

"Then, if it was heat that made it rise, why does not it rise now?"

Rollo could not tell.

"I will tell you how it was," said his father. "Heat makes air more expansive. When air is heated, it swells; when it is cool, it shrinks again. Now, if it swells, it becomes lighter, and so it is buoyed up by the heavier air around it; just as wood at the bottom of the sea would be buoyed up, and would rise to the surface of the water. Now, the heat of the lamp heats the air that is in the glass chimney, and swells it. This makes it lighter; and so the air around it, which is heavier, buoys it up, and it carries up the feather with it."

"No, the down, father," said Nathan.

"Yes, the down," said his father.

"Then it seems to me, after all," said Rollo, "that it is the heat which makes it rise."

"Yes," said his father, "it does, indirectly. It expands the air; that makes it lighter; then the heavy air around it buoys it up, and, when it goes up, it carries up the down. So that it is not strictly correct to say, that the heat carries it up. The heat sets in operation a train of causes and effects, the last of which results in carrying up the feather."

"Now," continued his father, "there is always a stream of air going up, wherever there is a lamp, or a fire, or heat, which heats the air in any way. The expanded air from a fire goes up the chimney. The cool and heavy air in the room and out of doors crowds it up."

"The air out of doors?" said Rollo. How can that crowd it up?"

"Why, it presses in through all the crevices and openings all around the room, and crowds the light air up the chimney. All the smoke too is carried up with it, and it comes pouring out at the top of the chimney the whole time."

"You can see that the air presses in at all these crevices," continued Rollo's father, by experiment."

"What experiment is it?" said Rollo; "let us try it."

"I will let Nathan try it," said his father, "and you may go with him and see the effect." "First," he continued, "you see by the smoke, that the air really goes up the chimney; and I will show you that other air really crowds into the space, from other parts of the room."

So he took a lamp from the table,—not the study lamp; it was a common lamp,—and held it at various places in the opening of the fireplace, by the jambs and near the upper part; and Rollo and Nathan saw that the flame, in all cases, was turned in towards the chimney.

"Yes," said Rollo, "I see it is drawn in."

"No," said his father; "strictly speaking, it is not drawn in; it is pressed in, by the cool and heavy air of the room."

"I thought," said Rollo's mother, "that the chimney drew the air from the room into it."

"That is what is generally said," replied Mr. Holiday, "but it is not strictly true. The common idea is, that the hot air rises in the chimney, and so draws the air from the room to supply its place; but this is not so. In the first place nothing can arise unless it is forced up. The lightest things have some weight, and would, if left to themselves, fall. The hottest and lightest air in a chimney would fall to the earth, if there was no cooler and heavier air around it, to force it to rise;—just as the lightest cork, which would rise very quick from the bottom of the sea, would fall back again very quick, if the water was not there."

"Remember, then, Nathan and Rollo, that, when a fire is built in a fireplace, so as to warm the air in the chimney, it makes this air not so heavy; and then the cool air all around it in the room and out of doors, presses in, and crowds under the light air and makes it ascend."

"But, father," said Nathan, "you said I might perform an experiment."

"Very well, I'm ready now. Take the lamp, and carry it around the room, and hold it opposite any little opening you can find."

"I can't find any little openings," said Nathan.

"O yes," said his father; "the key-hole of the door is a little opening, and there is a narrow crevice all around the door; and you will find little crevices around the windows. Now, hold the lamp opposite to any of these, and you will see that the air presses in."

So Nathan went with the lamp, Rollo following him, and held the lamp opposite the key-hole, and the crevices around the door

and windows; only when he came to the window, his father told him to be very careful not to set the curtain on fire.

Rollo wanted Nathan to let him try it once; and so Nathan gave him the lamp. He said he meant to make a crevice; and so he pushed up the window a very little way, and held the lamp opposite to the opening. The air pressed the flame in towards the room, in all cases.

"People commonly say, that it is drawn in," said his father, "but that is not strictly correct; it is really pressed in. There is no power of attraction, in air the that is in the room, to draw in the air that is out of doors, through the crevices; but the air that is out of doors, is so heavy that it presses in, and crowds the warm and light air up the chimney."

"And now," said his father, "I cannot tell you anything more this evening; but, if you remember this, I will give you some further instruction another time."

"Well, sir," said Nathan, "only I wish you would tell me a little story, as you did last evening. Have I not been still?"

His father had noticed, that he had been very still and attentive, but did not think before, that it was in expectation of being rewarded with a story.

"Well," said his father, "I will tell you a story, or give you a little advice. How should you like a little advice?"

"Well, father, a little advice; just which you please."

"I advise you, then,—let me see,—what shall I advise you?—No, on the whole, I will tell you a story. Once there was a man, and he was a philosopher. He understood all that I have been explaining to you about the air being light when it was hot.—So he got some very thin paper, and made a large paper bag.—He cut the paper very curiously, and pasted it together at the edges in such a way, that the bag, when it was done, was round, like a ball; and it had a round opening at the bottom of it. In fact, it was a large paper ball."

"It was so large, that, when it was swelled out full, it would have been higher than your head."

"O, what a large ball!" said Nathan. "But what was it for?"

"Why, the man thought, as hot air is lighter than cool air, and floats up, that perhaps, if he could fill his paper ball with hot air, it would go up too."

"And did it?" said Nathan.

"Yes," said his father. "He filled it with hot air; and the hot air was so light, that it rose up, and carried the paper ball with it."

"How did he get the hot air into it?" said Rollo.

"Why, he held it over a little fire, with the mouth down.—Then the hot air from the fire went into the ball, and swelled it out full."

"How high did it go," said Nathan.

"O, it soared away," said his father, "away up into the air very high; until at length it got cool, and then it came down."

"I should like to see such a ball as that," said Nathan.

"Such a ball as that is called a balloon," said his father.

"I wish I could see a balloon," said Nathan.

## MARY LUNDIE DUNCAN.

(Concluded from Page 122.)

### THE BRIDE.

It would be very easy and very pleasant to fill pages with glowing passages from her diary and her correspondence, but we have not the room for extended extracts. Perhaps the reader has already learned from these that Mary Lundie was a girl of sweet spirit; that her powers, naturally of a high order, were cultivated by education, and that she was formed by nature and grace to adorn whatever sphere in life the Providence of God should prescribe for her. Before the close of her twentieth year, we find her betrothed to the Rev. Mr. Duncan, a young clergyman of the Church of Scotland. A new field of duty and of pleasure, of responsibility and trials, was now opening before her, and the preparation she made to meet the work allotted, is worthy of being imitated by those who are looking forward to the same high calling. Her heart she sought to improve, her mind to store with knowledge useful for her station, and well did she succeed. Her letters at this period breathe a spirit of calm and joyful anticipation of coming pleasure, such as does one good to contemplate, and we would love to linger upon this period of her history as one invested with peculiar interest. Our young readers will be pleased with a little