Population dynamics at the spas of Roman Dacia.  
Case study: the population of Băile Herculane

Imola BODA¹, Călin TIMOC², Victor BUNOIU³

Abstract. The present study analyses the importance of the Băile Herculane spa resort, based on epigraphic discoveries and cartographic sources. Social mobility, along with the presence of urban elites from various towns, passing through, can shed some light on the renown enjoyed by the Băile Herculane hot springs during the Roman and Late Roman periods. The authors also attempt to research the local religious life, as well as the layout of the settlement’s sacred enclosures, an endeavour never before attempted. The results of such an analysis, in comparison with other spa resorts in Dacia, enables the possibility to understand how the town and its public edifices, dominant during the Roman period, developed, as well as the urban layout of Băile Herculane.


Keywords: Roman period, epigraphy, population, religion, topography.

The population of Băile Herculane

During all periods, humans have sought ways to treat their ailments as best they could, even if this implied travelling to a very distant spa resort. The hope of a full and speedy recovery was often assured by the spa’s renown and hot springs which, being blessed by the
Population dynamics at the spas of Roman Dacia

gods of health, attracted, like a magnet, a socially diverse and foreign population which, through its temporary presence, influenced the resort’s development.

The steep slopes of the adjacent Cerna Mountains to the west, as well as the Mehedinți Mountains, had always limited human habitation in Băile Herculane. The ancient spa resort could stretch over a length exceeding 1 km, while the maximum width of its two terraces is at most approx. 150 meters (Figure 1). Even though it was dominated by waterworks, wells, aqueducts and basins, the ancient spa resort was still organized according to a Roman city’s strict rules.

Unfortunately, due to continuous habitation and the systematization that followed consecutive administrative regime changes, especially in the last two centuries, the Roman ruins have almost completely disappeared, with only chronicler accounts, statues and inscriptions left, mostly held in Vienna, still hinting at the existence of an ancient settlement. As such, a somewhat precise identification of areas General Hamilton’s troops excavated, who had orders to clear the land of ruins and make room for new Habsburg spa resort,

Figure 1. Sketch depicting the Băile Herculane spa resort.
is extremely important for understanding how the Romans exploited the lands and hot springs.

In the making of this study, we analysed 17 votive monuments (01BH–17BH), two funerary monuments (18BH–19BH), one stamped brick (20BH), to which we added the two unepigraphic tombstones, in order to have a full overview of the spas. Regarding inscription texts, all 20 of them were in Latin.

Regarding the material of the epigraphic monuments: six of them are marble (01BH, 02BH, 03BH, 13BH, 14BH, 18BH), five are limestone (07BH, 08BH, 12BH, 16BH, 19BH), and obviously a clay stamped brick (20BH). Unfortunately, in a large number (eight cases: nos. 04BH, 05BH, 06BH, 09BH, 10BH, 11B H, 15BH, and 17BH) the material is unknown (it is also unknown where most of the monuments disappeared to). To these, we add the two unepigraphic tombstones made of limestone-dolomite.

In total, 33 people are mentioned in the 20 inscriptions and here we also include both those who made the monuments, as well as those people—if any—these monuments are made for.

First of all, we wish to mention that, regarding the sex of the individuals, only two are women, with the rest being men: Iunia Cyrilla (02BH — perhaps a patrician from south of the Danube, who came here for treatment) and Septimia Valentina (19BH — tombstone states she was 54 years old).

Regarding the legal status of these 33 people, we notice that four were slaves, while the rest are Roman citizens. Interestingly enough, slaves erect monuments raised exclusively for their masters’ health and on their command (02BH — the slave wished to remain anonymous; 06BH — Syntrophus; 09BH — Felix; 15BH — Eutyches). It is important here to specify the occupations of those arriving in our focus area. We mentioned the four slaves, who were involved in administering private or public fortunes: 02BH was the administrandis of Iunia Cyrilla’s personal wealth, Syntrophus is referred to as vilicus, Felix worked at statio Tsierna (his exact role is not mentioned in the inscription), and Eutyches was an actor.

