

JOURNEY OF A NEUTROPHIL



KENNESAW STATE UNIVERSITY

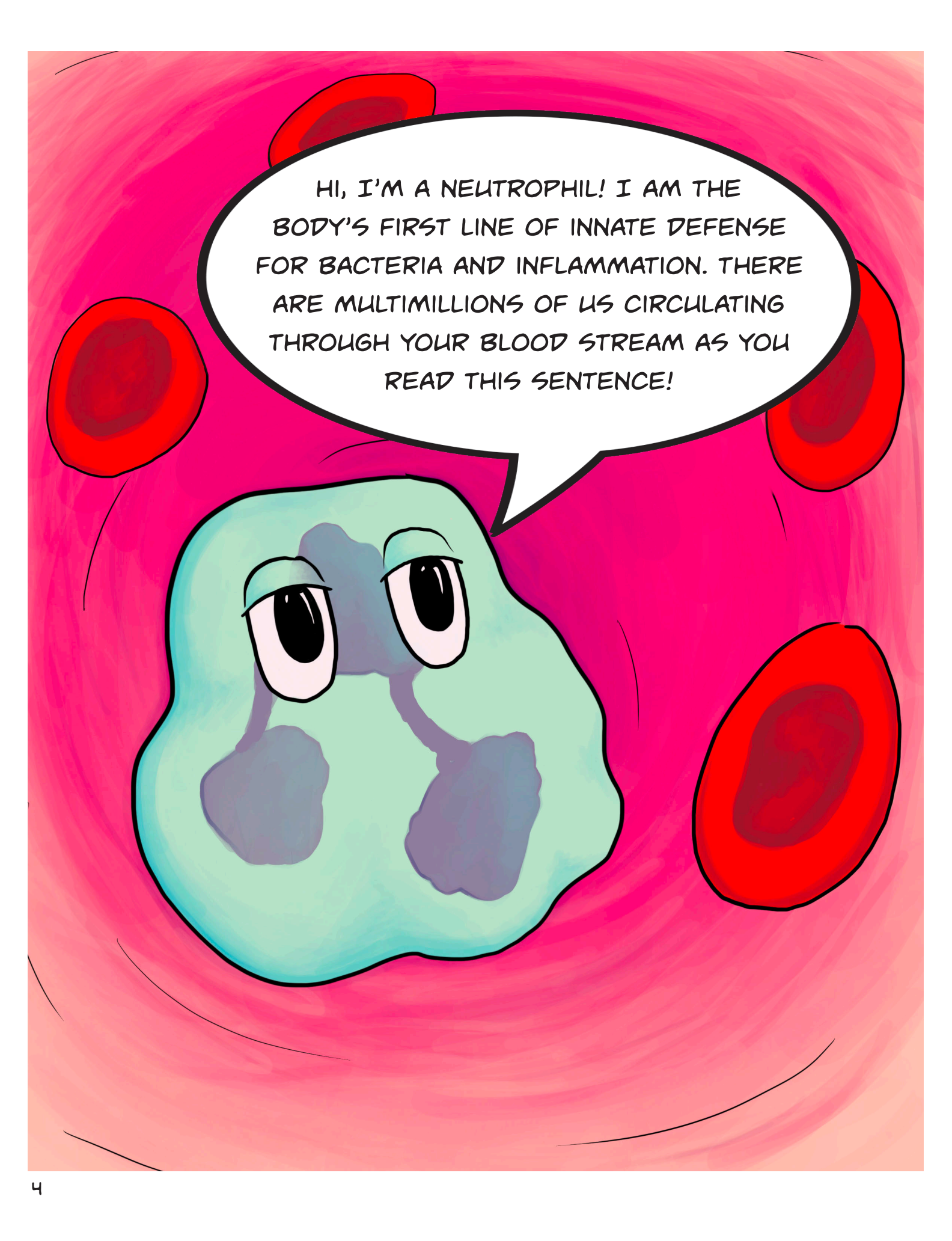
JOURNEY OF A NEUTROPHIL:
A COLLECTIVE PROJECT BY STUDENTS AND FACULTY AT
KENNESAW STATE UNIVERSITY

