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Unruly lives, human genetics and the search for rare blood*

Jenny BANGHAM **

The plot of *Emergency Call* (1952) – part public-information film, part cinematic thriller – revolves around a search for ‘rare blood’. A five-year-old girl with a very unusual blood group has arrived in hospital suffering from leukaemia. The doctors need to find three donors each able to provide a pint of the blood that she needs to survive. The film begins with doctors at the hospital frantically calling up the local Regional Transfusion Officer to find out whether they have any blood that would match that of the little girl, Penny. Explaining that there is “none at the bank; they’re going to check the register for suitable donors and ring me back”, the doctor reassures her mother:

“There are bound to be donors on the register who belong to Penny’s group. It’s a nationwide organization. In a matter of hours we shall have all the blood we need.”¹

But the doctor was over optimistic. Not long into the film they discover that the only three people alive in the country with the correct blood group are: a missing boxer; someone they refer to as a “coloured” sailor; and a “murderer on the run”. The boxer is pre-occupied with evading the clutches of a criminal gang who had attempted to fix one of his matches; the sailor refuses to donate owing to a past experience when his blood was rejected because of the colour of his skin; while the ‘murderer’ – who is known to have the correct blood group because of forensic tests carried out at the scene of his crime some years before – is now living under an assumed name and new identity. The film follows the heroic doctor as he sets out to find and persuade the unruly would-be donors to give their blood.

Weaving of a drama around ‘rare blood’ combines themes of race, civic duty, bureaucracy, and identity. These are also the major themes of my book project,

which argues that the technologies of blood testing, storage, and administration helped to expand and consolidate the science of human genetics. Blood groups were produced and studied in hospitals, transfusion centres, doctors’ surgeries and university laboratories. They were also the first (and until the 1960s almost the *only*) sharply defined human genetic traits. Through the institutions, technologies and networks of blood transfusion, geneticists accumulated vast quantities of blood-group data, turning them into resources for studying human identity, difference and belonging. This short paper offers a glimpse of how the infrastructures and bureaucracy of blood transfusion in Britain shaped postwar genetic research.

Diversity and inheritance

Blood groups were first defined in 1901 by immunologist Karl Landsteiner in Vienna.² He observed that mixing samples of blood from different individuals often, but not always, caused red cells to clump together, or ‘agglutinate’. Landsteiner accounted for those patterns of agglutination by categorising people into groups, which eventually became the familiar A, B, O and AB.³ Landsteiner understood agglutination to be caused by proteins called antibodies

* The following is a modified version of a talk presented to the Société de Physique et d’Histoire Naturelle de Genève on 29th October 2014 for the SPHN Marc-August Pictet prize 2014.

¹ Gilbert, L., *Emergency Call* (Nettelfold Films, 1952). My own transcription.

² Material in this section is drawn from the dissertation: Bangham, J., *Blood groups and the rise of human genetics in mid-twentieth century Britain* (University of Cambridge, 2013).

³ For many years, the blood groups were denoted using several different names; only in the late 1930s did these become internationally standardised.

reacting with proteins called antigens on the surface of the red blood cells. The antibodies in one blood sample attached the antigens of the other sample, causing red cells to clump together (Fig. 1). Landsteiner's ABO groups were both a way of categorising people, and of detecting the antigens on the surface of red blood cells.

Landsteiner's research attracted widespread attention from immunologists, serologists, clinical pathologists and surgeons, who gradually incorporated blood groups into transfusion protocols. The rising significance of blood groups in transfusion medicine after the First World War sustained various other kinds of research, including a vast proliferation of studies on the blood-group frequencies of different national, religious and so-called racial populations.⁴ During the turbulent 1920s and 1930s, blood groups, like the physical measurements of bodies, became part of European discourses on nationalism, colonialism, race and ancestry. Serologists, anthropologists and doctors sought to incorporate ABO blood-group percentages into new racial classification schemes, to stake claims to territory, to justify the movement of people, and to prevent migration across borders. By 1939 research on the geographical distributions of blood groups had involved tests on an estimated 1.3 million people.⁵