Important people in the society, politics and administration of Roman Dacia were present in Băile Herculane. So we begin our list with governors such as Claudius Gallus (05BH), Calpurnius Iulianus (07BH), Simonius Iulianus (14BH) and M. Sedatius Severianus (03BH +

---

5 Cf. www.romans1by1.com
6 It’s apparent that two people have Greek cognomens: Syntrophus and Eutyches. Considering the frequency of these names in Roman Dacia (cf. www.romans1by1.com), this doesn’t imply the Oriental origin of these two, but merely the popularity of naming children such, or who could have come from anywhere or even be locally born.
7 PISO 1993, 162–166.
8 PISO 1993, 79–81.
Population dynamics at the spas of Roman Dacia

176. We continue with a procurator centenarius (C. Iulius Paternus — 06BH)\textsuperscript{11}, a conductoris publici portorii (T. Iulius Saturninus — 009BH)\textsuperscript{12} and two Drobeta decurions (P. Claudius Iulius — 11BH and L. Iulius Bassus — 018BH). Concurrently we wish to mention the five persons (legati Romam) who accompany Governor M. Sedatius Severianus of Colonia Sarmizegetusa to Rome (03BH — Ulpius Secundinus, Marius Valens, Pomponius Haemus, Iulius Carus, Valerius Valens), on the occasion of being promoted to the rank of consul\textsuperscript{13}.

Also mentioned is P. Aelius Antipater, who later fulfilled priestly duties. The epigraphic monument is placed by Eutyches, his financial administrator, for his employer's health. Eutyches was probably from Apulum, where P. Aelius Antipater is mentioned as a Ivir of Colonia Apulensis\textsuperscript{14}. He is also mentioned in Colonia Sarmizegetusa as a flamen of Colonia Apulensis and as a sacerdos Arae Augusti\textsuperscript{15}. The inscription from Sarmizegetusa was erected later than the ones at Apulum and Băile Herculane, because in the first two, chronologically, the title of sacerdos Arae Augusti is not mentioned, however the dedicator or his slave would have surely done so.

Also mentioned are soldiers or former soldiers (veterans), coming to Băile Herculane in order to treat various illnesses or injuries, incurred due to their profession during their long period of military service: M. Aurelius Veteranus (01BH), Mercurius ?(08BH), L. Pompeius Celer (12BH), and T. Aurelius Geminianus — veteranus (10BH).

Not in the least, we mention one augustalis from Colonia Sarmizegetusa (Q. Vibius Amillus — 13BH), who, for the health of his son Iulianus, erects a monument dedicated to the god Hercules Salutiferus.

Five people identified in the epigraphic corpus stand out, because their presence in Băile Herculane has been questioned; we refer to T. Iulius Saturninus (09BH)\textsuperscript{16}, Iunia Cyrilla (02BH), C. Iulius Paternus (06BH), P. Aelius Antipater (15BH) and M. Sedatius Severianus (03BH + 17BH). We believe these high ranking people indeed visited Băile Herculane for treatment, leaving afterwards only to later send a slave/representative to erect an inscription thanking the gods in their name.

**Population mobility in Băile Herculane**

Following the presentation of relevant data regarding Băile Herculane’s population, we desire to tackle the social mobility of the above mentioned town. Therefore, analysing

\textsuperscript{10} PISO 1993, 61–65.
\textsuperscript{11} PISO 2013, 212–217.
\textsuperscript{12} PISO 2013, 293–301.
\textsuperscript{13} PISO 1993, 61–65.
\textsuperscript{14} IDR III/5, 215.
\textsuperscript{15} IDR III/2, 217.
\textsuperscript{16} MIHAILESCU-BÎRLIBA 2010, 145–147.
epigraphic monuments brings attention to people from another seven settlements, including
22 individuals who, most certainly come from different areas to get treatment (Figure 2).

As it the inscriptions show, we know exactly how many people arrive in the spa resort
from the following settlements: Colonia Sarmizegetusa (03BH, 13BH), Apulum (01BH, 05BH,
07BH, 10BH, 14BH, 15BH), Dierna (09BH), Drobeta (11BH, 18BH), south of the Danube
(unfortunately, the precise location is unknown; 02BH, 06BH), and an individual originates
from Odorheiu Secuiesc (12BH).

An intriguing inscription, sent to Rome for Sedatius Severianus’ nomination as consul17, is
dedicated to Dis et Numinis Aquarum by Ulpius Secundinus, Marius Valens, Pomponius
Haemus, Iulius Carus and Valerius Valens. They raise this altar to the gods in gratitude for
returning unharmed to their home in Dacia (03BH).

