

北京航空航天大学四年级博士生和五年级直博生

学校奖学金申报表

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类 别	<input checked="" type="checkbox"/> 三年级博士生 <input type="checkbox"/> 四年级直博生				学科/专业	生物医学工程	
承担 科研 任务 情况	项目名称	课题来源		课题负责 人	本人承担的具体工 作		
	动脉系统旋动流抑制动脉粥样硬化所起生理作用的研究	国家自然科学基金 基金		邓小燕	研究动脉粥样硬化的发生 机制		
	一氧化氮在动脉中的输运规律及其与动脉粥样硬化局部性现象的相关性研究	国家自然科学基金 基金		邓小燕	计算NO在家兔主动脉中的 运输规律		
	血管支架植入后力学环境变化影响血管支架内再狭窄和晚期血栓形成的机制研究	国家自然科学基金 基金		邓小燕	计算血管支架植入后力学 环境的变化		
已取得 研究成 果(论 文、专 利、获 奖等)	论文题目	本人排名		发表年月	期刊(会议) 名称	被检索 类型	
	Numerical simulation of haemodynamics and low-density lipoprotein transport in the rabbit aorta and their correlation with atherosclerotic plaque thickness	1		2017.4	Journal of the Royal Society Interface	SCI 源	
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	本人 承诺	本人所填写的以上内容均为真实情况。 <div style="text-align: right;"> 本人签字: <u>李晓银</u> 2018 年 06 月 04 日 </div>					

导师 意见	同意 / 不同意 该同学申报学校奖学金。 <div style="text-align: right;"> 导师签字：_____ <div style="display: flex; justify-content: space-between; width: 150px; margin-left: 10px;"> 年 月 日 </div> </div>
学院学位 评定分委 员会意见	同意 / 不同意 该同学获得学校奖学金。 <div style="text-align: right;"> 签字：_____ （学院代盖） <div style="display: flex; justify-content: space-between; width: 150px; margin-left: 10px;"> 年 月 日 </div> </div>

Research



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Numerical simulation of haemodynamics and low-density lipoprotein transport in the rabbit aorta and their correlation with atherosclerotic plaque thickness

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Two mechanisms of shear stress and mass transport have been recognized to play an important role in the development of localized atherosclerosis. However, their relationship and roles in atherogenesis are still obscure. It is necessary to investigate quantitatively the correlation among low-density lipoproteins (LDL) transport, haemodynamic parameters and plaque thickness. We simulated blood flow and LDL transport in rabbit aorta using computational fluid dynamics and evaluated plaque thickness in the aorta of a high-fat-diet rabbit. The numerical results show that regions with high luminal LDL concentration tend to have severely negative haemodynamic environments (HEs). However, for regions with moderately and slightly high luminal LDL concentration, the relationship between LDL concentration and the above haemodynamic indicators is not clear cut. Point-by-point correlation with experimental results indicates that severe atherosclerotic plaque corresponds to high LDL concentration and seriously negative HEs, less severe atherosclerotic plaque is related to either moderately high LDL concentration or moderately negative HEs, and there is almost no atherosclerotic plaque in regions with both low LDL concentration and positive HEs. In conclusion, LDL distribution is closely linked to blood flow transport, and the synergetic effects of luminal surface LDL concentration and wall shear stress-based haemodynamic indicators may determine plaque thickness.

1. Introduction

It is well documented that atherosclerosis is much more prone to occurring in particular regions of the arterial system where the geometry changes sharply, such as arterial branching, curvature and vascular stenosis, which is referred to the localization of atherosclerosis [1,2]. Two mechanisms have been proposed to explain the phenomenon [3]. One is the vascular responses to abnormal blood flow-induced shear stress [4–6]. The other one is the localized alterations in mass transport [4,7–15]. For the shear stress mechanism, it is believed that