哈维的心脏:血液循环的发现

=Harvey’sHeart:TheDiscoveryofBloodCirculation

(英)格雷戈里(Gregory,A.) 著

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Dedication

For Sheelagh, with love

序 言

美国政府在普及文化知识的过程中，曾实施了 RIF (Reading Is Fundamental)，即“阅读是最基本的”计划。阅读不仅让我们获得各种各样的知识，也是培养、巩固和提高语言技能，特别是阅读理解能力的重要手段。

在外语学习中，阅读也受到普遍的重视。著名应用语言学家克拉申(Krashen)曾提出输入假设(Input Hypothesis)：认为第二语言的习得必须有可理解的输入(Comprehensible Input)；同时，语言输入还需要达到足够的量(Adequate Exposure)。在我国，阅读已成为绝大多数英语学习者学习英语的主要方式，教材是接触英语的主要媒介。众所周知，英语语言浩如烟海，要想把英语学好，光靠阅读教材是远远不够的，必须有足够的课外读物作为补充。目前，我国市场上的英语课外读物虽然琳琅满目，但科普读物较少，面向大学生和研究生的科普读物则更加匮乏，难以满足需求。《科学的演进》系列丛书正是在这种背景下引进的。

本系列丛书由在英国和新西兰著名大学讲授科学史的教师撰写，英国 ICON 公司 2002 年出版，共 13 册，内容涉及天文、地理、数学、计算机、医学、生物学、哲学

和历史学等领域。作者们通过讲述科学发展的历史，在让读者领略科学研究的乐趣、矛盾和斗争，增强人们战胜困难的信心和勇气的同时，也让读者学到了地道而实用的现代英语。

在保持原著原文不变的前提下，为帮助读者阅读和理解，本丛书以导读和注释的形式增添了三个部分内容：即 Guiding Questions（引导性问题），Footnotes（脚注）和 Reflection（反思）。Guiding Questions 置于一章之前，以调动读者的思维，激活读者大脑的认知图式（Cognitive Schemata），使读者在阅读过程中处于积极认知的状态；参照我国大学生的英语水平，Footnotes 为同页的生词注释了国际音标、词性和词义，并对相关的文化背景和语法难点作了简短的解释；章末的 Reflection 是对该章内容的小结，也是对 Guiding Questions 中部分问题的回答。读者可根据自己的需要，决定 Guiding Questions 和 Reflection 的阅读顺序。本系列丛书可作为大学生及研究生的英语课外读物，也是广大英语爱好者自学英语的理想材料。

最后需要说明的是，本丛书的内容仅仅是一家之言，如读者能由此而激起阅读的热情和对科学的兴趣，那就是我们最大的欣慰。另外，由于导读者水平有限，如有不妥之处，敬请批评、指正。

向朝红

2002 年 8 月

Introduction

Guiding Questions

1. What was the remarkable discovery William Harvery made at some time around 1618?
2. Why was Harvery's discovery so remarkable and so momentous?
3. Who are the three ancient Greeks Harvey most admired?
4. How should we look at the vivisection and the use of animals in research in the seventeenth century?

At some time around 1618, William Harvey[①], an English physician, made a remarkable discovery that was to revolutionise thinking about the human body. He found that the blood circulated around the body, and did so rapidly. He also discovered a great deal about the motion and function of the heart, believing it to pump blood around the body. Today, we take these to be basic and evident facts. So why were these discoveries so remarkable

① William Harvey 哈维(1578—1657, 英国医师、生理学家, 实验生理学创始人之一, 阐明血液循环原理及心脏作用, 提出胚胎组织"渐成说")

and so momentous?