![Figure 2. Map depicting population travel routes toward Bâile Herculane.](image)

17 PISO 1993, 61–65: M. Sedatius Severianus (150/151–153), of senatorial rank, was from Limonium (Gallia); he was first
a Questor in Sicily and then people's tribune Rome, becoming Praetor in 143, he is then commander of the V
Macedonica legion between 144–147, then curator viae Flaminiae (between 147–150), afterwards replacing C. Curtius
Iustus to become governor of Dacia during 150–151 AD. His administration lasted until early 153, when he became
consul suffectus in Rome. It seems he wasn’t granted this office in absentia, as we know from this inscription that a
delegation was present for his investiture in Rome; he was also a patron of Colonia Sarmizegetusa. A few years later, he
is named governor of Cappadocia, where we find him at the end of Antoninus Pius’ reign and the beginning of that of
Marcus Aurelius and Lucius Verus, the brother emperors. It is also known that this senator had a tragic end, being
ambushed in Armenia in 161 by the Parthian army and, after a short battle in Elegeia, dies in battle along with his
entire army. This date is the end of Legio IX Hispanica, which lost all its banners.
In Roman Dacia, four spa resorts are known to have existed: Germisara/Geoagiu, Aquae/Călan, Săcelu, and Băile Herculane. Germisara and Aquae, along with the resort targeted by the present study, are the most well-known both archaeologically and epigraphically.

The accompanying map shows that Roman Dacia’s population preferred Băile Herculane for treatment, even though Germisara or Aquae were geographically closer. The reason for this preference cannot be accurately determined, as no source could provide the needed insight, especially considering epigraphic sources also attest the importance of the Germisara resort, as shown below.

The population mobility in Germisara/Geoagiu and Aquae/Călan

From Germisara / Geoagiu there are 34 votive inscriptions\(^{18}\), referring to 31 people, 14 of which originated from other areas. Thus we have: governors (from Apulum)\(^{19}\), soldiers (from Micia\(^{20}\), Hoghiz\(^{21}\) and Apulum\(^{22}\)), decurions from Apulum\(^{23}\) and Colonia Sarmizegetusa\(^{24}\) and one augustal from Colonia Sarmizegetusa\(^{25}\). In this case, the number of relevant areas is much lower compared to Băile Herculane, which is apparent even at first glance. The other people are from Cigmău fort (the Numerus singularium Peditum Britannicorum auxiliary unit) and its civil settlement.

From Aquae / Călan we have, in total, nine votive inscriptions, which mention six people. Attendance at these spas is much lower when compared with Băile Herculane and Germisara, as we only know of a soldier from Apulum (C. Valerius Ingenuus)\(^{26}\), a procurator from Colonia Sarmizegetusa (Q. Decius Vindex)\(^{27}\) and four decurions from Colonia Sarmizegetusa (C. Iulius Marcianus\(^{28}\), M. Aurelius Valentinus\(^{29}\), Grattius Paternus\(^{30}\), Lucius Grattius\(^{31}\)).

Aquae was a statio, a Roman settlement on the Sarmizegetusa–Apulum highway (the imperial road) and a hot spring spa included in territorium Colonia Sarmizegetusa. The Pagus

\(^{18}\) IDR III/3, 231–247; ILD 318–329; PISO 2015, 47–68.
\(^{20}\) IDR III/3, 246.
\(^{21}\) IDR III/3, 233.
\(^{22}\) IDR III/3, 244; ILD 318, 319.
\(^{23}\) IDR III/3, 245; ILD 327.
\(^{24}\) IDR III/3, 236, 237; ILD 328.
\(^{25}\) IDR III/3, 242.
\(^{26}\) IDR III/3, 15.
\(^{27}\) IDR III/3, 7.
\(^{28}\) IDR III/3, 10.
\(^{29}\) IDR III/3, 17.
\(^{30}\) IDR III/3, 18.
\(^{31}\) IDR III/3, 19.
Aquaensis was led by a praefectus who was also decurion in Colonia Sarmizegetusa\textsuperscript{32}, which explains the decurions’ presence.

By comparing social mobility of all three resorts we can observe some similarities, but also important differences. All spa resorts in Dacia are visited by people from all the province’s social categories. However, the frequency is not the same. Apparently, Băile Herculane, being closer to the Danube and having a greater diversity of hot springs, attracted more visitors. Even from an archaeological viewpoint, the ruins cover a greater surface and the number of hot spring pools if clearly superior compared to the other resorts. Furthermore, a clearer presence of civil servants/magistrates and urban elites from all of Dacia’s major towns and cities can be epigraphically observed at Băile Herculane, though soldiers are statistically less represented.

