THE BRITISH APOLLO—INDICATIVE OF EARLY EIGHTEENTH CENTURY INTEREST IN NATURAL PHILOSOPHY 1708-1711

BY

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1708-1711

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Florence Ford McCann

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PREFACE

For a cross-section of early eighteenth-century thought, few sources are as valuable as The British Apollo, that popular periodical which flourished from 1708 until 1711. In it we see the reflection of a wide range of interest in such fields as literature, etymology, law, religion, mathematics, science, natural history, metaphysics, and affairs of the heart.

Scientific interest predominates, with religion holding second place and affairs of the heart, third. It is this curiosity in matters pertaining to natural philosophy that will be considered in the following chapters. This blanket term includes a variety of problems connected with man himself and with the world about him. It does not take in the more particularized field of mathematics, nor the more complex ones of philosophy and metaphysics.

What were people thinking about during those comparatively quiet years between the scientifically productive last
half of the seventeenth century and the golden age of science in the last half of the eighteenth? What problems worried them? What old superstitions still darkened their minds? These are the questions this survey will attempt to answer, through the medium of The British Apollo.

F.F.M.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>CHAPTER</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>PREFACE</td>
<td></td>
</tr>
<tr>
<td>I THE GENESIS OF THE BRITISH APOLLO</td>
<td>1</td>
</tr>
<tr>
<td>The Apollo Organization</td>
<td>1</td>
</tr>
<tr>
<td>Earlier Influences on the Apollo</td>
<td>3</td>
</tr>
<tr>
<td>Seventeenth-century periodicals</td>
<td>3</td>
</tr>
<tr>
<td>Seventeenth-century science</td>
<td>15</td>
</tr>
<tr>
<td>II THE INTEREST IN ASTRONOMY</td>
<td>19</td>
</tr>
<tr>
<td>III THE INTEREST IN BIOLOGY</td>
<td>31</td>
</tr>
<tr>
<td>Of Plants</td>
<td>31</td>
</tr>
<tr>
<td>Of Animals</td>
<td>35</td>
</tr>
<tr>
<td>Of Human Beings</td>
<td>70</td>
</tr>
<tr>
<td>IV THE INTEREST IN CHEMISTRY AND PHYSICS</td>
<td>119</td>
</tr>
<tr>
<td>V THE INTEREST IN PHYSICAL GEOGRAPHY</td>
<td>133</td>
</tr>
<tr>
<td>Hydrology</td>
<td>133</td>
</tr>
<tr>
<td>Meteorology</td>
<td>140</td>
</tr>
<tr>
<td>Mineralogy</td>
<td>150</td>
</tr>
<tr>
<td>BIBLIOGRAPHY</td>
<td>161</td>
</tr>
</tbody>
</table>
THE BRITISH APOLLO—INDICATIVE OF EARLY EIGHTEENTH CENTURY INTEREST IN NATURAL PHILOSOPHY

1708–1711
Chapter I

THE GENESIS OF THE BRITISH APOLLO

Of the various schemes undertaken by Aaron Hill, The British Apollo was undoubtedly of most interest and value to the greatest number of people. Yet, ironically, it was an undertaking for which its promoter had comparatively little enthusiasm after the first few months. To the energy and perseverance of Hill's assistants the Apollo owed whatever popularity and success it later attained.

Published twice weekly until Number 79, then three times a week for the remainder of the four hundred and ten numbers (ending May 11, 1711), the Apollo was a one-sheet folio selling for a penny. During its comparatively brief existence, it

1Among other things, Hill was interested in play writing, theatrical management, the repair of Dagenham Breach, publication of The Present State of the Ottoman Empire, and schemes for extracting oil from beech-mast and for manufacturing wine in England. For further details concerning Hill's projects, see Dorothy Brewster's Aaron Hill, New York, 1913, chapter II.
underwent several changes in form and issued several supple-
ments. In arrangement it was chiefly questions and answers, in-
terspersed frequently with verse. The verse form is also used in a number of regular questions and answers. Occasionally a question will be found in dialect, Greek, Latin, or Hebrew, the reply usually being worded in the same language as the query.

The questions deal, in general, with three main topics: theology, natural science, and "affaires du coeur," with scattered interest in literary matters, legal problems, metaphysics, mathematics, and unadulterated foolishness. They are answered, for the most part, in the spirit in which they are sent, although occasionally there is an apparently serious question answered in such a flippant manner as to make one wonder whether such a method might not tend to decrease the paper's circulation. Readers on the whole must have been well satisfied, as even those most thoroughly rebuffed seem to have sent in further questions. Only occasionally do we find a contribution signed, but in such rare cases the contributor, appearing again and again in succeeding numbers, becomes a definite personality whom we come to recognize as an old friend.

It is difficult to tell just who was associated with the Apollo, and practically impossible to ascertain which questions each one answered, since anonymity was part of the stock in trade. We do know that Aaron Hill was the prime mover in the undertaking, assisted chiefly by Marshall Smith and to a lesser degree by John Gay, Dr. James Mauclerc, Dr. William Coward, possibly Dr. John Arbuthnot, and perhaps Roger Grant. To what extent the questions may have been composed by these editors themselves to fill up space or catch the public's fancy, we shall probably never know. The most logical procedure is to consider them as bona fide inquiries, indicating the trend of public interest at that particular time.

Before we turn to the Apollo itself for evidence of the scientific tendencies of the period, we should glance at two most important phases of the preceding century—factors which had a very definite influence upon The British Apollo: late seventeenth-century periodicals and late seventeenth-century science.

The distinctive features of The British Apollo: the question-and-answer method, the topics treated, and the format, were all foreshadowed in the periodicals of the preceding century. It was no new procedure in the field of journalism, though it was a most significant one. The majority of those periodicals which were technically ancestors of The British Apollo resembled only vaguely that early eighteenth-century
publication; many had a short, sometimes unsavory existence. Most important are those which definitely appear to have influenced the Apollo as regards purpose, subject matter, or method of presentation.

Prior to 1708, at least three publications of importance had employed the question-and-answer method: The Athenian Gazette of 1690, The Gentleman's Journal of 1692, and Defoe's Review of 1704. Minor periodicals, as The Lacedemonian Mercury and The Post Angel, had also adopted it successfully; none had so entertainingly presented both questions and answers in verse form.

To some extent, The British Apollo treated a different type of subject matter, although preceding publications had in several cases indicated where public interest lay. As we have noted, the Apollo's information dealt chiefly with theology, natural science, and "affaires du coeur." Aside from several denominational weeklies which had made their appearance at various times, only two comparatively successful periodicals had dealt in considerable detail with religious affairs. The Compleat Library, edited by Richard Wolley in 1682, featured original articles on the Scriptures; John Dunton's The Post Angel: or, Universal entertainment: a new Athenian Mercury, etc., with a spiritual Observator upon each head also showed a religious trend. The latter appeared monthly from January 1701 and contained unusual news items, obituaries, book reviews, poems, and essays. Numerous compilations such as the
Miscellanea Sacra of the early eighteenth century dealt with religious topics, but not in any really informative way.

Prior to 1708 scientific periodicals were chiefly annual publications. However, Robert Hooke's Philosophical Collections, seven numbers of which appeared in 1679, was made up chiefly of scientific articles, being a commentary on useful discoveries. Scientific in part, yet extremely practical, was John Houghton's Collection for the improvement of husbandry and Trade. This appeared September 8, 1681, published monthly (approximately) until September 24, 1703, at the cost of one penny per copy. One of the most valuable periodicals of its class, this paper included a variety of subjects and employed the talents of such men as John Evelyn and John Worlidge. Also scientific in the popular manner was the monthly History of Learning, 1691, which, in addition to literary criticism, dealt with scientific discussions of new developments in natural philosophy, physics, and mathematics. This may be considered as one with its sequel, J. de la Crose's Works of the Learned, which soon ceased to appear as a monthly but survived for a time with several issues a year.

Throughout the latter part of the seventeenth and early part of the eighteenth century, miscellanies were unusually popular, and The British Apollo incorporated some of the better features of these. A monthly collection of poems, the 1697 Miscellanies over claret had a decided vogue at that time, as did Pacquet from Parnassus, a 1702 miscellany of verse plus
some prose. John Oldmixon's *Muses Mercury*, a monthly publication of 1707, resembled closely the earlier *Gentleman's Journal* which we shall consider shortly. Subtitled *The Monthly Miscellany*, Oldmixon's periodical included items pertaining to opera, literature, and the stage; some few translations; songs, and poems by such literary figures as Roscommon, Steele, Garth, Motteux, Tate, Dennis, Manning, and others. Another contender for popularity appeared shortly as *The Monthly Miscellany: or Memoirs for the Curious*, a most interesting and unusual journal, edited or at least largely compiled by James Petiver. It included essays on all kinds of subjects: divinity, law, philosophy, natural history, and science. There were also news items, advertisements, book reviews, travel accounts, poetry, and short sketches. A glance at the contents of the first volume reveals: "American Flowering Ferns," "A Voyage to the Levant," "A Novel," "The State of Poetry in Ancient Greece," "The Virtues of China Drugs," "A Voyage to China," "Maxims of Piety and Morality," and "American Beasts."

But all other periodicals of those days pale into insignificance beside the literary efforts of John Dunton, whose *Athenian Gazette* appeared March 17, 1690, and continued until February 8, 1695—"Dunton the literary projector...a crack-brained, scribbling bookseller, who boasted he had a thousand projects fancied he had methodized six hundred, and was ruined by the fifty he executed." ³ Since this literary effort was so

...
decidedly a direct ancestor of *The British Apollo*, we shall do well to consider it at greater length than its predecessors. Dunton originated the plan for *The Athenian Gazette*, but it was not long before he took Dr. Richard Sault as joint editor. Shortly after the second issue appeared, these two were joined by Dunton's brother-in-law, Samuel Wesley. Although Dunton had previously been connected with Wesley in several business ventures, it was not long until the two men parted in irreconcilable hatred. 4 Richard Sault, the other partner, had previously translated Malebranche into English for Dunton, written "A Treatise of Algebra," and a preface to *The Second Spira*. 5 Sault was skilled in mathematics and later taught at Cambridge. The Athenian Society apparently consisted for a time of these three men only, occasionally assisted gratis by Dr. John Norris who refused to become a stated member of the group, but whose wide reading and phenomenal memory helped out on numerous occasions. Within a short time, however, Norris became alienated from his associates as a result of the Athenians' comment upon his criticism of Locke's *Essay concerning Human Understanding*. 6 Occasional contributions were also received from several of the

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4 For details concerning Dunton's story of this quarrel, see *The Life and Errors of John Dunton*, London, 1818, I, 164-165.

5 One of seven out of his 600 books, which Dunton repented printing.

most eminent writers of the age (Tate, Motteux, Defoe, Charles Richardson), including a laudatory poem from the pen of Swift, the novice.  

Intended originally "to open the Avenues, raise the Soul, as 'twere, and restore the Knowledge of Truth and Happiness, that had wander'd so long unknown, and found out by few," the Athenian Gazette immediately caught the public fancy. The editors sometimes found themselves at a loss for a solution, but never for an answer, and managed to go on replying to questions in a quiet, grave, sometimes evasive way, giving here and there a scrap of information. If we consider some of the answers absurd, we must realize that the questions inspiring them were no better. Asked when angels had their first existence, the oracles countered with "Who but an angel knows?" To a question whether public or private courtship is better, they replied that "Private is more safe and pleasant." Other catch questions inquired whether fishes think, whether snow is black or white, whether Adam and Eve had navels, what colour is, and where extinguished fire goes. Several years later, the Apollo editors were equally successful in being evasive when faced by some obviously unanswerable questions.

7Dr. Johnson later wrote, in his life of Swift: "I have been told that Dryden, having perused these verses, said, 'Cousin Swift, you will never be a Poet,' and that this denunciation was the motive of Swift's perpetual malevolence to Dryden." (Quoted in Dunton, op. cit., xvii).

8Dunton, op. cit., p. 248.
The Athenian Gazette had not long been under way when in 1691 Dunton was forced, "to oblige Authority," to change its title to The Athenian Mercury. This paper attained such popularity that Thomas Brown and William Pate promptly produced an imitative version of their own entitled The Lacedemonian Mercury, first issued February 1, 1691, as The London Mercury. This bubble Dunton proceeded to prick by advertising that all questions answered in the new publication would be answered all over again in The Athenian Mercury, with amendments, together with the life of Tom Brown, one of the culprits. A little coercion made the latter see things in Dunton's way, however, so that the threatened exposure of Brown's "wretchedly out of order" morals was not necessary.

Several other attempts were made to discourage Dunton and his associates. One such effort was Elkanah Settle's New Athenian Comedy of 1693, which burlesqued the aims and methods of the society. Dunton at one time remarked cheerfully of this drama that the author's genius was quite run out towards the conclusion of the third act, and could not carry it an inch farther. Apparently this attack bothered them less than

The reason for this change, as given in vol. I, no. 12, is: "Gaza signifies a Treasury, and therefore we reserve it for the general Title of our Volumes, designing to entitle 'em the Athenian Gazette, or Casuistical Mercury: and Mercurius signifying a Messenger 'tis the more proper Title for the single Papers, which run about to Coffee houses and elsewhere, to seek out Athenians."

10Dunton, op. cit., p. 190.
did the displeasure of a prominent earl who took offense at a question discussed by the Athenians, for Dunton and his con-
freres were forced to pay twenty-five guineas to a certain Captain M—al before being permitted to continue publication.

On the other hand, the Marquis of Halifax provided a valuable testimonial by admitting that he read the Mercury regularly,
and had received great satisfaction from many of the answers. Also in the "satisfied customers" list were numbered Sir Willia
William Temple, Sir Thomas Pope Blount, Sir William Hedges,
and Sir Peter Pett. In spite of all draw-backs, the Athenian Mercury was unquestionably of great importance. Unique in
plan, it was valuable for its dissemination of knowledge, and
decidedly popular. More than any other publication, it served
as a model for the later-day British Apollo.

A short while after the first issue of The Athenian Mercury, another important publication made its appearance.
This was The Gentleman's Journal, edited by Peter Anthony Motteux, translator and dramatist. In reality a sort of mis-
cellany, this resembled the modern magazine more nearly than any other periodical appearing for many years. Published
monthly during 1692, 1693, and part of 1694, each number con-
tained a small amount of news, essays on various subjects (as "An Historical Account of Music," "An Account of the Nature of Dryness and Moistness," "Of the Possibility of Perpetual Motion"),

11 Dunton, op. cit., p. 191.
fables in prose and verse, short sketches and verses by such literary figures as Matthew Prior, John Oldmixon, John Dennis, Nahum Tate, Tom Brown, Sir Charles Sedley, Mrs. Aphra Behn, and Thomas D'Urfey. This Gentleman's Journal also boasted three decidedly modern features: short book reviews, riddles designed to be followed in the succeeding issue by the correct answers plus a list of the successful solvers, and a "Lover's Gazette" section in the popular question-and-answer form later effectively employed in The British Apollo.

The third important periodical to make use of this same form of presentation was Defoe's Review of 1704. Carried on for the first six months while the author was in Newgate prison, this Weekly Review of the Affairs of France was later called A Review of the Affairs of France, with some Observations on Transactions at Home. Early in 1706 the paper once more changed its title to A Review of the State of the English Nation, and continued until June 11, 1713, presenting news of the times, plus commentaries on current affairs, and a few essays. Answers to correspondents were printed under the title of "Advice from the Scandal. Club." After the second volume, this division was retitled "Miscellanea." Here we find problems similar to those discussed in pages of The Athenian Mercury: immortality of the soul, Biblical subjects, and similar popular themes. Defoe admittedly added this section in order to increase the Review's circulation, but at the same time made a decided effort to avoid the trivial and the absurd.
Since The Athenian Mercury was so obviously the prototype of The British Apollo, we may well wonder to what extent the subjects treated in the two publications were similar. A consideration of four hundred questions from each of the two periodicals reveals interesting parallels, with in some cases enough variation to provide food for speculation. As regards questions of a purely literary nature, the Mercury included thirty-four, many of which dealt with the editors' opinions on certain books and literary passages. The Apollo printed only seven such questions, one of which closely resembled an earlier Mercury inquiry whether Milton or Waller was the greater poet. Seven Mercury and six Apollo questions dealt with word origins, the latter periodical referring the questioner in one case to the Mercury, where that same word had been explained years before. Readers sought legal advice from the Mercury in ten instances; from the Apollo in four. In the former case, most inquiries dealt with matrimonial complications, such as a woman having two husbands living, or the legality of marrying a deceased husband's brother. Affairs of the heart were unburdened upon the Mercury in sixty-five cases; upon the Apollo in fifty-four. Twelve of these latter were identical with earlier Mercury questions, although the answers varied considerably. One hundred and ten inquiries concerning religion

12 The questions from The Athenian Mercury and The British Apollo were selected consecutively from volumes most nearly corresponding in order of time.
were sent to the Mercury, as opposed to seventy-four sent to the Apollo. Nearly one-fifth of the former and one-third of the latter sought some rational interpretation of Biblical passages. Other queries nearly identical in both periodicals dealt with baptism, the number of people destined for heaven, light existing before the creation, whether the Bible countenanced the marriage of cousins and the use of patches, of what a sin against the Holy Ghost consisted. Sixteen Mercury and seventeen Apollo readers asked questions concerning metaphysics, both groups being concerned with the rational power of souls and their condition after death. Only two readers sent mathematical problems to the Mercury; thirty-four to the Apollo. Scientific questions were more evenly divided, the Mercury printing fifty-seven and the Apollo sixty-seven. Questions proposed to both papers included matters pertaining to the sun and moon, and queries concerning the infinite divisibility of matter. It seems odd that the Mercury should have received only two obviously pointless questions apparently calculated to confound the editors, whereas the Apollo inspired nineteen. We must note, however, that the editors of both periodicals had an effective system of dealing with such foolishness.

We may safely say that the Apollo is indebted to the Mercury for its general set-up and method of presentation. Although several Apollo questions are nearly exact duplicates of earlier ones in the Mercury, we cannot honestly conclude that they were borrowed from the latter periodical. In most
instances the similar queries deal with topics of such general interest as affairs of the heart and the relative merits of two popular poets. In fact, the Apollo is so prompt to acknowledge its indebtedness to the Mercury that it is difficult to believe that there was any conscious plagiarism on the part of the former, even when identical questions concern such a technical subject as the infinite divisibility of matter.

Questions answered in the two periodicals fall generally into the same classifications, although there were many more of the miscellaneous type, difficult to allocate, sent to the Apollo. The editors of that publication seem to have discarded (or at least to have refrained from printing) complaints from unanswered readers, and to have wasted less space on apologies and promises to answer more questions next time. There are, however, more obviously foolish queries answered in the pages of the Apollo. Possibly if the editors had not presented answers to that type in such entertaining form fewer such questions would have been sent in. The same holds true for rhymed queries. Apollo seems to have encouraged more questions in verse form by answering in a most amusing manner those submitted. By means of such novel approaches to the Mercury type of subject matter, and by the inclusion of numerous short verses, the Apollo numbers attained decidedly more variety. From a cursory survey of the two periodicals, it would appear that the Apollo more nearly succeeded in being amusing as well as instructive, discriminated more as to questions answered, and in general covered a wider range of subject matter, than
did the earlier **Mercury**.

To a degree, all of the three important forerunners of the Apollo (The Athenian Mercury, The Gentleman's Journal, and Defoe's Review) had been influenced by the scientific progress of the period. Their pages reflected the interest people were beginning to take in the discoveries by scientists at home and abroad. From the earlier blind dependence upon authority, people were turning to a reliance upon direct observation. As a result, astronomy and physics were being placed on a more solid basis, and every effort was being made to bring order out of the chaos of anatomy and physiology.

This new science appealed more to the curiosity of the average man than to his intellect. People suddenly felt a desire to know the wonders of the world about them, to understand apparent phenomena, and to investigate strange and unusual facts. Notable scientific advances were being made, but at the same time many now fantastic speculations were being put forth. Highly developed vertebrates, such as eels, were supposed to be spontaneously generated. Maggots were thought to be similarly produced out of decaying meat—a theory long existent; fossils were considered the remains of half-formed beings. Even John Woodward, a leading authority on geology, and one of the founders of experimental plant-physiology, was completely confused regarding the true distribution of fossils in the earth's strata. Much remained to be learned.
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In recent discussions on the role of modern and official

employee relations in all of the areas not too much attention

has been paid to the question of how professional and official

are best adapted to the task of organizational change and in

order to achieve effective and meaningful change in the

system of employee relations. Besides the obvious need for

information that may be considered essential for an overall

circular view on the subject, there is also a need to consider

whether a more detailed look at the factors affecting the

change process can be made on the basis of the findings and

conclusions reached. It is generally agreed that the

change process involves both individual and organizational

factors. However, the extent to which these factors operate

in an integrated manner and their relative importance in

the change process is not fully understood. While it is

clear that individual factors, such as personality traits and

motivational factors, play a role in the change process,

organizational factors, such as the structure and culture of

the organization, are also important. Additionally, the

interaction between individual and organizational factors

is crucial in determining the outcome of the change

process. Therefore, a comprehensive understanding of the

change process requires an examination of both individual

and organizational factors.
To combat these and other erroneous theories through mutual research and a pooling of information, the Royal Society of London was formed in 1660 and chartered in 1662—a group which during the next few years was to include such now-famous names as Newton, Ray, Willughby, Leuwenhoek, Flamsteed, Wren, Boyle, Wilkins, Hooke, Wallis, Sloane, and Halley. In their discussions, all sorts of topics were treated: a universal language, grafting of oranges, power of the imagination, best methods of catching carp, raising tobacco, and the possibility of a Resurrection. They were determined to accept nothing simply from report; there must be demonstration wherever possible, otherwise the best evidence that could be obtained. Members of the society seem occasionally to have gone astray from their pledge to avoid the problems of "Divinity, Metaphysics, Morals, Politics, Grammar, Rhetoric, and Logic" and "to read in the Great Book of Nature to walk in its Garden and taste its plenty, instead of idle talking and wandering," but they certainly were progressive at heart and did everything in their power to further the cause of true science. This was doubly difficult in view of the fact that the Royal Society members themselves were by no means free from the popular beliefs and superstitions of the time. Sir Christopher Wren


related in good faith an alleged instance of "sympathy" between a wound and a bandage lately removed from it; attempts were made to produce vipers from the powdered lungs and livers of those reptiles; and several magnetic cures were reported. Even Harvey clung long to the old superstitions.

Aside from their actual experiments and mutual interchange of observations, the Royal Society proved helpful in several other ways: suggestions about how ordinary people could further scientific investigation by careful observation and reporting; popular lectures given in London by individual scientists; publication of scientific books; publication under the title Philosophical Transactions of all papers read at the meetings of the Royal Society. It is difficult to determine to what extent the latter publications were familiar to the public. Certainly copies were on sale in London, Cambridge, Exeter, Bristol, and perhaps Ireland and Scotland. University students came in contact with the Transactions in classes and undoubtedly discussed them among themselves. But the public could scarcely have been familiar with them to any great extent; questions sent to The British Apollo would seem to indicate that they were not widely known. It is safe, however, to assume that the average layman knew the gist of what was being done, but that few took the pains—granting them the ability—to follow the researches carefully. In any case, the

15 Duncan, op. cit., p. 16.
majority of the four hundred and twenty-five questions sent in to The British Apollo, dealing directly or indirectly with science, show more interest in natural phenomena noted in the course of every day life, than in scientific technicalities. Apollo readers were not interested in the anatomy of the asterias caput medusae (star fish) or in an explanation of the earth's strata; they wanted rather, to know where swallows spent the winter and whether coffee was really harmful as had been reported. Then, as now, interest centered around the unusual, the weird, the marvelous, and the monstrous.

It is with this group of questions—dealing more or less directly with natural science—that we shall be concerned in the following chapters. A consideration of these, with their answers, should clarify the trend of public thought and indicate to what extent the Apollo assisted in the dissemination of fact and the abolishment of superstition.
One of the greatest accomplishments of seventeenth-century science was to provide a satisfactory basis for astronomy and to go far toward destroying the old astrological superstitions. By the middle of that century, it had become fashionable to dabble in astronomy, and even amateurs were making truly remarkable discoveries. All of this was dependent, of course, upon Galileo’s construction of the telescope in 1609, followed by his discoveries concerning the four satellites of Jupiter, the nature of the Milky Way, the presence of sunspots, and other important facts. He led the way for the many who followed.

In the Royal Society (which had been in actual existence nearly fifteen years before it was legally organized) reports were read concerning comets, new stars, eclipses, and the Milky Way. The Ptolemaic versus the Copernican system was discussed at great length; men wondered what force could cause
the planets to move around the sun, and what the courses of
those movements might be.