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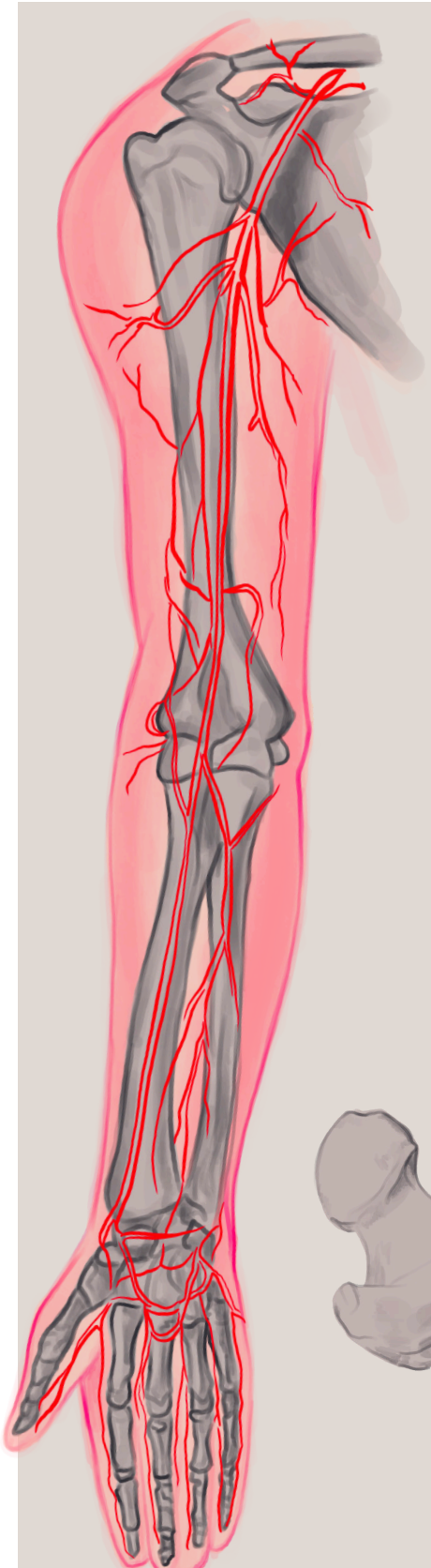
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HI, I'M A NEUTROPHIL! I AM THE
BODY'S FIRST LINE OF INNATE DEFENSE
FOR BACTERIA AND INFLAMMATION. THERE
ARE MULTIMILLIONS OF US CIRCLATING
THROUGH YOUR BLOOD STREAM AS YOU
READ THIS SENTENCE!



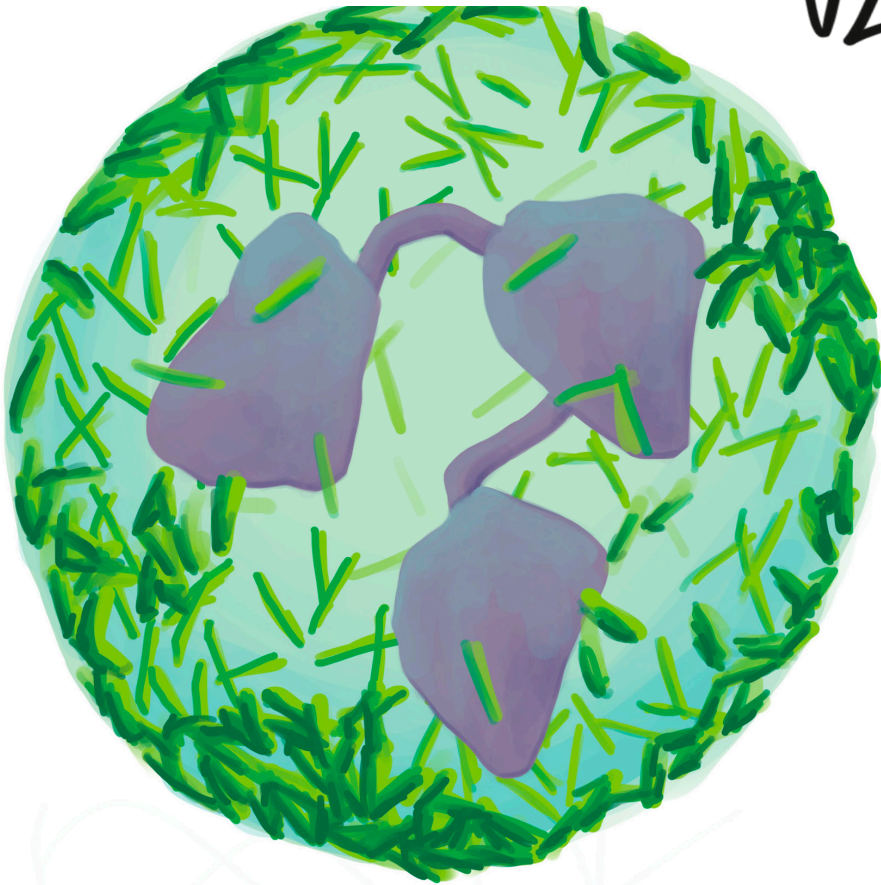
NEUTROPHILS ARE BORN IN BONE MARROW, THE SPONGY TISSUE FOUND IN LARGER BONES. MATURE NEUTROPHILS ARE REGULARLY RELEASED INTO CIRCULATION AND TRAVEL THROUGH THE VASCULAR SYSTEM. ONCE INSIDE BLOOD VESSELS, NEUTROPHILS HAVE A LIFE SPAN OF ROUGHLY ONE DAY.