The sacred topography of Băile Herculane

Very useful in understanding the urban organization and sacred topography (Figure 1), to which epigraphic discoveries are closely linked, are the works of 18\textsuperscript{th} century Habsburg scientists who visited Băile Herculane. They published rather accurate city outlines and, through writings and engravings, described how the spa resort on the Cerna’s banks and its Roman ruins looked like. For his research approach, Francesco Grisellini’s\textsuperscript{33} merit in reconstituting the context of how the statues, inscriptions and Roman walls were discovered is relevant. His 1774 sketched map of the spa resort is almost identical to Tolvai’s map\textsuperscript{34} and reflects realities portrayed on all era engravings, but also doubled by detailed, descriptive data: the hot spring basins can be seen on the Cerna’s banks, along with the ruins on the second terrace, less affected by Andreas Hamilton’s troops dig in 1736\textsuperscript{35}.

Several important discoveries were made around the Catholic military chapel (18\textsuperscript{th} century), such as the inscription dedicated to Aesculapius and Hygia (01BH + 02BH). If Nicolae Stoica of Hațeg is correct: "There, at Comorâște (the terrace toponym), where many stones with inscriptions were found, the Romans had as holy places their curch of Hercules, Aesculapius with Highba, with priest houses\textsuperscript{36}.

32 IDR III/3, 10.
33 FENEŞAN 1984, 204–214.
34 BOZU, MICLEI 2005, 123–142.
Population dynamics at the spas of Roman Dacia

Data presented by 18th century chroniclers led by Pascal Caryophyllus37, who inventoried and first published the discoveries from Băile Herculane, indicate that the population used the internal cure hot springs Hercule I and II, along with the Hygia spring, thermal waters found near the Cerna’s bank, at the contemporary town’s northern edge and near the Roman Hotel. This spa’s rock wall also contains an engraved votive relief, more a sketch actually, depicting Hercules with his club, which is probably from Antiquity. The six Hercules statues originate from around these springs, some almost 1-m tall, made of white marble and some of the inscriptions dedicated to the god-hero: 04BH, 07BH, 08BH, and 10BH. Some of these statues are not well known, as the vessel carrying them to Vienna on the Danube sank around Budapest38. Still, that they were found together near where the springs stemmed from indicates the location was a place for worshiping Hercules, the god’s physical strength being directly connected with the water’s healing power. It is possible that the springs had in their vicinity a temple dedicated to the Nymphs and Diana at Germisara (Geoagiu Băi)39.

According to older information, two armless statues and a stone representation of a woman lying down were discovered on the Cerna’s right bank, near the military sanatorium, between the Roman walls of a monumental building, adjoining the Catholic chapel’s high plateau. According to analogies from Pergamum, Aquincum and Tibiscum40, the dressed woman lying on her back, but raised on her elbow, is a standard representation, very popular in the Roman imperial era during the 2nd and 3rd centuries AD, especially of a nymph, with the sculpture—rather a high relief—being the decorative side of a large public fountain, with an open water basin. This proves a nymphaion existed here — several inscriptions originate from here: 03BH, 09BH, 12BH.

Judging by the dominance of votive inscriptions in epigraphic sources, other worship edifices were most certainly present in Băile Herculane. Unfortunately, the overlap of modern interventions and the urban systematization of the area, beginning in the 18th century, have completely destroyed the ancient ruins. The few walls unearthed by General Hamilton’s troops and marked on topographical sketches do not allow, at this stage of research, to clearly define either the urban layout, or that of the resort’s worship sites or the route of inner roads and outlying burial grounds.

The artistic value of the sculptures and the very good quality of engraving the Latin text on the stone monuments of Băile Herculane indicates however a spa resort with a highly developed religious and urban life, often visited and probably of some renown in the Roman Empire’s Lower Danube regions.