Meanwhile, researchers were studying the genetics of the ABO groups. The inheritance of most human traits was fiendishly complex and their study was plagued by problems of small family sizes. In 1910 serologists



Fig. 1. From Cyril Jenkins Productions Ltd, *Blood Grouping*, Imperial Chemical Industries Limited, 1955. Wellcome Library. View the film at <http://catalogue.wellcome.ac.uk/record=b1750596> © ICI/Wellcome Trust, 2011. Printed with permission of Wellcome Film (Wellcome Library, London).

Ludwik Hirschfeld and Emil von Dungern announced the ABO blood groups to be the first human characters inherited according to clear-cut Mendelian laws, provoking a proliferation of research on the specifics of their genetics. German mathematician Felix Bernstein used the now vast quantities of accumulating data on blood-group frequencies to test new techniques for studying Mendelian genetics in human families and populations. In 1924, he also proposed that the ABO blood groups were inherited via a single locus with three possible alleles: *A*, *B* and *O*. Around the world, serologists and geneticists used their own population data to test both Bernstein's novel mathematical techniques and his genetic hypothesis. Bernstein also proposed a way of detecting linkage (co-segregation) between blood groups and other human genetic characters, which offered a promising approach for mapping human chromosomes.⁶ In the early 1930s, Bernstein's work caught the attention of a community of influential geneticists in Britain, who seized on blood groups as tools for reforming the study of human heredity.⁷ Just as on the continent, this community mobilised blood groups in discourses about the disciplinary politics of genetics and race science, and incorporated them into discussions about British national identity in relation to its colonies and to Europe. With support from Britain's Medical Research Council and the US philanthropic Rockefeller Foundation, blood groups became central to a series of connected research programmes on human inheritance and diversity.

⁴ Mazumdar, P., "Blood and Soil: The Serology of the Aryan Racial State," *Bulletin of the History of Medicine* 64 (1990): 186–219; Schneider, W.H., "Chance and Social Setting in the Application of the Discovery of Blood Groups," *Bulletin of the History of Medicine* 57 (1983): 549; Schneider, W.H., "The History of Research on Blood Group Genetics: Initial Discovery and Diffusion," *History and Philosophy of the Life Sciences* 18 (1996): 277–303; Marks, J., "The Legacy of Serological Studies in American Physical Anthropology," *History and Philosophy of the Life Sciences* 18 (1996): 345–362; Turda, M., "The Nation as Object: Race, Blood, and Biopolitics in Interwar Romania," *Slavic Review* 66 (2007): 413–441; Boaz, R.E., "The Search for 'Aryan Blood': Seroanthropology in Weimar and National Socialist Germany" (Doctoral Dissertation: Kent State University, 2009).

⁵ Estimate from Schneider, "The History of Research on Blood Group Genetics: Initial Discovery and Diffusion."

⁶ Gaudillière, J.-P., and Rheinberger, H.-J., eds., *Classical Genetic Research and Its Legacy: The Mapping Cultures of Twentieth Century Genetics*, (London: Routledge, 2004); Gaudillière, J.-P., and Rheinberger, H.-J., eds., *From Molecular Genetics to Genomics: The Mapping Cultures of Twentieth Century Genetics* (London: Routledge, 2004).

⁷ Mazumdar describes the early phase of this reform, but leaves the story in the mid-1930s. Pauline Mazumdar, *Eugenics, Human Genetics and Human Failings: the Eugenics Society, its Sources and its Critics in Britain* (London: Routledge, 1992).

