

肠道菌群与运动学

Gut Microbiota & Locomotion

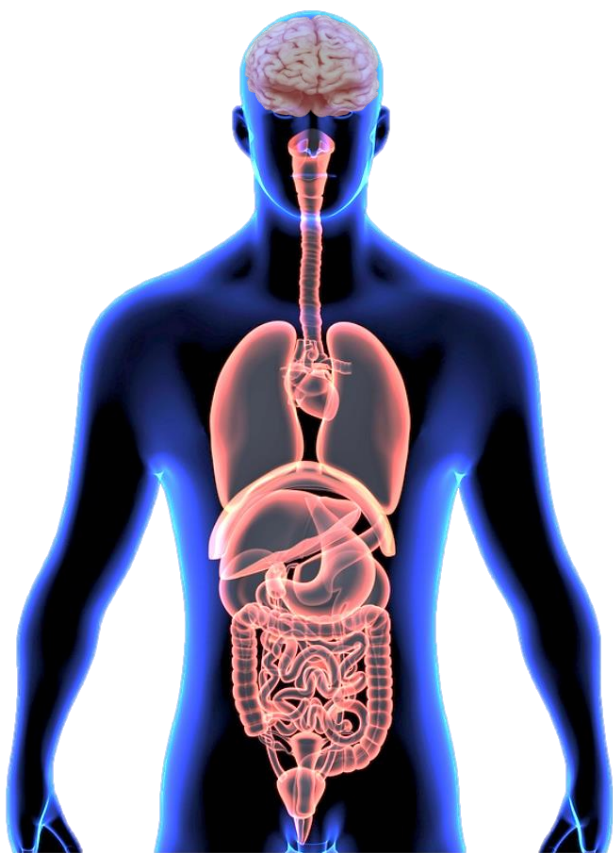
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2019年2月11日