By the last decade of the seventeenth century, Isaac
Newton had an answer to all such problems: he offered a new
conception of the heavens, earth, and the infinity of space;
he charted the position and motion of the planets, in relation
to the sun; he explained the phenomena of colors and analyzed
light rays; he found the air to be an actual substance, with
weight and related qualities of its own. Of the many scien-
tists and pseudo-scientists of his age, Newton was easily the
most distinguished, not only in astronomy and physics but in
divers related fields. Although not a regular attendant at
the meetings, Newton was a member of the Royal Society, and
was often persuaded by friends to send in accounts of his ex-
periments and observations. Newton's works are referred to
often in British Apollo answers.

Public interest in astronomy, as evinced in the Apollo,
was comparatively slow. Yet in 1711 we find one reader in-
quiring who "has wrote the plainest Astronomy, and where may
their works be had?" The editors recommended Luit's Astronomica
Institutio, on sale in Duck Lane, as "as easy a treatise of
Astronomy as you can well desire."¹ This was not one of the
books reviewed by the Royal Society in their Philosophical

¹ The British Apollo, London, 1740, volume III, p. 1002.
(All future references to the Apollo will be merely to volume
and page: as III, 1002).
To ascertain our lies (and you will know them even if I advise you not to)

on your deathbed about...
Transactions, which seems strange in view of the fact that between the establishment of the Royal Society and the date of that particular Apollo question, five hundred and forty-four books of a scientific nature had been discussed by that organization.

We find three definite questions concerning the Copernican theory. One asks whether "this terraqueous globe does continually move on its axis, and so the sun is fixt in its centre; or whether that is continually moving, and this orb fixed and immovable." If the latter be true the reader wishes to know "how does the sun compass it [the earth] in so small a space as 24 hours and why the moon in so long a space as 28 days?" The answer to this question explains that the revolution of the earth on its own axis may be gathered from the fact that infinite wisdom would scarcely choose a rapid, unnatural motion when such an easy, natural one was at hand. Further explanation shows that the speed of revolution of sun and moon is easily accounted for by the vastly greater distance of the latter from the earth. The second question on this subject is written in verse form, though apparently in all seriousness. It asks—referring to Apollo as the sun:

Some allow you a coach and four horses, and say,  
You ride round the globe in a natural day;  
Whilst others imprison you close in a CENTER,  
Out of which for your life you dare not once venture

\[2\text{II, 349.}\]
Whilst th' earth is whirl'd round in a vigorous flight,
Like a pig amongst mortals, transfixed with a spit,
Then tell us, good PHOEUS, which rightly has hit?

To this metrical query, the Apollo replies in like form, after warning the reader not to be so presumptuous as to probe such mighty secrets:

'Tis enough that APOLLO'S bright INFLUENCE reigns,
And quickens your thoughts with poetical strains;
You had best at a distance gaze up and admire,
For the blest in his WARMTH may be burnt by his FIRE.

In spite of Apollo's explanatory answer to a similar question in a preceding issue, we find a third reader venturing a query concerning "whether the sun goes round the earth, and the earth stand still; or whether they both move, and how they move?" To this Apollo replies briefly, agreeing with contemporary astronomers that the sun is an immovable center, round which the planets move by different revolutions and adding that the elliptical course of the earth is the reason she does not continue equidistant from the sun. Several issues later one reader, possibly the same querist, writes arguing that the immovable position of the sun and the elliptical shape of the earth are consonant neither with Scripture nor with reason. The reader quotes Biblical references to prove that in the days of Joshua the sun was stopped in its course from time to time and argues that if the earth were elliptical, the city of

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3II, 421-422. 4II, 610.
London must be sometimes elevated and sometimes depressed. The *Apollo* makes short work of the Biblical reference by replying that the Scriptures were never designed to teach us a method of astronomy, and that one must not take in a technical sense such phrases as are merely sanctified by convention. As to the elliptical shape of the earth, the answer is, of course, that it is not the earth itself that is elliptical, but rather her course round the sun.\(^5\)

Early in the life of the *Apollo*, we find a reader worried about how the earth can be supported by the airy element. The reply is that the two different motions of the earth (namely, its projectile and its gravitating motion) so affect and determine one another, as to produce its constant elliptical motion about the sun.\(^6\) Another reader wonders whether the sun, moon and stars are all in one sphere, or not, and receives the reply that the moon is the lowest with the sun next.\(^7\) Still another doubting Thomas inquires how the earth in its annual motion makes such a considerable inclination to the sun, and none to the fixed stars. This is answered by mention of the great distance of these fixed stars from the earth, hence their inability to exert any very powerful influence. The *Apollo* editor in this case, as in several others, concludes his technical remarks with the pious reminder: "Manifold are thy

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\(^5\)III, 970.\(^\)

\(^6\)I, 191.\(^\)

\(^7\)II, 567.
works, 0 Lord; in wisdom hath thou made them all."  

Once satisfied with the superiority of the Copernican system, readers apparently turned their attention to the more minute technicalities and apparent inconsistencies that they observed. "Why," asks a reader, "is it colder in the winter when the sun is nearer to us than in the summer?" ...The sun-beams not falling so perpendicular, but more obliquely," replies the Apollo, "the reflected rays are more scattered, and come not so near to those of incidence, and consequently are weaker," adding several illustrations to prove the point. Halley, years before, had calculated the proportions in which the warmth of the sun is shared along the various latitudes of the earth at each season of the year. His findings, which took into consideration even the possibility of atmospheric interference, had appeared in the Philosophical Transactions of the Royal Society, and had been an accepted theory since that time. 

"But is the sun really greater than the whole earth?" another reader asks, in effect. Yes, replies Apollo, "The magnitude of the sun beyond that of the earth is, according to computation, in the proportion of 450 to an unite." A third reader is worried because after he has started out from

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8 III, 698.  
9 II, 674.  
11 II, 574.
The page content is not clearly visible due to the quality of the image and the text appears to be in a foreign language. It seems to be a page from a book or a document, but the text cannot be accurately transcribed without clearer imagery.
London, with the sun directly overhead, he finds that three hours later, though he has gone contrary to the sun's course, that orb is still directly overhead. In answer, the Apollo points out that granted a difference in latitude, there is no spot in England where, on any day of the year, one may perceive the sun directly overhead; hence no two-or-three-hour journey would make any sensible difference to the eye of the traveller. It may be noted also that those who believe in the Copernican system may often express themselves in the common Ptolemaic idiom, speaking incorrectly of the "course" of the sun, whereas in reality the sun does not move. This confusion of Ptolemaic idiom with the Copernican system may be noted in many Apollo questions, as well as in numerous answers. It is almost equally current today, in common speech.

Two questions, sent in about a year apart, inquire about antipodes. One asks whether there is any such thing, and if so, whether they dwell above or below us. Apollo replies that since the earth has been proved spherical, it necessarily follows that there are antipodes for all inhabitants of the earth except in those parts of the globe which are uninhabited. Concerning their dwelling "above" or "below" us, the answerer points out that neither term is appropriate, since antipodes are equidistant from the center of the earth. "How do you prove," inquires the other reader, "that there are antipodes?"

12 III, 918-919.  
13 II, 458.
This question produces the reiterated statement that if the earth is round, there must be antipodes. There follow four clear, simple proofs as to the spherical shape of the earth, making use of familiar, everyday illustrations.  

A number of readers prove curious about the stars and planets. One such querist, anxious to know the reason for his seeing myriads of stars at times and none at others, is rebuffed with the remark that "Where the cloud passes from off your brain, you will apprehend the reason why a clear sky discovers the stars." Equally facetious is the answer to an astrological question submitted during the early months of the Apollo's lifetime: "The astrologer saith, That the planets, etc. have an influence on human nativities. What is the cause then that they have no regard to that of beasts?" Apollo replies: "We shall believe their influence equal on both, till you give us a proof of the contrary from the works of some beast of reputation." A question whether there is any such thing as starry influence on sublunary bodies, aside from that of light and heat, receives the answer that there is a third influence—"that arising from the reciprocal gravitation of all bodies unto one another; whence the original of tides." We find another question dealing with planets in the nature of an inquiry whether Jupiter approaches nearest to

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14 III, 754.  
15 III, 994.  
16 I, 107.  
17 I, 220.
and to develop a comprehensive understanding of the system. The components were
mechanically interfaced to ensure proper alignment and integration. The
interconnections were designed to allow easy assembly and disassembly
for maintenance purposes.

The initial prototype was constructed from aluminum and high-grade steel to
achieve optimal strength and durability. The design incorporated
advanced manufacturing techniques to ensure precision and
cost-effectiveness.

Conclusion

The project has successfully demonstrated the feasibility of the proposed
system. Further refinement and testing are necessary to optimize
performance and address any remaining challenges. The developed
technology holds promise for various applications, particularly in
the field of renewable energy.

References

Energy Conversion, 33(5), 1250-1257.

Engineering, 40(2), 145-152.

Engineering, 51(3), 324-331.
the earth in winter or in summer. The reply is that "in winter he approaches nearest to the earth in general (the earth being then in the perigaeum of that elliptical form, which it describes round the sun) but in summer comes nearest to a perpendicular over us in particular."\textsuperscript{18} Concerning this rotation of Jupiter, interesting observations had been made in the early years of the Royal Society, the results of which were published in \textit{Philosophical Transactions}.\textsuperscript{19} The gentlemen responsible for the conclusions set forth therein were Messrs. Hook and Cassini, who with the aid of a twelve-foot telescope had observed Jupiter from May 9, 1664, during the summer of 1665, until early in 1666, and concluded that the period of apparent revolution was nine hours and fifty-six minutes. The remaining Apollo question regarding planets comes from a reader who has read an obituary listing the cause of death as "planet-struck" and is anxious to know how this malady affects the sufferer. The Apollo takes this opportunity to explode an old superstition by pointing out that the idea is merely an old wives' tale, the truth being that when such people "know not what to make of a distemper, they give it in by some mysterious name, never known to physicians."\textsuperscript{20}

The one other main source of astronomical curiosity among

\begin{footnotesize}
\begin{enumerate}
\item I, 235.
\item \textit{Phil. Trans.}, vol. I, no. 10, p. 171.
\item I, 221.
\end{enumerate}
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Apollo readers is the moon, concerning which they ask a variety of questions. One of the more technical of these inquires how much the moon's apogaeum varies between one lunation and another, and receives this information to aid the reader in making the desired calculations:

The course of the Moon's APOGAEUM round the center of the earth is performed in 32 days 3 hours, and about 5 minutes; whereas a lunation, (which is called the synodical course of the Moon) exceeds its periodical course, which is performed in 27 days, and about 8 hours, but by two days and five hours.\(^21\)

One of the earliest lunar questions sent in asks Apollo's opinion concerning the moon's material substance, its size in comparison with the earth, and the face supposed to be visible in it. The reply lists the material substance as being "of a more rarified contexture than the earth,...less by about 45 proportions." The semblance of a face is laid to either the imagination or to a confusion with the term "phase."\(^22\)

Concerning the movements of the moon, one reader wishes to know why that body, in the space of twenty-four hours, sometimes moves in her orb more than fifteen degrees, and at other times scarcely twelve. The reply is, that it moves eccentrically with respect to us, the center of the figure it describes not being the same with the center of the earth. This varies the celerity of its motion, though only comparatively, as it moves always the same with reference to itself.\(^23\) To a query

\(^{21}\) I, 333.  
\(^{22}\) I, 36.  
\(^{23}\) I, 96.
why the moon looks bigger on the horizon than in the meridian, Apollo refers to the opinion of Dr. Wallis of the Royal Society, that this different appearance of the moon is due to the comparison we draw from the lands and other objects lying between us and the horizon.  

The two remaining questions on the moon are treated by Apollo with tongue in cheek. The one dealing with the possibility of the moon's being inhabited may be discounted by the fact that "Constantia" is inquiring only because she wonders whether lovers may not be more faithful there. Had the question been an obviously serious one, the Apollo might well have returned an informative answer, as the Royal Society had published a number of speculations on the possibility of people living on the moon. One of the most interesting of these may be found in the 1665 Transactions, a treatise by M. Auyout, in which he describes the changes that the reputed inhabitants of the moon would notice on the earth at different seasons of

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24 John Wallis, D. D., was one of the earliest and most versatile of the Royal Society members. From the date of his election in 1662, until his death in 1703, he contributed to the Philosophical Transactions numerous articles on astronomy, mathematics, cryptology, meteorology, and a variety of other subjects.

25 II, 419.  
26 I, 75.

27 Phil. Trans., vol. I, no. 7, p. 120.

28 Adrian Auyout, French mathematician and astronomer, credited with the invention of the micrometer and with being the first person to apply the telescope to astronomical quadrants.
the year. 29 The second obviously pointless question on the moon, sent in by Thomas Trump, asks whether the moon in Ireland is like the moon in England. To this Apollo replies facetiously that while there may be a sisterly likeness between the two, they are "by no means fully alike, for certainly nature, who adapts all things proper, would give a far more glorious moon to GREAT BRITIAN, than to little Ireland." 30

From the foregoing questions it may be seen that although the early eighteenth-century interest in astronomy was not overwhelming, there were a number of laymen inquiring into the causes of certain phenomena and seeking the solution to many apparent inconsistencies. Answers to their queries were furnished by the Apollo in an elementary way, not too technical, well-suited to the mental caliber of its readers.

29 These observations by Auyout and his confrères of the French Academy were made the object of one of the more humorous of Samuel Butler's satires, "The Elephant in the Moon." Butler also undertook a "Satyr upon the Royal Society," an unfinished fragment of which remains.

30 I, 158.
Chapter III

THE INTEREST IN BIOLOGY

Far more extensive and intensive than the early eighteenth-century interest in astronomy was the interest in the various forms of biology, particularly those phases dealing with animals and human beings. Interest in flowers and trees was apparent to some extent, and dozens of inquiries were received concerning medicinal herbs. Since these latter were dealt with chiefly as cures for various ailments, we shall consider them under the heading of Physical Disorders rather than under Plant Biology.

For the sake of convenience, then, we shall consider first, the interest in plants; secondly, in animals; thirdly, in human beings.

Prior to the formation of the Royal Society, there was only the most rudimentary knowledge of plants, their formations and functions. Under the guidance and encouragement of that group
of scientists, important discoveries were made in the late 1600's concerning plant classification, plant sexuality, analogies between plants and human beings, cellular structure of plants, and the flow of sap. The sexuality of plants was by far the most important of these findings. It was first suggested by Sir Thomas Millington soon after the establishment of the Royal Society,¹ and was soon adopted by two of the leading men in that field—Grew and Ray.² The latter worked for a long time on a detailed classification of plants, as did Willughby, well-known zoologist. Yet in that last decade of the seventeenth century men working in England on the question of plant sexuality had no idea of the vast potentialities of cross-pollination. Detailed knowledge of botanical forms came fast during those years, but as late as 1708, when The British Apollo entered the periodical field, plant biology was still in a distressingly sketchy form.

It will be noted that only four Apollo questions deal directly with flowers, one with oranges. The first question asks why a seed taken from a single flower, and sown, produces a double flower—to which the Apollo offers the erroneous reply that probably the new earth affords a greater quantity of the juice necessary for the generation of that flower, than did the old earth.³ The second question asks why a seed taken

¹Some authorities credit this to Nehemiah Grew, but recent opinion seems to favor Millington.
³I, 181.
from a flower of one color produces a flower of various colors. On this answer, too, the Apollo goes far astray by blaming the diversity of colors on the reflection and refraction of light, and by continuing: "to produce a variety of colours in a flower, nothing more is requisite, than that some alteration be made in the situation of those parts, out of which its superficies is compos'd, which may be easily effected, by some small difference in its nutritious juice, or by the ambient air." A third reader is intent on knowing how a certain flower, brought from Madeira the year before, has been able to live and reproduce itself without benefit of any roots or any water. In this matter, the Apollo appears better qualified to offer a solution, as the answer suggests that the flowers "may be of such a nature, as to condensate the air they receive within the pores; and...that air may be condensated into moisture." Londoners of this period had an excellent opportunity to become acquainted with rare plants as there appear to have been several gardens devoted to such about the city. Particularly complete was the Company of Apothecaries' Physic Garden at Chelsea. In 1693 we find an account by Dr. Sloane of several unusual trees, one a silver pine brought from the Cape of Good Hope. Mr. James Petiver's relation in the Royal Society records describes in detail a number of the more unusual flowers brought from the East and

4 I, 182.  
5 III, 979.  
West Indies, from America, and from the Cape of Good Hope.  
That odd flower known as the cat-tail comes in for its share of attention when a reader wishes to know whence the name. Apollo explains that the weed is called "equisetum" in Latin, and "horse-tail" in good English. In some parts of France it is "chaquene," which answers to the English word "cat-tail."  

To the querist who wishes to know why oranges never grow in England, Apollo points out that such northern climates are too cold to bring them to maturity without artificial heat which would in some measure make up for lack of the natural. Oranges had prior to this time been of some interest to Royal Society members, accounts of progress in the culture of that fruit having been read before the group at various times. Of particular interest is a 1675 letter from an Italian observer, telling of an unusual tree near Florence, which had branches, leaves, flowers, and fruit of a most peculiar nature. Some

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7Op. cit., vol. XXVII, no. 333, p. 416. A particularly weird vegetable is described in a question sent by the Royal Society, at the instigation of Sir Robert Moray, to Sir Philberto Vernatti, resident in Batavia in Java. This asks for further information concerning a vegetable said to grow on the island of Sambrero, north of Sumatra. It reportedly "grows up to a Tree, shrinks down, when one offers to pluck it up, into the Ground, and would quite shrink unless held very hard." If forcibly pulled up, it is found to have "a Worm for its Root, diminishing more and more, according as the Tree groweth in Greatness; and as soon as the Worm is wholly turned into the Tree, rooting in the Ground, and so growing great." If pulled up when young, it "turns, by that time it is dry, into a hard Stone, much like to white Corral."--Thomas Sprat, History of the Royal Society of London, London, 1722, p. 161.

8II, 474.

9I, 183.

resembled oranges, some lemons, some citrons, while a few showed
the characteristics of all three forms. It was this sort of
information, the story of an orange with a lemon pulp, for in-
stance, that fascinated the Society members in the later sixteen
hundreds, just as it did the less scientifically minded laymen
of the following decade.

This same interest in the unusual is apparent in the
British Apollo questions dealing with animals. Querists are
eager to hear the explanation of facts that seem to them irre-
concilable, of oddities they see about them every day. This
group of questions divides itself easily into the following
classifications:

On animals in general  5
On birds                27
On fish                11
On frogs and snakes    8
On insects             10
On various other animals  40

In the field of animal biology, John Ray had probably done
more than any other seventeenth-century scientist, to bring
order out of the existing chaos. His classification of animals
took into account two general groups: sanguinea and exsanguinea.
Those he divided as follows:

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\begin{align*}
\text{sanguinea} & \quad \begin{cases} 
\text{with lungs} & \quad \{2 \text{ ventricles (viviparous quadrupeds, whales, birds)} \\
\text{with gills} & \quad \{1 \text{ ventricle (reptiles)}
\end{cases} \\
\end{align*}
\]
Of these groups, scientists seem to have been most in the dark concerning fish. They knew a little about quadrupeds, and had observed a few insects under the microscope, but fish were as yet an enigma to them. And as for such borderline groups as whales and eels—these continued for years to be unrecognized as distinctive types.

In The British Apollo, as in the Philosophical Transactions, there appear to be two recurrent topics of discussion: the question of spontaneous generation and the nature of ambergris. Even Harvey, so progressive in many matters, believed in the former, notably of certain kinds of insects. Ray, Swammerdam, Leuwenhoek, and other scientists rejected the theory, as will subsequently be seen. It seems odd that such a prosaic substance as ambergris should have captured the interest of scientist and layman alike, yet we find nearly as many treatises and questions appearing on that topic as we do on spontaneous generation. Occasionally there is a tendency to confuse ambergris with amber—possibly because of the prevalence of the latter along the shores of the Baltic, where the sea would be likely to cast up ambergris.

Several of the general questions sent to the *Apollo*, on the subject of animals, deal with their mental powers: one inquiring whether brutes think; another, whether all living creatures (particularly the horse) have brains; a third, why beasts can move their ears but men cannot; a fourth, which beast is the most cunning. *Apollo* replies to the first of these questions in an unusually long treatise proving (by the use of instances cited by John Ray, Sir William Temple and Plato) that brutes unquestionably think. This answer disposes of the possibility that animals may perform certain rational actions through mere instinct, and follows through with the usual Scriptural support. The question inquiring whether the horse has brains, is given little consideration by the *Apollo*, which replies: "That an horse hath no gall hath been an old erroneous opinion, but that he hath no brains is a new one; and none but the brainsick or brainless will vindicate it." To the querist concerned about the ability of beasts to move their ears, *Apollo* explains that many beasts lack this ability, just as men do, but that those possessing it have special muscles called "erectores and depressores," which are constructed for that particular purpose. *Apollo* gives the fox credit for being the most cunning of beasts, because of its ability to throw off the pursuing hounds when hunted.

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12 III, 1029-1032.  
13 II, 360-361.  
14 I, 166.  
15 I, 173.
...
The one other Apollo reader interested in animals in general, is desirous of knowing how the wild beasts inhabiting some islands in the Indies first came there. The answer is that they were either taken there originally by men, that they swam there, or that their islands were formerly a part of the continent. 16

Throughout the Apollo issues, there is a considerable interest evinced in birds. Prior to that time, the foremost authority was Willughby's work, published in 1686 by Ray, 17 but many contributions to that field of learning had been furnished since then by Linnaeus and Latham. Throughout the Philosophical Transactions, excellent bird descriptions by Forster are numerous although as late as Apollo days the Royal Society files show a number of completely erroneous superstitions current at the time. Five such beliefs are reflected in Apollo queries.

One of these superstitions is refuted in the answer to a question why birds are immediately struck dead when flying over the Dead Sea. According to the reply, there are certain noxious fumes arising from the bituminous deposits of the sea, which when blown aloft by heavy winds may have given rise to some such erroneous notion. However, one member of the Apollo group has observed that not only do great numbers of birds fly over that sea, but many perch on reeds, floating sticks, seaweed, and similar objects close to the water, without experiencing any ill

16 II, 641.  
17 Willughby's Ornithologiae.
effects. A second popular superstition concerns swan songs. One querist asks whether swans sing at any time of their lives, or whether it be only just before their deaths; another more metrically minded reader inquires:

If silver swans presaging death is nigh,
With tunes melodious, on a gliding Stream,
Their parting life from death strive to redeem,
Or sing in mournful notes their elegy.

To the first query, Apollo gives the opinion "that they never sing at all, but that the original conceit was grounded on the fable of the ancients, that the soul of Orpheus was transmitted into a swan, for which reason the Greeks and Egyptians held that bird in great veneration." To the rhymed query, Apollo replies in kind:

The silver swans, no more than other fowl,
With tuneful notes presage impending death,
The notion of their dying, tuneful breath,
Was meant an emblem of a pious soul.
Such, whose fair life, white as their snowy down,
Not stain'd with the opprobrious marks of vice,
Arriving at the gates of paradise,
Their end with joyful resignation crown.

It is interesting to note that this same superstition had been discussed some sixty years earlier by Sir Thomas Browne in his Pseudodoxia Epidemica. Here we find reference to Plato's story of Orpheus' becoming a swan, and to that bird's being sacred

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18 II, 451-452.
20 III, 907.
now been a common characteristic among these A. However,
contrary to what was once thought, some social norms and
practices have changed and are still evolving to
accommodate these changes.

This is due to the increasing awareness of
people regarding the impact of social norms on
society. This has led to a shift in thinking about how
social norms can be reformed to
address modern challenges.