FEMORAL BONE

• BONE MARROW

BONES AND



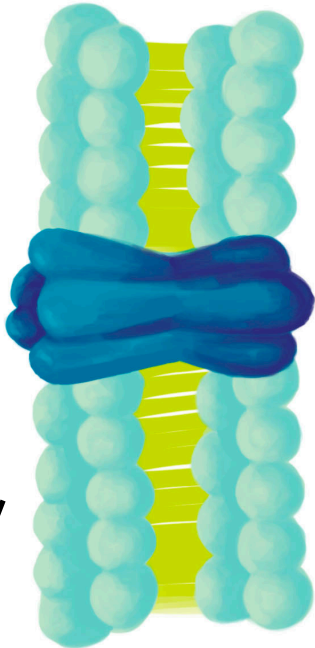
ACTIN
FILAMENT



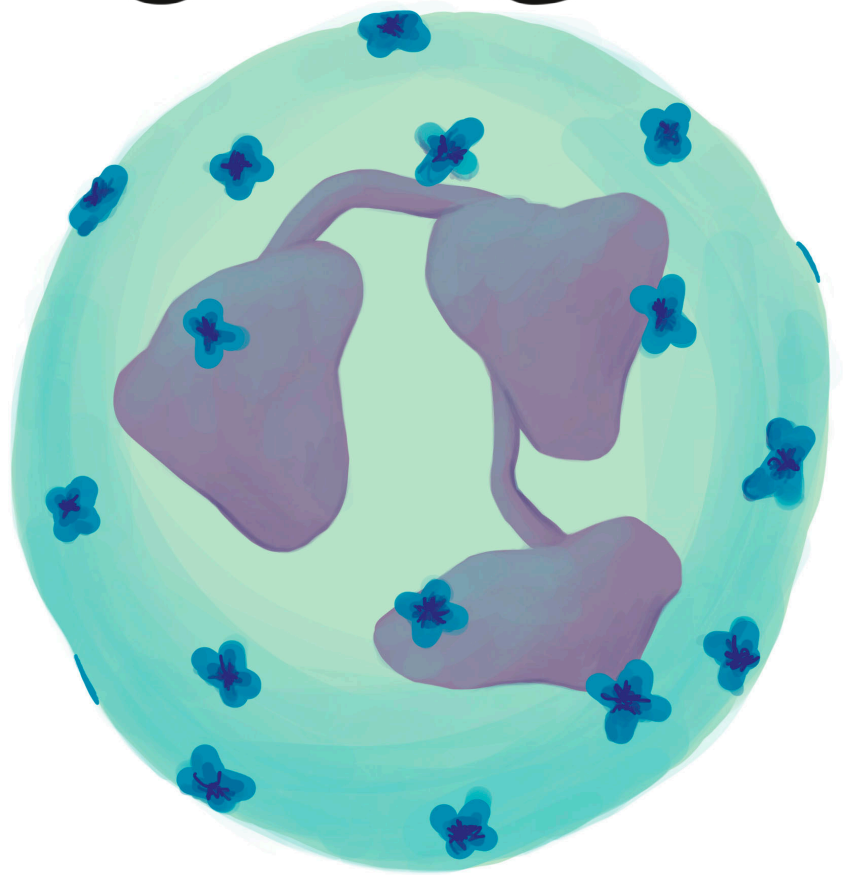
MY "BONES" AND "BLOOD" GIVE ME STRUCTURE AND HELP ME MIGRATE TO MY DESTINATION. MY BONES ARE CALLED THE CYTOSKELETON AND MY BLOOD IS CALLED CYTOSOL.