37 IDR III/1, Istoricul cercetării, 20–22.
38 IDR III/1, Istoricul cercetării, 20–22.
40 TIMOC 2004, 78.
Conclusions

We wanted to find out which deities were the most worshiped in the three spas resorts. By analysing votive monuments, we concluded that, statistically, no pattern emerges from the comparative analysis of the number of inscriptions erected for the same deity in the three spas. Instead, we have a mathematical pattern regarding the spread of a certain deity in a given locality. We can easily ascertain that Hercules' holy springs were dominant in Băile Herculane (we have until now 12 epigraphic monuments dedicated to this god), the same as those of the healing Nymphs in Germisara (we have 15 inscriptions dedicated to the Nymphs. A special inscription was erected by C. Sentius Iustinus, centurio of the legio V Macedonica, to the Nymphs, Odrysta, Asklepios, Artemis, and Hypnos\(^{41}\)).

For Aquae/Călan, obvious in this diagram, we cannot ascertain the local preference for a deity over another. No particular deity seems to “dominate” at Aquae, though there is a preference for Greco-Roman deities in the population, probably because of clerks from Colonia Sarmizegetusa who, by virtue of their high office, express their religiosity primarily towards the Roman state’s official deities (Figure 3).

Reviewing Băile Herculane’s population and social mobility begs the question: what do we actually know about the local populace of this area? The only sources on this issue consists of the two funerary monuments (18BH + 19BH), along with two un-epigraphic monuments\(^{42}\) from the studied area. According to I. Piso\(^{43}\), L. Iulius Bassus’ tenure as municipal decurio, the one killed by latrones near Băile Herculane, could indicate that the spa resort had been part of Drobeta’s territorium since the beginning, in which case it would be the only specific example regarding the issue of the local population.

In conclusion, if we take into account the information’s chronological component, which for Herculane epigraphs is fairly consistent in the data, we can see that from the mid-2nd century, very early, the resort enjoys a good reputation among all social categories and is an important point on Dacia’s demographic mobility map. Until the time of the Severan dynasty, it undergoes continuous development, after which, despite the difficulties of the 3rd century military anarchy, it remains one of the most popular resorts north of the Lower Danube (Figure 4). As indicated by epigraphic sources, notables and soldiers continue to come to get treatment and to thank the gods for healing, while stamps on tegulae material indicates that buildings were still constructed in the area, while the spa establishments are restored by the army and administration of the late Roman era.

\(^{41}\) PISO 2015, 47–68.
\(^{43}\) Information provided by Prof. Dr Ioan Piso, to whom we offer our gratitude for his graciously offered suggestions.
Population dynamics at the spas of Roman Dacia

Figure 3. Divinities attested in the three spa resorts: Băile Herculane, Germisara and Aquae.

Figure 4. The dating of the epigraphic monuments.
Inscriptions from Băile Herculane

01BH: CIL III 1560 = IDR III/1, 54 = EDCS-26600755
Di[i]s Magnis / et Bonis Aesculap(io) et Hygiae / Marc(us) Aur(elius) Vete/ranus praef(ectus) leg(ionis) / XIII G(eminai) Gall(i)eniana(e) / v(otum) l(ibens) m(erito) p(osuit)

02BH: CIL III 1561 = IDR III/1, 55 = AE 1962, 233 = EDCS-26600756
Aesculap(io) / et Hygiae / pro salute Iuniae / Cyrrilae quod a / longa infirmita / te virtute aqua - / rum numinis sui / revocaverunt / t(utor) b(onis) a(dministrandis) eius v(otum) s(olvit) l(ibens) m(erito)

03BH: CIL III 1562 = IDR III/1, 56 = AE 2005, 23 = EDCS-26600757
Dis et Numinibus / Aquarum / Ulp(ius) Secundinus / Marius Valens / Pomponius Haemus / Iul(ius) Carus Val(erius) Valens / legati Romam ad / consulatum Seve/riani c(larissimi) v(iri) / missi incolu/mes reversi ex voto

04BH: CIL III 1563 = IDR III/1, 59 = EDCS-26600758
Hercule / tibi / v(otum) s(olvit)

05BH: CIL III 1564 = IDR III/1, 57 = EDCS-26600759
Herculi / pro salute Imperatoru m / Severi / et Antonini f ili(? ) / consev/vatorii Augustorum / dominorum nos/trorum C(audius) Gallu/s c(larissimsus) v(ir) legatus eorum / pr(o) pr(aetore) cum suis / v(otum) s(olvit) l(ibens) m(erito)