肠道菌群
Gut Microbiota

脑

- 帕金森症/ Parkinson's Disease
- 多发性硬化/ Multiple Sclerosis

神经

- 渐冻人症/ Motor Neuron Disease
- 重症肌无力/ Myasthenia Gravis

**骨 骼
关 节**

- 类风湿性关节炎/ Rheumatoid Arthritis
- 骨质疏松/ Osteoporosis

肌肉

- 少肌症/ Sarcopenia
- 肌肉流失/ Muscle Wasting

头
脑

菌
肠
脑
轴

肠
脑

Brain

BBB

Neurotransmitters

Neuropeptides & Neurohormones

Cytokines

Bioactive Signals

ENS

Epithelial Cells

Mucous Layer

Gut Microbiota

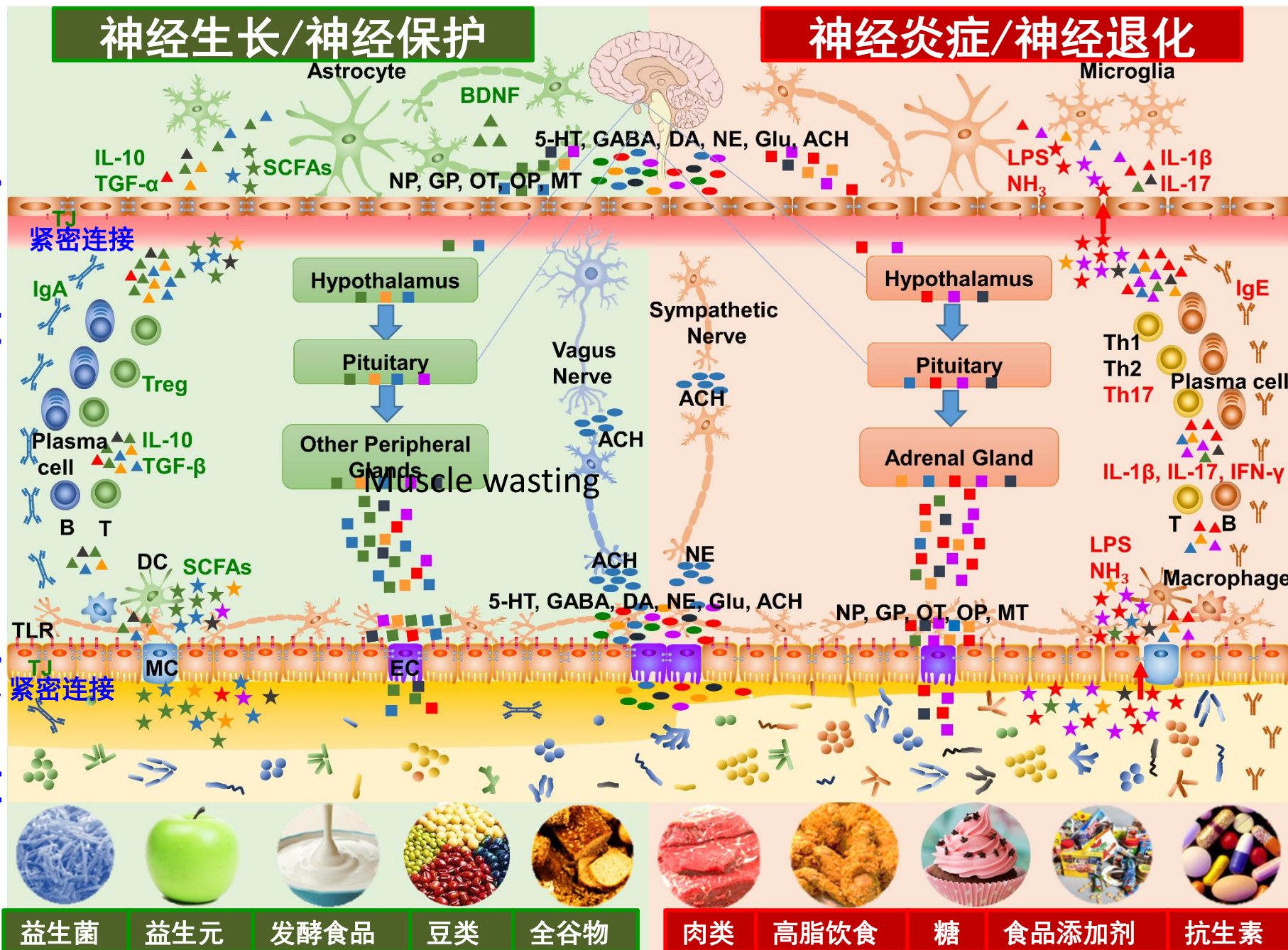
Influential Factors

血
脑
屏
障

肠
道
屏
障

神经生长/神经保护

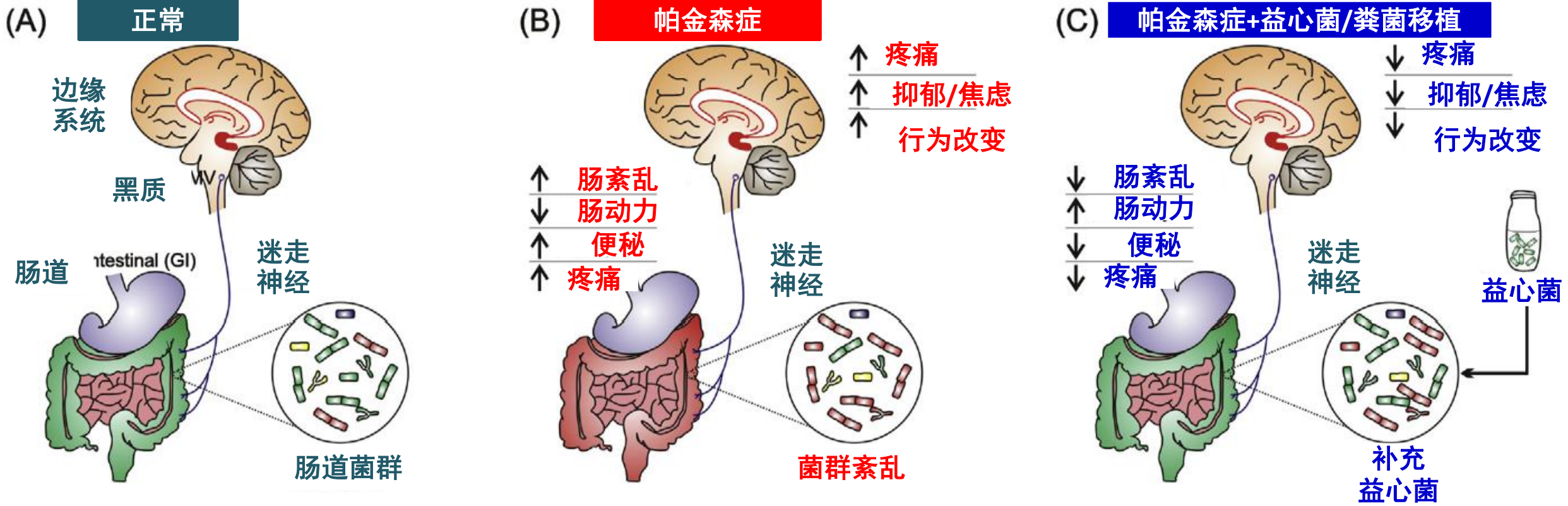
神经炎症/神经退化



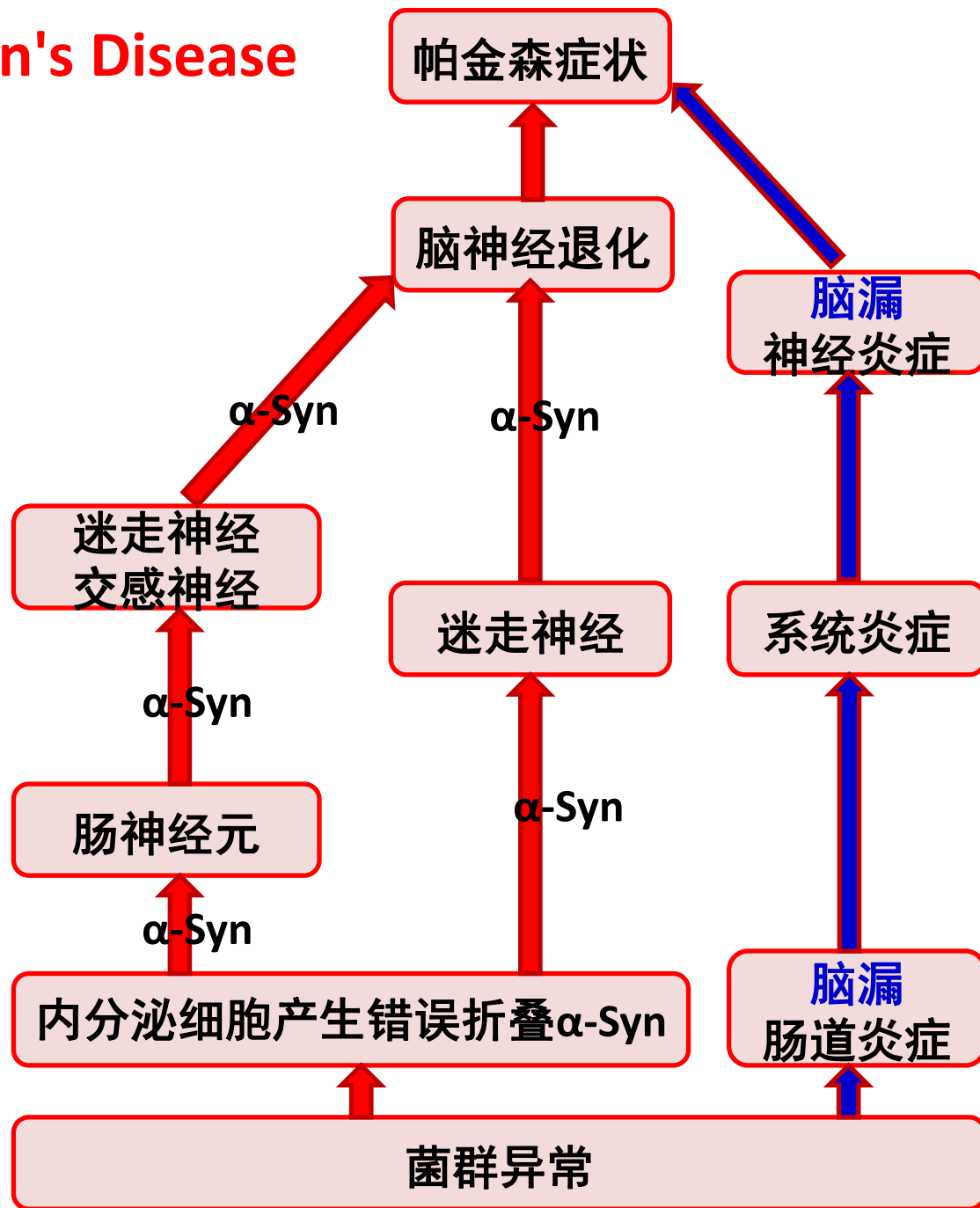
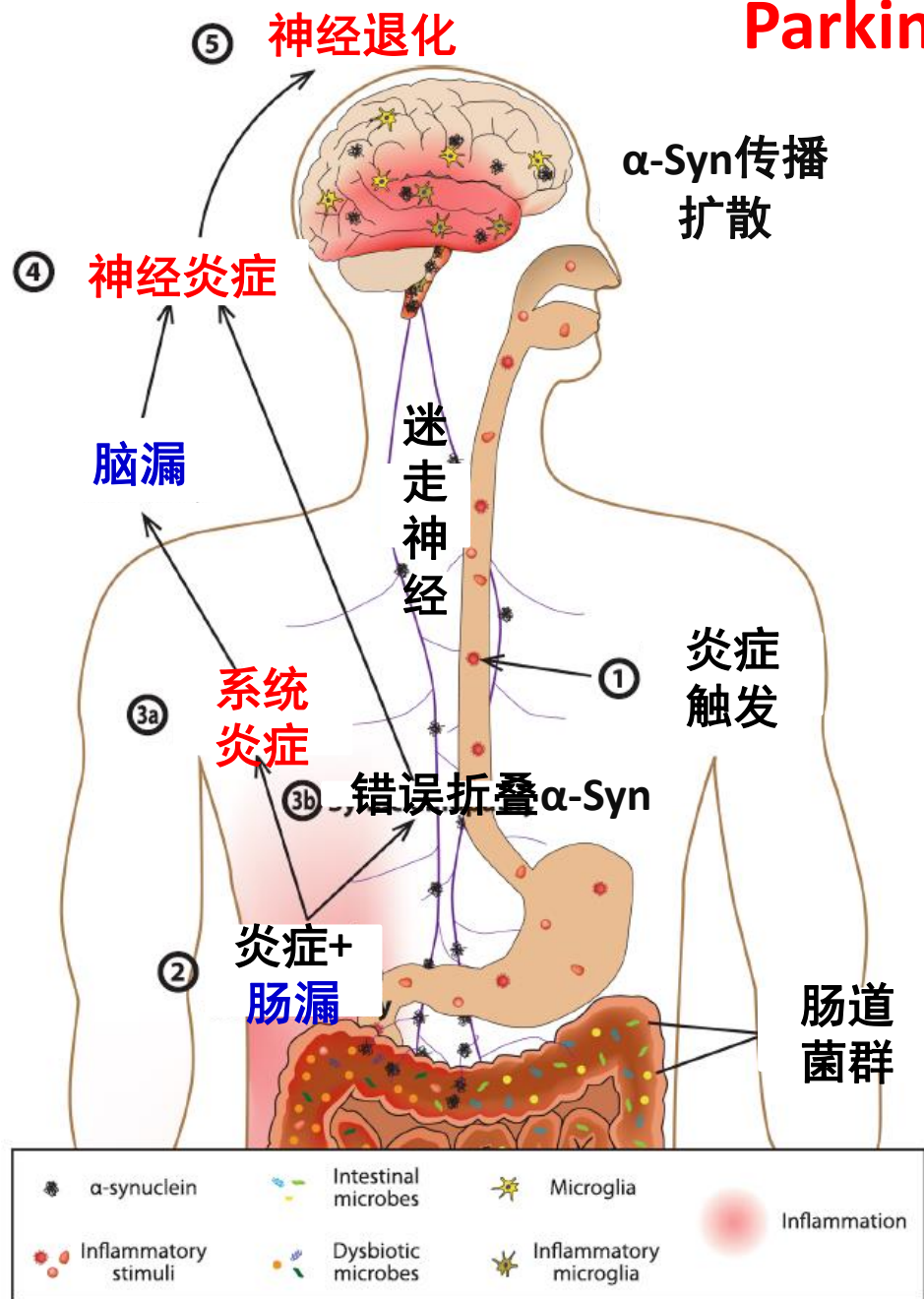
脑
漏