MY **BONES** ARE MADE OF MANY ROD-LIKE FILAMENTS THAT CAN ACTIVELY BE CONSTRUCTED OR DECONSTRUCTED. THESE FILAMENTS ARE MADE-UP OF ACTIN BUILDING BLOCKS, AND THUS ARE CALLED **ACTIN FILAMENTS**. THESE ACTIN FILAMENTS TOGETHER FORM THE MAIN PART OF MY "SKELETON" CALLED THE CYTOSKELETON. MY CYTOSKELETON, AND ALL ITS COMPONENTS, GIVE ME SHAPE AND ALLOW ME TO MOVE MY "BODY".

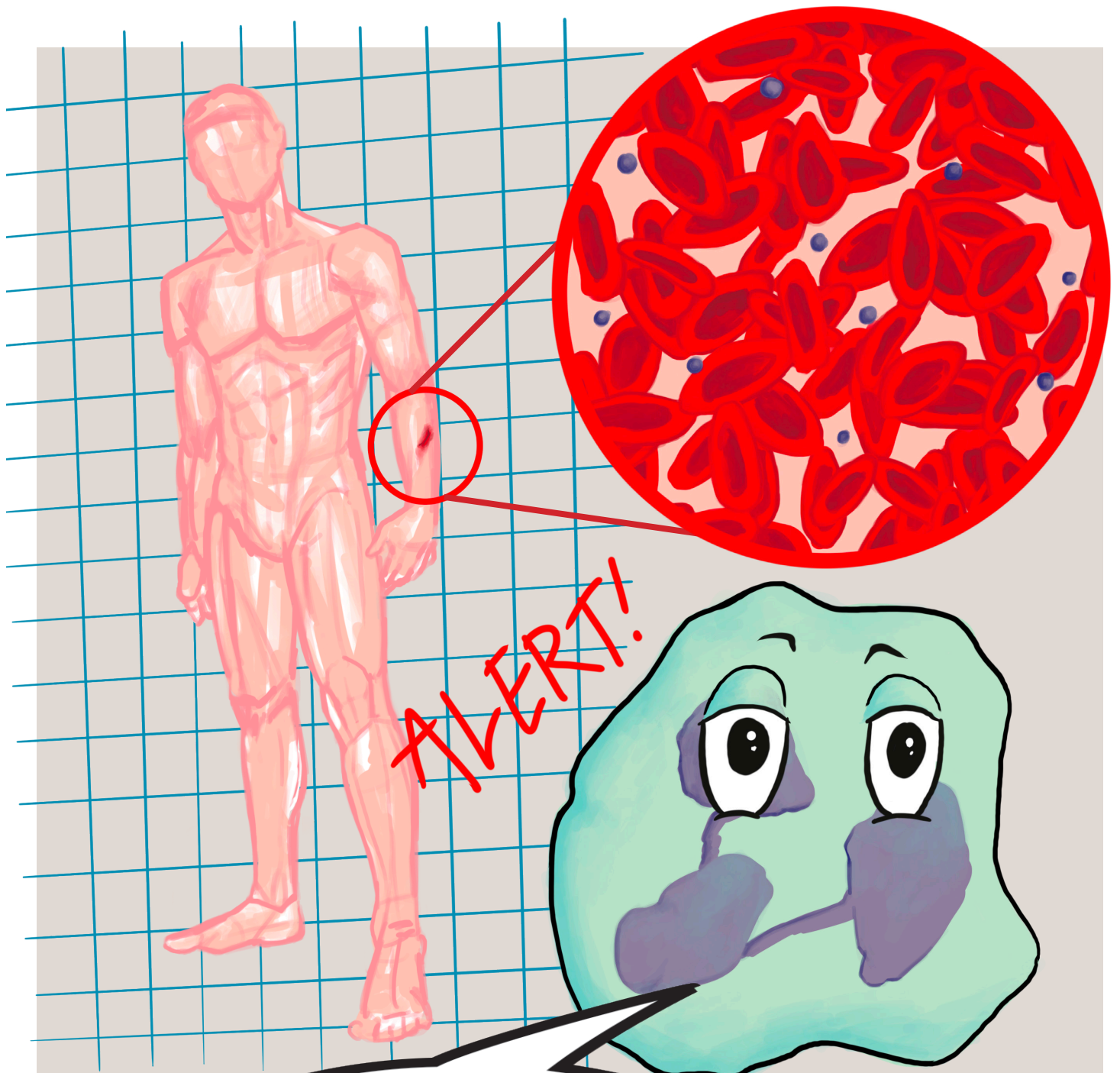
BLOOD



·SIDE VIEW OF ION CHANNEL



MY **BLOOD** IS CALLED **CYTOSOL**, AND ENCAPSULATING MY CYTOSOL AND CYTOSKELETON, IS MY PLASMA MEMBRANE. MY CYTOSOL IS MOSTLY WATER AND CONTAINS MANY TYPES OF NUTRIENTS AND PROTEINS