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Coagulation Chaos

By Sophie Menzies

It's Garry's first day as head of Essie's haemostasis team, where he's stationed in the clotting command centre alongside Phil and Flo. Phil is Garry's seasoned mentor who keeps him on track when coordinating the coagulation cascade — sometimes with guidance, often with sarcasm — while Flo, chief of surveillance, keeps Garry up to date as the cascade rolls out.

Garry is already being put to the test when Essie takes a tumble and cuts her knee. Now, he's frantically trying to manage the team to successfully conduct the coagulation cascade. However, this involves tight regulation of everyone involved, from vitamin K and platelets to all twelve — give or take — clotting factors.

Will Garry be able to contain his inner frenzy and produce a successful clot? We join him to experience his management firsthand, as well as the rollercoaster of emotions he faces as the chaos of coagulation unfolds.

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It's happening. Stay calm. I can't believe this is really happening and on my first day! I'm screwed! No, there's no time for this flapping about in a panic, pull yourself together. First, we have to — dammit, I can't think! What comes first again?!

"Earth to Garry," says my mentor, Phil, his voice dripping with sarcasm, "Essie's bleeding out here."

"Right! Sorry! Alright, let me think, first step is to… constrict the blood vessel! We need to squeeze the blood vessel walls to slow down the bleeding. Activate vasoconstriction!"

"Vasoconstriction confirmed," Flo reports. "Blood flow is reduced'.

"Can we now confirm collagen fibres are exposed at the site?"

"Confirmed," nods Flo.

Good, that means the platelets have something to stick to — we're getting there…

"Alright, Platelets, you're up." The platelets team is keen to get going. "Get down to that vessel and stick to those collagen fibres!" And off they go.

Those platelets really were chomping at the bit.

"You might as well just send Von Willebrand down too," Phil says, "The platelets get cranky if they're left waiting around."

"Oh yes, good idea," I nod, "Von Willebrand! Quickly! Go with the platelets please. Don't keep them waiting!"

"Can't forget about Von Willebrand now, can we Garry?" Phil chuckles, "Who else would bring the collagen fibres and platelets together to form that all important plug?"

He is right, that Von Willebrand factor is quite significant!

"Platelets confirmed on site, Garry," Flo interrupts, "They've made contact with the collagen fibres."

"And Von Willebrand?'

"Not quite yet."

"But we have to meet the 30-to-60-seconds-after-injury target! Where are they?"

"Garry, it's barely been one second," Phil quips, "Just be glad Essie has Von Willebrand Factor… you know it'd be a nightmare without it. Also, I think the name for that target needs a rethink."

I can't even imagine it. No Von Willebrand?! The thought makes me shudder…without that, even minor bleeds would take ages to stop. However, I do agree — the target name needs updated.

"Von Willebrand present on site, Garry," Flo interrupts, not a moment too soon, "Platelet plug confirmed to be forming at the location of vessel damage".

"Finally! That's fantastic," I say, relieved, "We're officially over the first hurdle, folks."

Now it's time for the big task. This is going to be pure chaos; how will I manage this?! No… focus… we just have to get the fibrin fibres there so we can mesh them and form the clot. Easy… totally fine… definitely not complex at all.

"Garry, wakey wakey," Phil teases. "Are we stemming this bleed or having a crisis?" he jabs.

"Sorry! Alright! Flo, we're going to need all hands on deck — Essie's fall has damaged both the vessel and nearby tissue, so we need the intrinsic and extrinsic pathways ready to go."

"I've put an alert out," Flo replies, "All clotting factors are on standby and ready when you are, Garry."

"Great, thank you. So, we'll start with getting the extrinsic team moving. That means we need our Extrinsic Pathway Initiator — Factor 7 — to the vessel please! Oh, and Thromboplastin will meet you there for activation."

"On my way!" Factor 7 calls back.

"Now for the Intrinsic Initiator. Factor 12! Time to head down to the vessel! Let us know when you make contact to confirm your active form, please!"

"Will do, boss," Factor 12 replies as he vanishes to the coagulation site.

Both pathways have now been triggered; this is a good start. I just hope all the clotting factors are as eager as our pathway initiators…

"Factor 7 has met thromboplastin at the site, Garry," Flo reports, 'We can confirm his activation to Factor 7A".

What a relief!

"And, just in, Factor 12 has reached the site and made contact with the damaged vessel, he is confirmed to be in his active form, Factor 12A."

"We're on a roll, Garry," Phil remarks with a hint of pride.

"Don't jinx me, Phil!" I warn, "There's still much to do."