肠
漏

肠漏与帕金森症/ Parkinson's Disease



Parkinson's Disease



健康

多发性硬化/ Multiple Sclerosis

中枢
神经系统

神经元

小胶质细胞

星型胶质细胞

脱髓鞘和轴突损伤

小胶质细胞和星型
胶质细胞激活

血脑屏障

脑漏

免疫细胞浸润

循环

T cells

细菌
易位

肠漏

肠道屏障

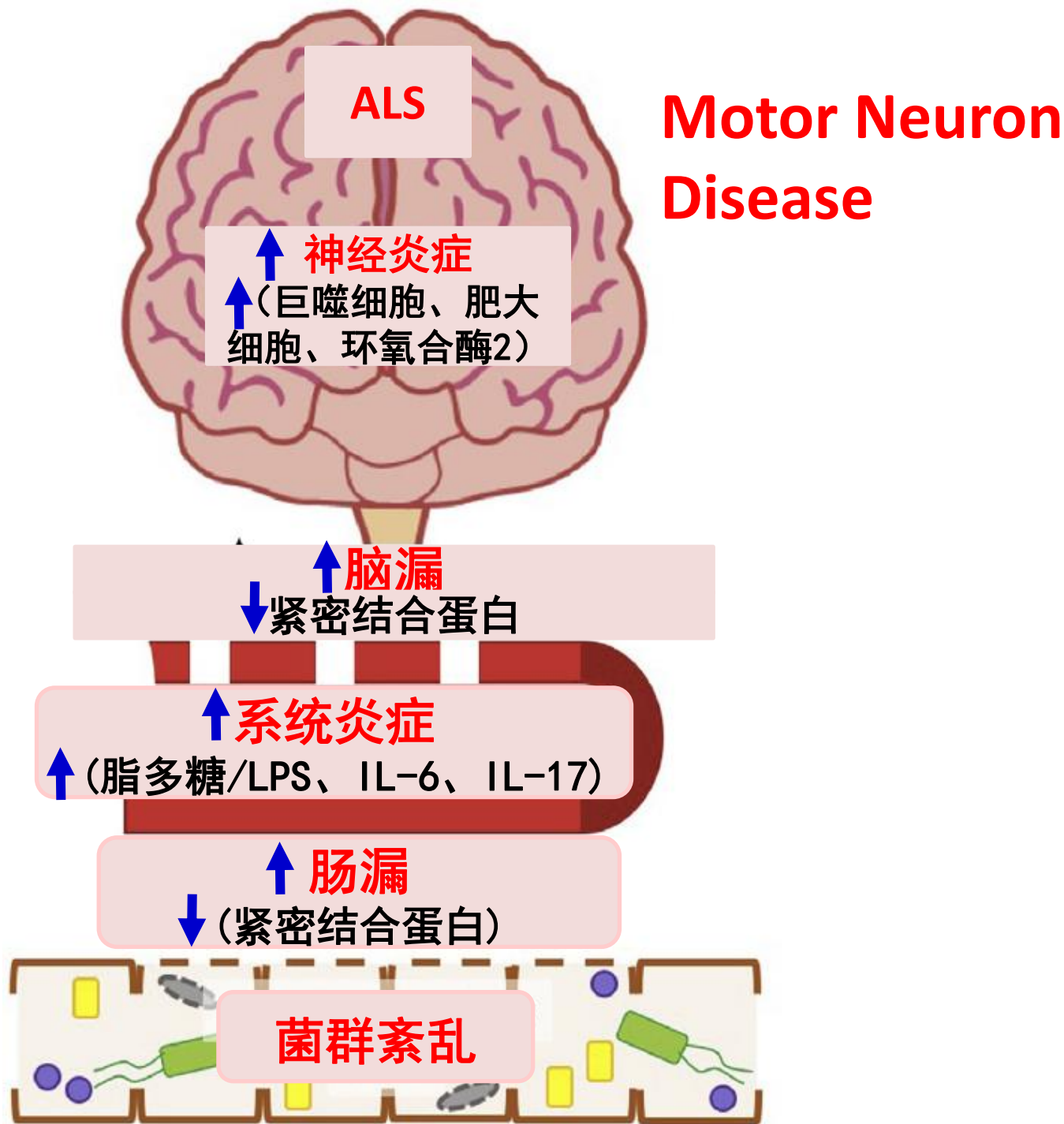
Dysbiosis

菌群
紊乱

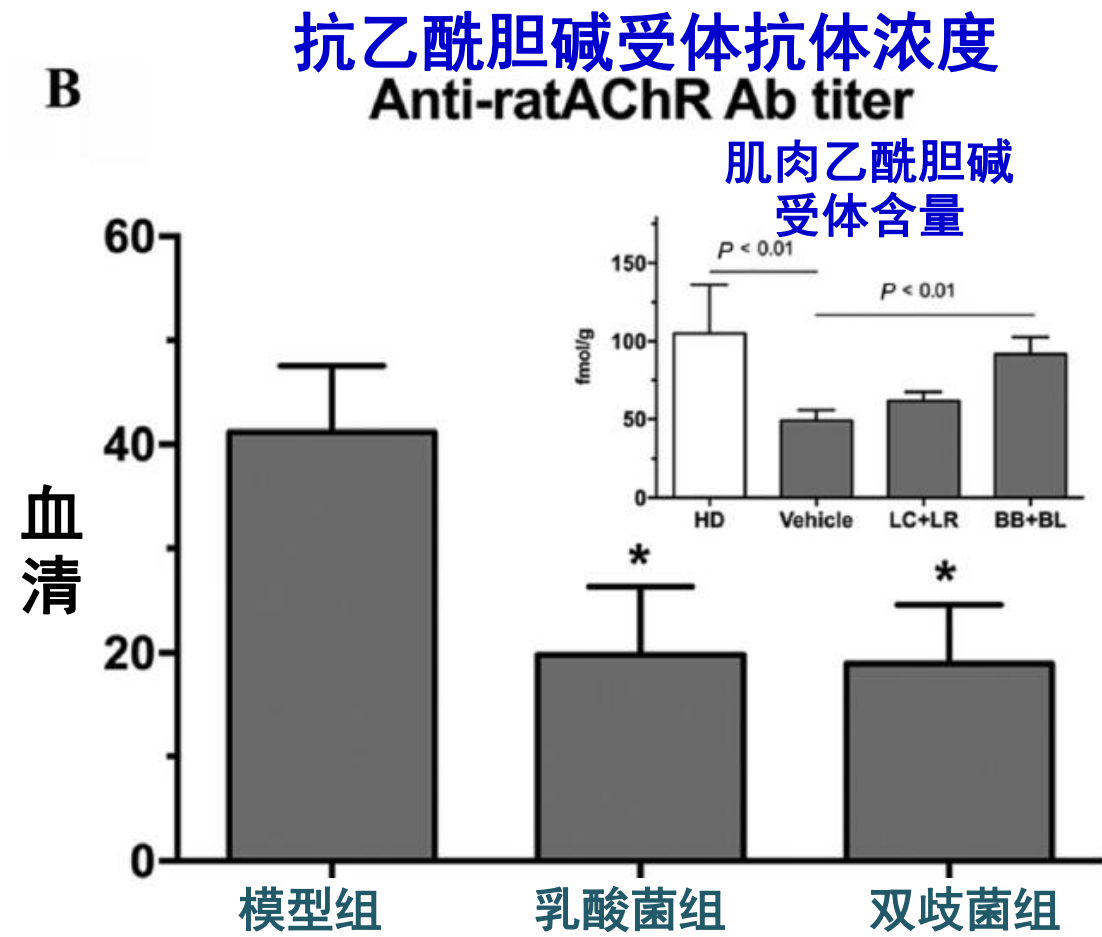
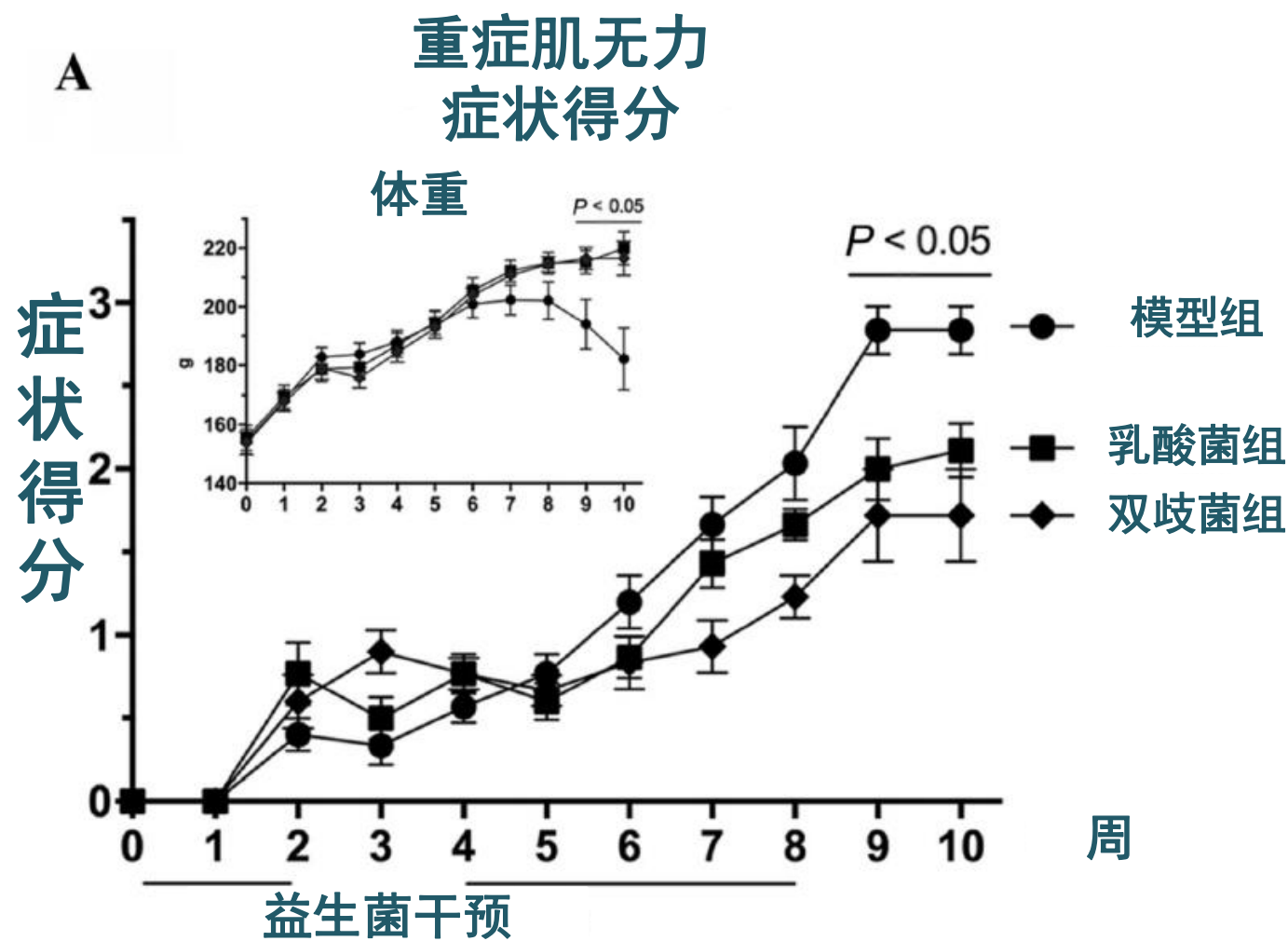


