mosphere and Space, intern. conf. (by invitation), San Antonio, Tex. (Southwest Research Center, 331 Gunter Bldg., San Antonio.)

10–13. American Dental Assoc., Dallas, Tex. (H. Hillenbrand, 222 E. Superior St., Chicago, Ill.)

12–14. Society for Experimental Stress Analysis, annual, Albany, N.Y. (W. W. Murray, P.O. Box 168, Central Square Sta., Cambridge 39, Mass.)

12–15. Society of Naval Architects and Marine Engineers, 66th annual, New York, N.Y. (W. N. Landers, SNAME, 74 Trinity Pl., New York 6.)

16–21. Radiological Soc. of North America, Chicago, Ill. (D. S. Childs, 713 E. Genesee St., Syracuse, N.Y.)

16–23. Scientific Information, intern. conf., Washington, D.C. (Mrs. M. Sheppard, Intern. Conf. on Scientific Information, Natl. Acad. of Sciences–Natl. Research Council, 2101 Constitution Ave., Washington 25.)

17–19. Association of Military Surgeons of the U.S., Washington, D.C. (R. E. Bitner, Suite 718, New Medical Bldg., 1726 Eye St., NW, Washington 6.)

17–20. Conference on Magnetism and Magnetic Materials, Philadelphia, Pa. (H. B. Callen, Dept. of Physics, Univ. of Pennsylvania, Philadelphia.)

17–22. Radiological Soc. of North America, Chicago, Ill. (D. S. Childs, Sr., 713 E. Genesee St., Syracuse 2, N.Y.)

18–20. Air Pollution, 1st natl. conf., Washington, D.C. (Dept. of Health, Education, and Welfare, U.S. Public Health Service, Washington 25.)

18–20. Standards, 9th natl. conf., New York, N.Y. (American Standards Assoc., 70 E. 45 St., New York, N.Y.)

18–21. Weather Radar Conf., 7th, Miami Beach, Fla. (K. C. Spengler, American Meterological Soc., 3 Joy St., Boston 8, Mass.)

18–22. Pan-American Dental Cong., Mexico City, Mexico. (Association Dental Mexicana, Sinaloa 9, Mexico 7, DF, Mexico.)

19–21. Electrical Techniques in Medicine and Biology, 11th annual conf., Minneapolis, Minn. (O. H. Schmitt, Univ. of Minnesota, Minneapolis.)

20–22. Acoustical Soc. of America, 56th meeting, Chicago, Ill. (K. Kramer, 3839 Grand Ave., Western Springs, Ill.)

20–22. American College of Cardiology, New Orleans, La. (P. Reichert, Empire State Bldg., New York 1.)

20–22. International Symp. on Tuberculosis, Philadelphia, Pa. (M. J. Schwartz, Deborah Sanatorium & Hospital, 642 Widener Bldg., Philadelphia 7.)

20–23. American Anthropological Assoc., Washington, D.C. (W. S. Godfrey, Jr., APA Logan Museum, Beloit College, Beloit, Wisc.)

20–23. European Confederation of Agriculture, Vienna, Austria. (M. H. Abegg, Confédération Européenne Agriculture, Brougg (Argovie), Switzerland.)

21–22. American Soc. of Animal Production, annual, Chicago, Ill. (H. H. Stonaker, Animal Husbandry Dept., Colorado State Univ., Fort Collins, Col.)

24–26. Fluid Dynamics, division of American Physical Soc., San Diego, Calif. (R. J. Emrich, Dept. of Physics, Lehigh Univ., Bethlehem, Pa.)

24–26. Mechanisation of Thought Processes, symp., Teddington, Middlesex, England. (The Secretary, Natl. Physical Lab., Teddington, Middlesex.)

24–6. Plant Specialists, 4th Latin American conf., Santiago, Chile. (R. Cortazar, Departmento de Investigaciones Agricolas, Ministerio de Agricultura Casilla 4088, Santiago, Chile.)

27–29. Central Assoc. of Science and Mathematics Teachers, 58th annual, Indianapolis, Ind. (N. G. Sprague, Indianapolis Public Schools, 1644 Roosevelt Ave., Indianapolis 18).

(See issue of 19 September for comprehensive list)

Letters

Blood-Group Nomenclature

The correspondence regarding blood-group nomenclature published in the 23 May issue of *Science* [**127**, 1255 (1958)] calls for amplification and clarification, so that readers may not be misled.

The original Rh factor was discovered by Karl Landsteiner and Alexander S. Wiener in 1937. This blood factor is now designated **Rh_0**. When the related blood factor **rh′** was discovered by Wiener in

1940, he pointed out that three possibilities had to be considered regarding the simultaneous heredity of **Rh$_0$** and **rh′**.

1) Distinct genes determining the respective blood factors **Rh$_0$** and **rh′** could be postulated, located in different chromosomes (heredity with independent assortment).

2) Distinct gene loci for **Rh$_0$** and **rh′** might exist, located within the same pair of chromosomes (linkage with crossing over).