WHICH I NEED TO FUNCTION. MY PLASMA MEMBRANE IS POROUS AND PASSIVELY ALLOWS WATER TO MOVE THROUGH. SOMETIMES I NEED MORE OR LESS OF A NUTRIENT IN MY BODY. TO STAY HEALTHY AND MAINTAIN FUNCTIONS, I USE **ACTIVE PUMPS AND PASSIVE CHANNELS** EMBEDDED IN MY MEMBRANE TO GET THE NUTRIENTS THAT I NEED. THIS WAY I CAN OBTAIN NUTRIENTS PASSIVELY BY DIFFUSION OR ACTIVELY IN EXCHANGE FOR ENERGY.



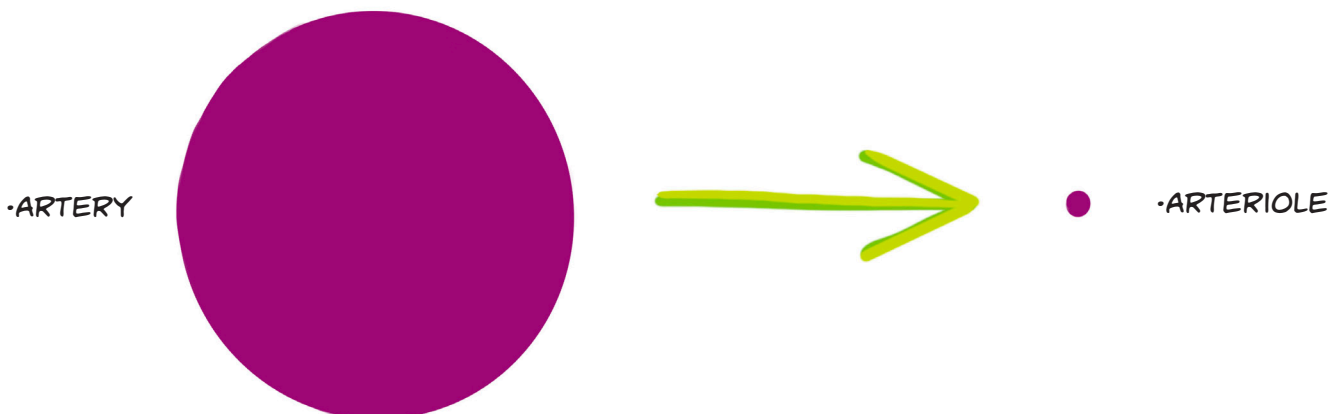
ALERT!

I SENSE A CHEMICAL SIGNAL
RELEASED BY MY ALLIES. THIS CHEMICAL
TELLS ME THAT THERE IS A BACTERIUM IN THE
BODY. IT IS MY DUTY TO FOLLOW THE TRAIL TO
THIS BREADCRUMB AND NEUTRALIZE THE
BACTERIUM.