Amyotrophic Lateral Sclerosis

渐冻人病与脑漏

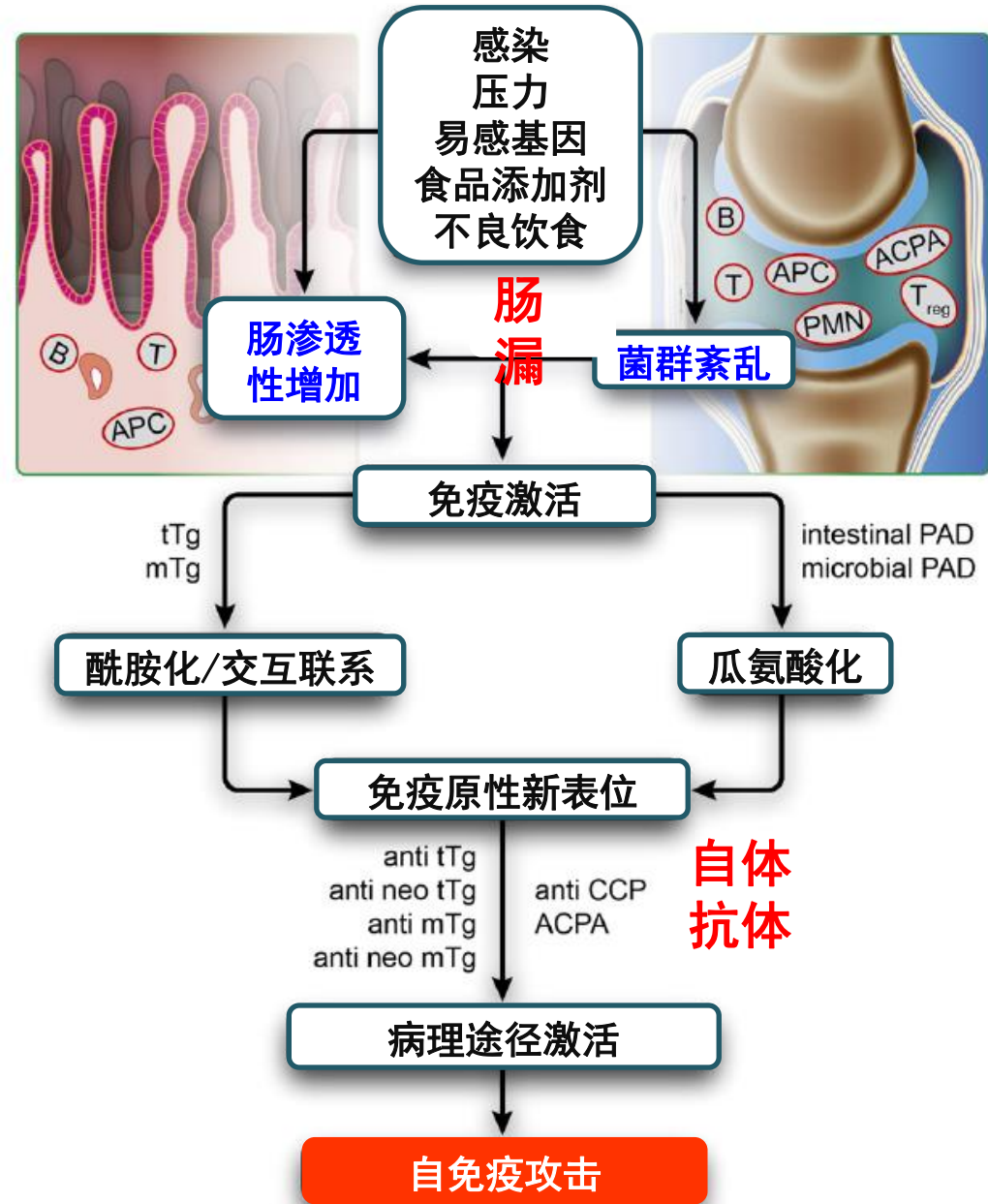


肠漏与重症肌无力 Leaky Gut & Myasthenia Gravis

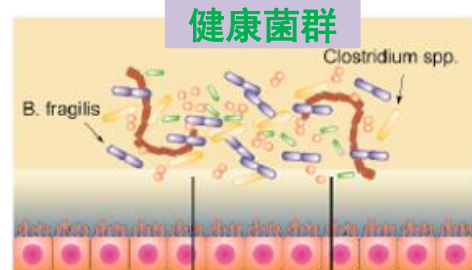


菌-肠-关节轴 Microbiota-Gut-Joint Axis

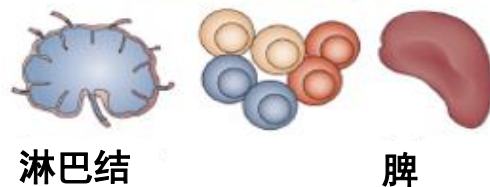
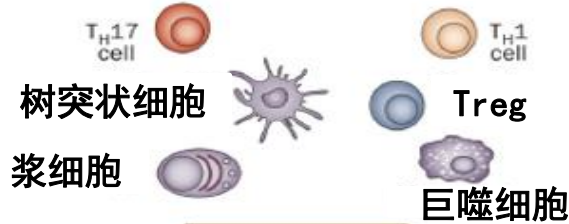
肠漏引发骨关节自身免疫攻击
Leaky gut causes bone and joint
autoimmune attack



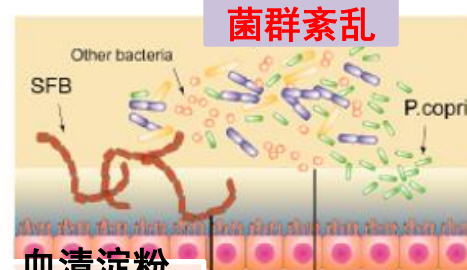
肠腔
黏液层
肠上皮
固有层
循环
外周免疫器官



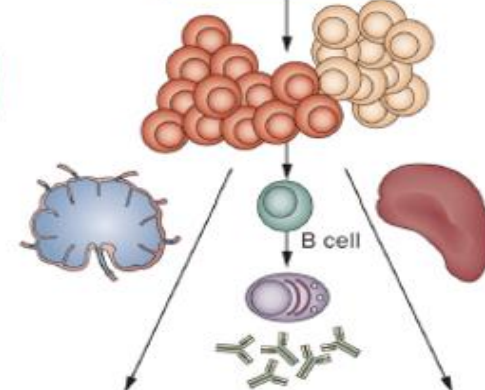
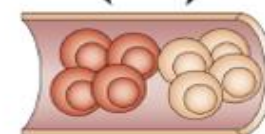
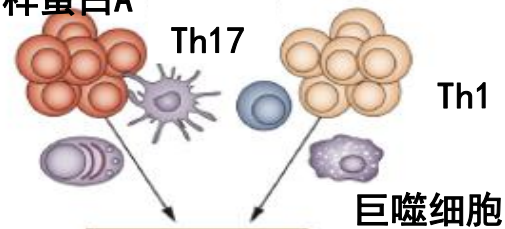
多糖A SCFAs