In conclusion, the
transformation of social norms is
an ongoing process that requires
continuous effort and
understanding. It is essential to
recognize the importance of
adaptability in addressing the
complex issues of our time.
to the Greeks and the Egyptians. After considering the dis-
sent of various authors, the falsity of reputed stories, the
unsuitability of the swan's vocal organs to the production of
music, and the distinctly unmusical note of all swans personally
observed, Browne concludes that "we cannot assent thereto.
Surely he that is bit with a Tarantula, shall never be cured by
this Musick; and with the same hopes we expect to hear the
harmony of the Spheres." 22

Two Apollo questions deal with superstitions concerning
cocks: one, that there are such things as cocks' eggs; the
other, that the crowing of a cock will frighten a lion. To the
first, Apollo replies with a decided NO, and adds that there is
just as much likelihood of a man's falling into labor as of a
cock's laying an egg. 23 To the second, Apollo replies that "the
poor cocks have often prov'd the notion false by a very dear
experience." 24 Browne had discussed this notion of cocks' eggs,
too, in his seventeenth-century work, with these interesting
conclusions:

For if we should grant that Cocks growing old, and unable for
emission, amass within themselves some seminal matter, which
may after conglobate into the form of an egg, yet will this

22 The Works of Sir Thomas Browne, edited by Charles Sayle,
23 I, 225.
24 I, 74. Browne, however, gives some credence to the
ancient accounts of such occurrences, and there is a similar
theory discussed in Chambers' Cyclopædia (London, 1728) that
hens will fly away at the sound of a harp that has been strung
with fox-gut strings.
substance be unfruitful. It is not indeed impossible that... some generation may ensue,... but that this generation should be regular... is beyond our affirmation, and we have good reason to doubt. 25

Browne in this instance was considering the "vulgar error" that certain types of lizards proceed from cocks' eggs hatched under toads or serpents. In support of his theory that some sort of generation may possibly be expected from a cock's "egg," he cites the case of certain "strange and unseconded shapes of worms" which have developed in the body of man "from putrid humours."

The last Apollo question to deal directly with superstitions concerning birds asks whether storks ever live in a monarchical government, the idea having been current for centuries that they would live only in a republic. Apollo refutes this latter tenet by citing instances of their having been reported in Thessaly, Egypt, France, Persia, and the Turkish dominions—all of these monarchical governments. 26 The answer just cited may be considered as definite proof that the Apollo occasionally transplanted answers bodily from the Pseudodoxia Epidemica. From Browne's explanation, one hundred and eighty-five words in length, the Apollo omits one phrase, lengthens one clause, gives seven words simpler synonyms, and makes two other minor changes ("Jeremy the prophet" becomes "the prophet Jeremy" and...

26 I, 109.
Browne's Biblical quotation becomes a mere reference to "Jer. viii, 7"). Occasionally the Apollo gives credit to a source, and in one case even refers the reader to Browne's works, but in this instance no such acknowledgement is made. Whether this is an instance of "padding," with the question itself inserted by the editors, will probably never be known.

Only a few bird questions sent to the Apollo are at all technical: one inquires the nature of the cramp in young birds; another asks how the flight of birds is performed. To the former question, Apollo replies that the disorder is "nothing else but a numbness proceeding from cold"; to the latter, a scientific answer is given concerning the muscular fibres, "swelled and contracted by the influx of animal spirits from the brain." For further information concerning the flight of birds the reader is referred to Alfonso Borelli's De Motu Animalium, Chapter 22. One reader wishes to know why there are more larks than tom tits, when the latter have been known to hatch as many as twenty-four at a time, as opposed to the larks' four or five. Apollo sets the querist straight in this matter by pointing out that nine or ten is the usual number of young tom tits hatched, and that the larks breed not once, but three times during the year. Accounting for the turkeycock's head being sometimes blue and sometimes red, Apollo states that

28 II, 351.
29 I, 157-158.
30 III, 899.
"the Turkey-cocks colours proceed from their passions, or their animal spirits intense operations." The variety of colors on a dove's neck is credited to its reflecting different rays of light in different situations. Two reasons are given for the appearance of owls and bats in the evening only: the weakness of their sight, which cannot bear the light of day; and the fact that their prey does not come abroad till evening.

Apollo seems in doubt about the sincerity of the reader who wishes to know why a goose stoops when she enters the barn door, but after a few humorous verses replies that it may be that the shade of the barn affects the goose's weak sight. Another semi-humorous query concerns the reason a turkey-cock "exclaims" at the sight of a red petticoat—the explanation being that the bird, so proud of his own colors, cannot endure the presence of a rival hue.

One reader is worried about whether a bird dies a natural death, since he has never yet observed one that had not been shot, starved, or otherwise killed. Apollo rightly points out that one man's experience does not necessarily warrant such a sweeping generalization, and adds that even a bird apparently dead of starvation may have come to that end as the result of some perfectly natural distemper.

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31 I, 55.  
32 I, 80.  
33 III, 1000.  
34 I, 159-160.  
35 II, 422.  
36 III, 794.
see why it is considered a crime to harm a robin, obviously a destructive, malicious bird. Apollo mentions, in the robin's favor, its attractive coloring and delightful song, and defends its actions by attributing them to the dictates of nature. 37

Two questions attesting an interest in the affairs of the times, both submitted by the same subscriber, concern the way in which a carrier pigeon, taken from London to Edinburgh, was able to return to its home twice successively in a very short time. After a great deal of "beating around the bush," including instances of Levantine pigeons' returning a distance of twenty-four leagues, Apollo narrows down the possibilities to the birds' organs of sight and of smell as being responsible for this unusual ability. And since in the case of the flight from Edinburgh the former would certainly be out of the question, Apollo concludes the solution is that the pigeons follow a scent they leave in the air—"some effluvia or emanations which did continually flow from their bodies." 38 The subscriber, not at all satisfied with that explanation, returns several issues later with three arguments to disprove it: (1) that the pigeon, if carried in a pocket or bag, could scarcely leave any scent; (2) that the circumvolution of the air would quickly disperse any scent in the intervening nine or ten days; (3) that the pigeon does not return over the same course, but rather in a direct line. These arguments are refuted rather feebly by

37 III, 913. 38 II, 582-583.
Apollo, who contends that unless the pigeon were in a hermetically sealed jar it would surely leave some emanations in the air, which even turbulent winds could not entirely disperse, and that even though the pigeon did return by a more direct route, it need not deviate so far from the original course that all the "scent" would be lost. The argument apparently ended on that note, for no more pigeon fanciers appear in the pages of the Apollo.

Four other questions on the subject of birds receive scant consideration. To the inquiry why the cock's song is more harmonious than that of other feathered creatures, Apollo replies:

The feather'd choir, who stretch their warbling throats, 
And fill the woods with sweet, harmonious notes, 
Have by strong heat their mellow'd voice refin'd, 
Which only warms the cocks of all the kind; 
Cramp'd by chill cold, each hen attends her mate, 
And, unlike London wives, is seldom known to prate.

Asked why a drake has a curled feather on his rump, Apollo answers: "For distinction, as fools have in their caps." To the misguided reader who ventures to inquire whether parrots understand what they speak, the answer is returned: "As well as you what you read, or you'd hardly have ask'd Apollo so wise a question." An inquiry why the lark, who soars so high, makes its nest on the ground, is turned to moralizing account by Apollo in a rhymed reply. After suggesting that the lark seeks

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39 III, 993-994.  
40 III, 724.  
41 I, 42.  
42 I, 144.
the ground as being the safest place for rest, the oracle adds:

A most pathetic emblem this,
To dig it out the surest bliss;
Teaching that grandeur's most refin'd
When 'tis with condescension join'd. 43

Of the five remaining bird questions appearing in the Apollo, three deal with swallows (their peculiar characteristics and winter migration) and the remaining two with the migration of other birds. Readers wish to know why swallows always seek to build their nests in gloomy chimneys, and why those birds fly so low during the wet season. The former query merits the reply that since the swallow apparently seeks heat rather than cold, by appearing in summer rather than in winter, that probably accounts for its preferring a warm, dry chimney for its home. 44 The answer to the second query has to do with the swallow's search for food, as Apollo claims that the bird flies lower in pursuit of the flies which are forced to descend when a shower is approaching. 45 Concerning the whereabouts of swallows and cuckoos in the winter, Apollo replies that in spite of the popular belief that these birds hibernate in hollow trees and subterranean vaults, it is more probable that they seek a warmer climate, as the woodcock seeks a colder one. 46 Readers had prior to this time been concerned over the disappearance of woodcocks in summer and starlings in winter. To this the reply

43III, 885. 44I, 216.
45III, 699. 46I, 135.
As I was running out of energy, I started to slow down. Suddenly, I saw a beautiful flower garden. I was so excited that I decided to explore it further. As I walked through the garden, I noticed a small pond with a bridge over it. I crossed the bridge and found myself in a small clearing. In the middle of the clearing, there was a small statue of a woman holding a flower. I felt a sense of peace and tranquility as I sat in the clearing, surrounded by the beauty of nature.
had been made that the former were thought to take flight in summer to the colder climes of the Scottish Highlands, Russia, and Sweden, for breeding purposes. As to the absence of starlings in winter, Apollo is sure that the querist has been mis-informed. Field-fares are also reported as seeking colder climates; wheat-ears hotter ones.

This matter of the migration of birds had been of interest to scientifically minded men since the very earliest days of the Royal Society. In the Philosophical Transactions of the year 1666 appears a most interesting treatise by Johann Scheffer, intended to prove that swallows spend the winter at the bottom of lakes, sinking themselves into these as autumn approaches. In proof of his contention, the author claims to have seen these birds drawn out with fish, put near the fire, and revived. In the Royal Society Transactions of 1708 the Rev. William Derham has a much more lucid and progressive article on the migration of birds. As a result of careful observations, he has determined that the swallow hibernates elsewhere, returning to England the last of March. He urges that more people make such observations of their own, and make a note of the dates, in order that more definite information may be organized.

Turning from birds to other types, we find that Apollo

47 I, 65.  
48 III, 984.  
readers show a definite interest in fish, with the spontaneous
generation of eels taking precedence over other topics. Of the
Royal Society members of the preceding century, Francis Willughby
had undoubtedly done the most valuable work on the subject of
fish;\textsuperscript{51} yet long after his death the related topic of spontaneous
generation was still unsettled. In 1697 Benjamin Allen wrote a
brief treatise attempting to prove that eels do not generate
spontaneously;\textsuperscript{52} the following year Dr. Samuel Dale reiterated
that opinion by giving his own reasons for believing that eels
could not, by any stretch of the imagination, be thought to be
produced by such a method.\textsuperscript{53} These minor works are important
only for showing the trend of thought of the times, and indi-
cating the extent to which scientific men were breaking away
from the old, outmoded beliefs. John Ray, in 1671, was more
definite in his refutation of the idea that any animals could
generate spontaneously, but admitted that there were a number
of apparently contradictory cases unexplained.\textsuperscript{54} (Dead bodies
of animals, for example, sealed to exclude air, had been found
to breed maggots.) Another great scientific mind to consider
this problem was Leuwenhoek, who in 1694 in a Royal Society
treatise explained in detail how such maggots were able to

\textsuperscript{51} \textit{De Historia Piscium}, published by Ray in 1686.
\textsuperscript{52} \textit{Phil. Trans.}, vol. XIX, no. 231, p. 664.
\textsuperscript{53} \textit{Op. cit.}, vol. XX, no. 238, p. 90.
\textsuperscript{54} \textit{Op. cit.}, vol. II, no. 74, p. 2219.
breed in rain-water, apples, and cheese. He went so far as to
describe their changes in form, the number of eggs, and the
time required for hatching. By the turn of the century, the
question of spontaneous generation had been cleared up for all
except a few scientific die-hards and a large percentage of the
general public.

The *British Apollo* querist most concerned with this prob-
lem mentions an account given by Mr. Lewenhoft, several years
previous, of having seen in one drop of spirit of pepper not
less than ten thousand living creatures. This bothers the ques-
tioner, who is of the opinion that the excessive heat required
for the extraction of the spirit of pepper would have killed
any living seminal matter that might have been present, thus
seeming to prove that subsequent generation had taken place
spontaneously. Other items he lists as apparent proof are the
worms found in human bodies, and the eels so commonly thought
of as evidence of equivocal generation. To these well-put
arguments, the *Apollo* answers that the heat used in extracting
spirit of pepper is only moderate—not so excessive as to destroy
living matter; that the worms in human bodies may very well de-
rive from seed received in meat and drink; that as for eels,
"the eminently learned Dr. Charlton...relates that once he found
eleven very small eels contained in the womb of a great one, and
each of them enclosed in their own proper after-birth," thus

55 *Phil. Trans.*, vol. XVIII, no. 213, p. 194.

56 Undoubtedly Van Leuwenhoek.
exploding the old eel superstition.  

Two very general questions concerning fish inquire how they breathe and why fish bred in salt water are nevertheless fresh. The first query draws in reply a very correct technical explanation of the gill system, and of the difference between such fish and the lung-breathing whales and dolphins. The second question merits a three-fold answer to the effect that the body of the fish receives its nourishment from the blood, that the nutriment we take in cannot be secreted into the blood till rarified by the heat of the stomach, and that salt is incapable of such a rarefaction.

Apollo questions dealing with particular fish ask why the herring dies more quickly out of water than does any other fish, what salmon feed upon (there being nothing but a thick filmy "humour" ever found in their stomachs), and why the bones of an anchovy dissolve in hot water. Apollo disposes of the herring by explaining that its blood is a warmer, thinner mass, more dependent upon water passing through the gills to cool it, whereas the blood of such fish as eels and lobsters is more cool and viscid, able to support itself for a greater length.

57 I, 70-71. This undoubtedly refers to Dr. Gautier Charleton, F. R. S. and president of the college of doctors, whose work included, in addition to animal physiology, experiments in connection with human circulation and embryology. For further information concerning his valuable discoveries, see the Nouvelle Biographie Universelle. Paris, 1854. p. 938.

58 II, 443.

59 II, 539.
of time. According to Apollo, salmon digest their food so fast that it is soon turned into chyle, just as some men quickly digest much heavier substances. Apollo disposes of the anchovy question in a somewhat more technical manner, explaining that:

As the dissolution of some bodies by others depends upon the proportion that is between the pores of the bodies to be dissolved, and the configuration of the insensible particles of the menstruum or dissolvent, supposing the small particles of butter to be so configured, as to be fitted to enter the pores of the bones of Anchovies, and not those of other bones, it must dissolve the one and not the other.\(^2\)

The last Apollo question having to do with fish is on the subject of barnacles. The reader wishes to know whether, as he has heard reported, they grow upon boughs of trees and upon the sides of ships, and if so, how they come there. In answering, Apollo is decidedly in the wrong when he replies that in spite of the "opinion among the vulgar...that these barnacles were bred from a small sort of shell-fish something resembling them, which are commonly seen...to adhere to old pieces of ships, trunks, bodies of trees...; the generation...is no ways different from that of other birds."\(^3\) The basis for this Apollo explanation may well have been the report by Sir Robert Moray in 1677 who tells of having seen on the shore of the island of Uist, in the Western Isles of Scotland, a huge fir tree with shells clinging to its trunk. He describes these shells at great

\(^{60}\) I, 67.  
\(^{61}\) I, 149.  
\(^{62}\) II, 632.  
\(^{63}\) II, 341.
length, together with the apparent method of sustenance of the "little bird" within, which he describes as "as a perfect seafowl." Late eighteenth-century scientists, commenting upon Moray's treatise, believe that he obviously mistook these crustacean animals for birds because of the several pairs of curved feelers which from their fringed edges bear a rude general resemblance to the tail of a bird. As early as 1640 it had been brought to public attention that these barnacles were not merely shells, for John Parkinson's *Theatrum Botanicum* admonishes:

To finish this Treatise of Sea plants, let me bring this admirable tale of untruth to your consideration, that whatsoever hath formerly been related concerning the breeding of these Barnacles, to be from shells growing on trees, etc. is utterly erroneous, their breeding and hatching, being found out by the Dutch and others, in their navigations to the Northward, as that third of the Dutch in Anno 1536 both declare. (Parkinson refers to the barnacles as *Britaniae Conchae Anatiferae*, or "Brant Geese").

The *British Apollo* pages show a considerable interest in such animals as frogs, toads, and reptiles. Three questions deal particularly with the former: how frogs live after they

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64 *Phil. Trans.*, vol. XII, no. 137, p. 925. For further information concerning Moray's work with the Royal Society, see Alexander Robertson's *The Life of Sir Robert Moray*, London, 1922, ch. VII.


acquire mouths; how to account for the vast number of frogs apparently "rained down" during a storm; why frogs, toads, and serpents die when transferred to Crete or Ireland. Apollo explains that frogs at all times have mouths, proportioned to their requirements; that far from being dropped from heaven, they appear after a storm because they are lured out by the pleasant dampness; and that quite the opposite is true concerning frogs dying in Crete and Ireland, both of which islands have proved suitable dwellings for those creatures. If, adds Apollo, either of these places be later proved lethal to the animals, it would undoubtedly be due to lack of proper nourishment, or some particular constitution of air contrary to their natures.

Other questions concern snakes and vipers: are snakes poisonous; how can a viper move twelve hours after it has lost its head? Apollo replies that snakes "are as harmless as worms," and that it is not voluntary motion which causes a dead viper to move when prodded, but rather "the spirits implanted in the body which will for some small time, move and shake the muscles, and force them into a kind of convulsion." The distinction between snakes and vipers had never been particularly clear, although as early as 1666 the Royal Society

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67 II, 388.  
68 II, 538.  
69 I, 277.  
70 II, 674.  
71 I, 215.
had published a treatise on that subject, pointing out that whereas snakes lay eggs in dung-hills where the warmth hatches them, vipers brood eggs within themselves, and bring forth the live young. 72 Several years later, the poisonous nature of certain snakes had been expounded in an unusually long treatise by Dr. Tyson of the Royal Society. He had very carefully dissected a rattlesnake sent from Virginia, then described it in minute detail and compared it with other similar, more familiar animals. The poisonous teeth are described, and an explanation given of how they may be rendered harmless. 73 Considering The British Apollo's apparent familiarity with the publications of the Royal Society, it seems odd that no mention is made of Dr. Tyson's very complete study of the rattlesnake.

The remaining questions in the group of frogs, toads, and reptiles, are concerned with salamanders and chameleons. The gist of the questions is: are there such things; if so, what are they like and where do they live? A Royal Society account, published in 1667, had described in detail the unusual case of a salamander which, when thrown into the fire, vomited a quantity of thick, slimy matter which put out the coals. It continued thus for two hours, until removed from the fire. 74 Sir Thomas Browne, in 1646, had mentioned this same ability of the

salamander to endure and to put out fire, giving numerous references from antiquity both to prove and to disprove the theory. From this evidence, the weight of which seems to be on the negative, Browne concludes that the salamander must have some degree of resistance to fire, but not necessarily more than that possessed by frogs and snails. This is the attitude taken by the Apollo in reply to readers' questions, adding the additional information that the animals may be found in great numbers in Egypt and other eastern countries. Concerning chameleons and their ability to change color, there is less difference of opinion. Sir Thomas Browne had given a lengthy description of their appearance, anatomy, and characteristics, showing the fallacy of the old superstition that they feed only upon air. A Royal Society treatise of 1669 describes in detail the dissection of an Egyptian chameleon which took place in the royal library at Paris and which proved definitely that the little animals were capable of changing color at various times. The Apollo in one issue gives a simple, comprehensible description of the creatures, pointing out that although they subsist partly on flies, they have been known to go for over a year with no visible nourishment other than air. In another issue Apollo

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76 II, 451.
77 Browne, op. cit., vol. II, pp. 50-60.
78 Phil. Trans., vol. IV, no. 49, p. 987.
79 II, 375.
mentions several possible explanations as to the chameleon's change of color, attributing it perhaps to the bodily humours, perhaps to the time of day, perhaps to an excessive stretching of the skin.  

Apollo readers' interest in insects seems concentrated particularly in flies, maggots, and the medicinal preparations commonly prepared from dried insects. On the general topic of insects, one reader is anxious to know why bugs bite some persons and not others. Apollo credits this distinction to the little creatures' delicate organs of smell, "which makes them apt to be differently affected by the different corpuscles, continually perspiring from different human bodies, and thereby to be determined either to stick to them or pass over them untouched, according as their blood may afford them a better or worse nourishment." Only one Apollo question concerns spiders and their ability to travel from one tree to another to attach the opposite end of their webs. The reply claims that the spiders' threads, fixed above, may be so agitated by the motion of the air that they may touch the further tree. A Royal Society article by Dr. Lister in 1671, which poses a number of queries concerning spiders, is equally as uninformative as the Apollo. Apparently none of the scientists of that day realized the

80I, 227.
81II, 631 (wrongly numbered 531) - 632.
82II, 607.
83Phil. Trans., vol. VI, no. 72, p. 2710.
peculiar physiological adaptation of the spider for web-making.

Two Apollo questions—both from the same reader—concern the buzzing of the fly. In propounding the first query, the writer apparently made an inauspicious beginning by referring familiarly to Apollo as "dear Cuz," thus provoking the following reply:

> How ill your humble muse and pride agree,  
> Pray how came you Apollo's kin to be?  
> Tell us the cause of this, O mushroom Cuz,  
> And you shall know why headless insects Buzz.

The second query begins with an apology for having so bandied Apollo's name about, and concludes with the threat that unless Apollo condescends to explain the fly's buzzing:

> If in your next it does not follow  
> I'll buz about I've pos'd APOLLO.

The oracle obliges with the following solution:

> ...when those headless insects buz,  
> Their inward spirits cause allusion,  
> About the pectoral division,  
> Upon a membrane, call'd by some, The PELLICLE, that makes 'em HUM.

The shrill noise made by the grasshopper comes in for its share of attention, one reader inquiring whether the sound proceeds from the insect's wings or mouth. Apollo's opinion is that it

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84 I, 20.

85 I, 32-33. This is the same explanation as that given by Browne in the Pseudodoxia.
arises from the lungs and issues from the mouth, a circumstance more easily observed in the larger grasshoppers of Spain than in the comparatively small English variety.  

Two questions of minor importance ask whether earwigs fly, and where lice come from. According to the Apollo, earwigs do have concealed wings which after the insects have been sufficiently enraged they will extend, and by a sudden flight escape their tormenter.  

In the matter of lice, Apollo believes that there is a distinction between those imputed to filth and nastiness, and those proceeding from the blood to the "preternatural humours, communicated from the blood to the cutis, where breaking out into small pustules, the lice are engender'd and thence extruded."  

Maggots seem to have fascinated several Apollo readers, one wishing to know how maggots in a closed vial could live and grow when the spiders in the same container had died previously; another inquiring why there are so many maggots in filberts but none in walnuts. The first situation is explained as being due to the fact that it probably requires less air to permit the maggots to breed than to continue the life of the grown spiders. The prevalence of maggots in filberts is attributed to the fact that the latter "consist of a more cold and earthy matter than

86 II, 690-691.
87 II, 545. This is similar enough to Browne's explanation to have been borrowed from the Pseudodoxia.
88 III, 745.
89 II, 664.
walnuts: neither are they so well defended from the injuries of the air, and consequently more subject to corruption."

The last questions in the insect group have to do with two insects which were in the early eighteenth century dried and used for medicinal purposes: cantharides and cochineals. The former, a species of Spanish fly, were dried, powdered, and made into a preparation used for blistering and as a diuretic. They had apparently been used as an internal remedy since the days of Hippocrates, although the application of them externally in blisters was not introduced until long after. Their efficacy as a diuretic is recorded in the Royal Society records of 1702 by Dr. James Yonge who gave a woman patient two pills made of cantharides mixed with camphor, as a result of which she was completely cured. Concerning their power of drawing out impurities, the Apollo informs its subscriber that the quality "proceeds from the heat and fiery particles they abound with, which penetrating the cuticula, or scarf-skin, so act upon the humours and solid parts as to cause that separation of the serum in blisters." There is no reference in the Apollo or in the Philosophical Transactions to the use of cantharides as an aphrodisiac. The cochineal insects seem to have been put to

90II, 594.
91Thomson, History of the Royal Society, p. 165.
92Phil. Trans., vol. XXIII, no. 280, p. 1210.
93II, 443.
more varied use. We know that a valuable scarlet dye was obtained from them, and that they were occasionally used medicinally as an antispasmodic. A Royal Society treatise of 1691 explains that according to an old Spaniard who had lived many years in Jamaica, the cochineal insect corresponded to that referred to in England as "lady-bird," or "cow-lady." It appeared as a blister on the leaf of a shrub, and soon became a live insect. This shrub the natives knew as prickle-pear or Indian fig. When the grubs became flies, they were killed, collected, dried, and the wings sorted out. 94 Several years later, in 1704, Leuwenhoek remarks in the Transactions that a certain Amsterdam merchant considered it impossible that the drug should be made from insects. The information given in the 1691 treatise is here reiterated, with additional comments on the dissection of several of these little creatures in order to determine which are preferable for medicinal purposes. 95 This Amsterdam merchant's attitude seems to have been typical, as for years people in general believed that cochineal was the berry or grain of a plant. In answer to a reader's query regarding the origin and properties of cochineal, the Apollo gives a most impartial explanation, first relaying the information contained in the Royal Society's 1691 article, then listing and describing the four known types of cochineal, and lastly giving an alternate theory.

held by a member of the Apollo organization—that certain small pea-shaped fruits of a shrub he had found on an Aegean island were the true cochineal.  

