

The Use of Barr Bodies to Determine Sex in Samples of Forensic Significance

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1. Background

Is the identification of Barr Bodies in human blood a reliable screening method for sex determination?

- Barr bodies are inactivated, condensed X chromosome that are found in female somatic cells. Females have only one Barr body per somatic cell while males have none due to only having one X chromosome.
- Barr bodies can be found on the edge of the nucleus of a cell. *See Figure 1.*
- This chromosome can be found in hair root sheath cells, saliva, buccal cells, pulp tissue, vaginal smears, and blood [1].
- Blood smears can be cured, stained, and viewed under 400X magnification on a compound microscope to detect the presence or absence of Barr bodies.
- Biological evidence, particularly blood, found at crime scenes could be examined for the presence of Barr bodies as a quick, low-cost screening method to determine sex. It may help narrow down suspects to a crime or as verification of an evidence source by sex.
- A blood sample with no Barr bodies found indicates the sample originated from a male. A blood sample with Barr bodies found indicates the sample originated from a female.

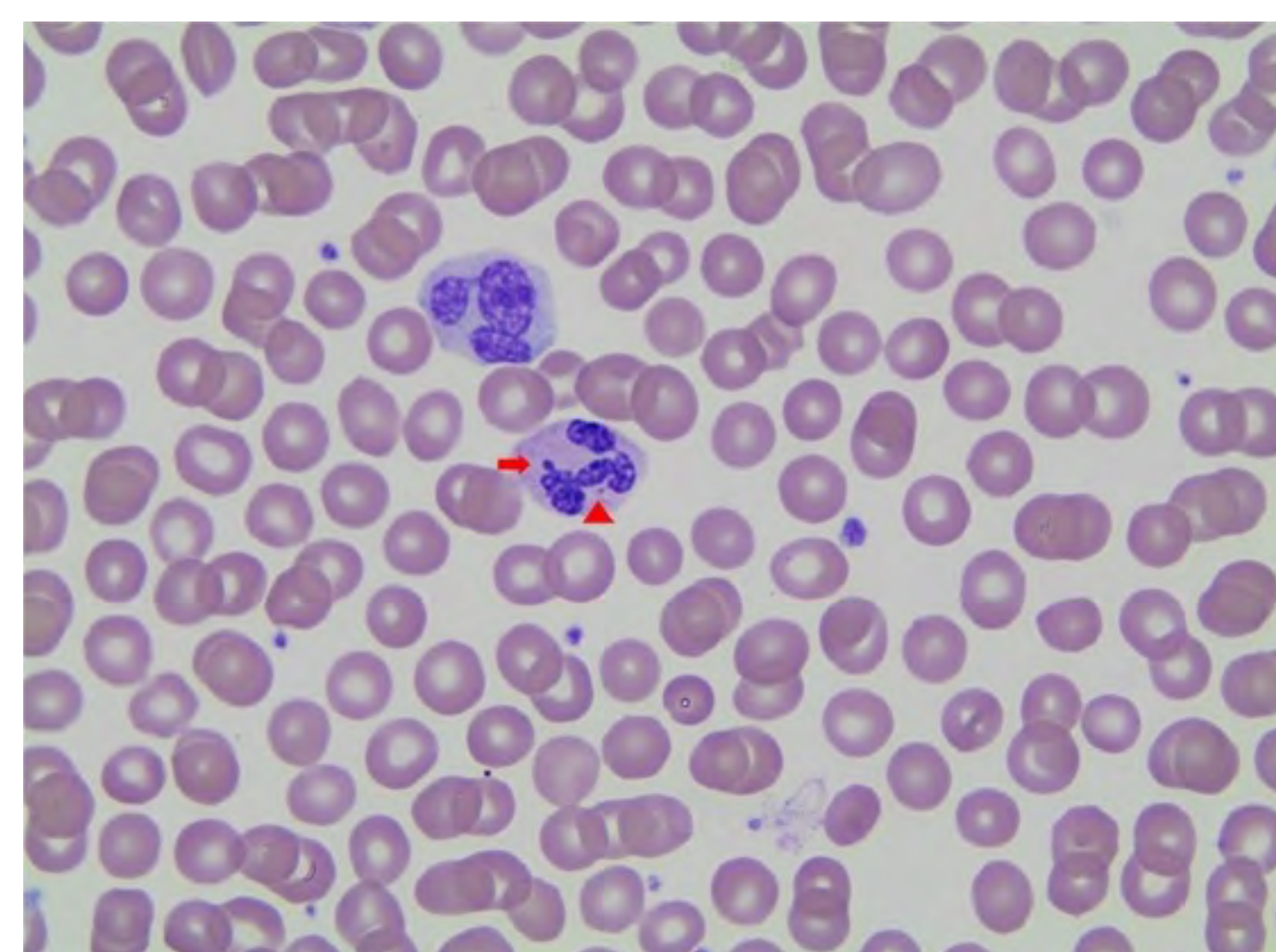


Figure 1: The arrows indicate the Barr body found in a neutrophil using Wright Giemsa stain.