健康的关节



血清淀粉样蛋白A



关节
翳

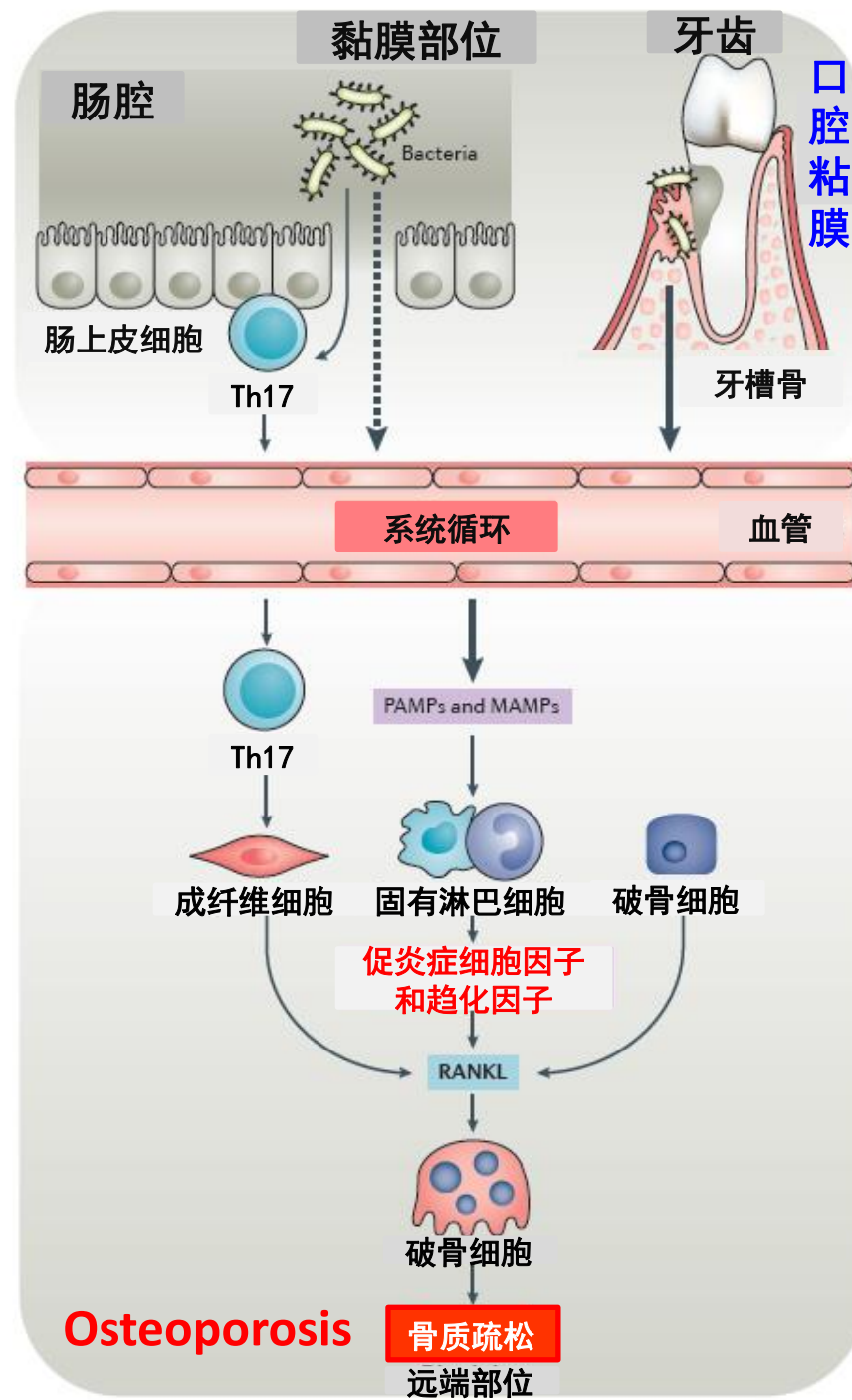
类风湿性关节炎

自体反应性Th1和Th17
→ 促炎症细胞因子↑

免疫复合物沉积

巨噬细胞、成纤维细胞
和破骨细胞激活
→ 软骨和骨退化

Rheumatoid Arthritis



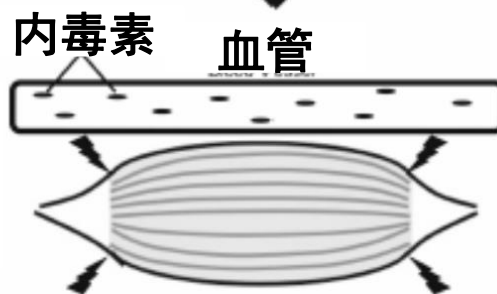
菌肠肌肉轴

肠道菌群异常
肠道渗透性增加



菌群变化:
多样性↓
双歧杆菌↓ 乳酸杆菌↓
产丁酸菌↓
变形菌↑ 炎症↑
紧密连接↓

循环细菌产物
增加 (如LPS)