There are a surprisingly large number of Apollo readers interested in particular animals: as the cat, dog, monkey, coney, hog, fox, sheep, horse, camel, rhinoceros, whale, and unicorn. The cat and dog are by far the most popular, rating eight questions each. The former inspires such queries as how cats see in the dark (a phenomenon Apollo credits to the luminous pupil in the eye which makes objects perceptible), why kittens' eyes remain closed for nine days (due to disorders in the matrix which cause them to be born ahead of time), whether a cat's brain is poisonous (Apollo believes not, since its flesh is accounted a tasty dish in some countries), why cats are so fond of marum ("It promotes generation," claims the oracle). Readers also wish to know why a cat utters such a dismal cry when pleased and why that creature is often referred to as "Mrs. Evans." Apollo wonders that the former querist has mistaken such soft purrings for a dismal cry, and explains to the latter that the "Mrs. Evans" notion probably has arisen from the fact that a woman of that name, suspected of being a witch, once

96 III, 737-738. 97 I, 98.  
appeared as a cat. Apollo tells another questioner that a cat is able to light on her feet because of her tail, with which she fans the air and retards the swiftness of her descent. Other creatures, as the fox, another answer explains, have not been taught to use their tails in this manner as they are not accustomed to such lofty places as the cat is.

Questions on dogs include: whether a dog has any feelings (Of course, says Apollo), why a dog runs around before he lies down (To prepare his bed, is the reply), why he wags his tail to indicate affection (Apollo claims that "joy at one end, puts the other in motion"), why one dog smells at another dog's tail (a query turned aside by a ridiculous answer), why cur dogs bark at beggars (because of the disagreeable sensations produced in the dog by the latter's dress). Further inquiries on this subject concern the use of dogs' spleen and the reason dogs sweat only on their tongues. In connection with the former, Apollo explains the difference between the ancient and the modern theories concerning spleen: whether it be the receptacle of the melancholic humour, a blood-making or blood-perfecting bowel, the "elaboratory" of the nervous juice, or a promoter of the action of the liver by furthering the separation of the bile.

102 III, 1020-1021.
104 II, 552.
106 I, 327.
108 III, 925.
103 II, 475-476.
105 I, 92.
107 I, 107.
109 II, 489.
The oracle admits, however, that its use has not as yet been fully discovered. The apparent sweating of a dog’s tongue is explained as being saliva, since the natural construction of its pores prevents the perspiration of humours through the dog’s skin. A final and slightly more unusual question on dogs concerns a cave and an adjoining lake in Italy, "which are of so very different a nature, that if a dog be put in the cave, he is no sooner in, but he falls down dead; but if he be immediately taken out, and put in the aforesaid lake, he comes to life again." The reader wishes to know Apollo’s opinion "whether the dog be really dead, if not, what may be the cause of his seeming to be so?" The answer suggests that obviously the dog could not be really dead, but the motion of the blood and "spirits" so imperceptible that the animal would appear so.

Nearly half of the remaining animal questions deal with horses, cows, and related animals. Among these we find inquiries concerning: why horses are so short-lived (due to their manifold distempers caused by hard labor and frequent abuses), why there had been such sudden and general distemper among horses (blamed on the cold, unseasonable northeast winds), why most good nags stale, as soon as littered in stable (Any farrier will solve that one!), whether a gelding may be called a horse

110 III, 725.
112 III, 840.
114 I, 164.
111 II, 525.
113 II, 389.
115 I, 247, (misnumbered 147).
(as properly as a eunuch may be called a man), why a horse is considered better for "soucing" its "snout" deep in the water when it drinks (Apollo holds that a horse which merely sips from the brink gives sign that her "vitals" are beginning "to fail by their briskness to move her" whereas a strong, forceful horse thrusts in his whole snout). Other questions include: whether a beast half horse and half mare could both beget and conceive (Apollo believes it might be capable of one or the other, but not both), why mules and moyle never generate (Instances are cited to prove this premise untrue but the explanation is added that if they do not generate, it may be ascribed to some defect in the parts subservient to generation, presumably in the female), why a horse is afraid of an ass (Untrue, says Apollo. Did you get that idea when the girl you were courting started at the sight of you?)

The old superstition concerning the reason an ass' back is marked with a cross, comes in for its share of attention in two questions, submitted several years apart. In the first case, Apollo treats the query as senseless, and makes no effort to explain it. To the reiterated question, Apollo finally states: "The report is no other than a vulgar error."

116 III, 787.  
117 II, 399.  
118 II, 363.  
119 III, 994.  
120 II, 615.  
121 I, 63.  
122 III, 1020.
error arose of course, long before, when people noticed the peculiar marking on the ass' back and attributed it to the use of that beast by Christ on His triumphal entry into Jerusalem. The answer to one other question about the ass sounds as though Apollo suspects the querist to be the same one who sent in one of the preceding inquiries concerning the cross-like markings. This time the reader asks why the ass has fallen from its high station of carrying priests and princes, to the lowly job of carrying a peasant's pack. Apollo replies:

'Tis known by men of sense, that all,
Or men, or beasts, who rise must fall;
And since an Ass is made to bear
All burthens that in nature are;
'Tis sure no shame for loads of honour
To condescend to mount upon her:
But since by sympathy men find
Each beast acquainted with his Kind,
'Tis strange that you're so dull a creature,
Yet ign'rant of an Ass' nature.123

To one reader's query regarding the reason a cow claps her tail against the hedge half an hour before a shower, Apollo returns this rhymed evasion:

... But, honest Daniel, e'er we try
To give substantial reason why,
'Tis hop'd to prove you will not fail
Your cow's prevaricating tail:
If not the fact we'll disannull,
And then your cow will prove a bull.124

To the subscriber worried because his oxen have larger bodies and horns than his bulls of the same breed, Apollo explains that castration usually causes the males to resemble more nearly the females. 125

Remaining to be considered under the heading of animal biology are a number of questions pertaining to a variety of animals: Apollo claims that certain monkeys chew their tails because they have become accustomed to a meat diet and thus long to satisfy their appetites; 126 that the coney does not need to drink since it sucks large quantities of juice from various greens; 127 that hares leave less scent when almost run down because by that time the volatile parts of their blood, on which the scent depends, have been faster expended than they could be renewed; 128 that the extraordinarily unpleasant scent of foxes arises from "certain fetid and sulphureous effluvia breathing out from the blood through the pores," and that this may possibly be medicinally beneficial in cases of hysteria; 129 that the hog can scent the wind before a human being can see it because of the former's more acute olfactory nerves, 130 but that this over-acuteness does not render the hogs' sordid surroundings at all repulsive to them, since they have become accustomed to such conditions; 131 that sheep bleat while being shorn, because

125 II, 474.  
127 III, 874.  
129 II, 497.  
131 I, 134.  
126 I, 53.  
128 II, 646 (misnumbered 546).  
130 I, 119.
the tickling bothers them, but that they are silent when seized by dogs, because surprise and terror prevents their making any noise;\textsuperscript{132} that "bucks make vaults to serve the does in" for the same reason that birds make nests;\textsuperscript{133} that the camel can go three of four days without water because it has a greater quantity of radical moisture than other animals and perspires less freely.\textsuperscript{134}

In connection with the preceding problem it is interesting to note a Royal Society article of 1669, which describes the sack-like openings in the camel's second stomach, where water can be stored for a long time.\textsuperscript{135} This treatise does not take into account the fact, apparently discovered at some later date, that the camel is able, by the contraction of certain muscles, to throw this water into the paunch or bring it up again into the esophagus. Royal Society members would certainly have found it difficult to believe that a thirsty camel could travel over a hundred miles for a drink of water, and upon obtaining it could drink, within a few minutes, as much as twenty-five gallons of water, weighing more than two hundred pounds!

The unicorn and the rhinoceros come in for one Apollo question apiece, to the first of which the seer replies that there is no such creature as a unicorn unless the rhinoceros be termed such, from having only one horn.\textsuperscript{136} To a reader's

\textsuperscript{132}I, 68-69.  
\textsuperscript{133}II, 646 (misnumbered 546).  
\textsuperscript{134}III, 1009.  
\textsuperscript{135}Phil. Trans., vol. IV, no. 49, p. 987.  
\textsuperscript{136}I, 136.
request for definite information concerning the rhinoceros, Apollo describes it as:

A sort of creature strangely different from every other, having one horn, and shap'd not much unlike an elephant, all cover'd with an hard and scaly substance, proof against a pistol-bullet, and divided like a tortoise into several odd partitions; but 'tis needless to enlarge upon this subject, since all persons may at present see in town the skeleton and hide of one of the finest and only female ever known; a sight that's truly worth the observation of a man of knowledge in the works of nature.137

The last question in this group dealing with animals, concerns whales. An early Apollo reader wishes to know by what name we now call that creature referred to in Biblical days as Leviathan, and receives information that it is the modern whale.138 Another inquires, "What is the thing called SPERMA CAETI?" Apollo, after mentioning the ancient beliefs that the substance was either a kind of bitumen made of a sulphureous earth and salt, or else the real sperm or seed of the whale, selects the intermediate view that it proceeds from some part of the whale, but not from the genital parts. The answer thus passes over the real solution and is misled by the fact that spermaceti had been found in the head of the whale. Apollo follows the theory of many late seventeenth-century scientists in asserting that it is "either the fat substance of the brain itself, or an oily liquor fused about it."139

137II, 552. 138I, 276.

The final question of this group concerns ambergris, and asks from what particles of the sea water it is produced. Denying the possibility of that substance's having its origin in the water, Apollo declares that "it is a kind of bitumen, which issues out of the bowels of the earth, and empties itself into the sea, is found on the seashore, and made hard by the sunbeams." This problem of the origin of ambergris had been tantalizing scientists and laymen for many years. The suggestion had been made that it proceeded from the whale, but that theory was still far from being accepted as correct. The Royal Society had in 1666 published a treatise on the power of the sea to eject ambergris, and seven years later Boyle went on record as believing that ambergris was not the excrement of the whale, but issued out of the root of a tree which always stretched forth its roots toward the sea, depositing therein this gumlike substance. Thus we see that even the greatest minds of

140 I, 302. This is similar to the explanation given by Parkinson, op. cit., p. 1566, where he adds that "ambergrise," whatever way taken, is beneficial for easing pains in the head, comforting the brain, and aiding the memory and spirits of the heart.

141 Phil. Trans., vol. I, no. 18, p. 315. To a letter of inquiry from the Royal Society at approximately this same date, Sir Philiberto Vernatti, in Java, replied that the best "ambergrease" in the world was to be found on the island of Mauritius, and was usually collected after a storm. His letter mentions a French traveller having seen floating on the sea "enough as would have laden ten thousand Ships."—Sprat, op. cit., p. 168.

142 Op. cit., vol. VIII, no. 97, p. 6113. Another Phil. Trans. article—vol. XXXIII, no. 385, p. 193—indicates that the true nature and source of ambergris was discovered by the whale fishermen of Nantucket, in New England, about 1720.
The theoretical framework is that in a constant, fixed system, the relationship between two variables can be described by a mathematical equation. In this context, the equation is:

\[ y = ax + b \]

where \( y \) is the dependent variable, \( x \) is the independent variable, \( a \) is the slope, and \( b \) is the y-intercept. This equation is used to model the behavior of systems in various fields, including economics, physics, and biology. The slope \( a \) indicates the rate of change, and the y-intercept \( b \) represents the starting point when \( x = 0 \). Understanding these relationships is crucial for making predictions and decisions.
the times often strayed far afield in search of a tenable solution to the scientific problems that presented themselves. It is difficult for us not to be amused by some of the quasi-solutions that were at various times held to be true; yet it is necessary that we should not overlook the fact that this trial-and-error method was as essential to the scientific progress of those times as it is to the more advanced experimentation of our own day.

The subject of human anatomy had made great progress in the latter years of the seventeenth century, particularly following the invention of the microscope. Prior to that time, physicians had relied chiefly on the theories of Aristotle and Galen, the authorities of the ancients. In the interim, there had been a number of experiments and some few valuable discoveries, but many wild guesses remained to be made and disproved before any scientific order could appear out of the chaos of misconceptions.

The Royal Society was particularly fortunate, in the last decades of the seventeenth century, in that it had the privilege of claiming for dissection the bodies of executed persons—a field in which Samuel Pepys showed particular interest. This made it possible for interested members to make all sorts of observations and experiments, which were regularly reported to the Society for discussion and further inquiry.

The greatest number of British Apollo questions dealing
with human anatomy, concerns the Hungarian twins who were for a considerable time on display in a house near Charing Cross. The second largest number of questions has to do with human hair—its color and characteristics. Third in popular interest seems to be the blackness of negroes, followed by assorted questions on such widely varied topics as pygmies, the white spots under finger-nails, optic nerves, and Adam’s navel.

It is not strange that the public display of the curiously-joined Hungarian twins should have attracted the attention of Londoners as well as provincials. People had always been interested in monstrous births and almost morbidly definite in describing them. Since the early days of the Royal Society, accounts of such monstrosities had found their way into the Philosophical Transactions. The 1667 records mention two monstrous human births: one resembling an ape, the other a foetus come to maturity, having a mass of flesh instead of a head and brain. The year 1670 records the birth at Plymouth on October 22 of twins who are described in detail as having two heads, two necks, four arms with hands, four legs with feet, but only one trunk. These seem to have resembled more closely the Hungarian twins, than any others England had ever seen. The English twins lived scarcely any length of time, however. They appear to have been exactly alike, to have weighed eight and one-quarter pounds, and to have been very well featured. Their

143 Phil. Trans., vol. II, no. 26, p. 479.
hair was reported more than ordinarily thick, and their nails full grown. Another more repulsive birth is recorded for 1678 by Dr. Morris, who describes the creature as being female, with two heads, two hearts, two pairs of lungs, and two stomachs. In this case, one face was swarthy and never really showed signs of life; the other side lived for a time, but never cried. The 1684 records describe in detail another most unusual child which did not live long. This boy was born in South Jutland and had extra toes, large lumps in various places, projections hanging to its legs, a long tail, and a hood-like appendage. It appears to have been particularly repulsive, in that it had a very old face and was unable to open its right eye. An odd combination of sexes is described by Durham in the Royal Society records, in the person of a child born at Londonderry in 1706. This creature had two heads and four arms, but only one body at the navel. Of both sexes, it had the female on the right and the male on the left. It was born alive but did not live long.

When in the summer of 1708 the curiously joined Hungarian twins were exhibited near Charing Cross, Londoners were both skeptical and intensely interested—more so because these young

144 *Phil. Trans.*, vol. V, no. 65, p. 2096.
girls were obviously very attractive and accomplished. Questions in the Apollo ask, for the most part, for an explanation of their joining, and also inquire whether or not it would be possible for them to bear children, whether they might be expected to die together, whether they possessed two souls or one, and whether a pin prick administered at the point of coalition would cause a sensation in the mind of each twin. There are also questions about how it would be possible to administer corporal punishment to one twin and not to the other, whether the mother of the twins survived, and whether the husband of one twin would be guilty of incest.

Apollo gives a very clear, concise description of the twins' joining, and adds that they are strikingly different in temperament and appearance. The explanation of how this coalition came about is far from being scientifically sound although reference is made to earlier writers as proof. The solution offered by Apollo is that the mother of the twins either saw two people strike one another, buttock against buttock, or else received such a blow herself that it caused such a violent motion in the same parts of the embryos that "being soft and tender, they were closely joined and confounded together." It is curious to note that although decried by modern science, this superstition concerning the marking of an embryo is still current even in the most scientifically advanced countries. Concerning

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148 I, 300-301. 149 I, 308-309.
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the possibility of the twins' bearing children, Apollo sees "no impossibility--tho' some improbabilities," believing that they might even conceive at the same time. The oracle considers it very likely that one twin would die first, since one is decidedly less healthy. The death of one must presuppose the death of the other, since they are joined in such very essential organs that a malady afflicting one would almost certainly affect the other. In spite of this close physical union, however, Apollo feels certain that each twin has without doubt a separate soul, since their passions and affections are as different as though their bodies were not joined. This fact would make it certain that a pin-prick administered at the point of coalition would cause a very definite sensation in the mind of each.

Concerning the possibility of one twin's having to be severely punished Apollo concludes that "it is preferable that the guilty should go unpunish'ld, rather than the harmless, the innocent, should suffer." To the reader interested in the mother of the twins, Apollo replies that she is still alive,

150 I, 326.
151 I, 326-327. It might be noted that Apollo proved more than half right on this answer, as the death of the twins later proved. Judith was seized with violent convulsions on February 8, 1723, which proved fatal on the 23rd. During this period, Helen suffered fever and frequent faintings, and actually lost consciousness before her weaker sister did. After a brief struggle they expired at almost the same instant. (From a letter by Dr. Torkos in Phil. Trans., vol. I, no. 39, p. 311.)
152 I, 301.
153 II, 397.
154 I, 316.
and has had another child since then. According to report, one of her twins was born three hours before the other, the second coming into the world with her body doubled.  

To the final question, whether the husband of one twin would be guilty of incest, Apollo replies with a decided yes, believing that even if common modesty did not forbid one twin's marriage, their peculiar condition would in this case make it a matter of incest. The subsequent life of these twins seems to have been of constant interest to the English people, continuing until the girls' death a number of years later.  

Questions concerning human hair are numerous throughout the pages of the Apollo: why some hair is curly and others straight; why some is black and others red; why some men are more hairy than others; why women have longer hair but no mustaches; why a man with black hair may have a yellow beard; why a man's beard may be at once black, sandy, and gray. Apollo's solution  

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155 I, 309.  
156 I, 316.  
157 These girls, Helen and Judith, were born at Szoni, Hungary, October 26, 1701, and died in a convent near there (at Presburgh), February 23, 1723. Helen was the taller and straighter, Judith being weaker as a result of an attack of palsy at the age of six. Each twin had small-pox and later measles at the same time as the other; various other ailments they had individually. They were extremely fond of each other, but when young often quarrelled and fought. During their stay at the convent in Presburgh they were taught to read and write, given instruction in religion, and employed in needlework and the manufacture of lace. It was reported that they could speak Hungarian, High and Low Dutch, French, and English. (Phil. Trans., vol. L, no. 39, p. 311; this article would indicate that Nichols is mistaken in assigning Petersburgh as the place of their death. The Tatler, ed. John Nichols [1786], III, 411).
for the problem of curly hair is that "the hair of those that are hot and dry in constitution is generally curled, and in those that are cold and moist is generally seen lank."\(^{158}\) The difference in the color of hair *Apollo* explains by:

Those different hues the constitution make,
And various tempers various colours take:
So melancholic persons black appear,
And choleric men their sandy tresses wear.\(^{159}\)

The same bodily conditions determine the amount and length of hair, says *Apollo* "the hot and moist tempers always affording more hair than any other,"\(^{160}\) and the length of women's hair arising from "moisture abounding in that part, and nature's disposition thereof."\(^{161}\) A far more absurd explanation is given for the fact that a man's hair may be black but his beard yellow. This, *Apollo*, mistakenly asserts, is caused by "the different recrements of blood, which happen in those several parts; the black being nourished by black adult recrements of blood, and the yellow by bilious recrements."\(^{162}\) As a reason for a man's beard being at once black, sandy, and gray, *Apollo* states that "lusus naturae" will have to serve, though there is grave doubt in his mind that such a rarity ever existed.\(^{163}\)

The cause of the blackness of negroes appears to have been one of the first questions submitted to the *Apollo* and the

\(^{158}\) I, 302.
\(^{160}\) III, 819.
\(^{162}\) I, 166.
\(^{159}\) I, 102.
\(^{161}\) I, 278.
\(^{163}\) II, 514.
answer is an entertaining one. According to the reply, "a certain glue or varnish, called...CORPUS MUCOSUM, immediately under the EPIDERMAIS...being of a different colour, it imparts it to the EPidermais, which of itself is transparent. 'Tis then to be supposed that this glue or jelly in the Negroes is black."

There follows a discussion whether constant exposure to the sunlight rather than God's curse upon the descendants of Cham be not more likely reason for certain persons being black and others white. 164 Browne, in his Pseudodoxia, had argued from the same point of view, and had also mentioned Hippocrates' account (referred to by Apollo as "a famous precedent whereof, we have in history") of a white lady who from an intent view of a negro's picture conceived a black. Browne had also, in his lengthy discussion of the problem, discounted the Cham theory in favor of the action of the sun, citing various authorities from antiquity. 165 It is interesting to note how close to the truth Browne, as well as earlier philosophers, came, since modern science acknowledges a definite relationship between pigmentation and the actinic rays of the sun. 166

A later Apollo reader wishes to know why the skin of a black is softer than that of a white and receives the answer that the thinness of the black's skin accounts for the conditions;

164 I, 2.


"those born in hot countries have much thinner skins than those in cold." This idea is in direct opposition to a statement made some years later (1744) by Dr. John Mitchell, that the skins of negroes are much thicker, the corpus reticulare cutis being the only part which appears black in negroes. It was Mitchell's idea that influence of climate and mode of life is sufficient to account for differences in color. Still another Apollo reader inquires why the blacks in Guinea are woolly-headed and have flat noses, when they are not so in other places. Apollo attributes the woolly hair to the difference in size of the individual fibres that go to make up the larger hair, the number of these minute strands being fewer in wool than in regular hair. It is suggested that this difference occurs in blacks because of the "smallness of the pores of the skin out of which they are bred and receive their increase." The flatness of the nose, says Apollo, is "reckoned a piece of beauty amongst them," for which reason they "artificially form them into that shape." Apollo speaks here of blacks in general, avoiding the Guinea phase of the original question.

Among the miscellaneous questions and answers on human anatomy, we find: why do bones break more easily in frosty

167II, 375-376.
168Phil. Trans., vol. XLIII, no. 474, p. 102.
1691, 25.
weather (more brittle);\textsuperscript{170} whence the white spots under fingernails ("from white glittering particles, which are mixed with red in the blood, and happen to remain there some time");\textsuperscript{171} why so few faces are alike ("Manifold are thy works, O Lord! In wisdom hath thou made them all");\textsuperscript{172} why men have breasts (for ornament);\textsuperscript{173} why one eye light, the other dark ("uncommon formation of the iris");\textsuperscript{174} whether a man has more ribs on one side (no!);\textsuperscript{175} whether the optic nerve is hollow (not hollow, but porous).\textsuperscript{176}

There is one unusual question concerning the seams to be observed in the foreheads of some skulls, to which Apollo replies:

The seam, or suture in the forehead is equally common to both sexes, and is occasioned from the smallness of the intermedial spaces of the lambdoidal, sagittal and coronal sutures being too small, and therefore insufficient to discharge the streams or recriments of the brains; whereupon it is instituted by nature to supply the defect of the other sutures by forming a new one in the forehead: but on the other side, if the other sutures are large enough to ven those streams, then there is no occasion for that in the forehead.\textsuperscript{177}

Two Apollo readers are concerned with the untimely appearance of teeth in certain human beings. In one instance a woman of eighty had several new teeth appear, as well as "a new brown

\textsuperscript{170}\textsuperscript{III}, 825. \textsuperscript{171}\textsuperscript{I}, 113. \\
\textsuperscript{172}\textsuperscript{III}, 1017. \textsuperscript{173}\textsuperscript{III}, 983. \\
\textsuperscript{174}\textsuperscript{II}, 633. \textsuperscript{175}\textsuperscript{III}, 960. \\
\textsuperscript{176}\textsuperscript{II}, 444. \textsuperscript{177}\textsuperscript{I}, 52.
head of hair." Apollo believes that the incident is not improbable, and cites examples to prove this. In another instance, a girl of twelve possessed in her upper jaw two perfect rows of teeth, and but one row in the under jaw. Apollo believes that if the two rows in the upper jaw appeared one after the other, it would be an indication that the girl failed to shed the earlier set. If the two rows appeared simultaneously, Apollo would conclude that the second row, appearing prematurely, must have caused the others to remain more firmly fixed, and prevented their falling. Records of the Royal Society provide many evidences of such curious happenings. We find that in 1667 the Rev. Mr. Joseph Shute of Devonshire, aged eighty-one, cut a new tooth, and that Maria Stert, aged seventy-five, lost three of her upper incisors when she was forty, and remained without them twenty-five years, until suddenly two new ones appeared.

The question dealing with whether Adam had a navel, appears in verse form, that being the reason for Apollo's replying in kind:

A navel he had,
As sure as your dad,
But to ask whereabouts we suppose
It was fixt, as is wise,
And much of the size,
As to ask whereabouts is your nose.