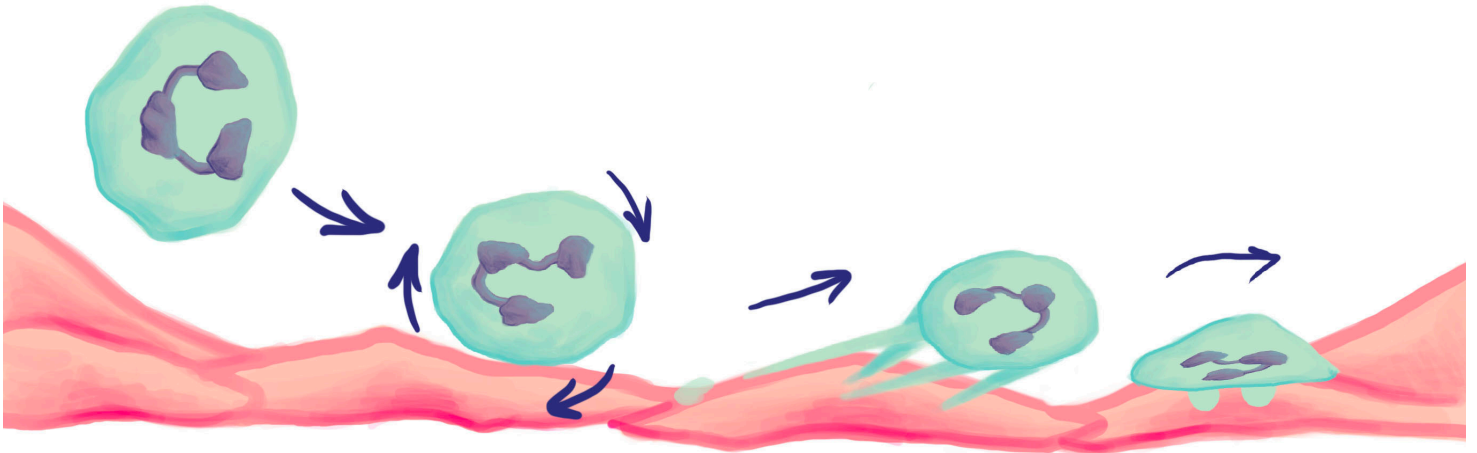
I AM CURRENTLY IN A LARGE ARTERY, AND A SMALLER ARTERIOLE IS COMING UP JUST AHEAD. IF I FOLLOW THIS CHEMICAL SIGNAL, I'LL BE LED TO THE BACTERIA THAT I NEED TO NEUTRALIZE.



THE OPENING OF THIS ARTERIOLE IS ABOUT 100 TIMES SMALLER THAN THE ARTERY. AND AFTER THE ARTERIES ARE THE EVEN SMALLER CAPILLARIES, SO I BETTER GET READY TO CRAWL.

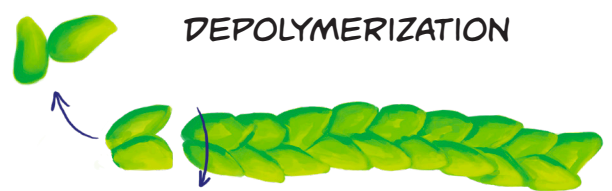
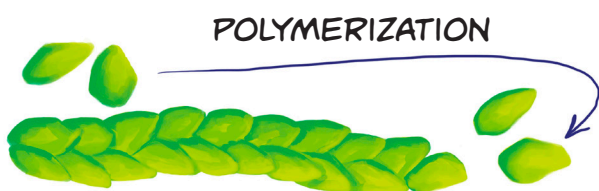
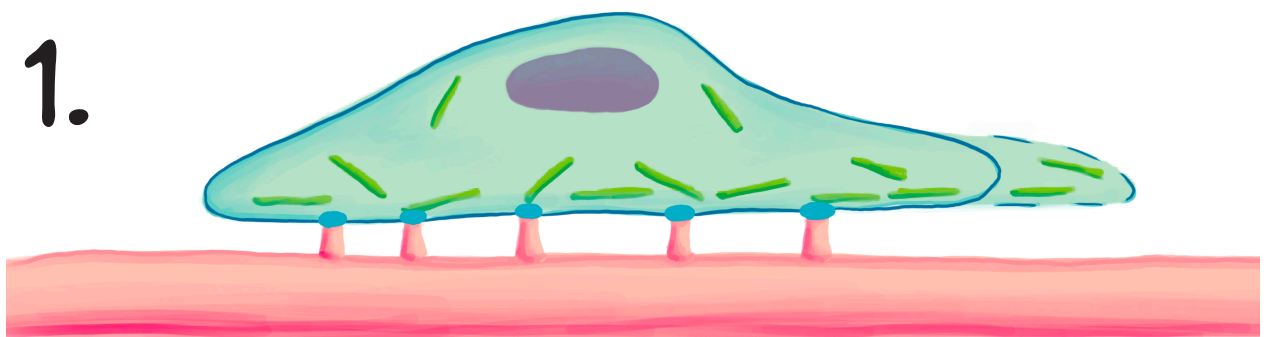


HERE, YOU CAN SEE HOW I LAND ON THE ARTERIOLE SURFACE AND ADHERE MYSELF. AS A CELL, I CAN USE MY CYTOSKELETON AND ITS COMPONENTS TO HELP ME CRAWL ON A SURFACE.



