THE ASTROBIOLOGY MATRIX AND THE "DRAKE MATRIX" IN EDUCATION. A. Mizser[1] and A. Kereszturi[2] ([1]Hungarian Astronomical Association, H-1461 Budapest, Pf. 219, Hungary (mzs@mcse.hu), [2]Department of Physical Geography, Eötvös Loránd University of Sciences, H-1117 Budapest, Pázmány sétány 1/C., Hungary (krub@freemail.hu).

Introduction: We organized astrobiology lectures in the Eotvos Lorand University of Sciences and the Polaris Observatory in 2002. We present here the "Drake matrix"for the comparison of the astrobiological potential of different bodies [1], and astrobiology matrix for the visualization of the interdisciplinary connections between different fields of astrobiology.

The "Drake matrix": Frank Drake published the first version of its formula in 1961. The versions summarize the components regarding to the possibility of life and intelligence beyond Earth in our Galaxy. In the last years there were important discoveries (exoplanets, extremophiles, ocean of Europa, reconstruction of ancient surface conditions of Mars) connecting to exobiology. The Drake formulae summarize a simple way our up to date knowledge nowdays too but it is useful to try to extend it on other ways. The "Drake matrix" (its name was given after Drake's pioneer work) shows the simple basic requirements which are necessary for the origin of the life like on Earth: *chemical circumstances* (metal content, molecular stability, liquid water), *energy source* (radioactive, tidal, electromagnetic) and *time length* of these. It is difficult to give exact parameters to these components, only a theoretical approach is summarized. All of these were analyzed for objects form interstellar grains to brown dwarfs. The components were characterized by short text.

The astrobiology matrix: We had found this table useful in the explanation "what is astrobiology" because it shows the interdisciplinary connections. In the horizontal and vertical axes various fields of sciences are visible with overlappings. It shows two "evolutionary" tendecies: 1. from top toward bottom time passes by and 2. more complex systems are produced (heavy atomic nuclei, moleculas, prebiotic systems, living organisms and ecological systems.

Conclusion: In Hungary it is difficult to integrate astrobiology in the education system but the great advantage is that it can connect different scientific fields and improve the view of students. We would like to get in contact with persons and organizations who already have experience in the education of astrobiology.

The astrobiology matrix

fields of science	planetology		astrophysics		processes
physics			nucleon synthesis, stellar yield	stellar mass	abiogen
			chemical evolution of interstellar matter	radia-tions	
chemistry	chemistry of the solar nebula		star and planet formation	radiation of young stars	prebiotic
	accretion, exoplanets	perturbation, impacts	activity of protosun	stellar neighbours during star formation	
biology, geology	early surface and atmospheric evol., prebiotic chemistry, extremophiles		changes in the solar activity		origin of life
	evolution of biosphere, surface, atm.			supernovae, molecular clouds, galactic tides	
	feedbacek of biosphere, global circulation, climate				evolution

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References: [1] A. Kereszturi (2002), "Drake matrix" and "Drake diagrams": new extensions of the Drake formulae, Second European Conference on Exo/Astrobiology.

The "Drake matrix" $N^* \cdot f_p \cdot n_e \cdot f_l \cdot f_i \cdot f_c \cdot L_c/L_* = N$ Drake formula

object type	location	matters: metals	matters: organics	matters: water	matters: molecular stab.	energy sources	time stability
interstellar dust	grain surfaces	low	variable	no	variable	UV, cosmic rays	variable
asteroids	subsurface	high	high	early	relatively good	UV, cosmic rays, impacts	short, early
icy bodies (comets)	subsurface	relatively high	relatively high	early	relatively good	UV, cosmic rays, impacts	short
icy moons	subsurface, surface	relatively high	relatively high	early, tidal	good in the outer parts	differentiation, radioactive, tidal	early,
silicate planets	subsurface, surface	high	relatively high	variable, surf/subs.	good near the surface	differentiation, radioactive	long time, decreasing
giant planets	atmosphere	medieval	low	atm. vapour	good in the atm.	contraction	decreasing
brown dwarfs	atmosphere	low	low	atm. vapour	good in the late atm.	contraction	late, decreasing