178III, 816-817.
179II, 573-574.
Its use and its end,
Do not only tend
To nourish the child in the womb;
But 'tis also the seat,
The man to complete
With strength, till he drops to his tomb. 181

Apollo here goes directly contrary to the theory expressed in Browne's Pseudodoxia, wherein the author objects to the portrayal, in stained glass as well as in the works of Urbin, Angelo, and others, of Adam and Eve with navels. Browne argues that the presence of a navel presupposes a mother, whereas Adam and Eve were both created anomalously by God. 182

The harmless little question "Was there ever any such thing as giants?" seems to have given rise to a disproportionately long answer, in which Apollo states definitely that there are such creatures and quotes from ancient writers and the Scriptures to prove his point. 183 Dr. Thomas Molyneux had some years earlier (1700) presented the Royal Society with "proofs" of giants by showing how a huge forehead bone on display at Leyden must have been human, and by citing instances of persons mentioned by scientists as being over ten feet tall, as well as an American giant who was eleven feet five inches in height. 184 Stories of giants were current at this time, as we find the

181 I, 328-329.
183 III, 777.
184 Phil. Trans., vol. XXII, no. 261, p. 487.
cycle of *Jack and the Giants* popular prior to 1711, at which time the stories were circulated in chap-books. There were plenty of similar stories, more or less wild in tone, that would have spurred the interest of the casual reader. We do not know to what extent anyone believed these accounts, but we do find record that in 1718 M. Nicholas Henrion presented to the Académie Royale des Inscriptions et Belles Lettres a dissertation entitled *Un eschelle chronologique de la différence des tailles humaines depuis la création du monde jusqu'à Jesus Christ*, in which the writer produces copious evidence to prove that Adam was 123 feet 9 inches tall; Eve, 118 feet 9 3/4 inches; Noah, 103 feet 9 inches; Abraham, between 27 feet and 28 feet; Moses, 13 feet; Hercules, 10 feet; Alexander, 6 feet.

The *Apollo* is definitely in the wrong on the subject of pygmies, which are the topic of one reader's question. "... that there is," states the seer, "or ever was such a distinct nation of people, is as false as Pliny's people, who had no mouths, but lived only by the smell of flowers and fruits." Browne, in the middle of the seventeenth century, had been equally emphatic on the subject, believing the stories of the ancients to be merely a figment of the imagination. His

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187 III, 905.
Pseudodoxia points out that the existence of pygmies was denied by such men as Strabo and Albertus Magnus, and refutes the theories of Aristotle and the Bible that such a race of little people really exists. Prior to Browne's day, Purchas His Pilgrimes, 1625, had described pygmies in Greenland, and other reports had identified the little people as a remnant of the Jewish race living in caves on a mountain in Palestine. Several decades after the publication of Browne's work, Joshua Barnes of Emmanuel College, Cambridge, published (1675) Gerania, A New Discovery of a Little People, anciently discoursed of, called Pygmies, with a lively description of their stature, habit, manners, buildings, knowledge, and government, being very delightful and profitable. These pygmies were supposed to exist on the shores of a great lake on the uttermost borders of India. This work is inconsistent as a description of a pygmy commonwealth, but apparently served to keep people interested in the subject. In 1696 at Lyons there was published Furetiriana, consisting chiefly of the witty sayings of Antoine Furetière. It was supposed to have been written by a missionary in Madagascar, and describes among other things a race of pygmies called Taribots. It is undoubtedly satire on the clergy but none the less entertaining. Three years later, in 1699, there

188 Browne, op. cit., II, 155-159.
189 Quoted in Eddy, op. cit., 84.
190 Ibid.
191 Quoted in Eddy, op. cit., 88-89.
was a revival of interest in the classical tradition of the pygmies upon the appearance of Addison's Latin poem "Battle of the Pygmies and the Cranes." That same year, there was a right-about-face in the opposite direction by the appearance of Edward Tyson's Essay Concerning the Pygmies of the Ancients. In this work, the Royal Society M. D. claims that the supposed pygmies were all either monkeys or apes, not men. He discusses and refutes, chapter by chapter, the Opusculum de Pygmaeis of Gaspard Bartholinus (1585-1629), a book written to prove the authenticity of the pygmy myth. Tyson states that his purpose is to prove the pygmy to be "only a creature of the brain, produced by a warm and wanton imagination, and that they never had any existence or habitation." Such was the state of the pygmy controversy at the time The British Apollo delivered its anti-pygmy ultimatum.

It is natural that the science of physiology should have been much slower in developing than that of anatomy. Since various physical functions were based on forces that could be neither felt, seen, nor easily explained, it was to be expected that people would for centuries attribute these to the influence of something mystical: some unusual aspect of the heavenly

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193 See John Ferriar's Illustrations of Sterne, London, 1812, vol. II, pp. 70-81, for a comprehensive list of classical writers who make similar use of the pygmy story.

194 Quoted in Eddy, op. cit., 74 (note 2), 81-82.
bodies, peculiar food one ate, strange animals, or even unusual dreams.

Following Aristotle's studies in embryology and Galen's theories concerning the heart and circulation of the blood, there stretches a period of fourteen hundred scientifically unproductive years before the advent in 1543 of Vesalius' Structure of the Human Body, the first work ever to question the authority of the ancients. From that time on, discoveries followed fast in the fields of circulation, respiration, and later of generation, although even at the time of the formation of the Royal Society, there remained a distressing amount of ignorance and superstition. Robert Hooke, one of the foremost seventeenth-century scientists, expresses in the preface to his Micrographia the hope of all clear-seeing men:

It seems not improbable, but that by these helps [scientific instruments] the subtlety of the composition of Bodies, the structure of their parts, the various texture of their matter, the instruments and manner of their inward motions, and all the other possible appearances of things, may come to be more fully discovered; all which the ancient Peripateticks were content to comprehend in two general and (unless further explain'd) useless words of Matter and Form. From whence there may arise many admirable advantages, towards the increase of the Operative, and the Mechanick Knowledge, to which this age seems so much inclined, because we may perhaps be enabled to discern all the secret workings of nature, almost in the same manner as we do those that are the productions of Art, and are manag'd by Wheels and Engines, and Springs, that were devised by humane wit. 195

Readers of The British Apollo show a greater interest in physiology than in anatomy, undoubtedly because of the new discoveries that were being made at that time, knowledge of which reached the average layman in more or less fragmentary form.

Questions may be grouped as follows:

- Animal spirits and vapours: 2
- Muscular motion: 5
- Bodily organs: 7
- Bodily liquids: 10
- Pregnancy: 7
- Sleep: 4
- Miscellaneous: 8

In order to understand the questions and answers dealing with "animal spirits," "vapours," and "humours," it is necessary to consider the classic attitude toward these rather ambiguous forces.

The Greeks held to the doctrine of four elementary qualities: hot, cold, dry, and moist. With these was associated the doctrine of the four humours, or bodily juices: blood, phlegm, black bile, and yellow bile. A person's health depended upon the proper proportion of these in the body, and disease resulted from their disproportion. It was thought that blood-letting would restore the proper balance among these humours. In addition to humours, it was alleged that each part of the body had its specific "vital spirits" which had to be regulated somehow in case of illness.

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In older medical use "vapours" were exhalations supposed to be developed within the organs of the body (especially the stomach) and to have an injurious effect upon the health. A somewhat different meaning of the term, current during the period with which this survey is concerned, indicated a morbid condition supposed to be caused by the presence of such exhalations: depression of spirits, hypochondria, hysteria, or other nervous disorders. It is in this sense described by Temple in his essay "Health and Long Life": "To all these succeeded Vapours, which serve the same Turn, and furnish Occasion of Complaint among Persons whose Bodies or Minds ail something, but they Know not what." Bayne in J. Duncombe's Letters speaks of them as "the dispiriting symptoms of a nervous illness called vapours, or lowness of spirits." A third use of the term, with a slightly different connotation, is as a malady in itself, "the vapours." This use was a common one throughout the eighteenth century as is indicated by Addison in The Spectator: "It is to a Neglect in this Particular that we must ascribe the Spleen, which is so frequent in Men of... sedentary Tempers, as well as the Vapours to which those of the other Sex are so often subject"; and by Defoe in Robinson Crusoe: "These things filled my Head with new Imaginations, and gave me the Vapours again, to the highest Degree."

The reason women "have the vapors commonly more than men" is explained by Apollo as:

...because the system of the nerves, as also the brain is softer and weaker than that of men; so that the passions of anger, fear, sadness, etc, as also troublesome or terrible objects easily pervert the dispositions or functions of those parts, which, when they are once hurt, are for the most part afterwards accustomed to those irregularities.198

Describing that intangible something known as "animal spirits," Apollo refers to them amusingly as "particles of the blood, so exceedingly rarified, and by mutual collision so particularly configurated, as to be capable of a swifter motion, and of a free passage through such parts of the body as are impervious to the other particles of the blood."199

The first questions dealing with muscular motion asks what that condition is, to which Apollo replies: "the contraction and relaxation of the muscles."200 Two other questions ask why infants smile when they apparently see nothing. The first of these Apollo considers irrelevant, and responds:

No wonder from sprightly young blood smiles appear Since old ones laugh out when they nothing hear.201

A similar question in a much later issue rates this interesting

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198 II, 511-512.
199 I, 309. During the sixteenth century it was claimed that planets in their revolutions emit vapors that penetrate these animal spirits of men, and so stir the passions that wars and revolutions follow.—Philip Shorr, Science and Superstition in the Eighteenth Century, New York, 1932, p. 44.
200 I, 261.
201 I, 94.
Smiles arise not always from an impression made on the mind by outward objects, but sometimes from internal causes, viz. from a perfect state of health, etc., which disposeth the mind to alacrity, of which smiles are one effect, and may the rather be expected from children, not only from their never having suffer'd under any indisposition, but also from their not being sensible of the troubles of human life, to allay their natural alacrity.

 Asked why gaping is catching, Apollo concocts the fascinating solution that—

...the steams of the blood being ejected out of the mouth, doth infect the ambient air, which being receiv'd by the nostrils into another man's mouth, doth irritate the fibres of the hypogastric muscle to open the mouth to discharge by expiration, the unfortunate guest of air infected with the steams of blood, as aforesaid.

One other reader, impressed with Apollo's "indefatigable search after the discovery of all things new and curious," asks for an explanation of the report that a man buried at Kensington the week before, had afterwards been heard to groan and strike the coffin, and had been "taken up again not without some signs of life." Apollo replies that the decision of one of the society's own men who investigated the case was that the Kensington man had been dead when first buried, and that the noises had been purely imaginary. It might have been more satisfactory to the world, adds Apollo, "if they had not buried him so soon [thirteen hours after death], and had chaffed him with warm things,

202 II, 444.  
203 I, 61.
and endeavored to bleed him when they took him up.  

Ten Apollo questions deal directly with organs of the body. To one inquiring the use of the spleen, answer is that its purpose is—

...to prepare the ferment in the blood, proceeding from saline particles, adhering to the inside of the coats of the vessels, which passeth thro' the splenick branches of the port into the substance of the liver, wherein the blood is prepared as by a ferment, to make a separation of choleric particles from the more pure blood.

Concerning the intestinum caecum, that pouchlike beginning of the large intestine, Apollo mentions the possibility of its containing a certain ferment, of its containing glands whose fluids serve to harden the excrements passing through the colon, of its being a second ventricle where certain aliments may be stored till a thicker and more nutritive juice may be drawn from them, or of its being the receptacle of the excrements of the foetus. Apollo admits, however, that its use is not as yet fully determined.

Whence proceeds the heat of liver, one reader wishes to know. Apollo claims it comes as a result of immoderate exercise, passions of the mind, drinking hot liquors, or possibly

204 I, 318-319.
205 I, 120.
206 I, 184. Dr. Martin Lister was an ardent adherent to the second of Apollo's theories: that the caecum hardened the excrements. (Phil. Trans., vol. XIV, no. 155, pp. 455-1683). Dr. Lister's views have proved sound, to the extent that modern science has found that water is absorbed from the large intestine, thus bringing about hardening of the gut content.
"from choler generated and lodg'd therein, by some obstruction of the gall-bladder, whence we may reasonably suppose the blood sufficiently tainted, and capable of creating the symptoms above-mentioned, though other causes may concur to the farther production of them." To the reader wishing to know whether there is a passage from the nose to the brain, by which snuff may injure the latter, Apollo replies that these perforations of the os cribrosum, containing the nerves, are too small to admit snuff particles, which will not prove harmful unless the overuse of such powders clog the passages and hinder the discharge of "excrementitious humours." To the reader worried about why the heart is felt to beat more on the left side than on the right, Apollo correctly replies that the tip or mucro of the heart is by nature tipped in that direction. One Apollo reader wonders "whether there ever was or is such a creature as a hermaphrodite, and how far both sexes prevail." The reply is that there are such creatures, but they are not equally powerful in both sexes, being generally insufficient for generation in one. Apollo speaks of a member of that society having seen several hermaphrodites—a privilege available to Londoners generally in 1668 when the famous Anna Wilde, described for the Royal Society, was on exhibition there. The Society's scientific records also contain

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207III, 1053-1054.
208II, 341.
209II, 583.
210II, 612.
211Phil. Trans., vol. II, no. 32, p. 624.
a letter of December 4, 1686, written by a Toulouse physician concerning a very extraordinary hermaphrodite of that city. This person, twenty-one or twenty-two years of age, had the exterior of a young woman, but "les marques réelles d'un homme bien puissant." Another similarly unique creature, destined to create a great deal of interest in 1730, was the hermaphrodite lobster which was presented to the Royal Society by Mr. Fisher of Newgate Market, and made the subject of a detailed description in the *Transactions*. Readers of the *Apollo* appear to have been interested to a considerable extent in bodily liquids, including blood, glandular secretions, and excretory matter. Until the advent of Lower, the old theory concerning blood had been that of Galen, who held that in the left ventricle of the heart, part of the blood mingled with air from the lungs, and was converted into a more refined substance called "vital spirits." These he thought to be conveyed by the arteries to various parts of the body, including the brain. These vital spirits upon entering the brain were refined into "animal spirits," which the nerves (hollow tubes) distributed all over the body. These spirits must have been a great help to perplexed doctors in their diagnoses of baffling cases. It will prove interesting to note how

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212 *Phil. Trans.*, vol. XVI, no. 186, p. 282.
very often the Apollo uses the term as a solution to all sorts of physical disorders.

With so much interest current during the late seventeenth and early eighteenth centuries in the matter of blood transfusions, it seems odd that no questions on that subject reached the Apollo, though the records of the Royal Society and the French Academy are full of such cases. Long before 1708, of course, transfusions had become an accepted though by no means a common practice. The average layman must have heard of the process, but could not have been familiar with it at first hand. It seems strange that there were no questions as to the possible results of unusual blood combinations, the transfer of various characteristics thereby, or the eventual effect upon the soul of the individual. Rather, Apollo readers wish to know why blood is red, whether there is an inosculcation of the arteries into the veins, and why a man can lose blood of a good color from his nose at the same time as blood of a bad color from his arm. Apollo attributes the red color of blood to either the "admixture of the nitrous air with it, as it passeth through the lungs," or the "mixture of salt and subacid juices with sulphurous ones"; \(^\text{215}\) shows how there can be successful circulation without any anastomosis or inosculcation of the arteries into the veins, \(^\text{216}\) and explains to the man with the nose-bleed that that blood came from a capillary vein or artery—the other from a larger blood

\(^{215}\text{I, 143.}\) \(^{216}\text{I, 112.}\)
vessel capable of containing the grosser and more impure blood.

Questions on glandular secretions ask the cause of tears, and the cause of the accumulation of spittle at the sight of some eatables. The former, Apollo attributes to—

...a great and sudden disorder in the blood, which is transmitted thro' the proper arteries, from the heart, to the glands of the eyes from whence (there separated from the blood) they are distilled in small drops, thro' several minute pores, and gushing violently from the corners of the eyes discharge the body of a troublesome guest, and must consequently afford an extraordinary ease to an afflicted mind on whatever occasion it becomes disordered.

The latter condition (accumulation of spittle) is assigned to "the communion of the nerves of the eyes and palate, which arise and run along together in one common trunk, till they are distributed to their respective parts, amongst which there is a certain sympathy or consent of action."

Two questions dealing with perspiration ask why vinegar causes some people to sweat, and how a man could sweat on one side of his face while at meals, and on the other side when at work. Apollo takes care of the first query by showing that the vinegar might very well meet with an alkali in the stomach, "from whose contrarieties an effervescence arises which nature endeavours to discharge by sweat." The peculiar case of the man who sweats on only one side of his body at a time is attributed to the possibility that the man may have had palsy at

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217 III, 302.
219 I, 3.
218 I, 16-17.
220 I, 127.
some time of his life, or at least some violent cold which cramped and corrugated the tendons and nerves on that side.

The last three inquiries on bodily liquids have to do with urine: why it is salt, why turpentine gives it the scent of violets, and why asparagus scents it as it does. Apollo replies that "urine receives its saline quality from the saline particles of food eaten, which, thro' the natural heat, and concoction of the bowels, are exalted even to a volatility." Sulphur is credited as being the agent responsible for the odor imparted to urine by turpentine and asparagus, with the additional information that the latter causes an increase in the amount of the excretion as well.

Apollo pages show a considerable interest in the subject of pregnancy. Development of knowledge in this field had been rapid in the latter part of the seventeenth century, the problem having been considered first by Boyle and later by Hooke and Lower. By 1708 scientists had learned that the absence of direct respiration by the foetus was counteracted by the mother's blood, which supplies the necessary live-giving elements. Apollo recognizes this fact in replying to a question on the respiration of the foetus and, notwithstanding in a very round-about way, explains why this respiration is not necessary. The cause of the "marking" of a foetus is cited by Apollo as

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being the deep sympathy between mother and child. Modern science, of course, repudiates this idea of marking, but enough remarkable coincidences appear from time to time to keep the superstition active. Concerning a man's claiming to have had several foeti in his stomach, Apollo states that the situation is utterly impossible, for while some other small living creatures might possibly be hatched in the stomach of a man who had swallowed their eggs in his meat and drink, no reasonable person could ever admit the possibility of a human foetus' being so produced.

Other inquiries about pregnancy ask: why weak women have the strongest children, how a woman could have two successful childbirths within twenty weeks of each other, why a seven-month child is more likely to live than an eight-month, and why an infant sucking a pregnant woman has an aversion to cheese. The weakest women, counters Apollo, do not generally have the strongest children, and even if they did, that might be because of the health and strength of the father. Apollo believes it quite possible for a woman to have two children born within twenty weeks of each other, and mentions that various authors have described such cases. He considers it less unusual

225 I, 166.

226 III, 770. Chambers' Cyclopedia of Arts and Sciences (1728) cites the case of a kitten bred in the stomach and then vomited up, and of a girl in Germany who for two years vomited toads and lizards. See Shorr, op. cit., p. 26.

227 III, 1052.
...
that the semen entered the partially-closed ovary at the time of the second conception, than that the second child remained in the womb for the required length of time, rather than following shortly after the first. Concerning the likelihood of an eight-month child's dying at birth, Apollo cites the theory that if the infant, after progressing toward birth during the seventh month, fails to be born then, it must remain two months longer in order to gain strength in preparation for a second attempt after the normal pregnancy period of nine months. If it fails to remain for the required two months, it is so exhausted by the effort toward birth that it cannot live. In answer to the last of the questions on pregnancy, Apollo explains that the infant sucking a pregnant woman has a very natural aversion to cheese, since the milk, which is sourish in itself, turns to cheese in the infant's stomach, with the result that if the child be fortunate enough to survive, it has the strongest antipathy toward cheese.

Four Apollo questions inquire about sleep. Why do we sleep better on the right side than on the left? (We don't, says Apollo, unless it be due to individual custom—but points out that the right side would nevertheless be most proper for promoting good digestion.) Why don't we catch cold as easily from just standing in one position as from sleeping in one

position? (Apollo explains that during sleep there is a retraction of the natural heat, thus permitting the circumambient air to enter the pores.) Why does intense sorrow produce sleep? (It usually has the opposite effect, Apollo claims, but individual constitutions vary.) How can men who are born blind, dream accurately of light and color? (Sorry, says the oracle, but you have been misinformed—they cannot.)

There remain to be considered a number of miscellaneous questions dealing with physiology. Beards grow more slowly in winter than in summer, asserts Apollo, because the heat of the latter season dries up the moisture so essential to the hairs' growth. Onions, because of their "flatulence," linger unpleasantly on the breath but are exceedingly good for one. You can't tickle yourself "because there is too great an analogy between the several parts of the same body," but when another person tickles you, you laugh "because when tangible impressions pleasantly assault the fibres, the spirits implanted there are gather'd together and delighted, and this sensation is communicated to the common sensory, whence the imagination and praecordia are in such a manner affected." The fumes of spirituous liquors account for a man's being so dry immediately after

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232 III, 966.
234 III, 972.
236 I, 238.
238 II, 641.
233 I, 125.
235 III, 980.
237 II, 496-497.
Castration hinders the voice breaking by lowering the heat of the body, thus averting the alteration which dilates the aspera arteria or wind-pipe. A man's head turns and makes him ready to fall when looking from a high place, because his imagination is so terrified by the sense of danger and distance of objects that the resulting confusion among the spirits of the brain makes them incapable of performing their regular motions. We are likely to think, when our eyes are closed, that the coach is moving in the opposite direction, since "the animal spirits floating in the brain receive a contrary tendency" and since we have no other means of judging motion, therefore our imagination is likely to suppose that the coach is moving in the opposite direction. Such is the information gleaned from the miscellaneous questions on physiology.

Physical disorders appear to have been almost morbidly interesting to readers of The British Apollo. Progress had been made during the seventeenth century in the field of classification of diseases, and physicians had even reached the advanced stage of making observations to determine whether a person was cured because of a certain remedy or in spite of it. There was still a notable tendency to blame any and all

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239 I, 211.  
240 I, 61.  
241 I, 3.  
242 III, 715.
The text on the page is not legible due to the quality of the image. It appears to be a page from a document, possibly containing scientific or technical content. Due to the distortion, it is not possible to transcribe the text accurately.
illnesses on some disorder of the "humours," "vital spirits," and similar ambiguities. Two more centuries were to elapse before the part played in disease by bacteria was to become known. Everyone had his own theory about causes and cures. Even such a reputable scientist as Johann Glauber had his favorite medicinal preparations as cure-alls. Glauber's "pièce de resistance" was a universal panacea obtained by heating the calix of antimony with tartar. He also specialized in a secret sal ammoniac (which was actually ammonium sulphate, and not the chloride) prepared from oil of vitriol and spirits of hartshorn; and solutions of gold or iron or mercury or antimony with muriatic acid or aqua regia.

Of the one hundred and three questions on physical disorders, The British Apollo has forty-six dealing with causes of various maladies, nineteen more requiring very brief answers, and thirty-eight others calling for slightly longer discussions. For the sake of brevity and coherence, the contents of the first group is indicated in the following table:

<table>
<thead>
<tr>
<th>PHYSICAL DISORDER</th>
<th>APOLLO'S THEORY OF CAUSE</th>
<th>APOLLO REFERENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>apoplexy</td>
<td>thick lympha obstructing nerves; tough phlegm, hurting the nervous parts; feroeus colluvices overflowing the whole head; extravasated blood hindering animal spirits.</td>
<td>II, 397</td>
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</tbody>
</table>

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<tbody>
<tr>
<td>bleeding in the night (nose)</td>
<td>a plethory, or fulness of blood, whereby veins suffer a forcible apertion.</td>
<td>III, 898.</td>
</tr>
<tr>
<td>blushing (two questions)</td>
<td>troubled spirits rise to hide the face; ill humour and passion.</td>
<td>I, 83; II, 453.</td>
</tr>
<tr>
<td>cancer</td>
<td>mass of blood confining itself within empty spaces of fleshy parts; hot mass of blood settled in empty spaces of the vessels parts them and raises a tumour.</td>
<td>III, 906.</td>
</tr>
<tr>
<td>chills after eating</td>
<td>digestive system attracts heat, leaving rest of the body with less.</td>
<td>I, 48.</td>
</tr>
<tr>
<td>coach-sickness</td>
<td>spirits in brain disordered, causing retarding in circulation of blood.</td>
<td>II, 512.</td>
</tr>
<tr>
<td>colds</td>
<td>lack of heat; lack of motion</td>
<td>I, 240.</td>
</tr>
<tr>
<td>colic</td>
<td>windy and acrimonious humours; a defluxion of nervous juices vitiated in the mesentery.</td>
<td>II, 428.</td>
</tr>
<tr>
<td>cramp</td>
<td>evil disposition of animal spirits; constriction or ill conformation of tendons.</td>
<td>II, 641.</td>
</tr>
<tr>
<td>dartings in the blood</td>
<td>evil disposition of blood</td>
<td>II, 552.</td>
</tr>
<tr>
<td>defect in the memory</td>
<td>cold ferous humours lodging in brain hinder animal spirits.</td>
<td>II, 466.</td>
</tr>
</tbody>
</table>

244 Boyle found the moss of a dead man's skull, though applied only to the skin, the most effective cure for nosebleed. Shorr, op. cit., p. 131. As late as 1750, we find Zedler's Lexicon recommending mistletoe held in the hand, as a preventative of nosebleed and apoplexy. Shorr, op. cit., p. 67.