In the era of open-heart[①] surgery, arterial bypasses[②] and blood transfusions[③], we believe we understand the motion of the heart and the blood very well. Doctors are familiar with the sight and feel of the human heart pumping away, and TV documentaries[④] bring these images into our homes. Such easy access to the human heart has not always been available, however. Prior to anaesthetics[⑤], blood transfusions and antiseptics[⑥], to open the chest and expose the heart meant certain death for the patient. Knowledge came only through animal vivisection[⑦] and human post-mortem[⑧] dissection[⑨], and both methods had significant drawbacks. One can discern the structure of the heart relatively easily from dissection, but not its motion and function. Vivisection was no great help, as the motion of the heart is swift and in a distressed subject[⑩] likely to be either rapid or dis-

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① open-heart surgery 体外循环心脏手术

② arterial bypass 动脉旁路术

③ blood transfusion 输血;输血法

④ documentary/dɒkjʊˈmentri/n. 记实性影片,记实节目,记录片

⑤ anaesthetic/ænɪsˈθetɪk/n. 麻醉剂

⑥ antiseptic/æntɪˈseptɪk/n. 防腐剂;抗菌剂

⑦ vivisection/vɪvɪˈsekʃn/n. 活体解剖

⑧ post-mortem/pəʊstˈmɔːtəm/adj. 死后的;验尸的

⑨ dissection/dɪˈsekʃn/n. 解剖

⑩ subject/ˈsʌbdʒɪkt/n. 解剖用的活体

organised[①]. So too, as soon as one opens a living heart to see its internal workings[②], the subject is likely to die. The motion of the heart is also complex. How many of us could say with certainty exactly how the heart beats? Where does the contraction[③] of the heart begin and where does it finish, or does it all contract at once? What function do the heart valves[④] perform, and when do they open and shut? The heart rises and falls in the chest as it beats. Which of these is muscular contraction and which relaxation[⑤]? At which point does the heart have its largest and smallest volume? The next time you see a documentary showing open-heart surgery, try discerning the basic motion of the heart yourself. Initially, it is by no means easy, even if you know what you are looking for. For those who know a good deal about the motion of the heart, remember it is one thing to look when you know what you are looking for, quite another to work out what is happening with no prior information, or even worse, in Harvey's case, with incorrect prior information. The heartbeat has a considerable cultural significance as a sign of life,

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① disorganised /dis ˈ naizd/ adj. 杂乱无章的; 凌乱的; 无系统的
② workings /ˈw ki z/ n. 运转, 运行; 活动
③ contraction /k nˈtr k n/ n. 收缩
④ heart valve 心脏瓣膜
⑤ relaxation /ri l kˈsei n/ n. 松弛, 舒张

both now and in the seventeenth century. But how, exactly, does the heart beat and what is its purpose? That was a key question that Harvey hoped to solve.

How the heart is connected to the major blood vessels① that bring blood to it and take blood from it is also reasonably evident from dissection. It is not in the least bit evident, however, how those vessels and their tributaries② relate to each other in parts of the body remote from the heart. Do they form open-ended③ systems, as was commonly thought prior to Harvey? Or are there several closed④ systems? Or do they join in one closed system? In an age when the capillaries⑤, the fine blood vessels that join the arteries⑥ to the veins⑦, were unobserved because of their minuteness⑧, this was not an easy question. Nor was it clear how quickly the blood flowed. Opening blood vessels is no great help here. Certainly we bleed quickly if cut in certain places, but if you make a hole in a water pipe when water is not flowing, it will still

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① blood vessel 血管

② tributary /ˈtribjut ri/ n. 支流

③ open-ended /ˈup n ˈendid/ adj. 开口的；两端开口的

④ closed /kl uzd/ adj. 封闭的，闭合的

⑤ capillary /k ˈpil ri/ n. 毛细管

⑥ artery /ˈ t ri/ n. 动脉

⑦ vein /vein/ n. 静脉

⑧ minuteness /mai ˈju tnis/ n. 微小，微细

leak rapidly. Harvey's discovery of the rapid circulation of the blood and the proper motion and function of the heart was remarkable relative to the knowledge, technology and methods available in the seventeenth century. Harvey's discoveries had to be inferred, not merely observed. He had to create a good number of ingenious① experiments and well-argued inferences② without ever having seen the internal workings of human beings.