免疫变化:
IL-1 β ↑ IL-6↑
TNF- α ↑ MCP-1↑

肌肉病理

大小
降解增加
合成受损

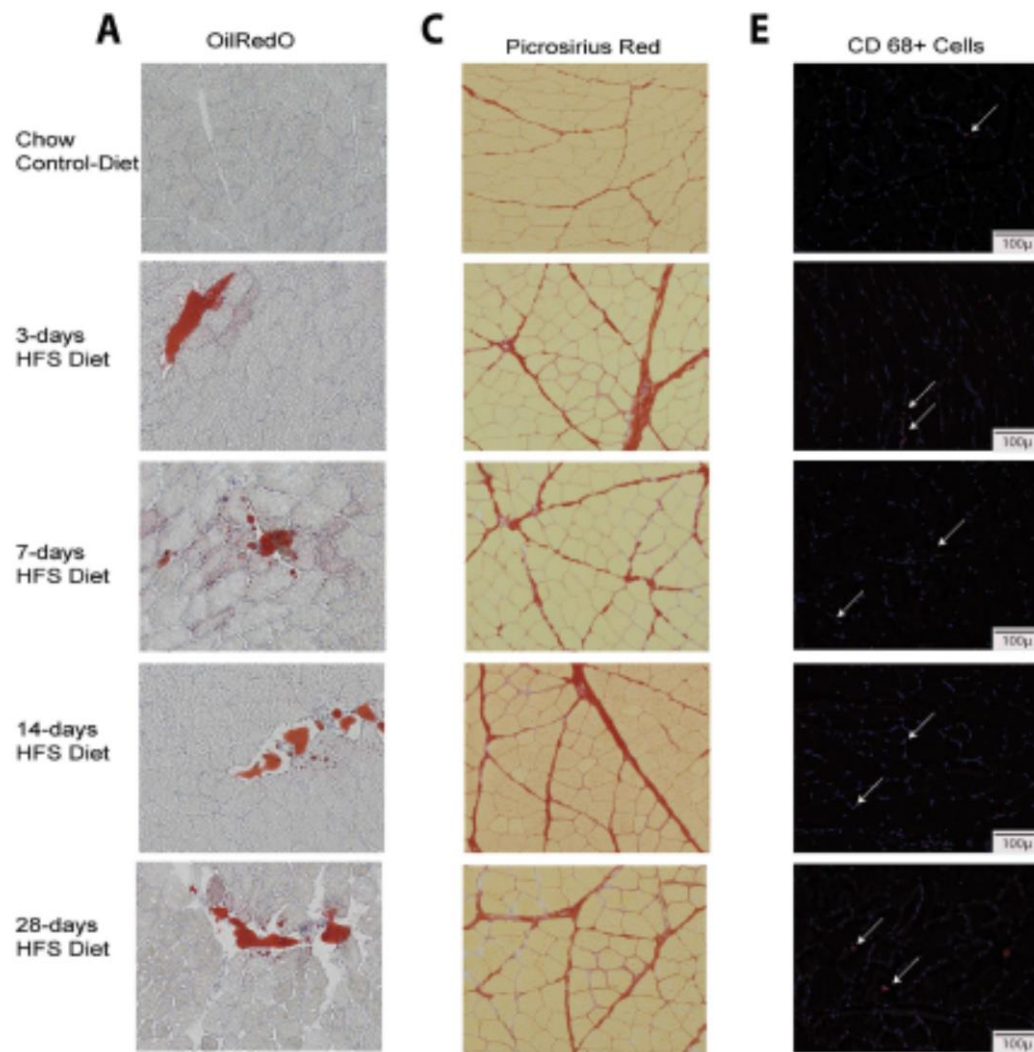
组成
脂肪浸润
MHC转变

肌肉损伤

功能减退
代谢失调, 力量和能力丧失

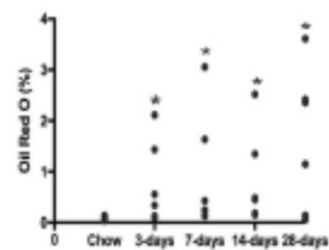
独立性丧失
生活质量降低



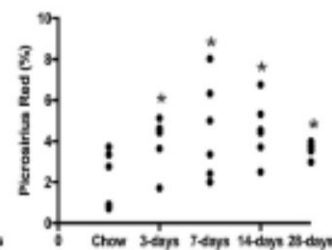


高脂高糖饮食
增加小鼠**股外侧肌**内
脂肪和胶原蛋白含量，
增加炎症

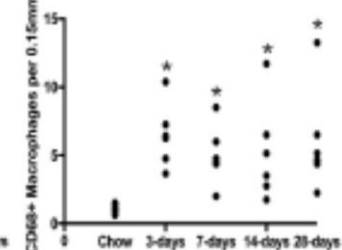
B 肌肉脂肪

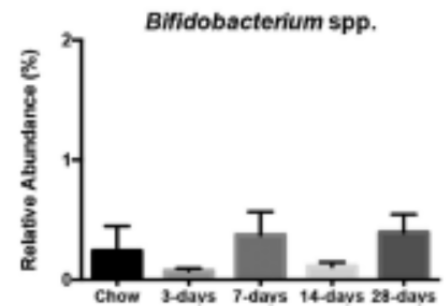
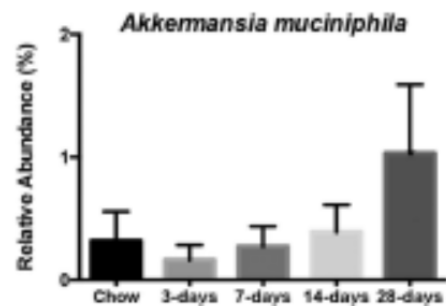
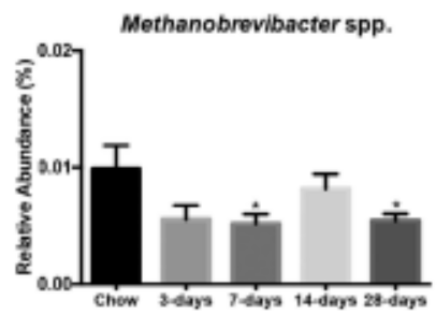
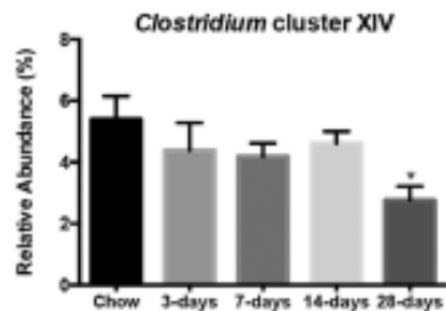
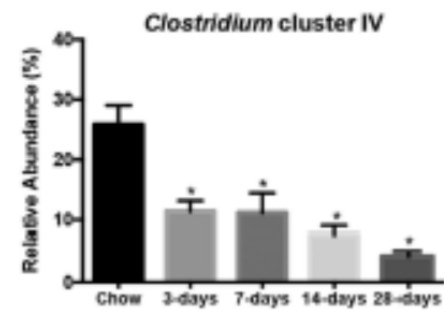
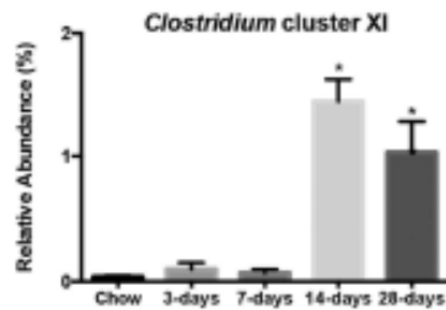
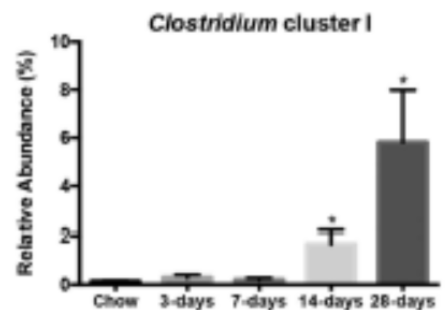
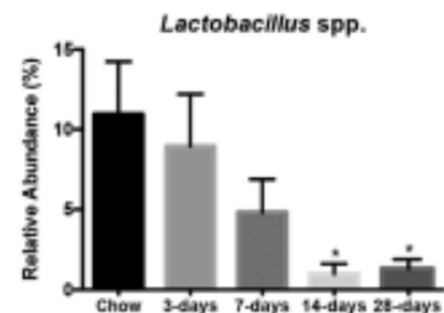
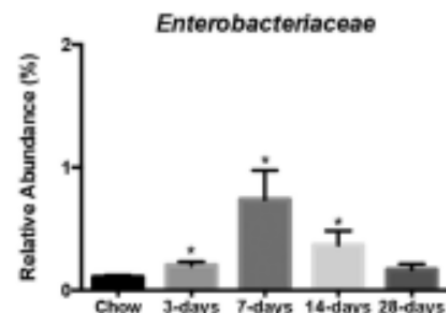
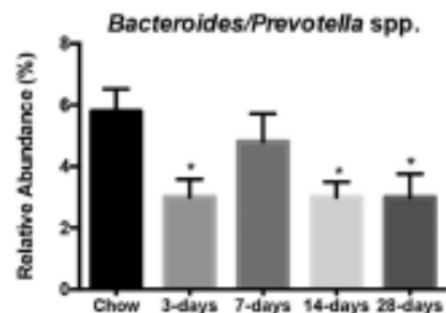