245 As early as 1700 the Royal Society had taken note of cancer and the possibility of removing it successfully. Phil. Trans., vol. XXII, no. 260, p. 476.
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<tr>
<td>diabetes</td>
<td>loose contexture of blood.</td>
<td>II, 664.</td>
</tr>
<tr>
<td>drunkard's seeing double</td>
<td>fumes of liquor disorder eyes.</td>
<td>II, 496.</td>
</tr>
<tr>
<td>excess phlegm at stated times</td>
<td>originally a cold; possibly consumption.</td>
<td>III, 958.</td>
</tr>
<tr>
<td>face swollen after toothache</td>
<td>peccant humour transmitted from interior to exterior part.</td>
<td>II, 640 (mis-numbered 546)</td>
</tr>
<tr>
<td>freckles</td>
<td>thinner portion of the choleric humour, allured outwards by face of the sun attenuating it.</td>
<td>I, 265.</td>
</tr>
<tr>
<td>giddiness after rising</td>
<td>weakness of brain causes perturbation of animal spirits.</td>
<td>III, 795.</td>
</tr>
<tr>
<td>gout</td>
<td>vicious dyscracy of the blood.</td>
<td>III, 960.</td>
</tr>
<tr>
<td>great amount of urine</td>
<td>loose texture of the blood.</td>
<td>III, 935.</td>
</tr>
</tbody>
</table>

246 To prevent such swelling, Parkinson had suggested the use of the root of the "black Chamaeleon thistle," bruised and boiled in vinegar. (Parkinson, op. cit., 972).

247 To remove freckles, Parkinson had mentioned the root of the wild cowcumber, boiled and steeped in strong vinegar; the distilled water of the Solomon's Seal plant; the seed of the Chaste Tree with niter and vinegar added. (Parkinson, op. cit., 163).

248 Parkinson had listed Scorsonera, or Vipers Grass as "very good against the swimming or turning of the braine." (Parkinson, op. cit., 409-410).

249 A treatise of the Royal Society in 1668 (Phil. Trans., vol. II, no. 34, p. 650) had mentioned gout as "owing to urinous acrimony, (urinos a putrilago)" not eliminated by the kidneys or by perspiration from the mass of blood, but carried along and deposited upon the ligaments and joints.
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<tr>
<td>grumbling of the guts</td>
<td>collection of wind, seeking a passage.</td>
<td>III, 869.</td>
</tr>
<tr>
<td>hair-lip</td>
<td>force of mother's imagination, or great fright.</td>
<td>II, 512.</td>
</tr>
<tr>
<td>hands and feet asleep</td>
<td>compression or constriction of affected parts hinders animal spirits.</td>
<td>II, 574.</td>
</tr>
<tr>
<td>heartburn</td>
<td>pain in stomach; from acid humour.</td>
<td>II, 482.</td>
</tr>
<tr>
<td>intermitting fevers(^{250})</td>
<td>stagnation of the pancreatic juice through obstructions in lateral ducts.</td>
<td>I, 127.</td>
</tr>
<tr>
<td>itch(^{251})</td>
<td>degeneration of lympha contained in miliary glands of skin, which by its volatility propagates sudden contagion.</td>
<td>I, 182.</td>
</tr>
<tr>
<td>kiby heels</td>
<td>entrance of cold atoms attracts blood and humours together, causing tumour which breaks and ulcerates.</td>
<td>III, 862.</td>
</tr>
<tr>
<td>palpitations of the heart (2)</td>
<td>tender fibres of heart discharge ill particles of blood; fright; other dis-temper.</td>
<td>I, 46.</td>
</tr>
<tr>
<td>pimple on tongue</td>
<td>sharpness or heat of the blood or stomach.</td>
<td>III, 1047.</td>
</tr>
</tbody>
</table>

\(^{250}\) Dr. William Cole in 1692 had described these fevers as a matter at first inoffensive (but afterwards maturing into a "fermentative, acrimonious substance") admitted into the roots of the nerves of the brain. (Phil. Trans., vol. xvii, no. 197, p. 657).

\(^{251}\) Dr. Bonomo in 1703 (Phil. Trans., vol. XXIII, no. 283, p. 1296) had described experiments made on various persons afflicted with the itch and assigned its cause to the biting of tiny animalcules in the skin, by means of which a certain amount of serum oozed out through the small apertures of the cutis and caused little watery excrescences to form.
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<tr>
<td>premature grayness (2)</td>
<td>predominance of phlegm in juice nourishing hair.</td>
<td>III, 960.</td>
</tr>
<tr>
<td>recurring drowsiness</td>
<td>phlegmatic or watery humour; abundance of blood thickening the animal spirits; extravasated blood filling ventricles of brain; thick vapours from a foul stomach.</td>
<td>I, 150.</td>
</tr>
<tr>
<td>running noses</td>
<td>constipation of pores through cold leaves ferous humours to be discharged by brain through nostrils.</td>
<td>II, 646 (mis-numbered 546).</td>
</tr>
<tr>
<td>Saint Vitus' dance</td>
<td>disorder of the animal spirits by an heterogeneous copula, which becoming fierce need to be so exercised and fatigued that they might be tamed, and the offending matter dissipated.</td>
<td>I, 158.</td>
</tr>
<tr>
<td>shortness of sight</td>
<td>too great a proportion of light; too great contraction of pupil of eye.</td>
<td>I, 78.</td>
</tr>
<tr>
<td>sleep-walking</td>
<td>animal spirits running through same passages as when awake, excite us to similar actions.</td>
<td>II, 584.</td>
</tr>
<tr>
<td>sneezing</td>
<td>sharp humours twitching the inward part of the nostrils.</td>
<td>II, 592.</td>
</tr>
<tr>
<td>snoring</td>
<td>impediment within or without the nostrils.</td>
<td>III, 725.</td>
</tr>
<tr>
<td>starting in one's sleep</td>
<td>dreams; worms; sharp humours, malignant fumes arising from stomach to brain; sickly constitutions.</td>
<td>II, 482. III, 883.</td>
</tr>
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<tr>
<td>tape-worms</td>
<td>ova conveyed into stomach via food.</td>
<td>II, 575.</td>
</tr>
<tr>
<td>thickness of drunkard's speech</td>
<td>fumes of wine assign perverse motions to the spirits.</td>
<td>I, 115.</td>
</tr>
<tr>
<td>vapours</td>
<td>distemper of the nerves caused by infection of animal spirits with vitiated and heterogeneous humours.</td>
<td>III, 1012.</td>
</tr>
<tr>
<td>wakefulness at three a. m.</td>
<td>indigestion.</td>
<td>III, 841.</td>
</tr>
<tr>
<td>watery eyes</td>
<td>abundance of ferous humours discharged by glands of brain.</td>
<td>II, 604.</td>
</tr>
<tr>
<td>worms in the face</td>
<td>corruption of blood and humours extruding putredinous matter to the skin.</td>
<td>III, 897.</td>
</tr>
</tbody>
</table>

The next group of questions are those Apollo finds it possible to dispose of briefly: Is green tea good for a person who has bilious colics and weak nerves? (Yes—particularly with milk.)

May wood betony safely be smoked instead of tobacco? (Yes—beneficially.)

Is it wholesome to smoke if the habit causes one to evacuate large quantities of saliva? (No—perhaps the nutritious juices may also be lost.)

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253 See Phil. Trans., vol. XIII, no. 147, p. 154, for accounts of unusual cases.

254 II, 664.


256 III, 832; III, 1055.
water, drunk from youth, be more agreeable than other liquors? (Beneficial to some; harmful to others.) Will abstinence reduce a red nose? (Possibly.) Will strong beer create a red nose? (Yes, but liquor is not the only cause of this condition.) Does covering the face while in bed make one pale? (The consequent sweating will cause paleness.) Is it harmful for young persons to lie with old? (An advantage to one; disadvantage to the other.) Is bleeding helpful to one afflicted with nosebleed? (Yes.) What are symptoms of consumption? (Thick, discolored spittle; languishing; loss of appetite; labored breathing; nocturnal sweats; dryness of flesh.) Whence comes surgery? (From God.) Can a person have small-pox twice? (No.) Will cutting the hair off relieve a cold? (It seems very plausible.) How is extravasated serum in the abdomen of dropsical persons evacuated? (Probably blood absorbs it.) Is deficiency of sight due to the color of the eye? (No.) Why do most persons die of the

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257 II, 551.
259 II, 512.
261 III, 941.
263 III, 826.

258 II, 583.
260 III, 877.
262 III, 858.
264 III, 832.

265 III, 986. See Phil. Trans., of 1684, vol. XIV, no. 165, p. 790, for Dr. Martin Lister's argument that small-pox is due to infection, rather than to seasonal changes; also vol. XXXIII, p. 379 for suggested treatment; vol. XXIX, p. 72, for first mention of inoculation.

266 II, 575-576.
267 I, 135.
268 II, 504.
third apoplectic fit rather than the first or second? (They don't.)

Will medicine cure a cataract of the eye? (It should.)

Should a person who has been ill a long time turn to medicine and a physician for a cure? (God apparently put both items there for use.)

What are the miraculous properties attributed to the ash tree? (Apollo must be further convinced that it has any, before commenting on this.)

Included in this section on physical disorders are questions on tea, coffee, tobacco, opium, and quinine. Apollo's answer to the inquiry about the beneficial and injurious effects of tea is so interesting that it merits quoting:

By tea, we understand you, green tea, which moderately heats and dries, opens, resolves, and attenuates, is diuretic and anodyne: takes away pains of the head, is good in difficulties of breathing, and eases gripping in the bowels: Contemperates the blood and humours, and is supposed to expell sleep, by repressing or resolving the vapours that ascend to the head: and so corroborates the brain as to enable it to be without sleep whole nights without injury: and is chiefly beneficial to cold and moist constitutions.

This explanation is generally parallel to that given in a 1684 number of the Transactions, in which tea is described as of a bitter, astringent quality, useful for cleansing the kidneys, strengthening the head and stomach, and preventing, if not curing, most chronic disorders. Tea had early been prescribed

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269 II, 450.  
270 I, 60.  
271 I, 52.  
272 III, 770-771.  
273 III, 764.  
274 Phil. Trans., vol. XV, no. 167, p. 870.
We have established a new paradigm for the analysis of complex systems. This approach, which we denote as the 'Extended Complex Analysis' (ECA), offers a comprehensive framework for understanding the interplay between various components within a system. The ECA method integrates advanced mathematical techniques with empirical data to provide insights that were previously inaccessible.

One of the key benefits of ECA is its ability to handle non-linear interactions and emergent behaviors. This is achieved through the development of novel algorithms that can extract meaningful patterns from high-dimensional data sets. The results of our initial tests have been encouraging, demonstrating the potential for ECA to revolutionize how we approach the study of complex systems.

We are currently working on expanding the scope of ECA to include interdisciplinary applications, such as environmental science, economics, and social dynamics. Through collaborative efforts with leading researchers in these fields, we aim to establish ECA as a foundational tool for interdisciplinary research.

In conclusion, the success of ECA relies on the continued support and engagement of the scientific community. We encourage all researchers to consider incorporating ECA into their work, as it promises to开辟 new avenues for discovery and understanding.
by a Dutch doctor, Bentekoe, as a kind of panacea, and even as an elixir to prolong life. In answering a question on the relative merits of "sage of virtue" and "India tea," Apollo explains that the latter has "much more efficacious properties than are in sage." The reply distinguishes between Bohea tea and green tea, but considers them equally valuable medicinally. This matter of the types and culture of tea had been fully explained only a few years before by Dr. James Cunningham, an English physician in China, who imparted to the Royal Society some rather detailed information regarding tea culture.

Secondary in interest to Apollo readers are "the excellencies and prejudices of coffee," which the oracle lists thus:

Coffee is a very great desiccative, it comforts the brain, dries up crudities in the stomach, and through its alcalious property, is wonderfully beneficial in scrophulous and scorbutical habits of body. Nor can we admit its inconveniencies in respect to some particular constitutions, as being subject to fur the stomach, engender obstructions, and to cause, rather than cure, (as some will have it) splenetical hypochondriacal distempers.

It will be noticed that the Apollo is more optimistic concerning the virtues of coffee than was Dr. John Houghton, who in 1699 told the Royal Society that the berry's only value was its oil, and questioned whether it did any more good than hot

275 Wolf, op. cit., p. 442.
276 I, 19.
277 Phil. Trans., vol. XXI, no. 256, p. 311.
278 II, 632.
tea or hot broth. His treatise is valuable, however, for its detailed description of coffee: the best kinds of beans, preparation of the drink, and an account of how it first became popular in England, after its importation in 1652 by Daniel Edwards, a Smyrna merchant, whose Greek servant prepared coffee for his master two or three times a day.

Far more optimistic than either the Apollo or Dr. Houghton concerning the medicinal qualities of coffee, was John Parkinson who as early as 1640 had thus described "the Turkes berry drinke":

Alpinus in his Booke of Egiptian plants, giveth us the description of this tree, which as hee saith, he saw in the garden of a certaine Captaine of the Janissaries, which was brought out of Arabia faelix, and there planted as a rarity, never seene growing in those places before. The tree saith Alpinus, is somewhat like unto the Evonymus Pricke-timber tree, whose leaves were thicker, harder, and greener, and always abiding greene on the tree; the fruite is called Buna, and is somewhat bigger than an Hazell Nut and longer, round also, and pointed at the one end, furrowed also on both sides, yet on one side more conspicuous then the other, that it might be parted into two, in each side whereof lyeth a small long white kernell, flat on that side they joyne together, covered with a yelloarish skinne, of an acide taste and somewhat bitter withall and contained in a thinne shell, of a darkish ash-colour: with these berries generally in Arabia and Egypt, and in other places of the Turkes Dominions, they make a decoction or drinke which is in the stead of wine to them, and generally sold in all their toppe houses, called by the name of Caova; Paludamus saith Chaova, and Rauwolfius Chaube. This drinke both many good Physicall properties therein: for it strengtheneth a weake stomacke, helping digestion, and the tumours and obstructions of the liver and spleene, being drunke fasting for some time together. The Egyptian and

279 Phil. Trans., vol. XXI, no. 256, p. 311.
Arabian women use it familiarly while their courses hold, to cause them to pass away with more ease, as also to cause those to flow that are stayed, their bodies being prepared and purged aforehand.  

To a question regarding the virtues of tobacco, Apollo replies concisely that it "is by nature hot and dry; it discusses, resolves and cleanses, is purging, emetic, anodyne and vulnerary, and is chiefly beneficial in cold and moist constitutions, and hurtful in the contrary." A reader desirous of knowing what particular mark indicates that the deceased died from opium, is informed that the operation of that drug is chiefly on the animal spirits, but that if a quantity is taken into the stomach it may inflame and disorder that organ.

Apollo cites the instance, from Dr. Mead's "Essay on Opium," of opium's killing a dog which upon dissection proved to have the stomach as clean as though scraped, free from all gastric juices, and slightly inflamed.

The next two questions concern Jesuit's bark. Apollo explains that it is used in the case of agues to stop the fermentation of the blood and avoid intermittent fevers. It is naturally astringent, and "proves purgative only by reason of

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281 III, 723. The Royal Society had in 1702 been favored with a comprehensive account of tobacco culture in Ceylon, by Strachan. See Phil. Trans., vol. XXIII, no. 279, p. 1134.
282 III, 742.
283 This must have been Dr. Richard Mead, whose work *A Mechanical Account of Poisons* had been published in 1702.
284 Quinine, sometimes called Peruvian bark, cinchona, or Jesuit's powder.
285 I, 119.
some peculiar temper or idiosyncracy of bodies, or thro' its meeting or fermenting with some heterogeneous humour in the stomach, whereby irritation is caused, and expulsion propagated." This Jesuit's bark, imported from Peru in 1640, was soon used all over Europe as a cure for fever, being recommended for that purpose by Richard Morton in 1697 and by Van Leuwenhoek in 1707. It was also credited with curing women of periodic convulsions.

Concerning the emetic quality of *crocus metallorum* when administered in wine, Apollo gives credit to "the saline and sulphureous particles of the antimony, whose subtile effluvia thus impregnated the wine with the aforesaid virtue." Such a mixture, however, loses its potency after the second dose is taken. In an explanation of how a cathartic operates, Apollo says:

Cathartic, or purging potions, receiv'd into the stomach cling to the inner coat thereof, their particles entring the nervous fibres, and causing a troublesome irritation, whereby the bottom and sides of the stomach are affected with expulsive contractions, and the purgative liquor with other humours is cast forth into the intestines, where meeting with the cholerick and

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286 II, 382.

287 *Phil. Trans.*, vol. XXV, no. 312, p. 2446.


pancreatick juices, the aforesaid irritation is continued, and the expulsion propagated.  

Asked how a small scratch may prove fatal, Apollo explains that the blood and humours are so extremely vitiated, that instead of being balsamic, they prove corrosive, thus aggravating the malady. Another reader, worried about how to distinguish smart from pain, is told that smart, a species, is a subdivision of the genus pain. Apollo accepts without question the story of the young man who fell head foremost into a tub of cheese and was considered dead until his revival on the third day. The answer suggests this to be due to a strong apoplectic fit, during which the influx of animal spirits was interrupted so that the appearance of death was maintained. It is advised that people should not be so hasty in the burial of persons supposedly dead from such a distemper.

There are a number of comparatively unrelated questions remaining to be mentioned under the general heading of physical disorders: How may the spleen be said to be defective? (Since it must serve the blood in some way, it is defective if unable to perform this office.) From what cause does hypochondriac melancholy arise? (Blood becoming degenerate, and "tainted with melancholic faeculencies," communicates "its adult recrements

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290 I, 215.
292 II, 420.
294 III, 861.
291 III, 785-786.
293 III, 1011.
to the brain and nerves, causing a variety of fancies."\textsuperscript{295} Whence proceeds the inability of a lady to use her arms? (Paralytic, probably; if painful, rheumatism.)\textsuperscript{296} In the case of eye trouble, is a green shade advisable? (No; a colorless one is preferable.)\textsuperscript{297} Whence the cause of malt liquors disagreeing with a person for a short length of time only? (Possibly sharp choleric humours in stomach were aggravated by malt, but reinstalled to health by a period of milk and water.)\textsuperscript{298} How may toothache be a sign of love? (Earnest desire for a thing makes the teeth water, consequently ardor of a person’s affection may attract such a flux of rheum to the jaws, as will occasion the ache.)\textsuperscript{299} Why does lady swoon at sight of spider on her sleeve? (Antipathy causes animal spirits which have once been driven into confusion by a meeting with some object, to react that way at future times.)\textsuperscript{300} How can eating cause a feeling of intoxication? (Brain being crowded with grosser vapours from food, the influx of animal spirits into the nerves is partly obstructed, rendering them remiss.)\textsuperscript{301} Why are those born deaf, also dumb? (Speech is from imitation, but deaf person is

\textsuperscript{295}Ibid. Zedler’s \textit{Lexicon} (1750) suggests that an ape’s heart roasted, and dried, and pulverized will strengthen the heart and dispel melancholy. Shorr, \textit{op. cit.}, p. 63.

\textsuperscript{296}I, 269.

\textsuperscript{297}I, 281.

\textsuperscript{298}II, 675.

\textsuperscript{299}II, 504.

\textsuperscript{300}I, 292.

\textsuperscript{301}II, 399.
Why should a person get sleepy in church, and how can one prevent this? (Probably lack of piety and devotion. Contemplate the beauty of holiness; reflect upon God.)

Why do persons wounded in the lungs have a smiling countenance? (Communication between nerves of those parts.)

Why do not men and women become wind-broken with violent coughs, fits, or exercise, as horses are by coughs and hard riding? (Disease is same, under different names.)

Why a singing and occasional pains in the ears after deafness has been cured? (Possibly some filth and impurities still remain in the ears.)

Why throw cold water on a swooning person? (Causes contraction of pores, surprises spirits to their wonted emanations, and restores the blood to its due circulation.)

Why is the specific C. F. never given in a fit? (It would fix the morbific matter, stop the pores, increase the heat, and make things generally worse.)

This problem of deafness had long baffled physicians, and was usually given up as hopeless unless caused by external difficulties or tonsils. The possibility of teaching deaf-mutes was discussed in a letter from Dr. John Wallis to Robert Boyle in 1670, which suggested various theories considered practical by the former. Phil. Trans., vol. V, no. 61, p. 1087. Apollo's answer to this question on deafness is correct as far as it goes.

This is probably "cassia pulp," sweet pulp of the pods of "the drumstick tree," called also "purging cassia." The pulp is a mild laxative.
the seriousness of their condition? (They are not really sensible of their illness, because of an outward show of health.)

When a cold or an ague leaves, why does it break out about the mouth? (Common in a cold, but uncommon in an ague, it enables the offending matter to be expelled.)

Why does costiveness in illness so mightily affect the brain? (Offending vapours ascend to brain, create disorder in the blood, causing catarrhs and other diseases of the head.)

Why are people stronger in fits? (Fits arise from conflict of nerves, which turmoil creates unusual strength.)

Why does pain cease if a person holds his breath? (Doubtful whether it does, or not; possible in case of abdominal pains.)

How can a person continue to feel the pain of a corn if the leg has been amputated? (Such a close union between body and soul, that the nerves still retain the sensation.)

The last question, listed under physical disorders because it is more generally applied to that phase than to any other, asks Apollo's opinion concerning the climacterical year. The answer lists the years determined by the addition or multiplication of the numbers 7 and 9 as being those most generally

309 III, 1056.
310 III, 715.
311 II, 443.
312 II, 641.
313 III, 946.
314 III, 917.

315 This superstition, still current, refers to the theory that great changes in one's constitution, health, or fortune, might be expected to take place in certain years, (determined by multiplying 7 by the odd numbers 3, 5, 7 and 9—to which some would add also the 81st year.)
dreaded, but explains that there are no "sufficient grounds to establish a rational fear" of such years, in spite of the authority of such men as Plato, Philo, and Pythagoras. It is once more interesting to note Apollo's dependence upon Thomas Browne for information on such items as this. The Pseudodoxia, after explaining the system of addition or multiplication of 7 and 9 (at greater length than Apollo does), also lists as authority Plato, Philo, and Pythagoras, but finds no "sufficiency in the received grounds to establish a rational fear." Apollo goes on to remark that the number seven is famous upon many extraordinary accounts, as the seven wonders of the world, the seven gates of Thebes, the seven cities that contended for honor, the seven stars in ursea minor, and many others. In this instance, however, Apollo concludes by referring the reader to "Dr. Brown's vulgar errors," where the matter is treated at greater length and in considerable detail. 317

Thus we find Apollo disposing of a wide assortment of questions on biology—plant, animal, and human. Some answers merely amuse, a few avoid the issue, a number of them are far from being scientifically accurate, but the vast majority manage to dispense some bits of information conceivably valuable to the reader. We cannot condemn the editors for their

316 I, 286.
inaccuracies, in view of the great amount of good they accomplished; we can wonder that they achieved any degree of accuracy in a period of blind groping and scientific bewilderment.
Chapter IV

THE INTEREST IN CHEMISTRY AND PHYSICS

In the decades immediately preceding the publication of The British Apollo, the main achievement in one scientific field was the successful effort to banish the mysticism of chemistry. The superstitious theories surrounding alchemy were to some extent destroyed, just as the old astrological farce was destroyed by the new astronomy. Such old terms as "bilious," "phlegmatic," and "choleric" were giving place to "acidic" and "alkaline." Scientists interested in chemistry and physics were working on problems of atmospheric weight, evaporation, color, light, magnetism, and related subjects; progress was everywhere apparent.

\[1\text{However, even in Chambers' Cyclopaedia (1728) alchemy rates a serious discussion with its four objectives listed: turning of baser metals into gold, finding of the elixir or universal medicine, discovery of a universal solvent, search for a universal ferment which when applied to any seed will increase its fecundity. Shorr, op. cit., pp. 21-22.}\]
The British Apollo shows a surprisingly large number of questions concerning these and other topics, with an interest in the commonplace phase of the topic predominating, as usual. The queries may be roughly classified as follows:

- Acids, oils, and salts: 8
- Air pressure: 2
- Falling bodies: 3
- Heat and cold: 16
- Light and color: 12
- Sound: 3
- Miscellaneous: 19

It is in connection with an understanding of the 20th verse of Chapter XXV of Proverbs that one Apollo reader inquires about the effect of vinegar upon nitre.\(^2\) The reply is, that vinegar augments the nitre's volatile acidity: figuratively speaking, "adding fuel to fire."\(^3\) Two more questions ask why some chemical oils sink and others swim, and why only aniseed oil freezes in winter. Apollo explains the former as being caused by the different degrees of salt and sulphur contained in them, those having most, being inclined to sink.\(^4\) Aniseed oil's volatile salt combined with the oleaginous distillations may produce a mixture that becomes stiff, or frozen, explains Apollo in answer to the latter question.\(^5\) Two readers wish to

\(^2\) Proverbs XXV, 20: "As he that taketh away a garment in cold weather, and as vinegar upon nitre, so is he that singeth songs to a heavy heart."

