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The role of platelet activation in antimicrobial host defence

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Background (1)

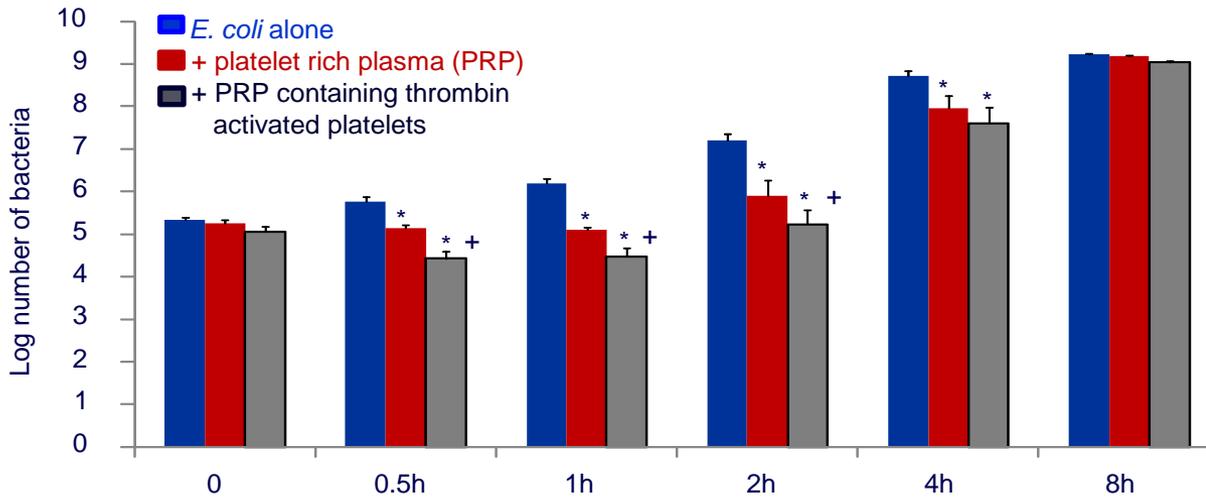
- Platelets are small disc shaped cells lacking a nucleus that circulate in the blood.
 - Activated platelets play a vital role in the horse's defences against injury and disease. However their activity must be tightly regulated so they do not cause problems such as tissue damage, instead of being part of the solution.
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Background (2)

- Bacterial infections are common in horses and studies using platelets from other species have shown they can kill or reduce the rate of growth of bacteria in a number of different ways.
 - This project looked for evidence that horse platelets have antimicrobial properties and that an enzyme family, protein kinase C (PKC), regulates horse platelet function.
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Project Outcomes (1)



*= significant reduction in growth when compared to *E. coli* alone

+ = significantly greater growth inhibition when compared to PRP

This graph shows that horse plasma containing platelets (platelet rich plasma) reduced the growth of *E. coli* bacteria

Addition of thrombin, a substance produced in the body which activates platelets, increased their ability to inhibit bacterial growth

Project Outcomes (2)



- Activated horse platelets may help to clear bacteria by forming superoxide anions – a type of free radical derived from oxygen. Free radicals produced in the body can be toxic to bacteria.
 - We also showed for the first time that activated horse platelets can produce superoxide and that PKC, an enzyme found inside cells, regulates the response.
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Impact on Thoroughbred industries



- Platelets may contribute to antimicrobial host defence in the horse.
 - Establishing which PKC isoenzymes are involved in regulating different platelet functions, and how they do so, could reveal ways of strengthening the contribution of platelets to the defence mechanisms of the horse.
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Scientist's Summary

- Bacterial infections are a constant threat to horses and the importance of white blood cells in fighting infection is well established.
 - However, there is evidence that blood platelets also contribute to the body's antibacterial defences, acting directly or by enhancing white blood cell function.
 - This project looked at some antibacterial properties of horse platelets and whether a particular family of enzymes, protein kinase C (PKC) isoenzymes, regulate platelet function.
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Scientist's Summary

- Horse plasma and horse plasma containing platelets inhibited bacterial growth to a similar extent. When the platelets were activated there was significantly more growth inhibition. Thus platelets appear to contribute to the antibacterial actions of the horse's immune system.
 - Horse platelets were shown to be capable of producing superoxide, a type of free radical derived from oxygen which is toxic to bacteria, in response to certain stimuli. However, platelets did not enhance superoxide production by neutrophils, white blood cells that ingest and kill bacteria.
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Scientist's Summary

- Lipopolysaccharide and lipoteichoic acid, which are part of the bacterial wall and can be released during infection, were found to activate horse platelets. However this did not result in superoxide production.
 - The PKC isoenzymes in horse platelets were identified and PKC shown to regulate platelet function.
 - Establishing the specific, and often different, regulatory roles of PKC isoenzymes could reveal ways of strengthening the contribution of horse platelets to defences against infection and beyond.
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