Harvey's discoveries were also quite contrary to accepted opinion, which had stood for some 1,500 years. Everyone but Harvey thought blood was generated③ in the liver④ and was gradually consumed by the body, giving it nutrition⑤. Blood flowed very slowly away from the liver to the other parts of the body, but not back to the liver. This was the view of Galen⑥, greatest of the ancient anatomists⑦, and accepted without question down to Harvey's time. Although Galen's views may seem odd to the modern eye, in the context of their

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① ingenious /in ˈdʒi nj s/ adj. 灵敏的,精巧的

② inference /ˈinf r ns/ n. 推断结果;结论

③ generate /ˈdʒen reit/ v. 产生,生成

④ liver /liv / n. 肝脏

⑤ nutrition /nju ˈtri n/ n. 营养

⑥ Galen /ˈeil n/ 盖仑(130—200AD,古希腊医师、生理学家和哲学家,从动物解剖推论人体构造,用亚里士多德目的论阐述其功能)

⑦ anatomist / ˈn t mist/ n. 解剖学家

time, they offered a plausible[①] and comprehensive account of the human body. Galen's account of the heart and arteries was attuned[②] to a very slow flow of the blood. He could easily explain rapid bleeding without a rapid circulation[③]. Galen's views were well entrenched[④], and were defended vigorously by intelligent, experienced men. Anatomists in sixteenth-century Italy began to examine the human body with the aim of improving on Galen, but no one suspected that he was radically wrong regarding both the motion of the heart and the blood. Harvey had two significant obstacles to overcome. There was the difficulty of conceiving not only of the circulation of the blood, but also of an account of the heart and arteries that would suit a rapid circulation theory, against 1, 500 years of tradition. Harvey had to amass sufficient evidence and arguments in favour of his new ideas to win over some highly sceptical[⑤] Galenic[⑥] opponents, and that, as we shall see, was no easy matter.

Their doubts were increased because Harvey's

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① plausible/ ˈplɔ z bl/adj. (论点等)貌似有理的;(说法等)貌似真实的

② attune/ ɪˈtju n/v. 使合拍,使协调

③ circulation/ s kjuˈlei n/n. (血液)循环

④ entrench/in ˈtrent /v. 使处于牢固地位

⑤ sceptical/ ˈskeptikl/a. 倾向于怀疑的;表示怀疑的

⑥ Galenic/ ɡəˈlenik/a. 盖仑的;盖仑派医学的

ideas affected our whole conception of how the body works. If Harvey was right about the cardiovascular① system, then Galen was wrong, not merely about the heart and blood, but also about digestion②, nutrition, respiration③ and aspects of organ function. Galen's physiology④ depended to a large extent on principles of attraction⑤. Parts of the body (including the heart and the arteries) were thought to attract what they required to themselves. Harvey's work showed this was quite wrong for the heart and blood, as the heart forces blood around the body. This prompted a complete re-evaluation of the attraction principle. A significant part of medical therapy⑥ in Galen's system was based on blood letting⑦. Blood was drawn from specific parts of the body, determined by Galen's conception of the blood system and the position of the organ thought to be affected, in order to treat a disease. If Galen was wrong on the blood system, however, this entire mode of treatment needed to

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① cardiovascular /ˌkɑːdiəʊˈvæskjʊlə/ a. **心血管的**

② digestion /dɪˈdʒestʃən/ n. **消化(作用);消化力**

③ respiration /ˌrespəˈreɪʃən/ n. **呼吸;呼吸作用**

④ physiology /ˌfɪzɪˈɒlədʒɪ/ n. **生理学**

⑤ attraction /əˈtrækʃən/ n. **吸引("吸引"这个概念在盖仑的生理学中起着关键作用。它是指血液和营养是被人体的各个部位吸引过去的,而不是被灌入或输入的。)**

⑥ therapy /ˈθerəpɪ/ n. **治疗**

⑦ blood letting **放血**

be rethought. The deeper significance of Harvey's discovery, then, was that it helped instigate[①] a complete rethink of the way that the body works and how it should be treated. Ultimately, Galen's anatomy[②] and physiology were not in need of improvement, as the Renaissance[③] anatomists had attempted, but complete rejection.

