appears, and a positron and an electron appear. $E = 2mc^2$, where E is the energy of the photon, and $2m$ is the sum of the inertias of the electron and of the positron formed. Energy in this case is converted into matter, and the inertia of the photon equals the inertia of the matter formed. In these two cases the quantity of matter is changed.

Hence, Eddy's conclusion that the law of conservation of mass (inertia) still holds is correct. But it is also correct that matter and energy are interconvertible, as evidenced in the cases where the positron and electron unite and disappear, the photon or photons appearing, and where the positron and electron appear at the disappearance of a photon. At least, these are the present interpretations of the experimental evidence.

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In a recent note (*Science*, 1946, **104**, 303), C. R. Eddy discusses a supposed "misconception in the minds of some scientists" concerning the meaning of the equation, $E = mc^2$, and the question of conservation of mass. To present a different view, I will recall a few definitions.

In proceeding from kinematics to dynamics, a third primary quantity is defined, namely, *rest mass* of a particle, denoted by m_0; the standard magnitude for this quantity is the rest mass of the International Kilogram. The secondary quantity, $m_0(1 - v^2/c^2)^{-\frac{1}{2}}$, is called the *relativistic mass m* of a particle, by definition. Omitting all definitions not pertinent to the present discussion, we come next to definitions of energy. Various quantities having the dimensions $[ML^2T^{-2}]$ are defined in such a way as to satisfy a law of conservation of energy. Or, to put it another way, it has always been found possible to define physical quantities representing individual forms of energy such that the total energy of an isolated system is conserved, where, by definition, *total energy* is the sum of all the energy quantities of various types identified with the system. The following are examples of individual forms of energy encountered in one way or another: kinetic energy of a particle; potential energy of a conservative system; heat energy; internal energy of a thermodynamic system; radiant energy; energy of a photon; molecular, atomic, and nuclear binding energies; etc. Another such quantity of immediate interest is the quantity mc^2 which, for convenience, I shall call the *inertial energy* of a particle (kinetic energy plus rest energy m_0c^2). In atomic disintegrations there occurs a change in individual amounts of inertial energy, and frequently there occurs a transformation of inertial energy into radiant energy or vice versa. Energy and momentum are conserved in all instances. Now, what does $E = mc^2$ mean? A perfectly legitimate and fruitful point of view is this: In order to maintain the law of conservation of energy, the quantity mc^2 is called the inertial energy of a particle, by definition; letting E denote this particular form of energy, the definition is expressed by the equation $E = mc^2$.

The conclusion of Eddy that "the law of conservation of mass still holds" is purely a question of definition. It may readily be seen that $m = m_0 + \Delta m$, where Δm is a kinetic increment equal to the kinetic energy of a particle divided by c^2. In atomic disintegrations, rest mass Σm_0 is not conserved in any case, and relativistic mass $\Sigma(m_0 + \Delta m)$ is not conserved when radiation is emitted. In the case of radiation, the quantity $h\nu/c^2$ has the dimension $[M]$. In accord with disintegration phenomena, $h\nu/c^2$ is called the *equivalent mass* of a photon. It is desirable to maintain a distinction between mass of a particle and equivalent mass of a photon in order to preserve appropriate distinction between matter and radiation. However, if we should choose to define a quantity, Q, having the dimension $[M]$, by the equation $Q = \Sigma(m_0 + \Delta m) + \Sigma h\nu/c^2$, we might then state a law of conservation of Q (a quantity which Eddy calls the total mass). That this procedure is not accepted practice may not be attributed to a misconception on the part of those who do not follow it. Conservation of Q is not employed as a specific law simply because association of the three types of quantities, m_0, Δm, and $h\nu/c^2$, on an equal basis would be a source of confusion without contributing anything toward clarification or simplification in our thinking; such conservation is already stated in more tangible terms by the laws of conservation of energy and momentum.

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Use of Shorthand by Scientists

Have many scientists adopted the use of shorthand to save time and to enable them to make more complete notes?

Steinmetz learned a Swedish system at college and later developed a system of his own which he thought was better. Hugh Callendar, physicist, also developed a new system for his use, measuring the time required for making each symbol. Callendar's system was adopted in mid-life by his colleague, Sir Joseph Thomson.

It would be interesting to have other instances reported in this section of *Science*.

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Correction on the Nomenclature of Human Plasmodium

In the nomenclatorial and zoological confusion in the names for the human malaria parasites (Sabrosky and Usinger. *Science*, 1944, **100**, 190–192; Beltran. *Gaceta Med. Mexico*, 1944, *74*, 61–74), one further point has been discovered.

It has usually been considered that there were only two different proposals involving *malariae* as a new specific name—*Oscillaria malariae* Laveran, 1881, and *Haemamoeba malariae* Feletti and Grassi, 1890. Actually it now appears that there were *three*!

Careful reading of Marchiafava and Celli (*Fortschr. Med.*, 1885, 3, 791–797) shows that they too were proposing what they regarded as a distinct new form, quite unlike any previously described: "Aus dem Gesagten geht hervor, dass die beschriebenen Körperchen nicht verwechselt werden dürfen mit irgend welchen zufälligen oder pathologischen Dingen, die man bisher in den roten Blutscheiben bemerkt hat. . . . so scheint es uns nicht fernliegend, sie als parasitäre Organismen anzusprechen und ihnen den Namen *Plasmodium malariae* zu geben.'' The name was italicized and unquestionably intended as a formal scientific name. This proposal of *Plasmodium* as a new generic name has been accepted, but the new specific name has apparently been quite generally overlooked.

