

Sara Rey has a PhD in interdisciplinary biology and is now in the third year of the NHS Scientist Training Program in Bioinformatics, genomics stream. We spoke to her about her career experiences.



How did you move from your PhD to your current role?

I had gone straight into research from my undergrad, and it had always been my aim to become a lecturer with a very small research group as I wanted to teach, but also really enjoyed the freedom to pursue research ideas and thought that it was a good way to fulfil both aims. I learned a lot more about academia while doing my PhD and decided that, as it currently stands, for a lot of reasons, building a career (or attempting to) in academia was not for me. I thought seriously about teaching in school for a while, but felt that my desire to learn new things might not be as fulfilled in that kind of job. I had visited the careers service at my local University and they had mentioned clinical science so I had been keeping an eye out, but none of the specialisms particularly appealed to me (although I was considering medical physics, I wasn't sure if I had the right background to be accepted).

One of the things that I had enjoyed the most during my research was learning how to write simple computer programs to automate analysis and when the bioinformatics genomics specialism opened for recruitment after I had missed the usual round of recruitment (genomics opened late the year I applied), it seemed perfect! It seemed a good opportunity to further develop my computing skills and interest in technology while also learning more about genetics (an interest I had for a long time - I nearly chose genetics at undergrad).

The job role appealed to me for a lot of reasons:

I enjoy feeling that my day to day job is making a difference to people and, although we are usually quite removed from contact with patients by a few steps, everything that we do is ultimately for the benefit of the patients. Genomics is a rapidly developing area and so I hoped I would have a chance to shape the future and develop new methods and software (and make improvements to existing ones) in my department. Genetics is fascinating and pretty much everyone I meet is very interested in it so there are plenty of opportunities for public engagement (also in reaching out to others (adults and children) to get people to engage with technology. It is also being funded well so there is potential for future employment and to be involved in expanding services, which is very exciting. I believe strongly in publicly funded healthcare, but understood that changes were necessary to enable it to continue. I wanted to contribute to keeping the NHS free at the point of use by being a part of the NHS and working towards making efficiencies. Finally, I thought that being paid (plus a funded MSc) to learn more about an area which I found interesting was really too good to pass up on!

My current role is a (nearly) third year healthcare scientist trainee in bioinformatics (genomics). On successful completion of the training, which involves a practical exam, a series of write-ups from work-based training and a part-time MSc at the University of Manchester (travel required!) I will be able to apply to be a registered clinical scientist in this area. My work placements and where I spend

the majority of my time are at the University Hospital of Wales in Cardiff which was my first choice of location (I have lived in Cardiff for 14 years), although I have done rotational placements elsewhere during the first year (first year rotations in other departments and/or locations are a key part of the STP).

What does a normal working day look like for you?

I arrive at work and then have a quick look through the things that I have planned to achieve during the day. Much of my work is alone, although sometimes I will observe something (perhaps at clinics, or someone doing some analysis or lab work). If I haven't got any observations planned then I sit down at my computer and start my work for the day. If I have observations then I go to those and then write-up some notes immediately afterwards. Even if I don't write up the full competency or reflective diary entry immediately I have to write the notes right away or I will definitely forget. I try to base my notes around the learning points that are the desired outcome of whatever I am observing so that it is easier to do the full write-up later. Sometimes I will have meetings with my section (for me this is next-generation sequencing at the moment, but depending on the learning module that I am doing it can be whichever section) or with my training officer or lead bioinformatician. As before I write-up minutes straight away so that I don't forget what was said (or what I need to do!).

I sit in an office with our lead bioinformatician, a clinical scientist in genetics, a couple of genetic technologists (sort of assistants to clinical scientists who do more of the lab work and routine analysis) and a couple of people from our local University as well. If I have issues when I'm doing my work for the day it is usually quite easy to ask one of them a quick question. In general the person supervising a particular rotational module is fairly available for questions and this is often quite informal, although if they appear very busy then I'll send an email rather than interrupting.

I do a fair amount of my work on my own personal laptop (not anything with patient data!) because of the restrictions of which software can be run on the trust's computers and lack of administrative rights to that computer. Since we got a high-performance computing cluster I have been able to do more of my work using that instead (connecting to it from my trust computer through putty). I know that other people have tackled this issue in various different ways, but for me using my own laptop and eduroam (with my University of Manchester log in) was easiest.