Transfusion and war

So by the end of the 1930s, blood groups were established traits for the study of genetic difference and in-

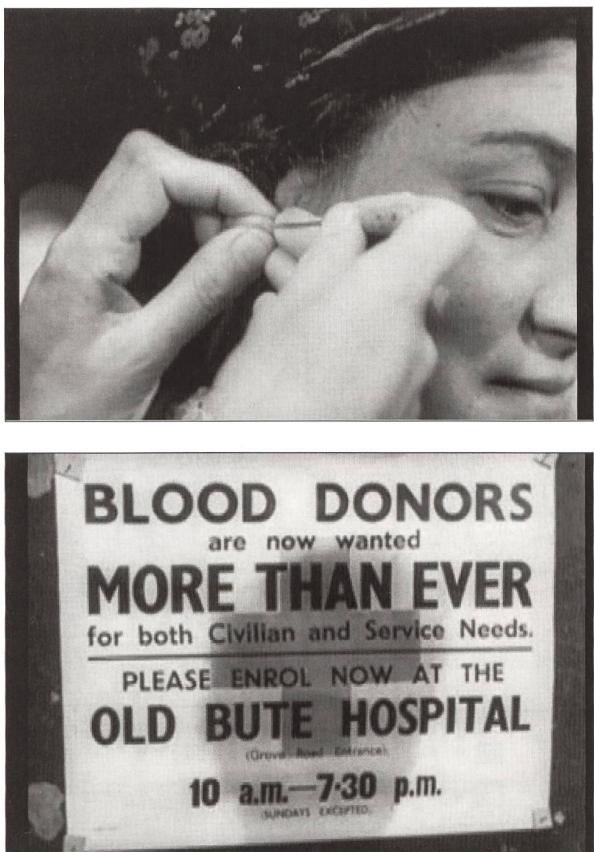


Fig. 2. Two stills from the wartime public information film *Blood Transfusion Service*, directed and edited by H. M. Nieter, a Paul Rotha production (Ministry of Health in cooperation with the MRC and the Blood Transfusion Units of the Fighting Services, 1941). The film was part of the drive to recruit donors, and it covered the history and development of blood transfusion.
<http://catalogue.wellcomelibrary.org/record=b1675865~S8>. Printed with permission of Wellcome Film (Wellcome Library, London).

⁸ Some material in this section has previously been published in: Bangham, J., 'Between the transfusion services and blood group research: Human genetics in Britain during the Second World War', in *Human Heredity in the Twentieth Century*, Gausemeier, B., Ramsden E., and Müller-Wille, S., (eds), Pickering and Chatto (2013).

⁹ For more on how the Spanish Civil War became a more general exemplar for the British Emergency Blood Transfusion Service, see Whitfield, N., 'A Genealogy of the Gift: Blood Donation in London, 1921–1946', (PhD dissertation: University of Cambridge, 2011), Chapter 2 and references therein; Buchanan, T., *Britain and the Spanish Civil War* (Cambridge: Cambridge University Press, 1997), Chapter 4.

¹⁰ For more details concerning the geographical locations of depots and their activities, see Vaughan, J.M. and Panton, P.N., 'The Civilian Blood Transfusion Service,' in Dunn, C. L., (ed.) *The Emergency Medical Services*, vol. 1, History of the Second World War: United Kingdom Medical Series (London: Her Majesty's Stationery Office, 1952), 334–355.

heritance.⁸ By now they were also indispensable to practices of blood transfusion. In Britain, plans for the wartime blood transfusion service began shortly after the Munich Crisis in September 1938. Inspired by the improved methods of blood storage developed by the Republicans during the Spanish Civil War, Britain's Medical Research Council (MRC) began planning a nationwide transfusion service.⁹ Blood could now be stored for up to two weeks in depots and delivered to hospitals where and when it was needed, relieving the immediate pressure on donors to be called up in emergencies. It also meant that blood could be collected in much larger quantities than before, which officials believed would be much needed in the face of anticipated air raids. To meet this demand the MRC launched a large-scale campaign to recruit donors, co-ordinating appeals in newspapers, on the radio, in cinemas, in pamphlets, at local institutes, and in medical journals (Fig. 2). The campaign was phenomenally successful; barely a month after the recruitment began, *The Times* announced that it had registered its first 100 000 donors.

