This Microscopy walk offers you a great opportunity to explore some interesting places in Prague. The guide was prepared as a useful handbook full of interesting microscopic stories connected to the monuments you will pass during this walk. The guide does not include the top places to visit in Prague, because they can be found easily elsewhere. On the contrary it aims to help you in discovering less-known but still beautiful places.

Are you ready for this exciting walk? Let’s start!

The microscopy walk starts at the entrance of the Prague Congress Centre (IMC 2014 venue). Walk the street “Na Bučance” (or “Na Pankráci” – depending on the direction you have chosen) to the Vyšehrad fortress. The fortress was probably built in 10th century on a hill over the Vltava River. The most significant monuments in Vyšehrad are Basilica of St Peter and St Paul, and the Vyšehrad Cemetery “Slavín”, where the famous sons of the Czech nation are buried. Then follow the street “V Pevnosti”. Pass the Tabor Gate. Then you will see the remains of the gothic peak “Špíčka” (an information centre is located there). Pass the Leopold Gate, St. Martin’s Rotunda, Plague Pillar, the Chapel of Our Lady of the Ramparts and finally reach the Brick (Prague) Gate. You can find the entrance to casemates – narrow passages with small shooting windows dedicated to Vyšehrad defence (but never used) - inside this gate. In the casemates complex, a monumental hall “Gorlice” is located, in which six original statues from the Charles Bridge are stored.
Microscopy story 1

A saloon shooting gun (Fig. 1) was conserved and preserved at the Institute of Chemical Technology, Prague.

Based on the object’s description and its design, it was supposed that the gun was originally from the gothic period and it was used for shooting from casemates or stone castle walls. It was supposed that later on the gun must have been shortened to be used for shooting plays in saloons. However, this idea was disproved by metallographic analysis and it was shown that the gun is a modern fake.

The structure of a saloon shooting gun is given in Fig. 2. It is current steel with feritic-perlitic structure. The content of carbon (about 0.2 wt.%), which determines the structure, exhibits that the gun was made from modern steel manufactured after 1830. The gothic gun would have been made from wrought iron – iron alloy with very low carbon and typical slag inclusions prepared by direct reduction, which structure is illustrated in Fig. 3.
The microscopy walk continues from Vyšehrad to the tram stop Výtoň. You can take tram No. 17 or walk along the Vltava River (about 1.5 km) to the tram stop Národní Divadlo (the National Theatre).
Get off at the stop “Národní divadlo” (on the river side). The **National Theatre** was opened on 11 June 1881 for the first time. Two months later, the theatre was completely destroyed by a fire. This catastrophe led to organization of money collection from people to rebuild the National Theatre. The theatre is decorated by a **triga** by Bohuslav Schnirch on the roof.

**Cafe Slavia** is located on Národní Třída opposite the National Theatre. The Cafe was known as a meeting place for writers, poets and other intellectuals. You can see not only pictures of cafe’s famous guests on the walls but also a famous picture of the Absinth drinker by Viktor Oliva, which refers to the fact that the Cafe Slavia was one of few places where Absinth was served. Nowadays, Absinth is still served but with a slight change in composition (without the wormwood). Nevertheless, the window view from the Cafe Slavia belongs to the best in Prague.

After a pleasant refreshment follow the Vltava River.
Microscopy story 2

The study of a triga statue (Fig. 4.) was performed with the aim to examine if the statue can cause safety risk and if it requires to be restored and conserved. The thickness of copper cover was measured by ultrasound non-destructive testing. It was proven that the thickness of all covering sheets is 3.5-12 mm. This result in combination with the results of mechanical testing from internal parts of statue confirmed that the statue is in satisfactory condition.

![Fig. 4. A triga statue on the National Theatre, J. Děd](image)

It was proven by metallographic analysis that the structure corresponds to historical cast copper with presence of voids (see. Fig. 5) and sulphide inclusions (see. Fig. 6).

![Fig. 5. Voids in structure of copper on triga statue, J. Děd](image)

![Fig. 6. Sulphide inclusions in structure of copper on triga statue, J. Děd](image)
Continue along the Vltava River and notice the wooden ice breakers (marked by a cross in the map). The best view of the Charles Bridge is from Novotného lávka.

Source: Google Maps
Microscopy story 3

Historical wood was usually treated by inorganic salts with fungicide, biocide and fire retardant function. It was believed that this kind of treatment prolongs the life of wooden structural material. When a wooden object is undergoing reconstruction, some pieces might need to be replaced. The question is how to keep the authenticity while treating new wood with inorganic salt.