Most recently I have been working on putting together an analysis pipeline for one of our targeted gene panels (basically a list of genes that we will sequence, usually these are involved in a particular disease or phenotype, e.g. a retinal dystrophy panel). This has involved trying out tools and analysing the results to select the best ones for our particular data set. It has also involved discussion with the clinical scientist about their requirements for the final data and what they will put in their clinical reports, as well as with the lead bioinformatician to ensure that things are in a standard format for our lab and they are happy with my analysis, the interpretation of the results and the final tool selection. Collaboration and good communication are really important in this job!

Other things I have done are work on designing a database for storing next-generation sequencing data, working with clinical scientists on clinical interpretation of results and report writing, observations at clinics, involvement in audit and other quality assurance processes (this is super-important for diagnostic work as you can imagine), working on my programming skills and advising on data protection issues around patient data. So things can also be quite varied!

What skills gained from your PhD/postdoc are useful in your current role?

Good record keeping (including minuting meetings and actions).

How to search for articles and other sources of information effectively and efficiently. How to skim text to get the salient points out quickly and assess quickly if something is of interest or not.

Tenacity. You have to be extremely self-driven and much of the planning for completion of my training has been organised by me. I think trainees should be prepared for the possibility of having to do rather a lot for themselves. There is not always a lot of direct “training” (depending on the area) and sometimes, again depending on area and module, trainees can instead be given a list of stuff to achieve and asked to get on with it. This can be really frightening, particularly at the beginning of the training where you’ve got no idea what you’re doing. Unfortunately a lot of labs do not or did not have any or a lot of bioinformatics support and so there can be limited guidance on what to do. The genetics scientists by and large put a lot of effort and time into helping, but the ones I have spoken to found the training programme quite difficult to interpret and therefore activities and projects quite hard to plan and arrange. Although I hope that this is changing, as more years of trainees go through the system and more bioinformaticians are recruited, a fair amount of confidence is required as are excellent google skills!

How to plan a project out and think about factors which might be barriers to successful completion and address them.

Collaboration with others and communicating with people who may not have a good grasp of what you are doing or need to be doing. Also how to deal with ‘difficult’ people and still get things done without causing offence.

Flexibility in approaching tasks and being brave enough to decide not to finish a project if it is not going well rather than try to complete it at all costs (letting go!).

Working independently without direct supervision and finding something to get on with without being specifically told what you need to do. Also prioritising work based on who is waiting for what and what needs to be completed soonest (rather than preferentially doing the things which are most interesting!).

For me specifically, a basic knowledge of programming and a passion for technology and strong interest in genetics.

What are the best things about your role?

The freedom to (by and large) plan my days. This is also one of the worst things about the role as there’s no-one keeping a direct eye on me a lot of the time so if I am not doing this very well then I run the risk of not completing the training on time!

The job is definitely not boring, I learn something new pretty much every day, although it can sometimes be very tiring and also incredibly frustrating at times like when you get stuck on something for a while and are feeling the pressure of having to complete things quickly so that you can finish the training in the allocated time.

The chance to work with and communicate with people from a variety of backgrounds with a lot of different specialisms (and with University people as well). The people in my lab (and the local University) by and large are really great people and try their best to help me out as much as possible.

The feeling that in some way the job you are doing is worthwhile and benefiting someone directly.

The chance to speak with patients and get involved with public engagement. Building trust in the NHS is really important to keeping it alive and I'm really privileged to be a part of that (no matter how small).

NHS and student discounts ;-).

What are the worst bits?

Unlike other specialisms, this one is almost all development work with very little routine working. This is really tiring and also means that things quite often take four or five times longer than you thought that they would as you run into unforeseen issues a lot (or make mistakes). There is no extra time for completion allowed, even though this course is technically a pilot year, and so, even though I do feel that learning by doing (and making mistakes) is a great way to learn, it can be quite stressful as there's the worry that you won't complete everything in time. Related to this is uncertainty regarding how much depth to go into for every topic.

The training model has been based on clinical specialisms with much more patient contact (e.g. medicine), and this has meant that some of the questions for some assessments are not very directly relevant to the assessment, e.g. observing at a software requirements gathering has associated questions about empathy with the patient. While it is not impossible to be creative and incorporate seemingly slightly off-topic questions in some way, this requires the assessor to be willing and able to do this and also sometimes unfortunately ends up feeling a bit forced.

