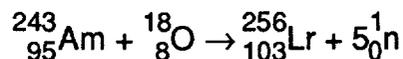
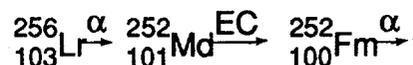


A subsequent identification of the atomic number of element 103 was made by Donets, Schegolev, and Ermakov at Dubna in 1965 (25). The nuclear reaction used was



Using a double recoil technique, they identified the α -emitter ${}_{103}^{256}\text{Lr}$ ($T_{1/2} \sim 45$ sec.) and linked it genetically to its granddaughter, the known ${}_{100}^{252}\text{Fm}$ via the decay sequence:



The relatively long half-life of ${}_{103}^{256}\text{Lr}$ (now known to be ~ 30 sec.) enabled Silva, Sikkeland, Nurmia, and Ghiorso (26) to establish in 1970 that element 103 exhibits a stable +3 oxidation state in solution, as expected by the actinide concept.

In the report of the original experiments of Ghiorso et al. (24) they suggested the name lawrencium (subsequently accepted by the IUPAC) and the chemical symbol Lw for element 103 in honor of E. O. Lawrence, the inventor of the cyclotron and founder of the Radiation Laboratory at Berkeley where so much of the transuranium research has been carried out. The finally accepted chemical symbol is Lr.

Rutherfordium and Hahnium (104 and 105)

There is considerable controversy over the discovery of the elements beyond lawrencium (103). Flerov and co-workers (27) bombarded ${}_{94}^{242}\text{Pu}$ with ${}_{10}^{22}\text{Ne}$ from the Dubna cyclotron and reported finding a nuclide that decayed by spontaneous fission with $t_{1/2} \sim 0.3$ sec. This nuclide was assigned to be ${}_{104}^{260}$ on the basis of nuclear reaction systematics. The name of kurchatovium (Ku) in honor of the Soviet nuclear physicist Igor Kurchatov was suggested later for element 104. Subsequently this group suggested that the half-life of this nuclide was 0.1 sec., then 80 ms and most recently 28 msec. The identification of the atomic number of the new species on the basis of thermochromatography of the chlorides of this element (in a glass column without packing material) was claimed by I. Zvara, K. T. Chuburkov, R. Tsaletka, T. S. Zvarova, M. R. Shalaevskii, and B. V. Shilov in 1966 (28). However, if the half-life of the ${}_{104}^{260}$ nuclide was 28 msec., it is impossible that it could have survived passage through the apparatus of Zvara et al. which involved a 1.2 sec. transit time for the volatile chlorides. Furthermore, an important part of the interpretation of the thermochromatography experiment was the assumption of a 0.3 sec. half-life for the species being detected. Much later Zvara and co-workers have claimed, in retrospect, that their original experiment probably measured the chemical behavior of 3 sec. ${}_{104}^{259}$ which would have survived transit through their apparatus. However, in the description of the original thermochromatography experiments, Zvara et al. stated "positively that the half-life could not be 3.7 sec." Because of questions about these thermochromatography