There really is a lot that can still go wrong… Before I forget, let's get the liver on the line.

"Vitamin K, are those clotting factors rolling off the production line?"

"Yes, sir! Quality control is up and running!"

"Great! We now need our intermediate factors of the intrinsic team to head down; Factor 11, you're up! Factor 9, you better get ready to go, too!"

"I'll be ready to go, Garry," Factor 9 informs. "We just need slow coach here to hurry up and get down there," she teases Factor 11 as he heads to the site.

"We should have an intermediate factor race one day," Phil ponders to himself.

"Not on my first day though, Phil," to which Phil chuckles.

"Factor 11 confirmed at the site," Flo updates, "He has made contact with Factor 12A which has activated him to his Factor 11A form."

"Oh, he was speedy today," Factor 9 giggles, "Ready for me to go, Garry?"

"Yes!" I say, "Get down there quickly and then we'll send the others for the converging of teams."

"Sir, yes, sir," she calls as she exits.

"Well, would you look at that, things are going well," Phil drawls.

"He's right," Flo chimes in before I could tell him not to jinx me again.

"Factor 8!" I call, "Time to go!" And she appears, ready to go. "Calcium, that means you're up too!"

"I know, I know," he says, trudging along behind Factor 8, "The body doesn't half work me overtime, you know."

"Stop moaning!" Phil calls out, "We get it, you're involved in everything, you're very important, and that includes now! Come on! Off you go, time to get some complexes forming."

"I hope Garry's replaced you because you're retiring, Phil!" Vitamin K chimes in mischievously, still on the line.

Flo and Phil laugh.

"They know they'd miss me" Phil chuckles.

"You're not retiring any time soon, ok!" I warn him somewhat desperately.

Have I missed anything? Factors 12, 11 and 9 from the intrinsic team are at the site and activated, and Factor 7 on the extrinsic team is activated too. Factor 8 is heading to the site now with calcium, which means the clot is on track.

"Factor 8 is on site," Flo reports, "Calcium's there too — it's locking 7A to thromboplastin to form the extrinsic tenase complex, and after he'll link up with 8A and 9A to form intrinsic tenase."

"Amazing! Amazing!" I squawk, unable to disguise my relief, "We're getting there, folks, we're forming a clot!" I'm almost singing the words.

"Don't jinx it!" Phil teases, smugly.

"Oh, shush." Flo directs her words at Phil, then says, "You're right, Garry. You're doing well, we're about halfway to success now."

"Yes, and still half to go," I redirect, "Including the big convergence of the intrinsic and extrinsic pathways."

"Before that," Phil interrupts, "Remind me again why exactly we need Vitamin K on the line."

"Seriously? You think now is a good time for a quick quiz?"

"Of course,' Phil replies, "Easy question, no?"

I groan. "Vitamin K modifies some of the clotting factors so they can bind with calcium; that way, they anchor to the platelets, where the clotting teams assemble."

Phil grins. "Top marks, Garry. Excellent answer."

"Anyways…Flo, what's the latest?" I ask.

"Both complexes of the intrinsic and extrinsic pathways have formed — we're set to proceed, Garry."

"Phew, ok." I take a breath. "Time for convergence."

Please go smoothly.

"Better shout the big man in, Garry," Phil says, doused in sarcasm, "Time to let the top dog shine."

Both Phil and Flo groan. *It's not often factors get nicknames like this, but when they do, it's rarely a compliment….*

"Factor 10!" I call out…. "Factor 10! You are up — time to go!"

Phil scoffs. “Ill-prepared as always….”

“This cannot be happening. He’s going to screw the whole thing up. Where is he?! This is his one job!”

What am I supposed to do without Factor 10?! This is a nightmare, we’re screwed!

Finally, the door swings open.

“You called, boss?” Factor 10 says, nonchalantly.

“Unbearable,” Phil mutters to himself.

“Yes, I did, Factor 10. I called on you multiple times.”

“Relax, Gazza,” he drawls, “The star of the show is here now, isn’t he?”

If he weren’t so necessary to this process, I would fire him right now.

“Would you please just hurry up and get down there? Everyone is waiting for you to converge the pathways,” I say sternly.

“Ok, ok. Chillax Gazza, all will be fine,” he says as he saunters off to the site.

“Chillax? Is he for real!?” I exclaim to Phil and Flo.

“He needs a serious talking to,” Phil remarks.

Flo nods in agreement. *And who said he could call me Gazza?!*

“Right, moving on. Could we get some more calcium to the vessel site please, along with Factor 5 and Prothrombin?” I call.