D 胶原蛋白



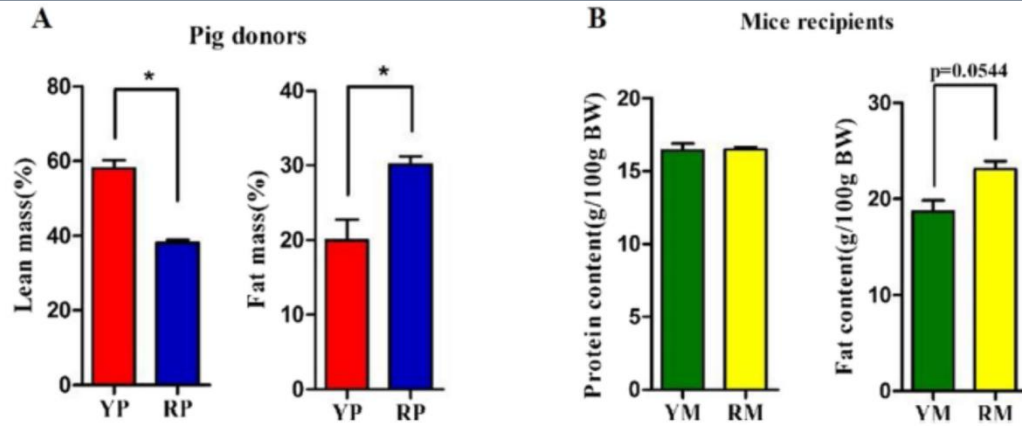
F 炎性细胞



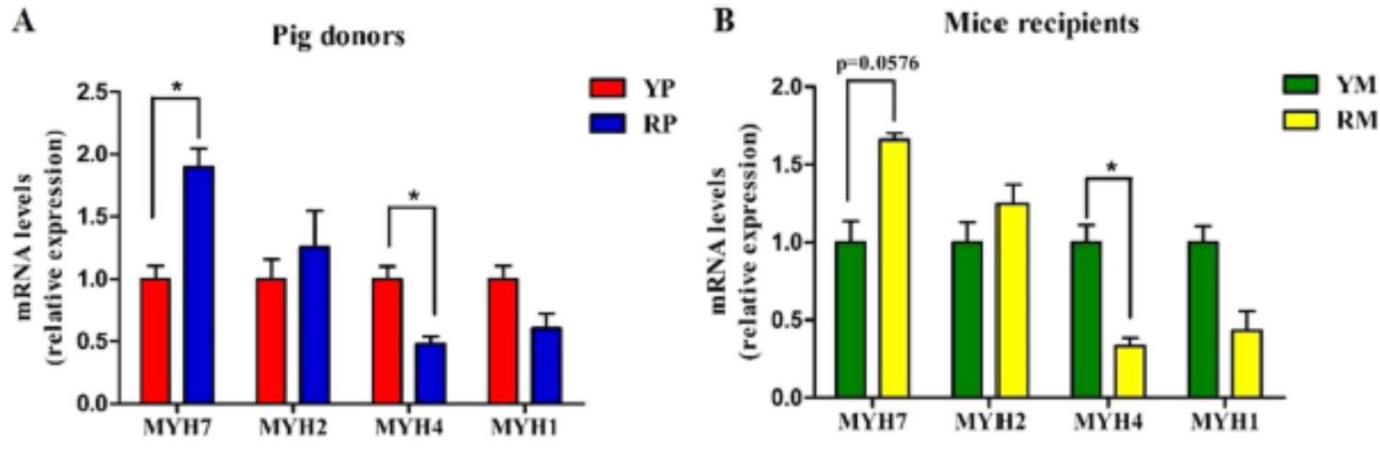


高脂高糖饮食
导致肠道菌群异常

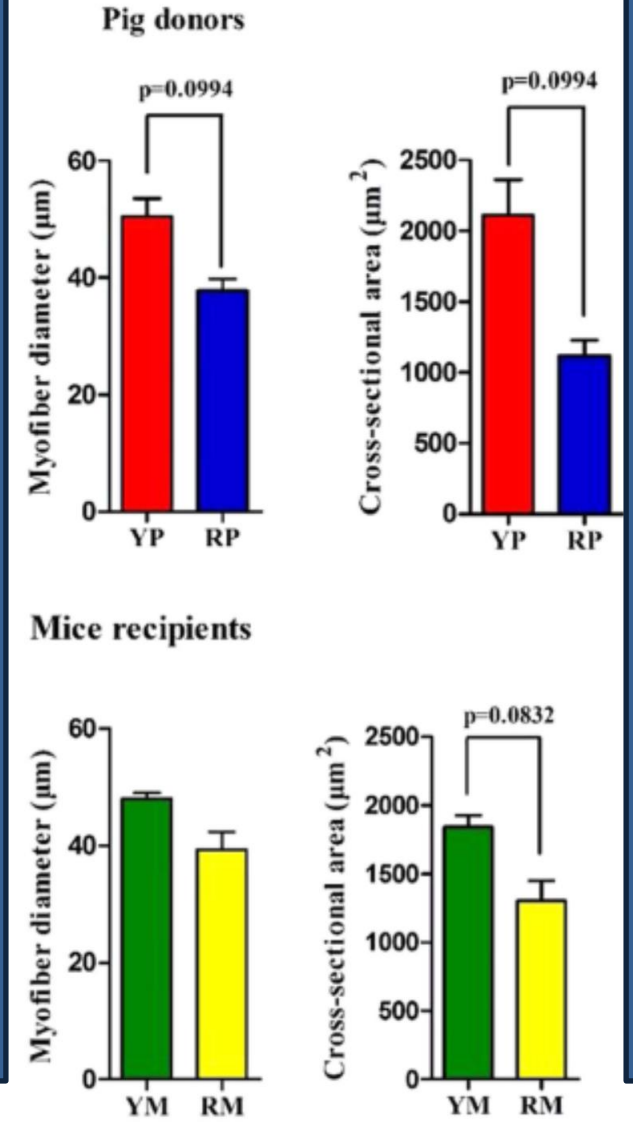
1. 供体和受体的身体组成



3. 供体和受体腓肠肌肌球蛋白重链（MHC）亚型基因表达



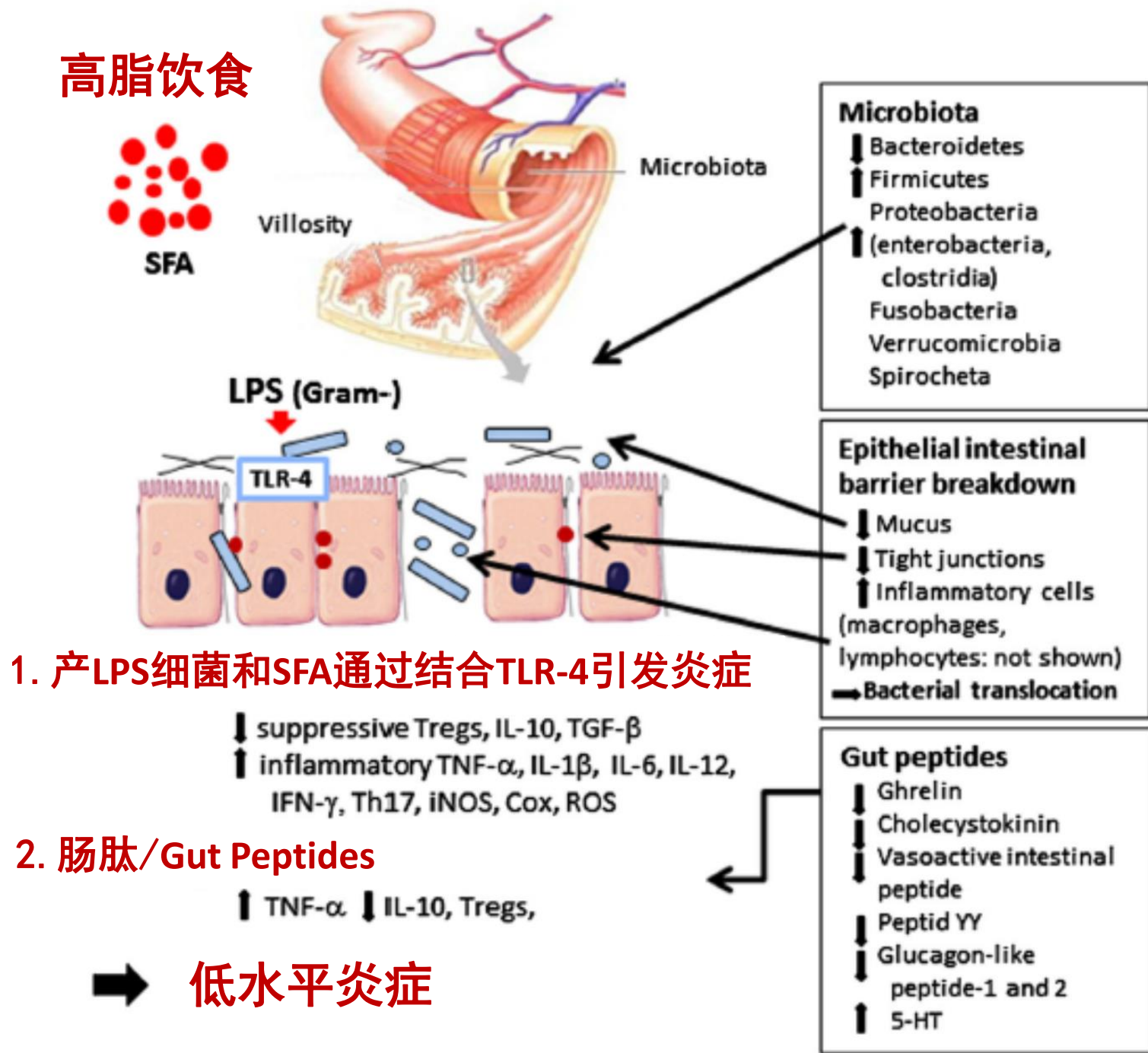
2. 腓肠肌肌纤维直径比较



2. 腓肠肌肌纤维横截面积比较

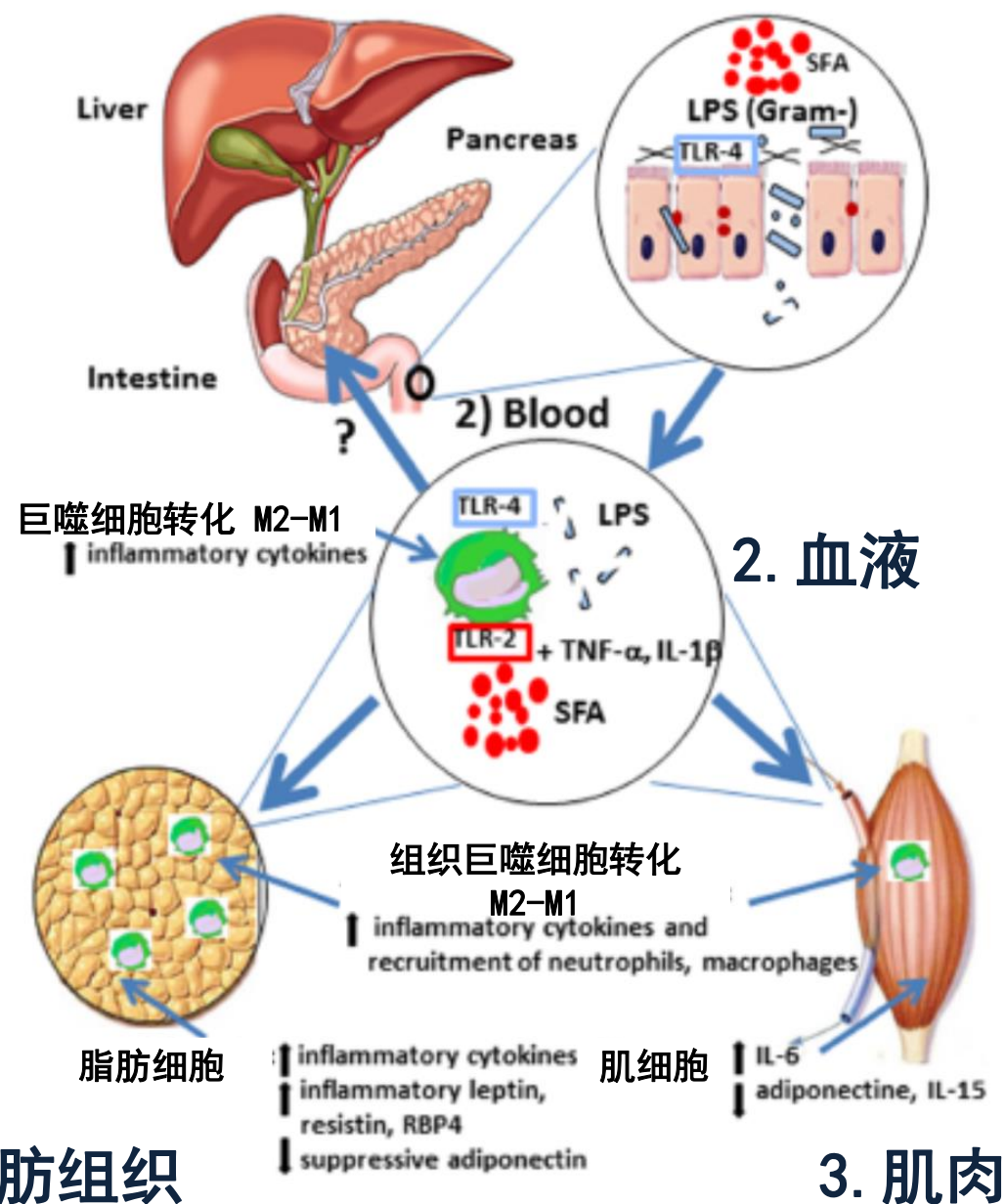
YP=瘦品系猪； YM=接受瘦猪菌群小鼠 RP=胖品系猪； RM=接受胖猪菌群老鼠