A lot of the software development competencies seem to fit developing software for a big lab with a large team of developers (very formal processes) far more than the real situation in many labs of one or two bioinformaticians collaborating with each other and other colleagues on software. This has made fulfilling these competencies a bit tricky and required extra work/explanation/write-up. Some of the learning associated with some of the modules can also be really difficult to arrange (e.g. seeing all phases of a clinical trial, participating in all stages of a software development life cycle). If these activities aren't occurring in your lab then you either have to do something which is 'similar' or try to find an external provider (takes a lot of time).

The large amount of paperwork I generate (write-up of competencies and University coursework etc) is frustrating as it takes up an enormous amount of time which could otherwise be spent learning new things or developing new skills. This is perhaps particularly annoying as there are such a lot of diverse things to learn in this specialism (programming, software requirements gathering, databases, genetics...). I would prefer a more streamlined approach to assessing the competencies perhaps incorporating other methods of assessment more e.g. discussions, pre-prepared questions and answers etc. I hope that this will come in time as the STP is developed further.

I and many others have done a lot of learning in our own time (although this is not a requirement or necessarily a bad thing), picking up Coursera and EdX courses to try and fill in gaps in our knowledge (of which there are many!). Because of the inter-disciplinary nature of bioinformatics/genomics there are a huge breadth of topics to cover. You have to be willing to accept that you won't be able to fully understand and be competent in all areas to the standard that you would wish to be and have to

note some things down to pick up later (and that statisticians, biologists and computer scientists will all look down on you- you will be a jack of all trades and master of none). The learning in this job will almost certainly never end. This is not a specialism for those who want to settle into a comfortable rut (this is also probably true of other specialisms).

One of the rotations is medical physics and you will have to attend the University of Liverpool with medical physics trainees. This will likely be extremely challenging for people without any maths or physics background, but it can be done! Also, be prepared to learn some mathematics particularly statistics as it is very useful for understanding how the tools we use (and may one day tweak or develop) work.

There is a requirement to travel away from home to attend the University (7 weeks 1st year, 3 weeks 2nd and 3rd year) and for exams. Different hospitals have extremely different funding arrangements for this but most people had to pay for it out of their own pocket and then hope to claim the money back afterwards. This also can be difficult for people with young children or other caring responsibilities.

You really need to love the job particularly in these early intake years where they are still piloting the scheme as there are loads of little niggles and annoyances which still need to be ironed out both from the national school and the University (although people are working very hard on this). I have dealt with the frustration from this by channelling this energy into making constructive comments and suggestions in the hopes of improving the training programme for future trainees. The job is not unlike doing a second PhD (with even more write-up!) and I wouldn't recommend it unless you are prepared for that kind of work (again, if you've already done one).

Probably from a personal perspective I found the initial lack of a professional in the area of bioinformatics available in my lab to be the most challenging thing, and my training officer felt the same way. This is because planning appropriate projects and tasks to fulfil competencies was very difficult for someone with no expertise in the area. A few of the projects have not ended up being quite right (in hindsight), but obviously the time that was spent on them has now gone. What this means is that I have ended up working very hard and putting in loads of extra hours, yet still feel that I am falling behind with completing on time (no matter all of the extra things that I would like to learn to be most effective at the job that aren't covered specifically in the training programme (e.g. statistics)). This should hopefully not happen for future trainees as there is more bioinformatics support available and training should be more streamlined as more trainees have gone through it. On reflection, it is probably more to do with being part of a pilot year where the professional job role has not yet been well established than it is reflective of the training in general.

Where do you see yourself going from here?

This one is actually a bit hard to answer. The standard progression would be to then work in an NHS lab as a registered clinical scientist and gain more experience and then take some additional training and/or exams to become eligible for more senior positions. In genetics currently, you have to have taken an exam to be eligible for the positions of principal clinical scientist (these are the heads of sections and things like that). It is also preferable if you have taken the part 2 of this process which is an oral examination on your practice and how you would respond to certain situations. This is in the process of changing to a new system of a professional doctorate called the HSST (Higher Specialist Scientific Training). I am not quite sure what this involves as it is entering its pilot year for genetics this year (bioinformatics has not yet started) but there will be a combination of service development and teaching in both scientific areas and management. At present these positions are only available to registered clinical scientists.

One of the major disadvantages of this training programme compared to some other graduate schemes is that the contract is only for the duration of the training. Even if performance on the programme has been excellent, getting a more permanent position after the completion of the training is very dependent on the funding and needs of your local laboratory. For more specialist service such as genetics and genomics, this can mean quite a serious house-move (e.g. there is only one hospital in the whole of Wales with genetics services, so I would need to go to England if I cannot obtain a post at the lab which trained me). This stands in contrast to other specialisms such as biochemistry where a lot of hospitals provide the service and therefore have jobs available.