What led Harvey to such a momentous discovery? What were the experiments and arguments that Harvey used to support his theory? Who and what did he have to struggle against in order to get this remarkable and controversial new idea accepted? These are some of the questions that this book will try to answer. Firstly though, we need to look briefly at the three ancient Greeks Harvey most admired, Hippocrates[④], Aristotle[⑤] and Galen. We also need to look at the nature of the Renaissance,

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① instigate /ˈinsti eit/ v. 教唆; 怂恿; 煽动

② anatomy/ ˈh t mi/ n. 解剖学

③ Renaissance /riˈheisns/ adj. (欧洲 14 至 16 世纪的) 文艺复兴的; 文艺复兴时期的

④ Hippocrates /hiˈp kr ti z/ 希波克拉底(460—370 BC, 古希腊医师, 被称为"医学之父", 生平不详, 现存《希波克拉底文集》, 内容涉及解剖、临床、妇儿疾病和预后等, 但经研究, 该文集并非一人一时之作)

⑤ Aristotle /ˈrist tl/ 亚里士多德(384—322 BC, 古希腊哲学家和科学家, 柏拉图的学生, 亚历山大大帝的教师, 雅典逍遥学派创始人, 著作涉及当时所有知识领域, 尤以《诗学》、《修辞学》等著称)

and at the advances in anatomy made by Vesalius[①] and Fabricius[②], in order to understand the state of anatomy, physiology and medicine as Harvey found it (anatomy studies the structure of the body, while physiology studies its function).

One final comment before we begin. Harvey carried out many experiments, often with fatal consequences, on live animals. It is necessary to describe these, in order to understand Harvey's arguments in favour of the circulation of the blood. This should not be taken to imply that I condone[③] such experiments. As a matter of historical fact, vivisection and the use of animals in research were taken for granted in the seventeenth century and were not matters of debate. The seventeenth century simply did not share, and indeed had no conception of, our twentieth-and twenty-first century attitudes towards the rights of animals.

Reflection

英国医生威廉·哈维于 1618 年前后发现，血液在人体内做快速循环运动。这在我们今天看来既基本又明显的事实，其发现在当时意义

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① Andreas Vesalius 维萨里(1514—1564，比利时医师、解剖学家，现代解剖学的奠基人，曾在意大利帕多瓦大学讲授外科学，首次以解剖人尸作教学演示，著有《人体结构》[7 卷])

② Fabricius(Girolamo Fabrici) 法布里齐(1533—1619，意大利解剖学家、外科医师，是威廉·哈维的老师和静脉瓣的发现者)

③ condone /k n ˈd un/ v. 宽恕，不咎(罪过)

非常重大。

哈维的发现与当时公认的盖仑的观点正好相反。盖仑是古代最伟大的解剖学家。他的观点的经历了1,500年之后仍然被人们毫不怀疑地接受。根据盖仑的观点,血液是由肝脏生成的,然后逐渐被全身消耗,为身体提供营养;血液从肝脏缓慢地流向身体的其他部位,却不流回肝脏。哈维的发现促使人们重新考虑人体器官活动。它意味着完全抛弃盖仑的解剖学和生理学理论。

1

The Background to Harvey's Discovery

Guiding Questions

1. Why was dissection of humans virtually impossible in Galen's time?
2. Why could Galen's ideas on the motion of the heart and the blood find defenders even in the seventeenth contury?
3. What made Galen believe that there were two quite separate blood systems in the human body operating simultaneously?
4. What views of Galen's did Harvey have to struggle to replace?
5. How did the Renaissance differ from the Middle Ages in its attitude toward learning and discovery?

6. What is the critical difference between medieval and Renaissance dissections?
7. Is it true that anatomy, prior to and during the Renaissance, was held back by a lack of bodies to dissect? Why?
8. How did Vesalius improve Renaissance anatomy?
9. In what way was Fabricius important for Renaissance anatomy?
10. What contribution did the art of Renaissance make to science and anatomy?

The beginnings of the systematic study of the human body can be traced back to the ancient Greeks and a collection of books known as the Hippocratic corpus[①]. These were written by Hippocrates (460—370 BC) and his followers around the fifth to the third century BC. The Babylonians[②], the Egyptians and other societies prior to the Greeks had a rudimentary[③] and practical knowledge of anatomy and healing techniques. It was the Greeks, however, who began to systematise[④] this knowledge. They introduced proper scientific method, and emphasised that diseases were due

① Hippocratic corpus 希波克拉底文集
② Babylonian / b bi ˈl unj n /n. 巴比伦人
③ rudimentary / ru di ˈment ri /adj. 初步的; 基本的
④ systematize / ˈsistim taiz/ v. 使系统化; 使成体系