06BH: CIL III 1565 = IDR III/1, 58 = EDCS-26600760
Herculi / pro / salute Imp(eratoris) / M(arci) Aurel(i) Anto/[nini Pi Aug(usti)] / [et Iuliae Dom]/nae Aug(ustae) matri / Aug(usti) et castrorum / sub cura Iul(i) Pa/terni proc(uratoris) / Syntrophus vil(icus)

07BH: CIL III 01566 = IDR III/1, 67 = ILD 186 = EDCS-26600761
Herculi Genio / loci fontibus / calidis Calpur/nius Iulianus / v(ir) c(larissimus) leg(atus) leg(ionis) V Mac(edonicae) / leg(atus) Aug(usti) pr(o) pr(aetore) / [pro]v(inciae) Daciae / [sup]er[vior]s / v(otum) l(ibens) s(olvit)

08BH: CIL III 1567 = IDR III/1, 68 = EDCS-26600762
Herculi / et / Veneri / Mercurius / PR E L N / cum suis

09BH: CIL III 1568 = IDR III/1, 60 = EDCS-26600763
Herculi Augusto sacrum / Felix T(itus) Iuli Saturnini c(onductoris) p(ublici) p(ortorii) / t(ertiae) p(artis) ex priv(atis) stationis / Tsiernen(sis) IIII I(dus) Dec(embres) anno XI / Barbaro et Regulo co(n)s(ulibus) / ex voto posuit

10BH: CIL III 1569 = IDR III/1, 61 = EDCS-26600764
Herculi Invicto / T(itus) Aur(elius) Geminianus vet(eranus) le/g(ionis) XIII Gem(inae) / Antoninian / ae ex voto posuit
Population dynamics at the spas of Roman Dacia

11BH  CIL III 1570 = IDR III/1, 62 = ILD 185 = EDCS-26600765
Herculi / Invicto / P(ublius) Claudi/us Iulius / dec(urio) col(oniae) / [D]r<o=U>b(etae) v(otum) s(olvit)

12BH: CIL III 1571 = IDR III/1, 63 = EDCS-26600766
Herculi In/victo L(ucius) Pomp/eius Celer / praef(ectus) coh(ortis) / I Ubior(um) v(otum) s(olvit)

13BH: CIL III 1572 = IDR III/1, 64 = EDCS-26600767

14BH: CIL III 1573 = IDR III/1, 66 = EDCS-26600768
Herculi Sanc/to Simonius / Iulianus v(ir) c(larissimus) / / praeses Da/iciarum

15BH: CIL III 1573a = IDR III/1, 65 = EDCS-26600769
Herculi Sancto Eutyches act(or) / P(ubli) Aeli Antipatri ex voto posuit

16BH: CIL III 1574 = IDR III/1, 79 = EDCS-26600770
I(ovi) O(ptimo) M(aximo) / Antesti/us Gaius / pro salute / sua et su/orum / v(otum) l(ibens) p(osuit)

17BH: CIL III 1575 = IDR III/1, 70 = ILD 187 = AE 1998, 1108 = EDCS-26600771
[D(eo)] Suc(ello) / pro salute / M(arci) Sedat(i) / Severiani / leg(ati) Aug(usti)

18BH: CIL III 1017 = IDR III/1, 71 = EDCS-26600775
D(is) M(anibus) / L(ucio) Iul(io) L(uci) fil(io) Sergia / Basso dec(urionis) mun(icipii) / Drobetae quaes/tori interfecto a / latronib(us) vix(it) an(nos) / XXXX Iul(i) Iulianus / et Bassus patri / piisimo / et Iul(ius) Valerianus / frater mortem / eius ejecutus / f(aciendum) c(uraverunt)

19BH: CIL III 12598 = IDR III/1, 72a = EDCS-2910085
D(is) I(nferis) M(anibus) S(acrum) / Septi(mius) Bitus et Septi(mia) / Valentina vixerunt / annis LIII pos(u)er/unt Septi(mus) Bas(sus) et Aur(elius) / Vale(n)s patris bene – / merentis

20BH: IDR III/1, 74 = EDCS-11200394
Figulinus

Acknowledgements. This work was supported by a grant of the Romanian National Authority for Scientific Research, CNCS-UEFISCDI, project number PNII-RU-TE-2014-4-0488.

References


© 2017 by the authors; licensee Editura Universității Al. I. Cuza din Iași. This article is an open access article distributed under the terms and conditions of the Creative Commons by Attribution (CC-BY) license (http://creativecommons.org/licenses/by/4.0/).