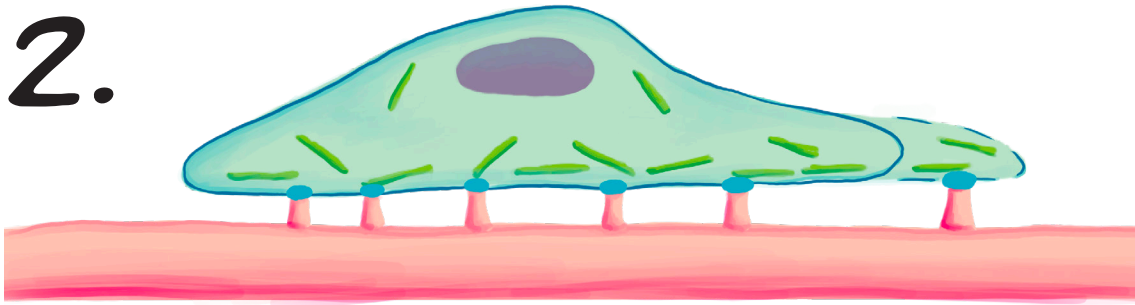
FIRST, TO EXTEND THE LEADING EDGE OF MY MEMBRANE. ACTIN FILAMENTS NEAR THE FRONT OF MY MEMBRANE POLYMERIZE AND INCREASE IN LENGTH. THIS GROWTH OF ACTIN FILAMENTS PUSH MY MEMBRANE OUTWARDS AND CREATE A PROTRUSION.

1.



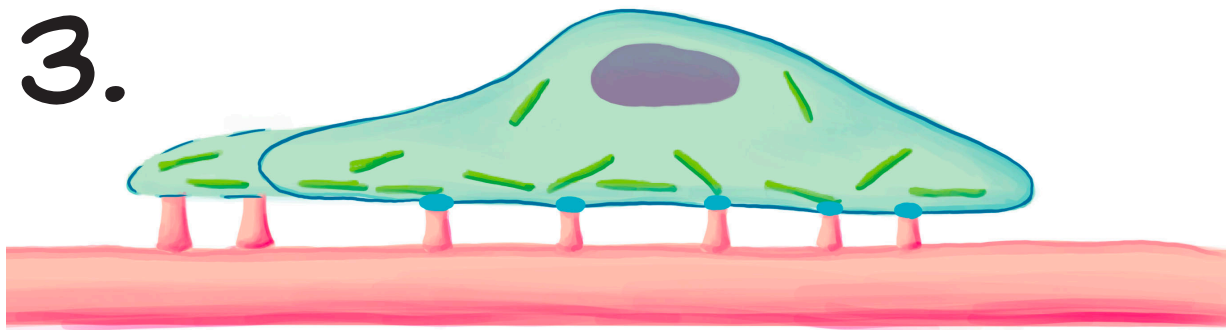
THEN, I ADHERE THIS NEW PROTRUSION TO THE GROUND SURFACE USING PROTEIN COMPLEXES CALLED FOCAL ADHESIONS. IN THIS WAY, FOCAL ADHESIONS ACT AS ANCHORS THAT ALLOW ME TO ATTACH MY CYTOSKELETON TO THE SURFACE I AM TRAVERSING.

2.

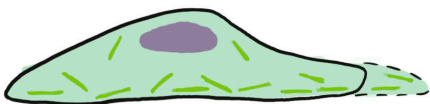


FINALLY, NEARLY SIMULTANEOUSLY, I CONTRACT MY REAR WHILE RELEASING NEARBY FOCAL ADHESIONS THAT ATTACH MY REAR CYTOSKELETON TO THE SURFACE.

3.



1.