Of the three identical specific names, it is now generally agreed that *malariae* Laveran applies only to the parasite of *falciparum* or malignant malaria. *Malariae* F. & G., which originally included both quartan and tertian parasites, was later restricted by Grassi and Feletti (*Arch. ital. biol.*, 1890, 13, 300) to the quartan parasite, at which time they named the tertian parasite *vivax.*

The situation is not so clear, however, with reference to the *malariae* of Marchiafava and Celli (1885). Their detailed descriptions, case histories, and figures in Plate VI have been critically analyzed by Martin Young, of the National Institute of Health, as follows:

''It seems to me definitely that most of the infections that they saw were *falciparum.* However, they seem occasionally to have run across a *vivax* infection. Some of the descriptions are definitely of *vivax* segmenters while others of the descriptions, especially where they mention the finding of crescents, are definitely *falciparum.*

''The generalized figures on the plate are difficult to identify, with some suggestive of both *vivax* and *falciparum.* The confusion arises from the fact that some of the cases they were looking at were very severe infections of *falciparum.* In such cases, it is not uncommon for the developmental forms of *falciparum* to be found in the blood stream. Therefore, from pictures with so little detail, it is hard to tell whether the forms shown are young stages of *vivax* or older stages of *falciparum.*''

Throughout the paper, Marchiafava and Celli referred frequently to such characteristics of *falciparum* or malignant malaria as the comatose fever, rapid onset of death, remarkable numbers of parasites (especially in the capillaries of the brain), and the presence of crescents. Besides this evidence, it may be noted that their cases originated during a very severe epidemic in Rome and the Pontine Marshes, where *falciparum* is the principal species of malaria.

There seems little doubt, therefore, that *Plasmodium malariae* M. & C. was based mainly on the malignant tertian parasite (*falciparum*). The benign tertian parasite (*vivax*) was seen, but there is no evidence of quartan.

If *malariae* M. & C. be considered to represent one species only, then the malignant tertian form would have to be considered the genotype of *Plasmodium,* in which case *Oscillaria* Lav., *Plasmodium* M. & C., and *Laverania* F. & G. are isogenotypic, all based on the same species (properly called *malariae* Lav. under strict interpretation of the Rules of Nomenclature, but generally known as *falciparum*).

On the other hand, if *malariae* M. & C. be regarded as originally composed of two species, it would then appear that the type has never been restricted to a single entity because the species name has been so long overlooked. Even though the malignant tertian parasite is unquestionably the major basis of Marchiafava and Celli's description, it appears that at this late date considerable confusion could be avoided by restricting the name *malariae* M. & C. to the benign tertian form. If such action were taken, and considering that all the human malaria parasites are congeneric (as they are usually regarded), the name would then be a homonym, and the correct name would be the next valid and available name, hence *vivax* G. & F., 1890 (= *malariae* M. & C., 1885, nec *malariae* Lav., 1881). Thus (1) *vivax* would become the genotype of *Plasmodium* M. & C.; (2) it would not be necessary to suspend the Rules of Nomenclature in order to designate a type for *Plasmodium;* and (3) the status of *Laverania* as a possible generic name for the malignant parasite (if segregated) would not be disturbed.

In order not to complicate any other action by the International Commission on Zoological Nomenclature, formal designation of the above is withheld, and it is presented as a suggestion to be considered as a part of the whole problem.

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Radioactive Hydrocarbons

In connection with our studies involving Carbon 13, we became interested in the radioactive carbon isotope of long half-life, C 14 (S. Ruben and M. D. Kamen. *Phys. Rev.*, 1941, 59, 349–354). Through the kindness of J. R. Dunning, of Columbia University, we received a small amount of C 14 prepared by bombarding C 13 with deuterons or N 14 with neutrons from the Columbia cyclotron. Subsequently, very much larger quantities prepared in the Oak Ridge uranium pile were made available to us.

Among the various types of radiocarbon compounds prepared were radioactive hydrocarbons. In view of their interest for the study of hydrocarbon reactions, the synthesis of *radiomesitylene* is described herein.

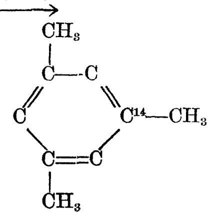
Starting with $BaC^{14}O_3$ the sequence of reactions was the following:

$$(1)\quad C^{14}O_2 + CH_3MgI \longrightarrow CH_3 \cdot C^{14}OOH$$

$$(2)\quad CH_3 \cdot C^{14}OOH + Ba(OH)_2 \longrightarrow Ba(C^{14}O_2 \cdot CH_3)_2$$

$$(3)\quad Ba(C^{14}O_2 \cdot CH_3)_2 \xrightarrow[500^\circ\text{ C.}]{\text{vacuum}} CH_3 \cdot C^{14}O \cdot CH_3 + BaC^{14}O_3$$

$$(4)\quad CH_3C^{14}OCH_3 + 2\,CH_3CO \cdot CH_3 \xrightarrow{H_2SO_4}$$



This radiomesitylene may appropriately be called *1,3,5-trimethyl-radio-1-benzene.* The probability of forming the di- and tri-radiobenzene was negligible with our concentration of C 14.

The first three steps gave yields of 94, 100, and 95