2. Materials and Methods

Materials

FORA Sterile Safety Lancet 30 Gauge	Heathrow Science Microscope Slide Box
COVDIEN Alcohol Prep Wipes & Band-AIDs	WMR Nitrile 200 Examination Gloves
VWR Plain and Frosted Micro Slides VWR VistaVision Cover Glasses, No. 2	Blood samples from male & female volunteers, approx. 100 total
Methanol (NF), Fisher Chemical Permout Mounting Medium	Giemsa's stain stock solution 8.0 g/L in glycerol/methanol (1:1)
Coplin Staining Jar, Globe Scientific Inc	Immersion Oil, MilliporeSigma Compound Microscope

Methods

Part One

- IRB approval was obtained for part 1 of the study; IRB approval will be obtained for part 2 of the study. (Study ID: Pro2020001547)
- 50 female and 50 male volunteers will be recruited to participate in the study.
- Each volunteer's designated finger will be prepped with an alcohol wipe.
- A safety lancet will be placed on the designated finger and the safety lancet will be pressed to prick the volunteer.
- The blood produced by the safety lancet will be dropped onto a microscope slide where a blood smear will then be created by the PI. *See Figure 2.*
- Each sample will be labeled with a unique identifying number and the sex of the volunteer it originated from.
- The sample will be fixed with methanol and let to air dry before placing a coverslip.
- The sample will be stained using a Giemsa stain. *See Figure 3.*
- Once the stain has dried completely, immersion oil will be placed on the coverslip.
- The blood smear will be viewed under the microscope under blind conditions, and the absence or presence of Barr Bodies will be determined for each sample.

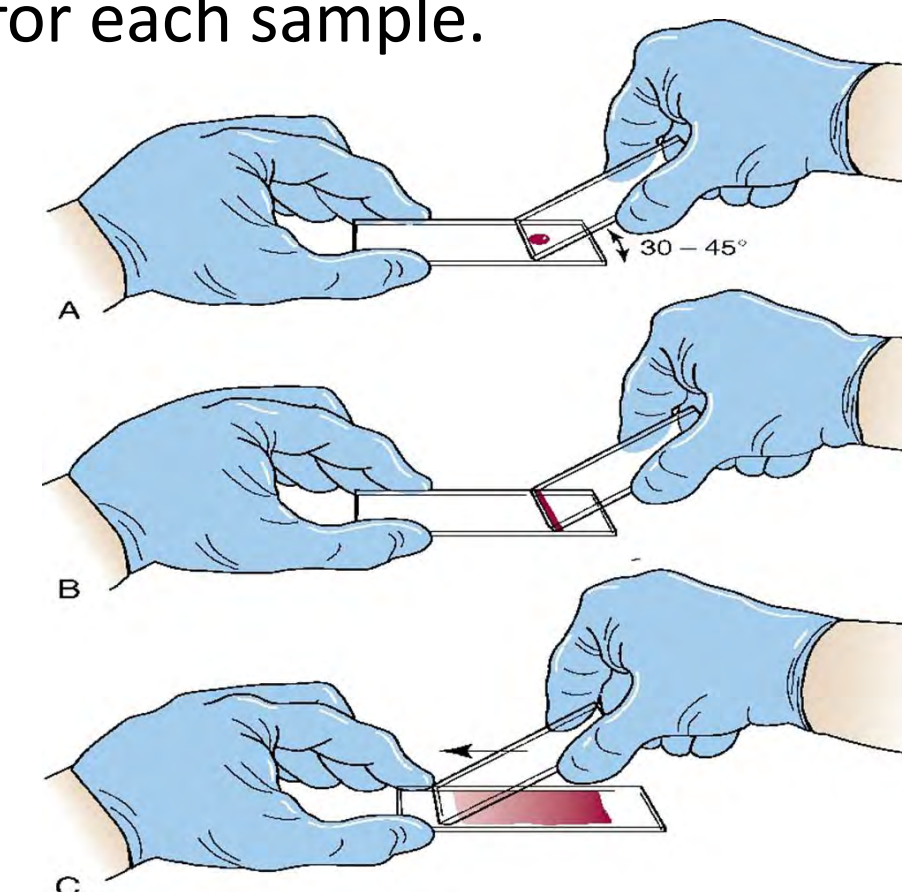


Figure 2: A depiction of how a blood smear is created. A drop of blood is placed on a clean microscope slide. Another slide is held at a 30-45° angle at the blood drop; this slide is pulled against the blood drop and swiftly pushed forward to create an even smear.

3. Methods Continued



Figure 3: A good smear sample before Giemsa staining (left) and after Giesma staining (right). Blood smears should be smooth and thin and have a feather-like tail for the best results.

Methods Con't

- The blood smear will be viewed again under unblinded conditions, and the absence or presence of Barr Bodies will be determined for each sample.
- The error rate of both trials will be compared to measure the reliability of correctly identifying the presence of Barr Bodies.

Part Two

- Ten medical examiners will be recruited to view the samples under blind conditions.
- True and false positive and negative rates will be recorded based on the results obtained from the samples.

4. Anticipated Results

The sex of each sample will be able to be determined by both the PI and the medical examiners. For unblinded trials, Barr Bodies will be found, and the sex will be correctly identified about 95+% of the time. For blinded trials, the sex will be correctly identified at least 70% of time. The medical examiners that will be viewing the samples under blind conditions will correctly identify the sex of the samples at a higher rate than the PI since they are more experienced and have a formal education in this field.

References

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Figure List

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3. *Figure 3.* "Blood Film." Infogalactic. Coinmac, July 6, 2012. https://infogalactic.com/info/Blood_film.

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