Other options include moving to academia (not so useful for those of us who have decided to leave academia!), doing a PhD (also not too useful for those of us who have already done one!), or industry (for genomics, companies that specialise in diagnostic pipelines or sequencing instruments are a possible option).

For me, I would like to continue to work in my home lab. If there is no job available at the end of the training programme, then I will have to look elsewhere. I may also explore trying to get a position as a technician in my home lab (although this would involve a pay cut). In the end, prospects are reasonably good for a permanent job after the training, and excellent for those willing to move around the country, but it is a lot of effort and time to put into something which might end up going nowhere for people unable to move. It is also a bit of a waste of public money to spend it on trainees who then leave the profession because there are no local jobs.

More generally speaking, it is quite difficult at present to predict where the NHS is taking genomics. It is a possibility that analysis of the kind that we currently do in our labs and are being training to do will end up being outsourced to private companies (as has been done with the genomics England project). If this happens, then demand for people with our skills in independent small labs will definitely decrease, although I think that each lab will probably require at least one bioinformatician. It may also be that genomics in the NHS will centralise to one or two specialist centres and this will be where our skills will be required. Another option for trainees on this training scheme is that we could end up doing some of the work currently done by genetics clinical scientists such as analysis of variants and writing reports for clinicians as this has also been quite a large part of the training programme so far.

What tips would you give our PhD students and early-career researchers wanting to get onto the NHS STP?

Application: Practice the online tests and don't expect to be able to finish all the questions properly. When I did it there was no negative marking, if that is still the case then make sure that you answer every question even with a guess. Try to think of examples from your life so far when answering the questions on the application and if possible put in a sentence on what you learned from the experience and how you apply that new knowledge now. Don't be upset if you don't get through the first time you apply. A lot of really good people don't and yet make excellent clinical scientists after applying in subsequent years. The online tests are a pass-fail to have your application considered. The application is what gets you invited to interview so spend a bit of time on it, think about the sort of things that you'd like to read as answers if you were the person reading the application and try to keep it short and unwaffly (there's a word limit!). Remember throughout the process that the NHS is all about the patient and ensuring that the patient has the best experience possible. If you don't share this opinion for any reason and aren't willing to sometimes make sacrifices yourself to benefit the patient (e.g. staying late to finish something, taking some work home) then think carefully before applying as you may struggle.

Interview: Take an interest in science in general and your specialism too- read a few papers etc. Keep up with the news affecting the NHS such as restructures etc- think about why this could be a good or bad thing and be prepared to answer questions and defend your viewpoint. Make sure you have a good understanding of basic stats and analysis methods, particularly those relevant to your specialism. Try to get an understanding of what your job will actually be like and how it might be done in the NHS. If you are lucky and able try to arrange a visit to a hospital, if not your department then a similar one. Make sure you read the work based learning guides (available freely from the national school of healthcare sciences website)- these will be important pointers on what the job is about and what to prepare for interview. Interview performance, as always, is measured not only in what you say but in how you say it. Don't forget this even though the interview 'speed-dating' process can be challenging as you only get 10mins with each station. If you don't have any idea how it went afterwards and feel that you said at least one colossally stupid thing then you will probably find yourself in good company (I certainly did this!).

Afterwards: You are able to rank locations for your work-based training in order of preference during the application, but this does not mean that you will get any of your preferred locations. Locations are assigned based solely on interview score so if you happen to have chosen a popular location you might not get it and be offered a different location for your training. If this happens, decide if you are willing to move or travel. If not then don't feel that you can't reject the offer and still apply next year in the hopes of a better location for you. They're fairly strict (or have been) on not allowing trainees to swap locations with each other directly, which is a bit of a shame so your only option has been to reject your place and go back into the reserve pile for re-allocation.

In the job: Be interested and helpful and get involved in everything you can. You never know when something you are learning that seems irrelevant could potentially end up as being useful in your field, and building contacts around the hospital can be very useful. Try not to get too stressed about the quantity of work; do your best and be as proactive as you can and things will start to get ticked off one by one. Build a good trainee network with fellow trainees in your area, in your specialism, in your year and in other years. These people have been an essential source of ideas for projects, clarification of what competencies mean and just general support when things got tough. Definitely do this!