure of children to passive smoking, which has been highly influential in changing attitudes and improving public health in the developed world, though things in the developing world are not so good.

However, I'm always conscious of whether the epidemiologist should be pushing such issues or if they should provide material for others who are better at it. Advocating your own study results can be very dangerous because you're not necessarily following a consensus. It's much better if the consensus is reached, perhaps by epidemiologists, and then pushed forward, but that rarely happens.

JG: What is your view of the current state of affairs for epidemiology?

JG: It's exciting in that it's moving into genomics and omics of all sorts, but there's a danger it's losing its way. I think people are not getting grounded in the traditional epidemiological methods and are launching into a GWAS or whatever is the next equivalent. On the other hand, there are many people in traditional epidemiology who seem to be rediscovering the wheel. Of course it's important to confirm results, but to keep doing so and not go beyond the original question is, I think, potentially dangerous. There are those in epidemiology who want to play safe, and it's much safer to criticize than it is to stick your head above the parapet with your own ideas.

Also, there are numerous chemicals being introduced into our environments all the time, and it's important to at least be aware of what there is and record it, and to develop methods of analyzing biological samples. There are agents that might be dangerous, with evidence largely based on animal experiments that might be irrelevant. Moreover, it's important to recognize that environmental exposures might have influences down the generations, where considering a current outcome will involve looking at the wrong person. Hopefully ALSPAC will carry on recording these things, as it's vital to investigate the epidemiology of ongoing environmental and dietary changes.

TP: Considering the future and what it might hold for epidemiology, where do you think the opportunities are?

JG: My crystal ball is on our current transgenerational research, building on Marcus Pembrey's studies with Olle Bygren in northern Sweden showing that what happened in the childhood of men in a village on the edge of the Arctic Circle appears to affect grandchildren through the male line. What was recorded in the 1800s about the harvests (famines and gluts), and where the grandfather was as a boy just before puberty in relation to these exposures, appears to affect his son's son in terms of survival rates and to some extent diabetes.<sup>11</sup> This is very exciting, and we're looking at pre-puberty effects in the ALSPAC fathers, and mothers, to try and track whether there are differences in their sons or daughters. We're looking at it all, with the subtle details that ALSPAC allows, and there are some really interesting developments.

TP: Are there enough people coming into the discipline to yield a healthy influx of new blood?

JG: I'm not best placed to judge from my personal ivory tower. There do seem to be large numbers here going through and getting doctorates, but I'm less sure of what they do subsequently. However, I don't think there are enough environmental epidemiologists in the UK – there are in the United States, but it's not seen as important in this country, and I think that's very dangerous.

TP: What's the single piece of advice you would give to somebody starting their career in epidemiology?

JG: I was very influenced by watching the London Paralympics opening ceremony, during which Stephen Hawking, who is incredibly disabled, said the most important thing is curiosity, and he's right. That's where the epidemiologist should be. Stop rediscovering the wheel, look at features we can't explain, stick your neck out, explore and solve what's happening. Epidemiology has the tools to do a lot more about this than any other discipline in my opinion.

TP: Going beyond epidemiology, what have been your major outside interests? Have you had time to have any?



JG: You are joking! Apart from watching my children grow up and my grandson, who's such a joy, I think that's enough actually. Being a grandparent is fabulous, and I have the added pleasure that my grandson is just finishing his DPhil at Oxford and I can't see him being anything other than an academic.

TP: So motivation, mode of thinking and communicating ideas is definitely in the genes?

JG: Or it could be the environment, or most likely some combination of the two. It's the way the environment and genetics interact that enthuses me most, and I think we still haven't got very far with this, though epigenetics will no doubt inform things much more. Some of my research now is intergenerational, and in ALSPAC we collected a lot of information about the parents and their childhood, and indeed some about their parents. Looking at these aspects is very exciting.

TP: So, the passion that drew you in is ...

JG: Yes, it's still there.

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### **About the Interviewer**

Tim Peters is Professor of Primary Care Health Services Research and Head of the School of Clinical Sciences, University of Bristol. A statistician with interests ranging from paediatric and perinatal epidemiology to community-based RCTs, he has worked with Jean Golding since 1980 when she introduced him to the 1958 cohort study during his Oxford MSc, through his PhD studies on the 1958 and 1970 cohorts, co-editing *Paediatric and Perinatal Epidemiology* and many studies in between.