“Of course, boss. We can’t keep the top dog waiting for his big job, can we?” they joke, sarcastically.

“I might start calling you Gazza,” Phil perks up.

“Don’t start!” I snip.

“Factor 10 is at the site, Garry,” Flo updates.

“Finally,” I groan.

"Factor 10 is activated. Calcium and Factor 5 are confirmed on site and Prothrombin is just arriving."

"The pathways have become one, Garry," Phil announces, both smugly yet sarcastically, "Closing stages coming up."

Final phase… I've almost done it. I just have to get prothrombin converted to thrombin, which will be done by Factor 10A teaming up with Factor 5A and calcium. Then it's just converting fibrinogen to fibrin and — wow, we really are almost clotted.

"Factor 10A, Factor 5A and calcium have made contact with prothrombin, Garry," Flo updates, "I can confirm prothrombin has been converted to thrombin."

"Excellent!" I squeak, "Fibrinogen! Get down there! Oh, and don't forget to take some calcium with you, you'll need it for the stabilising phase!"

"On our way, Garry!" Fibrinogen replies, hurrying to the site.

"She'll get down there in no time, Garry," Flo adds, "And she'll make sure calcium keeps up with her."

"I remember the days when Prothrombin and Fibrinogen were called Factor 1 and Factor 2," Phil reminisces, "We said the new names would never stick. Now look at them."

"Fibrinogen has arrived at the vessel," says Flo. "Thrombin has now converted her to Fibrin."

"This is it, Garry. The final step!" Phil declares with mock drama thick in his voice.

I cannot believe I've made it to the final step. We're going to form a clot!

"Last but not least — Factor 13, our finale factor, you're up!" I call out, giddily.

"My time to shine, eh?" she teases as she leaves.

"This wait is going to feel like forever," Flo says.

I was just thinking that.

"We could do another quick quiz to kill time, if you wish?" Phil suggests, his tone deadly serious.

"Please, no!" I plead.

"Sure you don't want to discuss our clotting command centre regulators, Protein C and Protein S?"

"Oh, I'm very sure — that's a different department's concern," I say, bluntly.

"Garry," Flo interrupts, "Factor 13 arrived on site. I can confirm fibrin fibres have meshed, and the clot is cross linked."

"We have a clot!" Phil grins.

WE HAVE A CLOT!

"You have successfully clotted off Essie's bleed, Garry," Flo says with pride.

"Essie will live to see another day then," Phil jokes.

"You just always have to ruin it," Flo jabs, and they continue their friendly bickering as Garry absorbs his triumph.

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Full of pride, Garry finishes his shift that evening on a high, unable to help reminiscing about his successful clot. As he's leaving the command centre for the night, he bumps into Factor 13.

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"Oh, hi Garry! That was quite the first day you had," Factor 13 says.

"Tell me about it — definitely not what I had in mind," I chuckle.

"Shame it was all for nothing too," she laughs.

What?

"What do you mean, 'nothing', Factor 13?" I ask, trying to contain my concern.

"Oh…" Factor 13 pauses, "You don't know?"

Don't say what I think you're going to say.

"I'll take that silence as a no…" she says quietly.

Please don't say it.

"Well… um… unfortunately, Garry…"

No.

"Essie… well… She picked the scab."

You have clot to be kidding me!

Scientific Statement

Haemostasis is an essential physiological process for stopping bleeding after blood vessel damage. Platelets, clotting factors, calcium ions, and supporting proteins circulate continuously in the blood, ready to mount a rapid, coordinated response to seal an injury and stabilise the developing clot. The concept of the control team characters is used for creative purposes only, to make the process of blood clot formation engaging and more accessible.

Following blood vessel injury, the first response is contraction of tiny muscles in the vessel wall to reduce blood flow. The vessel damage causes exposure of collagen fibres which circulating platelets bind to, aided by the protein von Willebrand factor.

Alongside this, clotting factors activate each other in a coordinated sequence, eventually producing thrombin, an enzyme which converts fibrinogen into fibrin threads. These threads weave through the platelets which have become bound to the damaged vessel, allowing for formation of a strong, stable clot to seal the injury. Calcium is essential to ensure clotting factors work effectively, and vitamin K is needed earlier in the liver to prepare several of these factors so that they can bind calcium effectively.

Clotting factors are typically described using Roman numerals; however, Arabic numbers were used in this story to improve ease of understanding. While clotting is often taught using the classic intrinsic and extrinsic pathways, we now know these function as an integrated system. The classic understanding has been used here to support the narrative structure.