高脂饮食



1. 胃肠道

高脂饮食



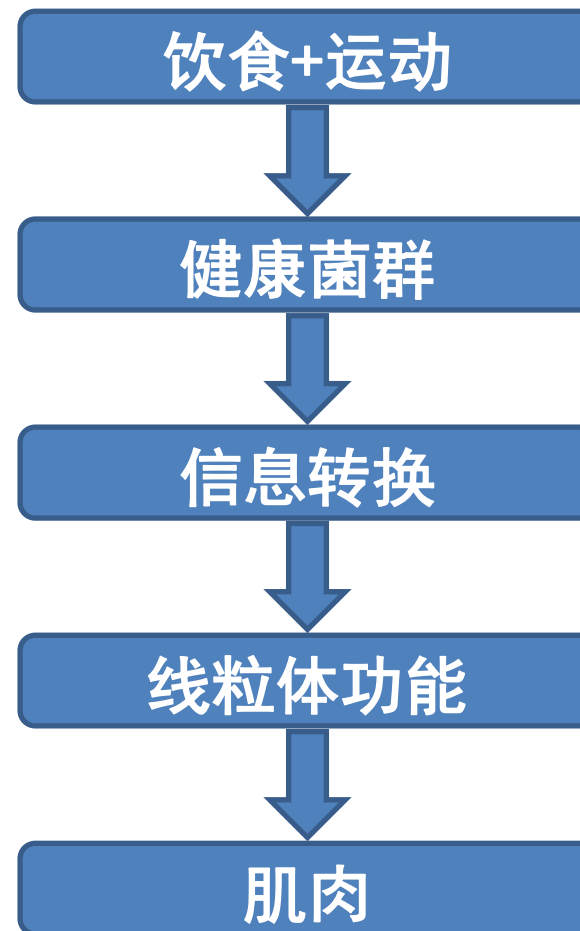
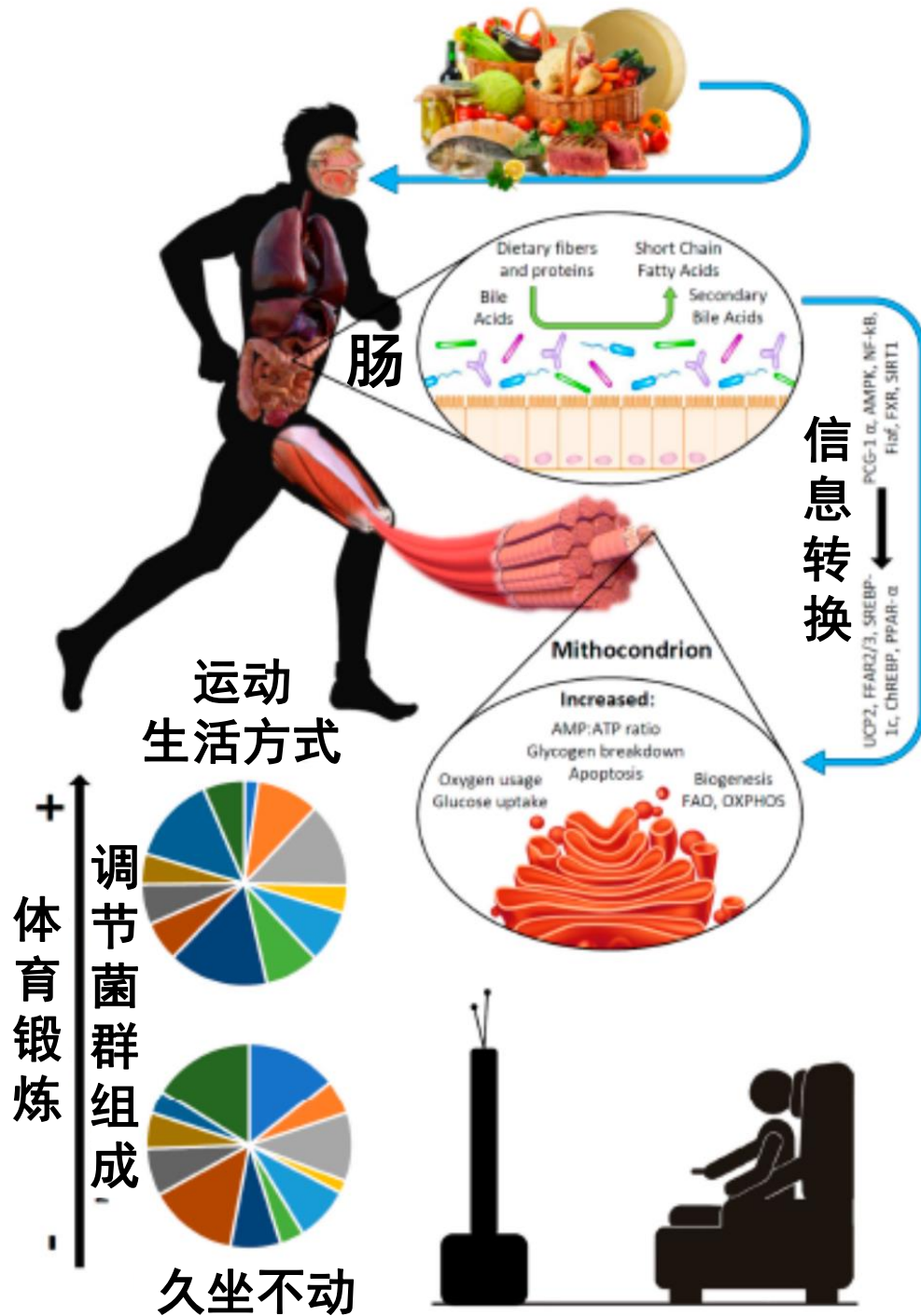
➔ 系统低水平炎症



Past



Present





压力

情绪紊乱，
疲劳，失眠，
抑郁

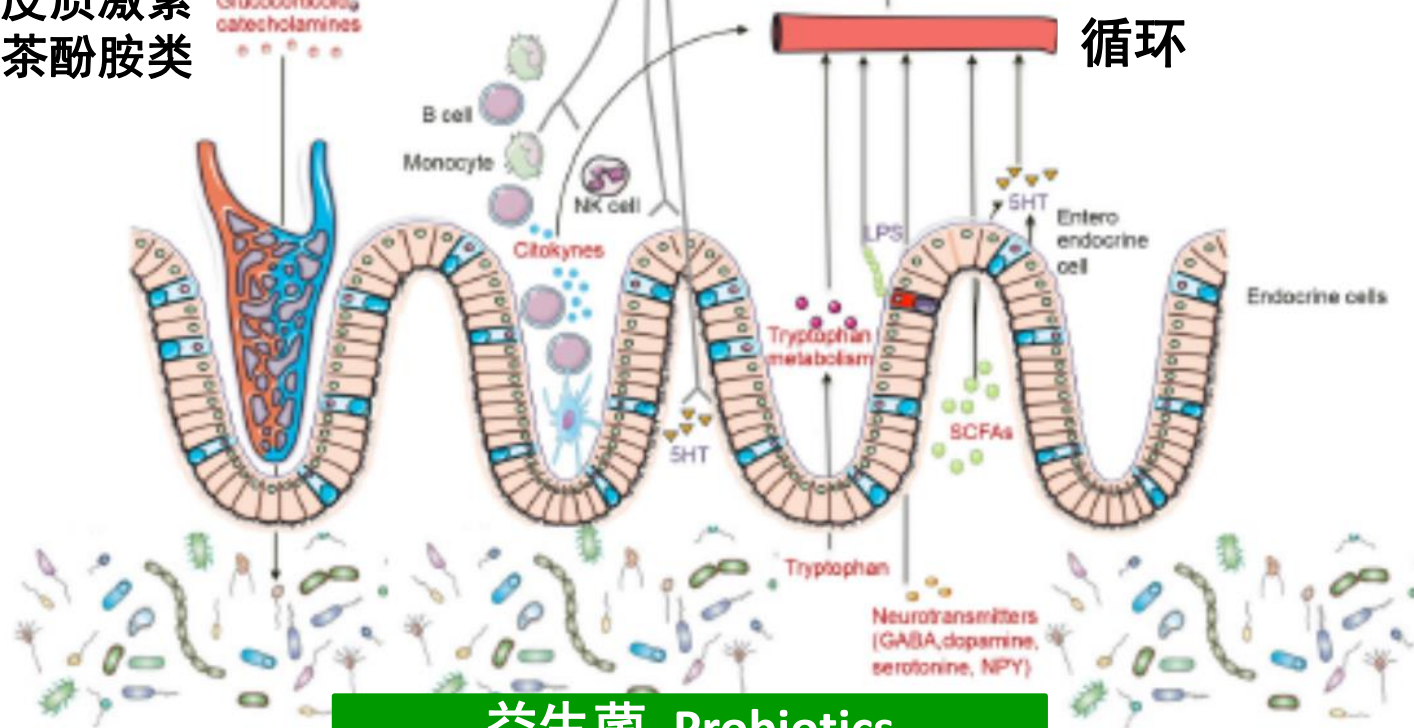
糖皮质激素
儿茶酚胺类

肾上腺

压力

迷走
神经

循环



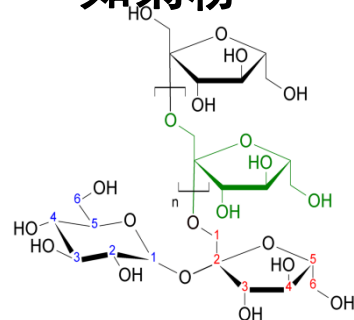
益生菌 Probiotics

益生菌



益生元

如菊粉



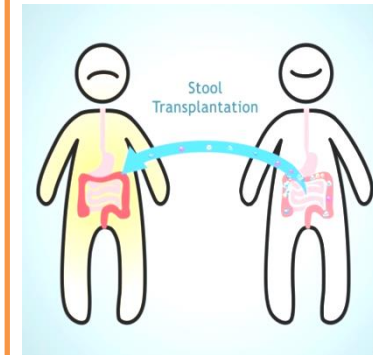
健康饮食



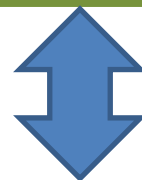
体育锻炼



粪菌移植



肠道菌群



运动能力