This massive increase in the numbers of donors meant developing a new bureaucratic structure for testing, listing and managing people and blood. The Ministry of Health established a network of "empaneling centres" where new volunteers would be tested and their details recorded on index cards along with their address and any medical conditions. Many volunteers registered at empaneling stations, while mobile teams of medical officers, nurses, secretaries, and transfusion technicians also tested and extracted donated blood at so-called "bleeding centres" in towns, villages and factories.¹⁰ Large numbers of female assistants were hired as clerks to manage this system of index cards, lists and labels. More generally, in Britain the Second World War intensified the ways that individuals were managed and monitored – through devices like identity cards and ration books; donor cards were yet another wartime, paper-based bureaucratic tool for keeping track of people.

Rare blood

Until this point, only blood of group O was collected for transfusion, because it supposedly contained no antigens that could cause reactions in the recipient (A and B-type blood was also collected from donors, but used only to make reagents for doing grouping tests). However, as the war went on, the simple ABO blood group system began to be broken apart. It turned out that red cells carried lots of different kinds of antigens, which sometimes affected the success of transfusion. With the discovery of more and more blood groups – including the Rhesus groups – blood simply classified as type O was no longer seen

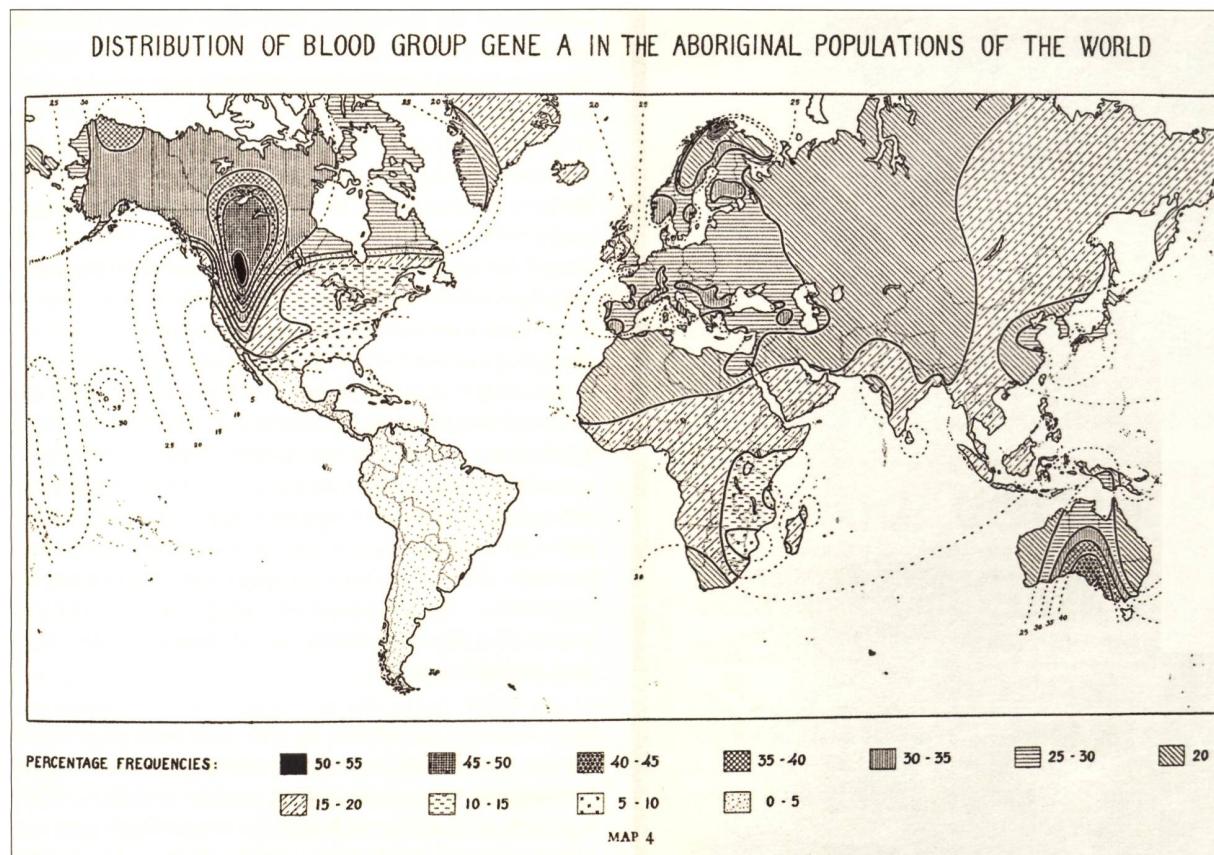


Fig. 3. Letter from R.A. Fisher to Robert Race, Wellcome Library, SA/BGU/E.7. Printed with permission of the Wellcome Library, London.

to be universally safe. Doctors now took care to test the blood groups of both donor and recipient and to *match* their blood types. In addition, the therapeutic potential of blood was expanding, so that transfusion was no longer a process that happened just in emergency situations, but also during the course of routine hospital operations. In most cases matching blood groups was relatively simple; but some blood groups were more common than others, and occasionally it was hard to find a match. So by the 1950s – with blood transfusion now a routine part of hospital care – much attention was being given to people with more unusual and *rare* blood.