3) Heredity might depend upon a series of multiple allelic genes. When studies on the distribution of the Rh factors in the general population as well as family data showed the hypothesis of separate gene loci for **Rh$_0$** and **rh′** to be incorrect, Wiener discarded the first two possibilities and adopted the theory of multiple allelic genes.

In 1944, Fisher revived and elaborated the linkage theory. The present choice, therefore, lies not between a theory of Wiener and a theory of Fisher but, instead, between two hypotheses both originally elaborated by Wiener; one of these (the linkage hypothesis) he disproved and discarded, but this has now been taken up by those using the C-D-E notations, while the other hypothesis (multiple allelic genes) is supported by the evidence accumulated by Wiener and others from family and population studies. In the absence of evidence of crossing over, some C-D-E workers have modified the theory to one of complete linkage. Since completely linked genes operate as a unit, this reduces to the multiple allele theory, so the choice then lies between two different ways of describing the multiple allele theory originally advanced by Wiener.

The basis on which the nomenclature question rests, however, is not genetic but serologic. It is significant that the original Rh-Hr nomenclature was devised by the discoverers of the Rh-Hr types and their heredity. As Landsteiner and Wiener have pointed out, antigens can give rise to multiple corresponding antibodies. The properties of the agglutinogen molecule which are responsible for the specific combination of an antigen with its corresponding antibodies are known as blood factors, so that every agglutinogen is characterized by multiple blood factors. Thus, it is essential to distinguish clearly between agglutinogens and their serologic attributes, the blood factors. Therefore, in Wiener's Rh-Hr nomenclature, a different type face is used for genes (printed in italics), agglutinogens and blood types (printed in regular type), and antibodies and their corresponding blood factors (printed in bold-face type). For example, as is shown in Table 1, gene *r* gives rise to the agglutinogen rh, which is characterized by the blood factors **hr′**, **hr″**, **hr**, and **Hr$_0$**; and so on throughout the table. For simplicity, the **Rh$_0$** variants have been omitted from the table, as well as other intermediate agglutinogens, and despite this the table lists a total of 17 **Rh**-Hr allelic genes and 13 Rh-Hr antisera of different specificities. It will be seen that the number of blood factors characterizing an Rh-Hr agglutinogen may range from two to seven, if the reactions of these 13 antisera are taken into account.

In contrast, the originator of the C-D-E notations, while famous for his contributions to biometrics, is not an immunologist and has never done a blood grouping test in his life. His concept of the Rh-Hr types is metaphysical in nature, and embodies the following premises, neither of which is correct.

1) To each agglutinogen there corresponds but a single specific antibody. Thus, no distinction is considered necessary between agglutinogens and blood factors. Corresponding to an agglutinogen or blood factor **X** there is assumed to exist but a single antibody, anti-**X**, and any antigen which reacts with anti-**X** is considered to possess the agglutinogen X.

2) If an agglutinogen X is known to exist, then any blood that lacks X always has in its place a contrasting agglutinogen x.

These two premises were used by Fisher to draw up the simple scheme of the Rh-Hr types shown in Table 2. This scheme has gained wide popularity and is quoted in most recent textbooks on hematology. The obvious reason for its popularity is its simplicity. However, the scheme is unrealistic, and those who use the C-D-E notations have exhibited a tendency to force their findings to fit the scheme. For example, they have reported the discovery of antibodies of specificity anti-d, but these reports could not be confirmed and were evidently based entirely on wishful thinking. On the other hand, the existence of other blood factors which do not fit into Fisher's scheme is denied by C-D-E protagonists in the face of overwhelming evidence. An outstanding example is the refusal to acknowledge the existence of the blood factor **C** of the ABO system. The contrast between Tables 1 and 2 is reminiscent of the contrast between the present knowledge regarding chemical elements and the simple metaphysical concept of the ancients of four elements—earth, air, fire, and water. The available data

Table 1. Partial list of Rh-Hr allelic genes, their corresponding agglutinogens, and the reactions with 13 of the available Rh-Hr antisera (Wiener's theory of multiple allelic genes).