Wood is composed of cellulose (43%), hemicelluloses (28-38%) and lignin (16-33%) and residual ash and compounds. Wood structure is illustrated in Fig. 7. It was proven that some of the historically used inorganic salts attack the cellulose and cause so called wood corrosion (CuSO$_4$.5H$_2$O, Fig. 8), some other cause cellulose exfoliation (H$_3$BO$_3$, Fig. 9) and the others dissolve lignin (Na$_2$B$_4$O$_7$, Fig. 10). Therefore the recommendation is to use modern fungicide, biocide and fire retardant which do not damage wood.
Our walk continues to the Charles Bridge. Its construction started in 1357 under the auspices of King Charles IV and finished at the beginning of 15th century. The bridge is 621 m long and nearly 10 m wide, resting on 16 arches shielded by the ice guards. It is protected by three bridge towers, two of them located on the Lesser Quarter bank and the third one located on the Old Town bank.

At the end of the Charles Bridge, turn to the right and continue to Hergertova Cihelna (marked by “A” letter in the map). A statue “The Streams” by David Černý is placed in the yard. The statue is made of copper and covered by a natural green patina. You can compare it with the artificial green patina at the Prague Castle at the entrance to the Presidential Office. This statue has two possible explanations: 1) It shows the bad habit and 2) it is based on the Czech idiom which can be in the nutshell translated as to pee = to make everything the easiest way.
Microscopy story 4

Copper covers by a patina in atmospheric conditions. The green patina is usually desired and it is used as decoration. Unfortunately, the black patina can be formed. It was believed that the black patina is formed on hidden places (e.g. under windows). If you look carefully on some copper roofs you can see that it is not true. Another idea was that the black patina has different phase composition. It is neither true. The reasons for forming different kinds of patinas have not yet been explained but structure (grain the size) of copper, impurities of copper and mainly the morphology of a patina layer play a role in this process. Both patinas are formed by an internal layer of cuprite and an external layer of brochantite. The brochantite layer on the black patina is thinner with high amount of porous, which makes the patina look black although the last layer is green.

Fig. 11. Green patina morphology, P. Novák, V. Procházková
Fig. 12. Black patina morphology, P. Novák, V. Procházková
From Hergertova Cihelna continue to the quarter called Kampa (Hroznová Street), cross Čertovka brook and you will reach Lennonova zeď (Lennon’s wall) in Velkopřevorské náměstí soon. The history of this wall started after the violent death of John Lennon when group of teenagers painted a small picture of him on the wall and placed a candle under the picture. This commemorative place was repeatedly damaged by the police and then re-painted so it demonstrated a continuous struggle between the painters and the police in the past.

Continue to Maltézské náměstí and follow Karmelitská street where the Church of Our Lady Victorious (Kostel Panny Marie Vítězné) is located. This church was built in 1584 and from 1620 it has its current name based on the triumphalist altarpiece (a symbol of re-Catholicism after the Battle of White Mountain). The Church of Our Lady Victorious is home of the famous Child-Jesus statue called the Infant Jesus of Prague.

The entrance to the Vrtbovská Garden is also located in Karmelitská Street. The garden was built in the beginning of 18th century and it is one of the most beautiful gardens in Prague. The garden was named after its owner Jan Josef from Vrtba. It was designed by František Maxmilian Kaňka. The statues were made by Matyáš Bernard Braun and the Venus fresco was made by Václav Vavřinec Rainer.

Source: Google Maps
Microscopy story 5

During the preservation and conservation of Infant Jesus of Prague altar some white areas were found on gilded pieces. The task was to reveal the origin of these white areas. The altar was gilded by amalgam (quicksilver) method which produces a thick layer of gold. After the metallographic study, it was found out that the altar was galvanic re-gilded in the past (a thin layer on the top of amalgam gilding and also on place where this gilding was damaged). The pre-step of galvanic gilding is galvanic silvering which prevents diffusion degradation of gold layer. As the altar was mechanically cleaned very often, the gold layer was abrasively taken off and the silver layer was visible (and looked like white areas).

Fig.13 shows the under-corroded gold layer. Fortunately, this damage is very rare in the church atmosphere.

Fig.13. Metallography of an under-corroded gold layer on copper, J.Děd, A.Michalcová
Microscopy story 6

Many silver objects were found in the gardens under the Prague castle. This silver was extremely brittle, which was caused by two mechanisms. The first one is impurities diffusion that weakens the grain boundaries. The other mechanism is forming of corrosion products on the grain boundaries (mainly chlorides from soil), as illustrated in Fig. 14.

Fig. 14. Structure of corroded silver with chloride corrosion products, J. Děd
The last part of our microscopy walk leads from Malostranské náměstí (Lesser Town Square) to Pražský Hrad (the Prague Castle) via Nerudova Street. You can admire beautiful architecture and also magnificent views of Prague scenery on the way. One funny but not a well-known place is The Hanging Cafe (marked by a green arrow in the map). You can hang there cafe for somebody who is out of money or you can try to ask if there is a hanging cafe for you.

The street “Ke Hradu” brings you directly to the Prague Castle where you can enjoy Prague – “the city of hundred spires”.

Source: Google Maps