evropský sociální fond v ČR
EVROPSKÁ UNIE
MINISTERSTVO ŠKOLSTVÍ, MLÁDEŽE A TĚLOVÝCHOVY
OP Vzdělávání pro konkurenceschopnost
INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ

Název: **Monitoring the properties of erythrocytes and leucocytes exposed to metal elements and compounds using flow cytometry**

Školitel: **Branislav Ruttkay-Nedecky, Jiri Kudr**

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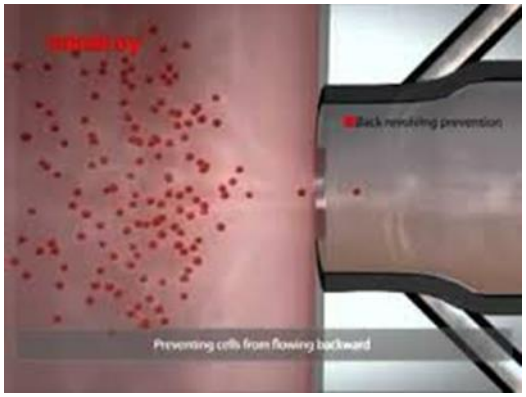
Reg.č.projektu: CZ.1.07/2.3.00/20.0148

Název projektu: Mezinárodní spolupráce v oblasti "in vivo" zobrazovacích technik

Hematology analyser BC 5800

- Number of blood cells can be measured on a hematology analyser.
- 24 parameters
- Leukocyte count and differential
- Erythrocyte count
- Platelet count
- Determination of the hemoglobin concentration in the blood

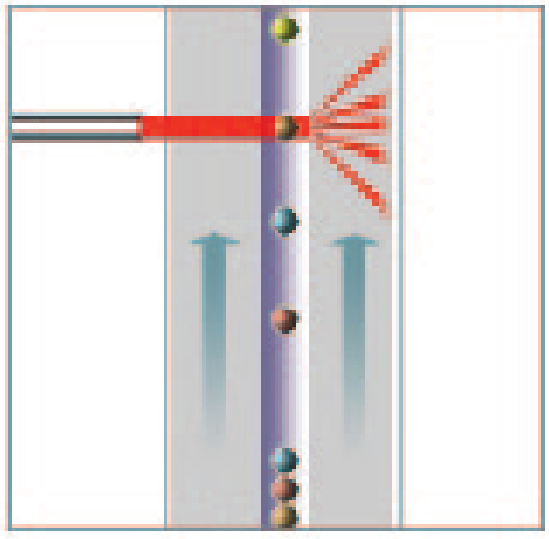
Hematology analyser



Principles

Impedance method for RBC and PLT counting

Cyanide free reagent for hemoglobin test



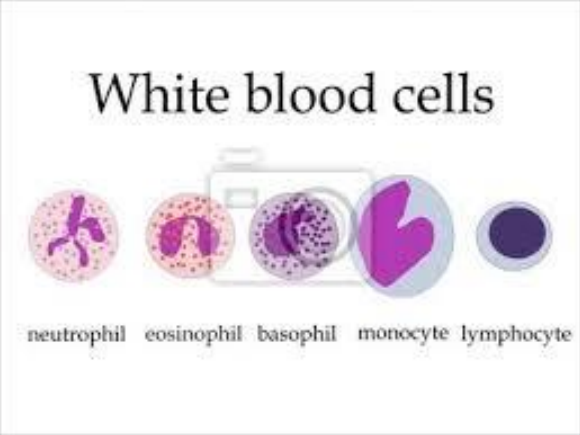
Flow cytometry + laser light scatter + chemical dye method for WBC differential analysis and WBC counting

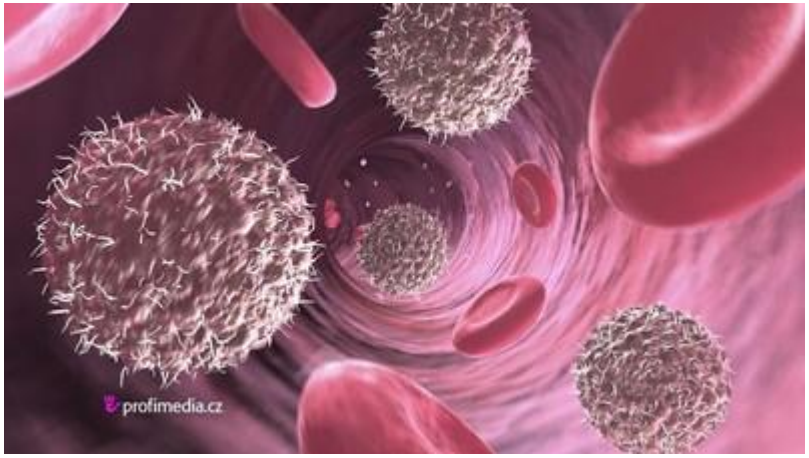
Complete blood count

- Number of white blood cells (WBC) – leukocytes, differential count: lymphocytes (LYM), monocytes (MON), neutrophils (NEU), eosinophils (EOS), basophils (BAS) a and their percentage content