The mystery and drama of pursuing rare blood – so vividly depicted in *Emergency Call* – was also felt at world's centre of blood group genetics in London: the Blood Group Research Laboratory. Early on, blood groups had been prized for their Mendelian simplicity: researchers had known for years that traits like eye colour, height, and many diseases were heritable to some extent, but their inheritance was immensely complicated and could not be fitted into any simple schemes. By contrast, blood group antigens were inherited in a way that appeared to follow simple Mendelian laws. As recognised by the MRC

and Rockefeller Foundation in the 1930s, blood groups offered the opportunity of *mapping* genes onto the human chromosomes. Furthermore, as blood became more and more differentiated, the fine detail of the genetics of the blood groups became a research programme in itself. A single blood group gene might have quite a complex architecture, and it was this kind of genetic research that was being carried out at the Blood Group Research Laboratory in London (Fig. 3).

The Blood Group Research Laboratory, which was housed at the Lister Institute of Preventative Medicine and directed by Robert Race and Ruth Sanger, carried out two principal kinds of work. The first was to provide a diagnostic service. Doctors in Britain or overseas might have a patient that had responded badly to transfusion but be unable to work out why. The Research Laboratory had in its freezers a huge collection of antibodies and red cells, so doctors would send samples to the lab for the most subtle and wide ranging blood group tests available.

The second kind of work they did in the laboratory was genetic research. Owing to the large numbers of diagnostic tests that they carried out, the Research

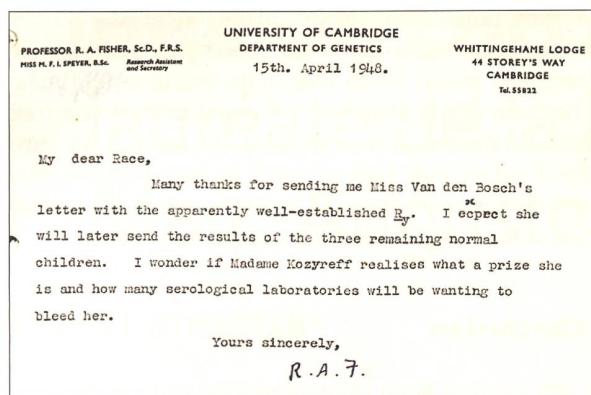


Fig. 4. One of nine fold-out maps in *The Distributions of the Human Blood Groups (1954)*. It was designed to show the percentage of individuals carrying blood-group allele A in different geographical regions of the world, and uses isolines and shading to indicate threshold frequencies across space. Permission to reproduce the image could not be obtained because the copyright holder, Blackwell Scientific Publications Oxford, no longer exists. The image is reproduced under provisions of 'fair dealing' for purposes of research, criticism, and review.

