

8. Achievements of the 19th Century.—The technical improvements of the nineteenth century far surpassed everything which had gone before. Along with these mechanical inventions came many other inventions and discoveries in the field of chemistry, physics and medicine—in fact, in every department of human effort. Against the background of man's previous career the nineteenth century stands absolutely unique. It is impossible to portray these facts in any condensed form, yet the effort to make a visible comparison is interesting and by no means profitless. Such has been made by one of the great scientists of the nineteenth century, Alfred Russel Wallace. It takes the form of parallel columns,¹ the first showing the achievements of the nineteenth century, and the second the achievements of the entire preceding space of man's existence.

*Of the Nineteenth
Century*

1. Railways
2. Steamships
3. Electric Telegraphs
4. The Telephone
5. Lucifer Matches
6. Gas Illumination
7. Electric Lighting
8. Photography
9. The Phonograph
10. Roentgen Rays
11. Spectrum Analysis
12. Anæsthetics
13. Antiseptic Surgery

Of All Preceding Ages

1. The Mariner's Compass
2. The Steam Engine
3. The Telescope
4. The Barometer and Thermometer
5. Printing
6. Arabic Numerals
7. Alphabetical Writing
8. Modern Chemistry Founded
9. Electric Science Founded

¹ Quoted by Richard T. Ely: *Outlines of Economics*, pp. 45, 46.

*Of the Nineteenth
Century*

Of All Preceding Ages

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| 14. Conservation of Energy | 10. Gravitation Established |
| 15. Molecular Theory of Gases | 11. Kepler's Laws |
| 16. Velocity of Light directly measured, and Earth's Rotation experimentally shown | 12. The Differential Calculus |
| 17. The Uses of Dust | 13. The Circulation of the Blood |
| 18. Chemistry, Definite Proportions | 14. Light proved to have Finite Velocity |
| 19. Meteors and the Meteoritic Theory | 15. The Development of Geometry |
| 20. The Glacial Epoch | |
| 21. The Antiquity of Man | |
| 22. Organic Evolution | |
| 23. Cell Theory and Embryology | |
| 24. Germ Theory of Disease, and the Function of the Leucocytes. | |

9. **Cumulative Effect of Advancement.**—Our admiration for the achievements of the nineteenth century should not lead us to conclude that the men of that period were more intelligent or industrious than those of preceding ages. The explanation lies in a favorable combination of circumstances rather than in the peculiar merit of any group of people. Perhaps the most important element was the opening up of vast areas of rich undeveloped land in the western hemisphere, which made available enormous supplies of natural resources

and served as a great stimulation to activity and invention. A second explanation is that material advancement is cumulative, and each new discovery opens the way for others, while each new invention adds to the possibilities of further improvements. However great the inventive genius of the men of the nineteenth century, they would have been helpless if they had not had certain basic principles and elemental facts to build on. In one sense, the man who first bound a rough stone to the end of a stout stick to make a rude hammer, showed more inventiveness and made a greater contribution to human welfare than the man who, ages later, invented the steam engine or the airplane.

Indeed, as we look back over the last hundred and fifty years, we are sometimes inclined to criticise the men of the period for not making still better use of their opportunities. This is particularly true with regard to the tendency to abandon the good things of the past because of the discovery of something better. The discovery of coal as a fuel, and of steam power, led to the partial neglect of water power, which should have continued to be used for certain purposes. The introduction of the railroad practically put a stop to the development of canals, in the United States at least. In the enthusiasm over the possibilities of wealth, reckless and wasteful use was made of many natural resources. We are now learning to realize the seriousness of these mistakes and to correct them as far as possible. We are taking thought as to the utilization of water power and the development of canals, and are trying to protect our remaining natural resources by means of what we have come to call the "conservation" movement.

10. The Capitalistic Era.—These are the factors which

account for our present type of industrial civilization, which is so completely dominated by capital that it has been called the "capitalistic era," or the "industrial stage of civilization." These designations do not imply that we have abandoned the expedients of the past, with such relatively unimportant exceptions as have been mentioned. We still extract materials directly from nature, we still hunt and fish, raise animals and practise agriculture, but we have added an entirely new set of expedients for increasing wealth, of such great weight as to give an entirely distinct character to our civilization. As in each previous advance, these improvements have made possible a much larger population in civilized countries. It might seem that they should also have opened the way for an abundance of comfort and material happiness on the part of all members of these societies. Why they have so largely failed to do this will be discussed later.

REVIEW.

Define capital. Distinguish between wealth and capital.

Name the three essential features of a machine.

What is meant by the "industrial revolution"?

Mention the great factors of the present industrial system.

How does the 19th century compare with the preceding ages in the matter of discoveries and inventions?

What purpose is embodied in the conservation movement?