\(^3\) I, 64-65.

\(^4\) I, 301.

\(^5\) II, 545.
know how salt, hot in itself, congeals water. The answer explains that the salt doesn't really congeal the water, but rather condenses it. 6 When snow is mixed with salt, says Apollo, "there ariseth such a compound, as is apt to insinuate itself into the pores of the water, and so entangle the particles that they can no more move as they did afore, nor continue in the same flux." Thus the mass loses its fluidity and becomes thickened. 7 Apollo tells another reader that salt produces a blue flame in fire because of the particles of sulphur it contains, 8 and that the "subtlety or volatility of the saline particles" contained in certain liquor makes the salts and crystals shoot into curious shape when the liquor is evaporated. 9

Another reader inquires concerning a mixture of spirit of hartshorn with a like quantity of sal ammoniac. He is worried because after the mixture had changed to a salt, four or five days later most of the salt had disappeared. Apollo explains that--

these spirits...in reality are nothing but the volatile salts dissolved in more or less phlegm.... No great wonder, then, that salts should be separated from them, as well by precipitation, as by sublimation. Now the cause...is the coalition and union of the two salts, by which, becoming too bulky and ponderous to be born by the phlegmatic parts, they must needs by their own weight sink to the bottom, and so constitute compound salt separated from both spirits. 10

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6II, 366.  
8III, 878.  
10III, 998.  
7III, 929.  
9I, 190.
Two questions concern air pressure forcing liquids to rise, as out of a crooked pipe. Apollo first explains that when the air has been sucked out, "the pressure of the air on the liquor in the other vessel forces it up, which then keeps running, because no air can intervene to repress it."\textsuperscript{11} To a later argument that this cannot be so unless the end out of the vessel be as low as that within, Apollo replies that the reader's objection only strengthens the original argument, since if the end out of the vessel be not so low as that within, then there is an intervention of air.\textsuperscript{12}

On the subject of falling bodies, a reader asks whether a stone falls faster as it approaches the bottom of a high precipice, to which Apollo answers a decided yes, since as the earth is the center of gravitation, all sublunary bodies gravitate more or less in proportion to their nearness to or distance from the earth.\textsuperscript{13} To a question of where a stone would fall to if thrown into a hole perforated through the center of the earth, Apollo replies that it could fall no farther than the center without falling uphill.\textsuperscript{14} Concerning what forces an arrow or bullet through the air, Apollo points out that all bodies must remain in statu quo, whether in motion or at rest, "unless extrinsically hindered. Therefore the motion of a bullet would never cease did not air resistance finally bring

\textsuperscript{11}I, 136.\textsuperscript{12}I, 207.\textsuperscript{13}III, 869.\textsuperscript{14}I, 78.
it to a complete stop."

"What are heat and cold?" asks a reader. "Is cold merely a lack of heat?" "Why do the philosophers say that fire is cold?" To these questions Apollo replies that heat is a species of motion and cold a cessation of that motion; and that philosophers do not claim that fire is cold, but that heat and cold are not in the objects, but are sensations produced in us, the one from motion, the other from rest.

"Why does snow melt faster upon stone than upon wood?" "Why is there snow on the Alps when it is so hot on the plains below?" These readers are told that snow melts faster on stone because the moisture of the air gathers more there since the stone's pores are closer and smaller, and that the sun's beams are not reflected as they are in the valleys, by the sides of the surrounding hills. To the last answer Apollo adds that the greater rarefaction of the atmosphere on the Alps may be another reason. Readers are told that they see their breath in winter rather than in summer because at the latter time it is rarified and imperceptible, at the earlier time it is more condensed. A razor in frosty weather cuts more easily if dipped in-

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15II, 559. This is a complete acceptance of Galileo's theory.

16II, 559; III, 810. This is an echo of Hooke's earlier rejection of cold as something positive.

17I, 80.

18III, 929.

19I, 11.

20II, 611.
to hot water, because the edge is thus rendered more supple and is less likely to be broken. The question why steel is sooner heated and softened than iron, receives a lengthy technical explanation concerning both the separate and collective characteristics of the substances involved, based on the theory that the particles of iron are more rigid and stiff than those of steel.

Asked why hot water freezes sooner than cold, Apollo replies that it actually doesn't, but that after having been first heated and then cooled, it may freeze sooner because of the evaporation of the spirituous parts. Asked why gunpowder, composed as it is of fiery particles, should be as cold as ice when it is dissolved in water, Apollo answers:

Because upon its dissolution there becomes a separation of its contrary qualities, and its inflammable ones which were before predominant, flying from so opposite a body, as that of water, leaves the languid particles of the gunpowder without a mixture, and consequently occasions an entire rest, which is, what we vulgarly call, intense coldness.

Apollo says that mutton cools sooner than any other meat, because its fat is of a harder consistence than the fat of any other meat, and that the "substance that boils out of fire" is "a resinous liquor, not much differing in its nature from turpentine."

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21III, 1041.  
22I, 236–237.  
23II, 618.  
24II, 625.  
25III, 1056.  
26III, 705.
Another reader has been puzzled by seeing a bladder blown about half full, laid before a large fire, and swelling until it burst. Apollo explains this as being due to the rarefaction of the air by the heat of the fire, so that the lack of "compression of the ambient air" leads to the bursting of the bladder. Other questioners ask how air can be blown from the body both hot and cold, why a greater fire extinguishes a lesser, and how it is possible for heat to be without fire. The replies give the information that if air is blown out short, it is hot, but if forced out at length, it is cool; that a greater fire extracts so many sulphurous and nitrous particles from the air that a lesser fire cannot burn; that heat differs from fire in two ways:

...either in the lesser motion of such particles as are capable of such a degree of motion, as is necessary to the production of fire, as in all combustible matter, when only hot; or in the motion of such particles as are incapable of any such degree of motion, as in ashes.

There are several unusual questions in the group dealing more or less directly with light and color. The chief interest seems to be in glass: how can it be solid and thick, yet transparent, a number of readers wish to know. Apollo's answers to these similar questions are remarkably consistent, explaining that the glass has rectilinear pores, which admit the rays of

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27 III, 905.  
28 I, 138.  
29 I, 113.  
30 I, 128.
light to pass through in straight lines.\textsuperscript{31}

Other readers inquire what color is; why naturally red
saffron when boiled makes the liquor yellow; why milk is white
instead of red, if made of blood; whether light is a body or
a quality. Apollo's answers vary in technicality and in scien-
tific value. Concerning color, Apollo refers to Newton's defi-
nition: "that affection, or quality of light, whereby it is
dispos'd to produce in us such a particular sensation."\textsuperscript{32}
Saffron
apparently "more naturally displays a golden colour, than a red
one," according to the oracle.\textsuperscript{33} Milk is made of chyle, not of
blood;\textsuperscript{34} light is both a body and a quality (according to
Newton's definition: "an heterogeneous mixture of rays dif-
ferently refrangible").\textsuperscript{35}

An early Apollo reader is worried over why the shadows of
persons outside appear inverted when they are reflected on a
wall through a keyhole, or some such passage. The reply given
is that--

Since a shadow is nothing else than a privation of light, since

\textsuperscript{31} I, 192 and 292.
\textsuperscript{32} I, 134. Newton's theory held that sunlight is not homo-
geneous, but a composition of seven main colors. Hooke's
Micrographia, quoted in chapter III, included elementary ob-
servations in this field, and helped pave the way for Newton's
subsequent observations.
\textsuperscript{33} III, 885.
\textsuperscript{34} I, 269.
\textsuperscript{35} II, 457. For further non-technical information concerning
Newton's theories, see Joseph Mayer's The Seven Seals of Science,
New York, 1937, ch. VI.
It is necessary that a straight line be capable of being drawn from the efficient cause of such privation to the body that is depriv'd of light, since the straight line drawn from the upper part of such as pass by the keyhole will necessarily terminate on the lower part of the wall, and another drawn from their lower part will, on the contrary, terminate on the upper part of the wall, and so proportionably throughout their whole body, it thence naturally follows, that a shadow thus produc'd must be inverted in its posture. 36

The other questions in this group on light and color, deal with apparent inconsistencies. Why does a straight stick look crooked in water? (Apollo reverts to the theory of Ptolemy that light is refracted out of its straight-line path in passing through various media, and explains that if you put the stick all the way in, it would appear straight.) 37 Why does the whirling of a fire-stick create the illusion of a circle of fire, although the fire is in only one place at a time? (The disproportioned swiftness of motion "so eludes the optic nerves, as that they are not able to represent the intervals." ) 38 Why are lighted coals red, and the flames of a different color? (Apollo applies Newton's theory of color and reflection to explain this apparent phenomenon.) 39 How does it happen that cattle on the Isle of Dogs may be seen at high tide, but not at low? 40 (The first time this question appears, Apollo gives

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36I, 66.
37II, 482.
38III, 757.
39Ibid.
40The Isle of Dogs, a peninsula jutting into the Thames, was in Elizabethan days the official junk-heap of London. It received its name possibly from the dogs that ate the garbage there, or possibly from the fact that at one time the king's hounds were kept there. Apparently it was in 1708 suited to grazing, since two Apollo questions mention the cattle seen there. In later days it became a melee of docks, riverside works, and poor houses.
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the simple reason: refraction; the second time, the condition is more fully explained as:

Because at that time the water is high enough to receive the light, reflected from the cattle, in such a manner, as that the same light entering a grosser medium, and therefore deflecting farther from a perpendicular, may by such a deflection elevate the objects to such an height, as to make them become visible to those at Greenwich.42

The Apollo questions dealing with sound are interesting chiefly because they touch on the subject of sympathetic vibration, a topic of scientific interest from the time of Galileo's earlier experimentation with the vibrations of strings. This sort of investigation was carried on at various times by members of the Royal Society, an account of several such experiments appearing in the Transactions.43 They found that when a certain pitch was attained another string on the same or on a different instrument would vibrate, and that these strings would also answer to a note from a wind instrument. They probed the reason Venetian glass could be cracked by the certain note of a trumpet or cornet. They even investigated the results of the difference in texture between metal strings and gut strings.

Apollo readers wish to know why a note played on one stringed instrument makes the strings on others vibrate, to which is answered: "The cause is a sympathy of motion imparted by the circumambient air."44 Another querist asks "in what

41II, 357.  
42III, 756-757.  
43Phil. Trans., vol. XII, no. 134, p. 839.  
44I, 143-144.
manner (if one whispers against the wall, on one side in the cupola of St. Paul's) the voice is retorted so very much louder to the other." To this Apollo replies that "sounds are communicated in arcuate lines, and therefore arcuate fabrics (such as the wall you speak of) are more agreeable to their extensive propagation. A third reader asks why a small rap on a bell will make more noise than beating with one's fist upon a butter-tub. Since the query is in verse form, Apollo counters:

All harder bodies make a bigger Noise, 'cause with elastic vigour They strike the air, and with a force Superior cause a quick divorce.  

The miscellaneous questions on subjects connected with chemistry and physics must not be overlooked, as they in several cases represent the beginning of important trends. An example of such are the two questions dealing with the possibility of perpetual motion. To both of these Apollo answers a decided no—adding that "how extensive soever art may be, there would be a defect in matter." The second time, he says further that he "would not discourage the inquisition of the ingenious," although "there can be no perpetual motion affected by the now known principles of mechanism." Members of the Royal Society had been equally emphatic on this point, papers in the Transactions showing that various objections had been

45 II, 674.  
46 II, 461-462.  
47 II, 208.  
48 II, 269-270.
set forth. In 1685 Dr. Papin went on record as feeling certain that perpetual motion could never succeed, and the following year a member of the French Academy, not satisfied with Dr. Papin's objections, showed further the absolute impossibility of perpetual motion. An Apollo question concerning suction merits an unusually long reply in which Apollo gives Newton's definition: "A tendency of one body to another; which tendency is in all bodies, but more intense in some bodies respectively to other particular bodies." Apollo follows this by an explanation of the difference between suction and pressure, and by divers examples of each.

Other important questions in the miscellaneous group include: Which element is most powerful? (Fire.) Is matter infinitely divisible? (Yes, says Apollo, adding proofs and refuting objections.) Will glass decay? (Yes, although imperceptibly.) Why does glass break, for no apparent reason? (Probably new, and exposed to air and use before thoroughly cooled and seasoned.) Has amber, the loadstone, an attractive virtue? (Apollo is doubtful of the use of the word "attraction,"

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49 Phil. Trans., vol. XV, no. 177, p. 1240.
51 III, 947-948.
52 I, 81.
53 I, 78.
54 II, 668.
55 II, 497.
but agrees with Newton that there is some such force.)

Concerning the cause of elasticity, Apollo replies--

When certain bodies are bent by external force the pores of the convex side are enlarged, and those of the concave straightened. When therefore the subtile matter, which with great velocity is ever running through the pores of bodies, enters the enlarged pores, but cannot pass through in the same quantity and with the same freedom, they strike the sides of the pores with so violent a force, as to reduce the bended body to its former state. We therefore ascribe elasticity to the peculiar con-texture of elastick bodies, and the vehement motion of ethereal matter.

One Apollo reader wishes to know how it is possible for straw both to preserve ice and ripen apples. Apollo disagrees with the latter use, believing rather that the straw is used to preserve the apples by preventing their becoming bruised and rotten. Straw's use for roofing ice houses is explained briefly. This matter of the preservation of ice by the use of straw is described at some length in a communication to the Royal Society in 1666, whose Transactions for that year contain an account of ice houses at Leghorn, Italy, which were thatched with straw, chaff being used around the ice as a further pres- servative measure. Both in Italy and elsewhere, this use of straw (and occasionally reed) seems to have been successfully employed.

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56 I, 235. Erasmus Bartholinus in 1669 drew attention to the fact that Iceland spar had a similar power of attraction. Wolf, op. cit., p. 368. The electrical properties and medi-cinal virtues of amber are discussed at length in Phil. Trans., vol. XXI, no. 248, p. 5.

57 I, 54.

58 I, 293-294.

59 Phil. Trans., vol. I, no. 8, p. 139.
The measurements and measurements have been taken and recorded for the purposes of the study.

The results show a significant correlation between the variables studied. This indicates a strong relationship between the factors examined.

Further analysis is required to fully understand the implications of these findings.
Two Apollo questions ask why cheese will sink but butter float, when put into water. To the first of these queries (a rhymed one), Apollo answers:

What occupies most room will swim,
What less, will sink beneath the brim. 60

The next appearance of the question (obviously by the same reader) is worded thus:

Butter and cheese of a bigness I'll trim,
Yet cheese it will sink, and butter will swim;
Which occupies most room, Mr. BRITISH APOLLO,
The butter or cheese, let your answer now follow?

Replies Apollo:

Which either does sink, we find all our pains
In vain to make sense sink into your brains;
To trim both, is only a subject for laughter,
Since 'tis more or less in respect to the water. 61

The five remaining miscellaneous questions are of varying interest: Why does the beating of a drum turn ale sour? (Com-
motion in the air causes fermentation in the liquor, an exalt-
ation of its tartarous parts, and a depression or dissipation of the spirituous.) 62 When a piece of bread is laid in water, why does the water rise in the bread higher than the surface of the surrounding water? (Air pressure is greater on surrounding water than that on which the bread is laid, thus forcing the

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60 I, 153.
61 I, 209.
62 III, 785.
water to rise in the bread.)

How do the parts of matter cohere? (Apollo despairs of giving a satisfactory answer, since the most able philosophers have failed, but lists the various theories in considerable detail.)

Why does a candle smell after the flame has been put out, but not before? (When candle is put out, sulphureous particles are separated and retarded, making us more sensible of the unpleasant smell.)

Why is an egg so hard to break lengthwise? (The two ends are so globular, that the pressure declines towards the cohesion of its parts, which is the reason an arch will bear more weight than a flat.)

Why do sparks fly from a flannel gown? (Apollo finds it difficult to assign a satisfactory explanation to this phenomenon, but believes "that flannel being apt to receive, and keep within itself some nitro-sulphureous particles, which may exhale out of the bodies of some people at certain times, there may be, at least, a sufficient quantity of them, to give some sort of light or flame, when they come to be put in a due motion for it.")

Thus the Apollo functions in the role of chemist and physicist for the early eighteenth-century layman. A number of the answers are necessarily mere guesswork; many of them are obviously incorrect; a few are basically sound insofar as the scientific knowledge of the period permitted.

63 II, 381-382.  
64 III, 709-710.  
65 III, 763-764.  
66 I, 215.  
67 I, 222.
Chapter V

THE INTEREST IN PHYSICAL GEOGRAPHY

As used in this chapter, "physical geography" is a blanket term indicating that branch of natural science dealing with the earth itself, as well as the subterranean and atmospheric forces that affect it. For the sake of coherence, the consideration of these factors is divided into the three classifications of hydrology (the waters of the earth), meteorology (atmospheric phenomena), and mineralogy (subterranean formations).

The early eighteenth-century interest in hydrology sent to The British Apollo an assortment of questions surprisingly naive and free from technicalities. These queries fall into three main groups: those dealing with the ocean, with rivers, and with springs.

The first question, of obvious interest to people in general, asks (metrically) what keeps the ocean within its
bounds, to which Apollo cleverly replies:

The ocean tumify'd appears,
But as a globular form it bears,
Which form it strictly comprehends,
Whilst to the central point it tends:
But why such wonders nature shows
Why earth and sea one globe compose,
The great Creator only knows.  

The second question, nearly as elementary, inquires whence comes the saltiness of the sea, a condition Apollo ascribes to the salt rocks and mines in the earth under the sea. Another reader asks how the Thames can be fresh if the sea is salt, to which Apollo responds that "the Thames is salt, till mingled with so great a quantity of fresh water, as to make so proportionably a quantity of salt to be imperceptible."  

A subject of enough interest to provoke four Apollo questions is tides. The oracle states that the sun and moon cause tides, which have their origin in the middle of the ocean. This matter of tides had been of constant interest to members of the Royal Society ever since that group's organization. Sir Robert Moray in 1665 wrote for the Society an account of some most unusual tides he had observed in the Western Isles of Scotland. The 1666 Transactions contain several treatises on the subject: one a long dissertation on the flux and reflux

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1I, 81.  
2II, 420.  
3III, 725.  
4II, 407; I, 156.  
5Phil. Trans., vol. I, no. 4, p. 53.
of the sea; another an explanation of how tides increase and decrease regularly at various seasons, according to the moon's age. A particularly interesting question on tides, from an Apollo reader, asks the reason people are likely to die either at high or at low tide, and is turned aside humorously by Apollo without further consideration. Several years prior to this time, however, there had been interesting speculations in the Transactions concerning this matter. Even the most eminent scientists had given it their attention when one of their confreres, Paschal, had made some rather detailed observations in this field. In order to determine the extent to which tides exerted their influence upon human births and deaths he divided the natural day into four periods of hours corresponding to the ebb and flow of tides. He then recorded the times of births and deaths in human beings and in animals, finding that none were born or died a natural death in the first or second tides, but every one either in the first or second ebbs. He next noted those afflicted with disease, finding that the malady appeared worst during the period of tides, and relaxed during the ebbs. From these observations he concluded that motion, vigor, action, and strength are most apparent during the period of tides; that rest, relaxation, decay and

8 II, 545.
dissolution belong to the ebbing periods.\(^9\)

One Apollo reader submits a question on the reason for the sea's swelling several days before a recent hurricane. This the oracle attributes to "subterraneous winds, making their way where they met less opposition."\(^10\) The two remaining questions dealing with the sea have to do with waterspouts, which Apollo claims are due to vapours which arise from the heat and fire within the earth, and force themselves through the sea, carrying the water before them.\(^11\) Another reader, admittedly disagreeing with this solution, sends in his account of waterspouts observed in the Mediterranean the preceding fall, a phenomenon which came close to causing a shipwreck. The reader feels that if the impetus had come from under the sea, the disturbance would have remained in one place, whereas the waterspout he saw had appeared to move swiftly past the ship, without benefit of wind or current. Apollo replying, feels that the case cited merely strengthens his original statement concerning the source of these spouts, "that it was something from within which determined their motion this way or that way, and which we may very well suppose to be some subterranean heat or fire not fixed in one particular place, but at different times kindled in different places and concavities of the earth, and

\(^10\)I, 93.
\(^11\)III, 800-801.
following the different turnings and windings of them." The account of waterspouts referred to in the Apollo is no more unusual than various other similar accounts of these phenomena elsewhere, particularly in the Royal Society's Transactions. One such observation was made by the Reverend Mr. Abraham De la Pryme, on August 15, 1687, when the season was dry, the weather hot, and the wind strong. He saw what he believed to be a waterspout appearing in the air, destroying everything with which it came in contact. From the fact that the observer concluded that it proceeded from a peculiar cloud formation, caused by contrary winds meeting in a point, and resembled a long, black tube, we may conclude that what he saw was a tornado cloud, which is even today often confused with a waterspout. Another such appearance was noticed by the Reverend Mr. Patrick Gordon in 1701, with the wind blowing a cold gale. This was apparently a true waterspout, lasting about twenty minutes, and followed by hail, wind, and increasing cold. The observer mentioned having seen several previously in the Mediterranean, during calm, hot weather, but never before in such a northerly climate in a windy March. A report from Mr. Alexander Stuart of a series of waterspouts observed in the Mediterranean early in the morning of August 27, 1701, described the phenomenon as being preceded by thunder and

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12 III, 1044-1045.
13 Phil. Trans., vol. XXIII, no. 281, p. 1248.
lightning. His account took into consideration the variations in the different spouts, and gave a technical description of each of them.\textsuperscript{15}

Questions sent to \textit{The British Apollo} on the subject of rivers deal not with the subject in general, but with four specific rivers: a stream near Bristol, the Thames, the Banjarmasseen in Borneo, and the Nile. The first question asks whether the river near Bristol is caused by nature or by art, since it flows between two huge cliffs of stone. \textit{Apollo} settles this by replying: "Doubtless, it was principally the work of nature, though art might perfect what nature began."\textsuperscript{16} To the reader concerned over the fact that water from the Thames is at first foul, but later becomes sweet when kept for a length of time, \textit{Apollo} answers that the apparent inconsistency may be caused by a greater quantity of sulphur and salt in that than in other water.\textsuperscript{17}

Another question asks why the Banjarmasseen, in Borneo, is in places unfit to drink during two months of the year. \textit{Apollo} attributes this condition to "some noxious and poisonous vapours arising at that time from the earth, under that place of the river."\textsuperscript{18} In reply to a rhymed request for information concerning the overflow of the Nile, \textit{Apollo} offers these

\textsuperscript{15}Op. \textit{cit.}, vol. XXIII, no. 277, p. 1077.
\textsuperscript{16}II, 600. \hspace{1cm} \textsuperscript{17}III, 723.
\textsuperscript{18}III, 829.
When the warm sun from Aethopian lands
Remits the fervour, and bids winter reign,
Successive show'rs o'er distant mountains smoke,
And falling thence, in rapid torrents roll,
Tearing, as thro' the delug'd lands they fly,
The muddy bottom of up-rooted earth,
And thick'ning with fat soil their growing streams:
Hence 'tis, that cov'ring with rich slime a ground,
Which the hot sun had burnt to sand before,
Aegyptian plenty does with Nilus flow,
And by his fall soon feels a sure decrease. 19

This matter of the inundation of the Nile is treated at great length by Sir Thomas Browne in his Pseudodoxa, where he cites all sorts of possible explanations, supporting each by appropriate references from antiquity. 20

The last British Apollo questions in the hydrology group deal with springs, and are decidedly similar in content. The matter of how springs are able to rise to such a level that they can flow from high hills, Apollo attributes to subterraneous heat which makes water rise in vapors and condense into fountains. 21 These springs are colder in winter, the oracle believes, because the earth's heat retires then, and returns in the summer. 22

Several questions concern the health-giving waters at Bath: what makes the waters hot, and what makes them turn

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19 II, 490.  
21 II, 368-369.  
22 I, 211.
...
silver objects to a golden color. Their heat Apollo ascribes to a sulphurous mine which is mingled with nitre and bitumen, from the last of which the silver receives its golden color. Apollo does not take up the waters' potency in matters pertaining to health, although the Royal Society's Transactions are full of observations concerning their efficacy in cases of palsy, epilepsy, convulsions, leprosy, itch, scabs, spleen, liver, mesentery, women's diseases, scurvy, stone, and barrenness.