Gene	Agglutinogen	Reactions with antisera of specificity												
		Rh$_o$	**Rh^A**	**rh′**	**rh^{w1}**	**rh^x**	**rh$_1$**	**rh″**	**rh^{w2}**	**hr′**	**hr″**	**hr**	**hr^v**	**Hr$_o$**
r	rh	−	−	−	−	−	−	−	−	+	+	+	−	+
r^v	rh^v	−	−	−	−	−	−	−	−	+	+	+	+	+
r′	rh′	−	−	+	−	−	+	−	−	−	+	−	−	+
r′^{w}	rh′^{w}	−	−	+	+	−	+	−	−	−	+	−	−	+
r″	rh″	−	−	−	−	−	−	+	−	+	−	−	−	+
r^y	rh$_y$	−	−	+	−	−	−	+	−	−	−	−	−	+
R^0	Rh$_o$	+	+	−	−	−	−	−	−	+	+	+	−	+
R^{0v}	Rh^v_o	+	+	−	−	−	−	−	−	+	+	+	+	+
$\bar{R}^0$	$\overline{\text{Rh}}_o$	+	+	−	−	−	−	−	−	−	−	−	−	−
$\bar{R}^{w1}$	$\overline{\text{Rh}}^{w1}$	+	+	−	+	−	−	−	−	−	−	−	−	−
R^{0a}	Rh^a_o	+	−	−	−	−	−	−	−	+	+	+	−	+
R^1	Rh$_1$	+	+	+	−	−	+	−	−	−	+	−	−	+
R^{1w}	Rh$^w_1$	+	+	+	+	−	+	−	−	−	+	−	−	+
R^{1x}	Rh$^x_1$	+	+	+	−	+	+	−	−	−	+	−	−	+
R^2	Rh$_2$	+	+	−	−	−	−	+	−	+	−	−	−	+
R^{2w}	Rh$^w_2$	+	+	−	−	−	−	+	+	+	−	−	−	+
R^z	Rh$_z$	+	+	+	−	−	−	+	−	−	−	−	−	+

Table 2. Fisher's scheme of the Rh-Hr types.*

Chromosomes	Agglutinogens or blood factors	Reactions with antisera of specificities					
		C	D	E	c	d	e
cde	cde	−	−	−	+	+	+
Cde	Cde	+	−	−	−	+	+
cDe	cDe	−	+	−	+	−	+
cdE	cdE	−	−	+	+	+	−
CDe	CDe	+	+	−	−	−	+
CdE	CdE	+	−	+	−	+	−
cDE	cDE	−	+	+	+	−	−
CDE	CDE	+	+	+	−	−	−

* As modified from the theory of linkage, previously disproved and discarded by Wiener.

amply demonstrate that the so-called "triple inheritance" discussed by Race and Sanger in the third edition of their book is fictional, since, as is shown in Table 1, the blood factors are inherited not in three's but in blocks varying from two to seven factors each. Perhaps the C-D-E notations are simpler; but the question involved is not merely one of choice between two designations for the same thing, and workers must decide whether they prefer to do what is simpler or what is correct.

The protest that the report prepared by the American Medical Association committee by four leading scientists is biased, and that the signers of the protest "shall continue to use the C-D-E nomenclature until such time as a properly representative international body arrives at a definite nomenclature" is misleading. The protest fails to mention that for the past decade Wiener has urged that such an international committee be formed, and that before the American Medical Association report was prepared, Fisher and Race were both invited, all expenses paid, to discuss the problem, but they declined.

ALEXANDER S. WIENER
Office of the Chief Medical Examiner, New York City

Equipment

The information reported here is obtained from manufacturers and from other sources considered to be reliable. Science *does not assume responsibility for the accuracy of the information. A coupon for use in making inquiries concerning the items listed appears on page 858.*

■ SCINTILLATION TRANSDUCERS, consisting of a thallium-activated sodium-iodide crystal optically joined to a 2-in. multiplier phototube, are available with crystals up to 2 in. in diameter and 3 in. long. Variations such as truncated conical ends, drilled wells, or other configurations can be provided. (Levinthal Electronic Products, Inc., Dept. 385)

■ INTEGRATOR is a tachometer-feedback, velocity-servo type; a mechanical differentiator is part of the servo link. Calibration is built-in, with 60 cy/sec line frequency as a reference. Linearity is ±0.25 percent, and accuracy is ±0.15 percent of full scale. Dynamic range is 52 db. Zero drift is less than 1 count/hr. Time from stop to full speed is 0.14 sec; time, full speed to stop, is 0.09 sec. (Research Appliance Co., Dept. 386)

■ ELLIPSOMETER for the measurement of extremely thin films by the use of elliptically polarized light comprises a spectrometer modified by the addition of a special arm that supports a compensator and its circle. The two telescopes of the spectrometer carry 14-mm polarizing prisms mounted in vertical divided circles. On the central table is mounted a bracket to which is clipped a polished, stainless-steel plate to take the film under observation. (Gaertner Scientific Corp., Dept. 394)

■ DISPLACEMENT is measured by a device that includes a transducer and associated electronic circuits. The transducer is a precision optical grating and photoelectric sensing head. A separate cabinet houses circuits that determine the direction of motion and control bidirectional counters of cold-cathode type. Accuracy is 0.0001 in. and counting rate is 5 kcy/sec. Electrical as well as visual output is provided. Single-axis and double-axis systems are available. (Ferranti Electric, Inc., Dept. 395)

■ ELECTRIC FURNACE performs continuously at temperature of 2700°F. Globar elements are used for heating. A temperature indicator-controller permits selection of temperature. Size of working chamber is 4 by 8 by 4 in. (Blue M. Electric Co., Dept. 396)

■ SHAKING BATHS feature variable speeds, variable stroke, and variable temperature from 0° to 100°C. Two sizes are available, 26 by 12 by 7 in. and 36 by 18 by 9 in. Baths are made of stainless steel with 1-in. insulation. Tem-