Laboratory would sometimes chance upon a *new* blood group. When this happened researchers would try to find that patient and test their relatives, in the hope of working out the genetics of that new group. So for the Research Laboratory, the diagnostic work they did was inseparable from their research on the genetics. In other words, people with unusual blood groups were simultaneously diagnostic puzzles and precious genetic resources.

The letter in Fig. 4 was sent to Robert Race by fellow geneticist R. A. Fisher in Cambridge reporting that he had found someone with a new blood group: "I wonder if Madame Kozyreff realises what a prize she is and how many serological laboratories will be wanting to bleed her". The archives of the Blood Group Research Laboratory paint a picture of the international pursuit of rare and unusual blood. Unusual blood was precious enough to function as a gift among researchers. One colleague – the head of

the Knickerbocker Blood Bank in New York, ended a letter to Robert Race saying: "You have been so helpful to us in our past appeals for assistance that we are once again sending this token of our great esteem – a freshly drawn specimen from the patient with this curious serum".¹¹

Mapping the world

For research on genetics, precious rare and unusual blood also came from people not in Britain but other parts of the world.¹² After the Second World War, there had been significant changes to the international organization of health infrastructures, including the transfusion services. The new World Health Organization (WHO) in Geneva sought to bring national and international institutions for blood transfusion and haematology under its own banner, attempting to standardise both bureaucratic technologies (such as the colour-coding of donor cards) and laboratory technologies (such as the antisera used to do blood-grouping tests). The WHO cast around for a central laboratory that could take care of the international standardisation of antisera, and chose the Blood Group Reference Laboratory, directed by haematologist Arthur Mourant and situated right next door to the Blood Group Research Laboratory at the Lister Institute in London.

By collaborating with the WHO, Mourant's lab was connected to a large international community of blood-grouping laboratories. Mourant saw in this arrangement a golden opportunity for research, and decided that alongside his practical work he would collect large quantities of data on the distributions of blood groups around the world, with the aim of mapping the genetic diversity of the world's peoples. So while he provided reagents and technical advice to transfusion specialists, doctors and missionaries on behalf of the WHO, he asked in return for blood specimens and data. By 1950, in a report to the MRC, Mourant was able to describe proudly how his congenial international working relationships had put him in a "unique position" for collecting "specimens of blood for anthropological work".¹³

Mourant was so successful at acquiring blood samples and records that he soon established a new centre for collating, organising and analysing results on the premises of London's Royal Anthropological Institute, where he oversaw a clerk, librarian and statistician responsible for turning blood-group results into genetic data. In the early 1950s, the work of the Nuffield Blood Group Centre was particularly focused on the collection of blood from what he called 'parental' or 'aboriginal' populations of the world – who were supposedly people who had stayed in one

¹¹ Cahan, A. "To Race," March 25, 1954. SA/BGU/E.3.1. Wellcome Library.

¹² Some material in this section has previously been published in: Bangham, J., 'Blood groups and human groups: Collecting and calibrating genetic data after World War Two.' *Studies in the History and Philosophy of the Biological and Biomedical Sciences*, 47, 74–86 (2014).