By such simple questions is the Apollo readers' interest in hydrology manifested. There is nothing subtle, nothing abstruse, nothing technical. Apollo's answers are in the main straightforward, occasionally amusing. The resulting impression is a pleasant change from some of the far-fetched questions and glaringly inconsistent answers to be found in some of the other categories.

Early eighteenth-century interest in meteorology apparently centered around such commonplace occurrences as rainbows, snow, thunder, and lightning, if one may judge from the questions submitted to The British Apollo:

<table>
<thead>
<tr>
<th>Topic</th>
<th>Frequency</th>
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<tbody>
<tr>
<td>Atmosphere</td>
<td>3</td>
</tr>
<tr>
<td>Echoes</td>
<td>3</td>
</tr>
</tbody>
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23 I, 321.  
24 II, 898.  
Rain, snow, hail  8
Sky colors        6
Thunder and lightning 4
Winds             4
Miscellaneous    3

The first group includes: whether the air itself is perfectly full and without pores, why a mist precedes a hot day, and how huge trees can be split by the cold. Apollo explains that there is no imaginable way of knowing whether the most subtile matter existent in the world be with or without pores, and points out that "in a morning preceding a hot day, the atmosphere is so dispos'd as to receive from the sun such a proportionable degree of heat, as is sufficient to exhale such a quantity of moisture as is enough to compose a mist." The question of the huge trees near Bologne split by the cold is disposed of by Apollo as follows:

The extreme coldness of the air seems to be owing to some very sharp and piercing nitrous salts dispersed in it, which insinuating themselves in great quantities into the wood of some trees, like so many small wedges, may be able to split the biggest of 'em, and especially those whose pores are so configurated as to admit them, but not to give them a free and easy passage.

A case similar to this, observed in the winter of 1683, was recorded in the Philosophical Transactions by Mr. Jacob Bobart. He claimed to have seen elms, oaks, ash, and walnuts split by the extreme cold with a sharp sound resembling the report of

26I, 40-41.  27III, 740-741.
28III, 918.
a gun. It was his conclusion that the trees were imperfect, possibly full of inbred diseases and cavities.29

Two Apollo questions ask what an echo is; the third, why an echo moves in an arcuate, and not in a straight line. Apollo defines an echo as

...the reverberation of a voice from hills, rocks, walls, banks, woods, wells, etc. and is caused by any of the above-mentioned repercussing bodies, stopping and reflecting the original sound, thro' arcuate lines in the air; of these are two sorts, the concurrent and the itinerant echo, distinguished by the quickness or slowness of their return; the first is, when we are near the repercussing body; the second, when at a distance from it.30

An echo moves in an arcuate line, says Apollo, because that sort is most agreeable to that circular motion of the air, which solves the phenomena of sounds.31

Readers' questions on rain ask where it comes from, and why the sky is so dismal just before a rain. Apollo answers that rain "proceeds from the vapours attracted from the earth and waters, which meeting together condense into clouds and becoming at length too ponderous to be suspended in the air, break, and shower down again upon the earth and waters."32 The sky is dismal just before, he says, because of the condensation of vapours into clouds which foretell the impending showers."33

29 Phil. Trans., vol. XIV, no. 165, p. 766.
30 I, 45. See also III, 925.
31 II, 420. 32I, 200.
33 I, 153.
The nature of hail interests two readers, to one of whom Apollo explains that "hail is the thicker clouds congeal'd in the higher regions of the atmosphere." Apollo points out that the second reader, who wishes to know why it often hails in warm weather but always snows in cold, "tho' hail be a more compact congelation than snow," is basing his argument on two false suppositions since water when congealed is really more rarified than when dissolved, and secondly, snow is engendered from thin vapours, and hail from drops of rain. Therefore the query proves itself false. It is easy to see how people would consider hail a heavier, more condensed matter, since in its congealed state it is so very destructive. The late spring of 1686 had seen a particularly vivid demonstration of this when in Flanders hail stones weighing over a quarter of a pound fell, leaving not a whole pane of glass in windows on the windward side of buildings. Trees were broken and in many cases beaten flat; small animals were killed; many persons were injured. Such evidence of the weight of hail as compared with rain or snow, the average layman found difficult to reconcile with known scientific experiments.

Questions on snow ask: what snow is, whether snow freezes in the air, and whether it can snow and freeze at the same time. Apollo answers that snow is "vapours congealed by the cold in

34 III, 832.
35 I, 7.
36 Phil. Trans., vol. XVII, no. 203, p. 858.
the upper regions of the air. Hence therefore is the reason, why snow is of so loose a contexture, namely, because it proceeds from thin and rarified vapours.\textsuperscript{37} On the second point, the two other readers are assured that:

Snow being nothing but water or vapours congealed, we may confidently affirm, that it freezes in that place from which it comes. Besides, since when it snows it is always very cold here below, and since experience, as well as reason teaches, that it is still colder in the middle region of the air, where the meteors are formed, we may very reasonably conclude, that in snowy weather it is cold enough there to freeze.\textsuperscript{38}

Probably the most unusual phenomenon concerning snow, current at that time and recorded in the \textit{Transactions}, was the story imported from Italy of a red snow that had been seen in Genoa. According to reports, white snow had fallen first, then red snow, which latter, when squeezed, had yielded water of the same red color.\textsuperscript{39} The Royal Society apparently offered no solution to this phenomenon, although the matter was the subject of widespread discussion.

A number of questions on sky colors occurred to Apollo readers, who inquire: Why does a red sky in the evening indicate a fair day? (This condition "proceeds from the dryness of the air intercepting the clouds, which else would dissolve into showers of rain, which are nothing else but...fruitful

\textsuperscript{37}III, 824.

\textsuperscript{38}III, 929-930. See also III, 831.

\textsuperscript{39}\textit{Phil. Trans.}, vol. XII, no. 139, p. 976.
drops derived from nitrous particles of air, besprinkling the surface of the earth.")

What accounts for the different colors in the clouds? (The different dispositions of the air imprint divers colours in the clouds.)

What terminates our sight? Why is the sky blue? (Apollo takes care of these queries in some verses which can be appreciated best through the medium of direct quotation:

The great Creator of this earthy ball,
Whose boundless pow'r and goodness fram'd us all,
Gave CHAOS form, chang'd DARKNESS into light,
And plac'd, 'twixt HEAVEN and us, a skreen to bound our sight.
A gloomy darkness stops our eager eyes,
And INTERPOSING light adorns the skies;
Thence mingled BLACK and WHITE familiar grew,
And knit in close embraces, form'd a BLUE.
But when dark fogs their heavy pinions ply,
And draw their misty curtains o'er the sky,
That lovely BLUE strait leaves its azure bed,
And 'till the sun's MERIDIAN beams are spread,
Thick VAPOURS interpose, and form a gloomy RED.)

Two Apollo questions concern rainbows: one by day; the other, by moonlight. The answers explain, briefly, that the various colors are caused by differently refracted light upon the falling drops of rain, and that even though the sun was not present at the time the other rainbow was seen by moonlight, nevertheless, if the cloud were near enough to the horizon, it might even then receive the influence of the sun's rays. A

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40 I, 119.
41 Ibid.
42 I, 74-75.
43 I, 224.
44 II, 474.
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nearly identical occurrence may be noted in the 1666 Transactions, which describes two most unusual rainbows seen at Chartres on August 10, 1665. These appeared at six-thirty in the evening, at right angles to each other, and occasioned considerable comment.  

Apollo readers appear to have been interested in the effects, rather than the causes, of thunder and lightning: Why does thunder sour beer and ale? ("by the violent agitation and new fermentation it causeth in those liquors, by which their spirituous parts are in a great measure dissipated or depress'd, and their tartarous parts exhaled."). Why does thunder damage oak trees only? (The oak by its inflexibility and resistance to the concussion is more liable to damage than other trees, yet the latter may be harmed by a more violent degree of motion.) What causes thunder and lightning? Why do they not appear in cold weather? ("Lightning is caus'd by the sulphureous and nitrous exhalations set on fire in the air. And the suddenness of their ascension disjects the air in so violent a manner as to produce the sound we call thunder....Those exhalations cannot be suppos'd to be set on fire in a cold air.") Why does blue lightning do most damage? ("The sulphur is predominant, which is of a quality more inflaming than


46 II, 532-533. See Phil. Trans., vol. VIII, no. 96, p. 6092, for an account of the effect of thunder and lightning upon wheat and rye in granaries.  

47 II, 566-567.  

48 II, 361.
Apollo readers submitting questions on wind seem interested in what the wind is, why the north wind is colder than the south, what causes the changing winds, and why the trade wind in the West Indies always blows within one quarter of the compass. "Wind," explains Apollo, "is a more than ordinary commotion of the air, and of the vapours which it carries with it." The north wind is colder because we are north of the sun, and consequently north wind proceeds from regions at a greater distance from the sun. The changing of winds is caused by "the motion of vapours and exhalations, the disposition of the earth, and the asperity and inequality of the superficies thereof, as mountains, valleys, woods, etc. whereby their courses are retarded and turned." Apollo answers the last question, concerning trade winds in the West Indies, in great detail, explaining all the various possible causes of such winds before concluding that--

...the best and indeed true solution is taken from the sun. For as the course of the sun is westward, and as the air is most rarified under the sun's meridian, so it follows from the necessary laws of statics, that the air which is more condensed, readily flows to that which is more rarified, in order to preserve an equal balance. Whence the air which is not at a greater distance than is mentioned above, from a vertical

49II, 458.

50III, 890. See Phil. Trans., vol. XV, no. 175, p. 1148, for a discussion of the cause of winds, by Dr. Garden of Aberdeen.

51III, 1047.

52II, 382.
sun, naturally follows the course of the sun. But since the
sun, as it passes the ecliptic, goes northward and southward,
it follows that to those who live under the line, the fore-
said wind is sometimes full east, sometimes east-north, and
sometimes east-south; and that to those, who live in the tem-
perate zones, it is sometimes full east, namely, when the de-
clension of the sun is too small to make a difference; at
other times to the northern sailors it is east-south, to the
southern east-north. 53

This answer of Apollo's is noticeably parallel to Halley's
account of trade winds and monsoons in the Transactions of 1686.
Halley's explanation, though far greater in length, seems much
more lucid than Apollo's, probably because the latter is forced
to compress a great deal of information into a small space.
Halley divides the waters of the world into three parts: the
Atlantic and Ethiopic Sea, the Indian Ocean, and the great
South Sea or Pacific Ocean. He considers each of these indi-
vidually, explaining from personal observation the wind vari-
atations in each section. 54 Apollo would have done well to refer
readers to this treatise, which would have been readily ac-
cessible to anyone interested in looking into the matter
further.

The last questions on meteorology, of a miscellaneous
nature, ask about meteors, dew, and fairy rings. Apollo re-
plies that the meteor described by that particular reader was
sustained by the "flux of the air," that it did not fall from
a star, and that the heat of the air may have been sufficient

53III, 762-763.

to give it light, "by giving the sulphureous particles so rapid
a motion as to enable it to deject the circumambient air, and
move only in the materia subtilissima, whence the original of
fire."55 Concerning the source of dew, Apollo informs the in-
terested reader that "the sun in the day exhales the moisture
of the earth, which, after sun-set, falls upon the ground under
the name of dew."56 Fairy-rings, those brownish, circular
patches apparent in many pastures, Apollo identifies as being
"occasioned by lightning, striking the part in that form, which
leaving sulphureous particles behind tinges the grass with that
deep colour."57 It is interesting to note that in 1675 Mr.
Jessop had described for the Royal Society two different types
of these "fairy-circles" which he had observed personally. One
was bare, seven or eight yards in diameter, making a round
patch somewhat more than a foot wide, with green grass in the
middle. The others were similar, but of several sizes, and
were encompassed by a circumference of grass, about the same
breadth, much fresher and greener than that in the middle.
Another scientifically minded layman had observed at close
quarters such a phenomenon after a great storm of thunder and
lightning. This circle was four or five yards in diameter, and
had not been there before the storm. After the remaining grass
was mowed, it came up more fresh and green in the place burnt

55II, 353. See Phil. Trans., vol. XXVII, no. 331, p. 322.
56II, 489.
57I, 198.
than in the middle, and at the next mowing time was much taller and ranker. These gentlemen, as well as other observers, seem to have been unanimous in ascribing these fairy-rings to lightning. 58

Thus we find Apollo readers as much interested in the invisible, less tangible forces of the atmosphere as in the concrete, more definite things of earth. There remain to be considered only the objects and forces pertaining to the unseen realm underground.

The term "mineralogy" is misleading unless it is made clear that the science includes not only a treatment of minerals as such, arranged into genera and species, but a consideration of the way they are deposited in the earth, the order in which they lie, and their connection with each other, as well as the extracting from the earth of such of them as can be applied to valuable purposes. When it is noted that readers of The British Apollo appear to have been most interested in mountains, earthquakes, volcanoes, coal, a few other minerals, and petrifaction, it will be seen that their questions touched on all three of these phases: mineralogy proper, geology to a certain extent, and mining.

In replying to a reader's question concerning the final cause of mountains, Apollo takes for granted that the querist

refers to their uses, and consequently mentions the production of springs and rivers, generation of metals and minerals, defense for the valleys against inclement weather, production of plants, and shelter for animals, concluding with his well-worn exclamation, "As manifold are thy works, O Lord, so in wisdom hast thou made them all!" It is very possible that this particular reader was seeking information concerning the origin of mountains, various theories regarding which Apollo would have had no difficulty in locating as far back as Agricola, who in the early sixteenth century advanced the opinion that hills and mountains are produced by two forces, the power of water and the strength of wind. Still more recent was Thomas Burnet's theory, in the late seventeenth century, that the earth resembled a gigantic egg, the shell of which was crushed by the great flood, causing the internal waters to burst out and fragments of the shell to form the mountains. Apparently the Apollo reader was satisfied with the answer given to his question concerning the "source of mountains," as no request for further information on that subject appears.

Apollo attributes the cause of earthquakes to winds which have long been imprisoned in the earth, and seek to force their way out. Various other theories were extant at that time: electricity, perhaps a sudden vacuum formed in the atmosphere. The ideas advanced by Browne in the Pseudodoxia seem to have

59 I, 220-221. 60 II, 385.
fallen out of favor during these early years of the eighteenth century, but to have been revived over a hundred years after their incipience. Browne held earthquakes to be caused by "sulphureous and nitreous veins being fired, [which] upon rarefaction do force their way through bodies that resist."  

Apollo takes the safe path in claiming these earthquakes to be due to "winds," without saying what forces cause or free the latter.

The cause of volcanic flame is assigned by Apollo to sulphurous mines within the volcano, whose fiery parts are kindled by constant motion there. Similar theories had been advanced by Agricola, who held volcanoes to be explosions of subterranean airs, vapors, and exhalations, and by Athanasius Kircher in 1665, who maintained that the earth contained various centers of conflagration which were connected with volcanoes.

Another Apollo reader writes for further information concerning an island recently sprung up from a subterranean volcano. The oracle apparently avoids the issue, making no mention of the island referred to, but merely arguing that a volcano could not possibly be completely subterranean. That such an island really did appear on May 23, 1707, seems indisputable in view of the evidence in the Transactions of the

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61 Browne, op. cit., I, 273.
62 I, 116.
63 Wolf, A History of Science, Technology, etc., p. 351.
64 I, 293.
Royal Society. This is an account by Monsieur Bourgignon of a new island which had become visible between the two Burnt Islands, commonly called Little and Great Cameny. According to the testimony of various observers, there had been an earthquake in the vicinity two days prior to the appearance of the island, which from the time it first became visible until June thirteenth or fourteenth, had been increasing in extent and apparently moving under foot. Smoke and underground murmurings were reported on July eighteenth, accompanied by flashes of fire. At the time of writing, late in November, the smoke continued thicker and more abundant, with an equally noticeable increase in the amount of fire and subterranean noise.65

One Apollo reader wishes to know whether coal grows, to which question the oracle replies that neither reason nor experience would indicate that it does.66 This question reflects the old alchemists' notion that minerals grow, just as plants and animals do. Another reader mentions the caution necessary to prevent air from entering coal veins, lest it irritate the remaining coal dust and cause an explosion. Apollo believes that this is not the real reason for air being harmful in coal pits, but that "'tis rather to be feared lest the nitrous particles, with which the air abounds, mixing with the loose sulphureous matter of the coal mine, should make a compound not unlike to gunpowder, and apt to be fired accidentally several

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66 III, 935.
ways, as by lighting a candle, a pipe, or the striking of some flint-stone but not by the air alone."\textsuperscript{67} This matter of the accidental firing of coal mines had been of constant apprehension to the people of those districts. The \textit{Transactions} are full of references to such calamities, notably the case of a coal mine at Benwell which in 1648 had been kindled by a candle, and according to a later account had been burning for thirty years. Another such fire had been reported in 1675, apparently started by the motion of a sled used to draw the coal,\textsuperscript{68} and a third near Newcastle in 1676, obviously the one referred to in the \textit{Apollo} question.\textsuperscript{69}

Miscellaneous questions regarding minerals, submitted by \textit{Apollo} readers, are six in number: (1) The difference between salt-peter and peter-salt ("The salt-peter consists of volatile parts, and shoots out into long crystals, which are pure nitre: the peter-salt is that which is crystalliz'd last, is fix'd as sea-salt, appears not much unlike it, and very little exceeds it."\textsuperscript{70} (2) The source and qualities of borax (Imported from Armenia, Macedonia, and Cyprus; may be either native, as in silver, brass, and copper mines, or factitious, a composition of saline bodies, diuretic and healing.)\textsuperscript{71} (3) The composition

\textsuperscript{67} III, 737.
\textsuperscript{68} Phil. Trans., vol. X, no. 119, p. 450.
\textsuperscript{70} II, 683.
\textsuperscript{71} III, 870.
of lime (Made of quarry-stones, by violent calcination in a
close kiln or furnace for many days.)\textsuperscript{72} (4) The growth and de-
cay of stones. (\textit{Apollo} explains their formation, but avoids the
issue of their decay.)\textsuperscript{73} (5) The sweating of marble before
rainy weather. (In such weather the air is thicker and cannot
penetrate the porous marble until it [the air] rids itself of
some of its grosser particles, which it leaves upon the
marble.)\textsuperscript{74} (6) The paleness of a "cornelian" under certain
conditions (Moist air sullies the stone in the manner of glass
that is breathed upon, but the stone soon returns to its
natural color.)\textsuperscript{75}

The two remaining questions in the section on mineralogy
deal with petrifaction. This term is technically applied to
the conversion of animal and vegetable substances into stone,
but in its more general use includes also the minor alterations
in such substances, as well as the mere impressions (fossil
imprints) of them.

The two \textit{Apollo} readers who inquire about petrifaction
wish to know: first, the reason for black oak trees being
found underground in Northamptonshire, in a locality where
there were no living trees within miles; second, the reason
a certain lake in the north of Ireland will petrify a holly
stick in a few years, yet have no effect upon any other wood.

\textsuperscript{72} I, 47. \hfill \textsuperscript{73} II, 374.
\textsuperscript{74} III, 906. \hfill \textsuperscript{75} I, 67.
Apollo believes that the oak trees mentioned must have been uprooted by the great flood or by some more recent one, have been carried here and there by the force of the waters, and eventually buried under loose earth or mud. The petrifaction of the holly Apollo attributes to the "peculiar configuration of its pores, by which it is more apt to receive the petrifying particles of the water...whereas the same particles only slide upon other woods, or have a free passage quite through them, and so can cause no alteration." The Transactions of the Royal Society are full of accounts of the marvelous powers of petrifaction possessed by this same Irish lake, as well as by certain localities in England. An account by Dr. Plott in 1665 describes a spot in Oxfordshire where wood was turned into stone apparently without the presence of any water. This substance, when scraped, was reported to have a peculiar odor, similar to burnt bone. Another account, this time by Dr. Richard Richardson, refers to a spot about twelve miles below York, where in 1697 were observed subterranean trees so black that, when polished, the wood seemed but little inferior to ebony. This locality was topographically entirely different from that described by Dr. Plott, in that the former lay along

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76  III, 754. See also Phil. Trans., vol. I, no. 19, p. 323; and vol. I, no. 19, p. 329.
77  II, 640-641.
78  Phil. Trans., vol. I, no. 6, p. 101. This was undoubtedly Dr. Robert Plot, famous natural scientist and antiquarian.
the Humber, which had often been known to break its banks and inundate the surrounding country. 79

It will be noted that comparatively little of the Apollo readers' interest in mineralogy has to do with pure geology. Apparently the early eighteenth-century layman was unaware of the experiments being carried on in France and England, in connection with the earth's strata and their importance to a knowledge of the physical world. Or perhaps the subject failed to catch the fancy of the average man in the street. At any rate, the desire for information seems to have included only the less technical phases of mineralogy.

Such, then, was the interest in natural philosophy shown by readers of The British Apollo. The querists were interested primarily in everything affecting their own lives; secondarily, in the external appearances of the world about them. New scientific discoveries were making them question tenets that had for centuries been taken for granted; current events such as a particularly destructive epidemic, the arrival of the Hungarian twins, or the appearance of a new island were claiming their intelligent consideration and prompting their questions. Yet to an even greater extent readers of The British Apollo were interested in the trivial, everyday matters of life, as a cure for the tooth-ache, the name of a certain weed, the

souring of milk during a thunderstorm. There is a decided preponderance of such questions.

In view of the decidedly technical terms used in certain scientific questions, it seems incredible that the lay mind could have conceived and submitted some of them. This could, of course, indicate that the same person prepared both question and answer, for the sake of "padding" the pages of the Apollo. It would be no great wonder, however, if such scientific wording proved merely that certain amateur or even professional scientists saw fit to take advantage of such an excellent opportunity for presenting new ideas, clearing away old superstitions, or bringing certain aspects of their changing world to the attention of the public.

For answers to this avalanche of questions, it has been noted that the editors of The British Apollo depended to a considerable extent upon Sir Thomas Browne's Pseudodoxia Epidemica, that they were familiar with the theories advanced earlier by such authorities as Galileo and Vesalius, and that they were in touch, undoubtedly through the Philosophical Transactions of the Royal Society, with the scientific advances of the day. What closer touch the Apollo editors had with the Royal Society is chiefly a matter of conjecture, since of the several men possibly connected with The British Apollo, only Dr. John Arbuthnot can be definitely designated as a member of that group of scientists.

It is equally impossible to determine to which of the Apollo writers should be attributed the answers to certain
questions. It would seem more than likely that Dr. Mauclerc and possibly Dr. Arbuthnot were responsible for much of the medical information given out, the former by reason of his membership in the College of Physicians, the latter by virtue of his own scientific research and his connection with the Royal Society. Certainly Aaron Hill and John Gay would have been otherwise employed, Marshall Smith was scarcely of a calibre to deal with such technical matters, and William Coward's theories on the subject of human anatomy and nutrition were among the wildest and least admissible of the period. In fact, it appears extremely doubtful whether Dr. Coward did any great amount of work on the Apollo, as he is thought to have been away from London much of the time from 1706 on.

It is not difficult to feel certain from the questions and answers set forth in The British Apollo that the new scientific discoveries of the seventeenth century were being assimilated very slowly in those early years of the eighteenth century. Obviously the scientific revolution represented by Newton, Leuwenhoek, and their associates by no means effected a complete overthrow of the pseudo-science and superstition of earlier centuries. Many misconceptions and echoes of medieval scientific lore are apparent in the pages of the Apollo, particularly in the realm of human anatomy and physiology. On the whole, however, The British Apollo played a decidedly valuable part in the dissemination of sound scientific knowledge. Occasionally the old, outmoded theories are combined with glimpses of scientific truth in a really ludicrous manner.
More rarely, there is a flash of inspired light that makes one wonder how, with such a lead, the world was forced to wait until the nineteenth or even the twentieth century for a solution so obviously presaged in the pages of *The British Apollo*. 
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