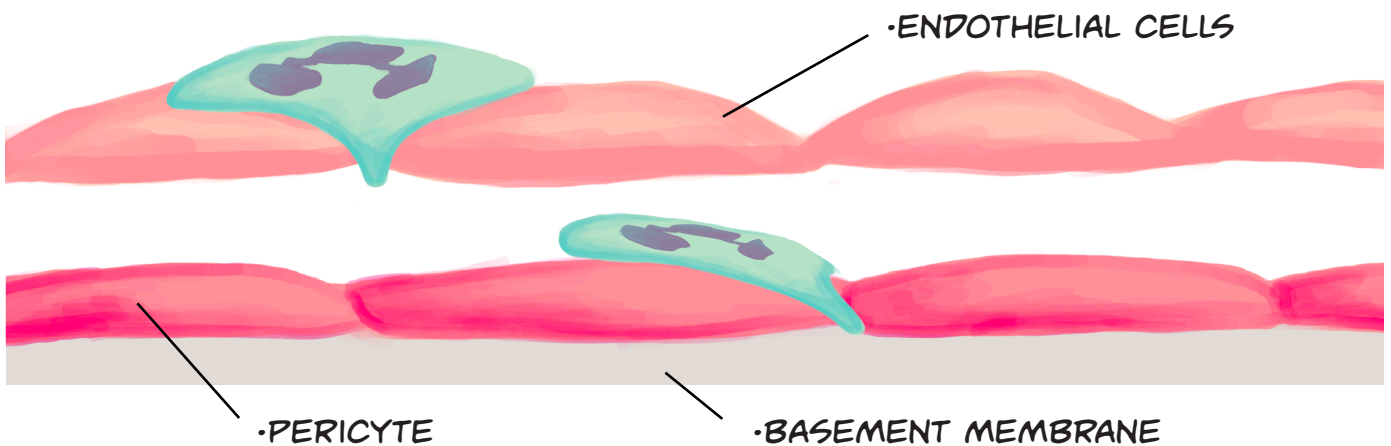
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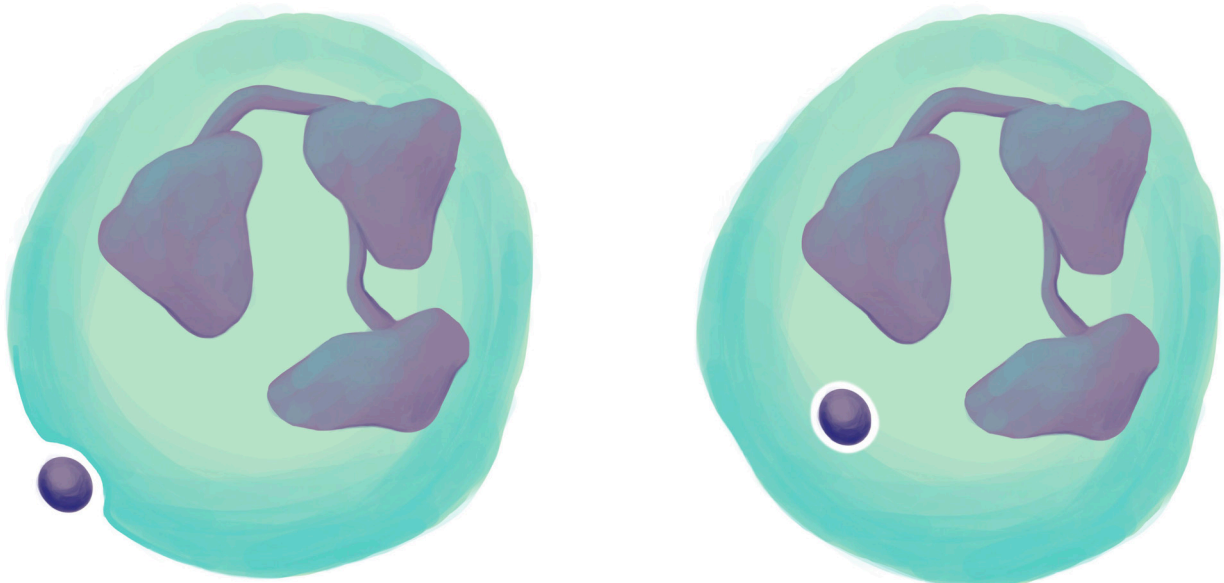
3.



TO GET TO THE BACTERIA, I NEED TO SQUEEZE THROUGH SEVERAL LAYERS OF CELLS; THE ENDOTHELIAL CELL LAYER, PERICYTE LAYER, AND BASEMENT MEMBRANE OF THE BLOOD VESSEL. *EXCUSE ME, ENDOTHELIAL CELLS!*



TRAVERSING THROUGH THESE LAYERS PUTS ME IN A CONFINED ENVIRONMENT, TO MOVE EFFICIENTLY I USE MY ACTIN-DRIVEN PROCESSES IN CONJUNCTION WITH MY PORES TO ALLOW FLUID TO PASS THROUGH ME. THIS REDUCES THE AMOUNT OF 'PUSHING' MY CYTOSKELETON MUST DO. FINALLY I HAVE ARRIVED AND CAN COMPLETE MY JOB AND WIPE OUT THESE BACTERIA!



TO BE CONTINUED...