¹³ Mourant, A.E., "International Blood Group Reference Laboratory: Proposal," November 10, 1950, WHO/BS/111, World Health Organization; Mourant, A.E., "Progress Report 1949–50 of the Blood Group Reference Laboratory," 1950, PP/AEM/C.1, Mourant papers.

geographical area for a long time and so offered access to the deep migrationary history of humans. For Mourant, such 'exceptional' populations apparently offered a glimpse of the deep structure of world diversity (Figure 4). But this work also connected back to the research by his colleagues Robert Race and Ruth Sanger on inheritance: apparently exceptional populations were expected to yield rare blood that could produce new knowledge about underlying genetics. Research on diversity was inseparable from research on inheritance, and both relied on national and international blood transfusion networks.

'Exceptionally valuable donor'

Emergency Call was a cinematic response to a real-life "search for rare blood" reported in British newspapers in 1950s, when a seriously ill woman needed a hospital operation but had a blood type that could only be matched by "one person in 20 000".¹⁴ Over the following week the newspapers described the rush of activity at blood transfusion centres around the county, and the eventual discovery of a suitable donor from Bristol. It was a satisfying newspaper drama, and over the next five years stimulated at least three BBC radio plays about the search for rare blood.¹⁵ But those in charge of Britain's transfusion service regarded the episode as a "scandal" and an "embarrassment" for the institution.¹⁶ Transfusion centres and depots had been overwhelmed with volunteers, most of whom did not know their blood groups, and many of whom had never before donated blood.

To avoid similar embarrassment in the future, the authorities in the service decided to establish a new register called the 'Rare Blood Panel'. This was a list of 2000 people from around the country with the most unusual blood types. Letters from transfusion service officials to members of this list illustrate just how highly the transfusion officers prized these donors. They refer to the donors' "very valuable service" and the "highly elaborate tests" carried out on the blood. It explains that to collect their blood "every effort would be made to meet [their] special circumstances", including extracting blood in donors' own homes.¹⁷ The transfusion officers decided that the list

of rare donors should be overseen at the Lister Institute, and that it was so important that a senior serologist would be on call on its behalf at all times. The Rare Blood Panel was a new bureaucratic tool that disciplined and formalised the search for rare blood types that had seemed so uncontrolled two years earlier, and that had been so suggestive for the plot of the film *Emergency Call*.

Conclusion

It was hard to keep track of people and their unruly lives. Near the end of *Emergency Call*, the doctor and the local police chief are travelling in a car discussing the methods used to find the women they had been looking for:

"Oh, we have our methods. Routine stuff mostly. Lodging house records, police and hospital records, food office, employment exchange, postal authorities, borough council files.... Bureaucracy has its uses."¹⁸

Methods for monitoring people had intensified, but were still incomplete enough to make a good drama. Tensions around bureaucracy were not new, and there is a much longer history to be told about state practices, the production of identity and its creative consequences and subversion. The British wartime and postwar period offer a specific example of how a paper-based system of marking bodies productively aligned therapeutic and research practices.

The 'search for rare blood' – at the cinema, in the Lister Institute labs, at blood depots – brought together the technologies of the transfusion services and the practices of research on human inheritance and diversity. It also illustrates the way that mid-century genetic research was made possible by the management of blood. Bureaucracy created uniqueness. Without the vast numbers of people recruited to a nationwide register, 'rare blood' could not be defined, let alone pursued and studied. The flourishing of mid-century bureaucratic technologies for managing people made rarity valuable for medicine and research – and compelling for newspapers and film.

Acknowledgements

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The lecture and essay are dedicated to Prof. J. Andrew Bangham

¹⁴ E.g. "Search for Rare Blood," *Times*, August 29, 1950, sec. News in Brief.

¹⁵ As revealed in a brief search of the new BBC online archive at: genome.ch.bbc.co.uk

¹⁶ "Meetings of Regional Transfusion Directors: Minutes," December 7, 1955, BN 13/31, National Archives.

¹⁷ "National Panel of Donors: Draft Letter to Donors Resigning for Reasons Other Than Age or Ill Health," 1952, BN 13/31, National Archives.

¹⁸ Gilbert, L. *Emergency Call* (Nettlefold Films, 1952). My transcription.