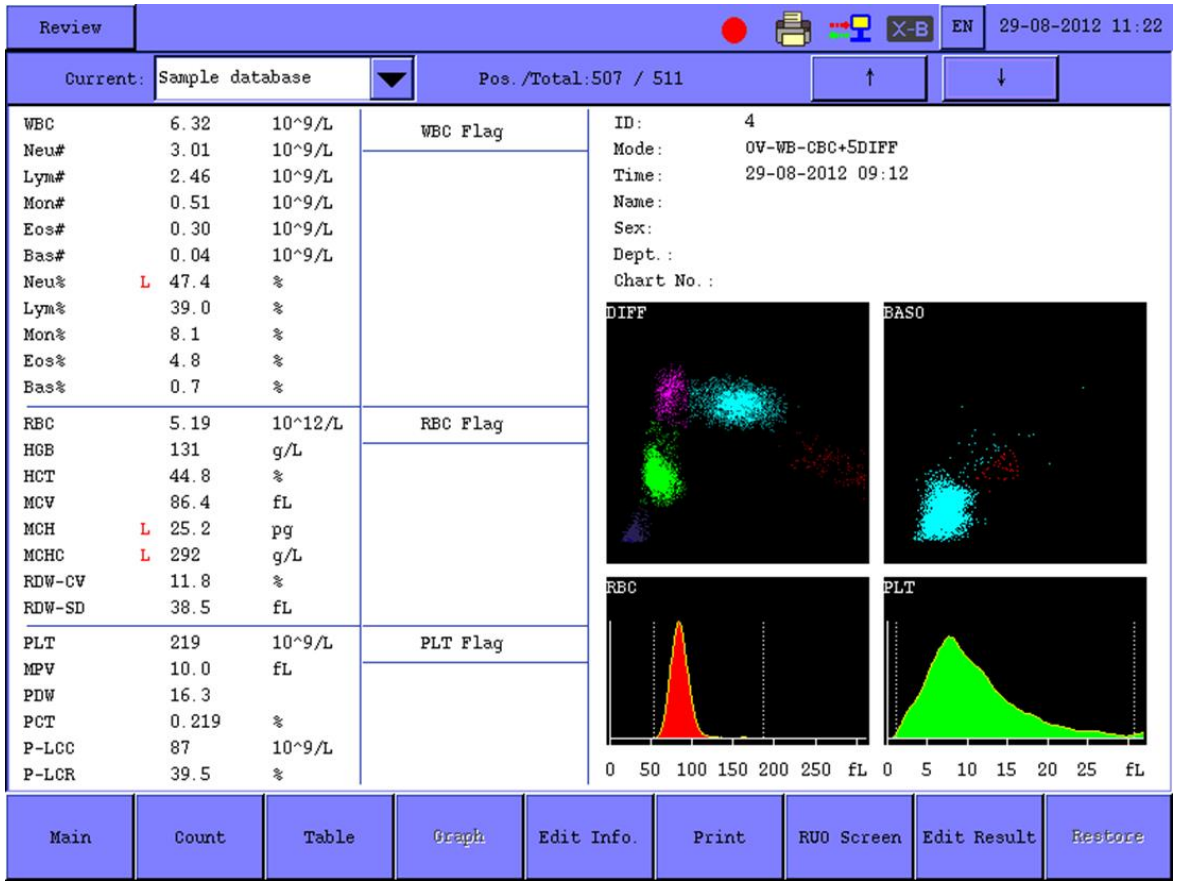
- Number of red blood cells (RBC) – erythrocytes, hemoglobin concentration in the blood (HGB), hematocrit (HCT), RBC volume (MCV), mean amount of HGB in RBC (MCHC), average concentration of HGB in RBC (MCHC), distribution width of RBC (RDW)

- Number of platelets (PLT) – thrombocytes, distribution width of platelets (PDW), platelet volume (MPV)





Complete blood count



Result of hematological blood test – blood count:

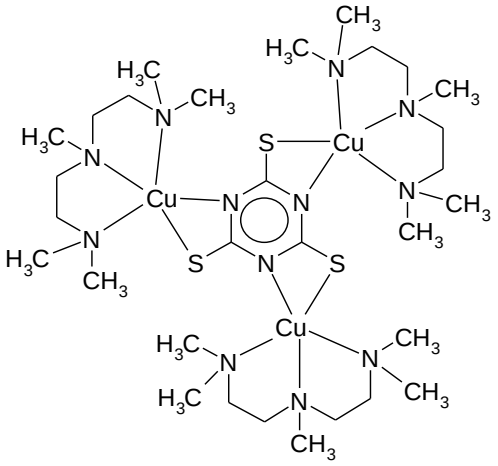
WBC - leukocyte count , RBC – erythrocyte count, PLT – platelet count, HGB- hemoglobin concentration in the blood

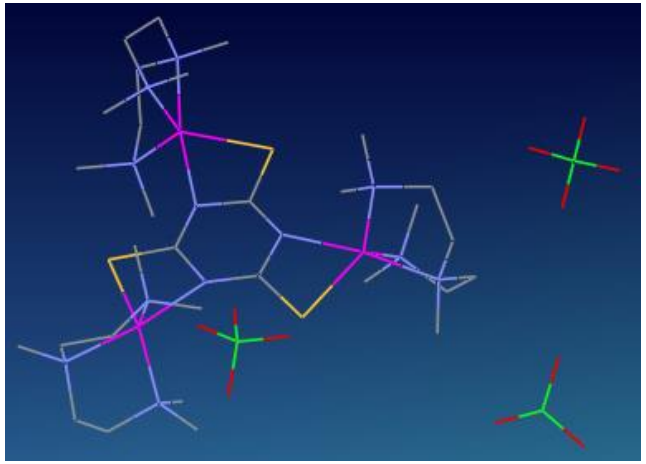
On the figures with black background: DIFF- differential except basophils (lymphocytes – green, monocytes – pink, neutrophils – blue, eosinophils-red, other cells - violet) , BASO-basophils (basophils-red, other cells - blue, RBC-distribution of erythrocytes, PLT-distribution of platelets

Aim of the work

- **Investigate interactions of metal complexes (Cu, Zn and Co) and metal nanoparticles (PdNPs, RuNPs) with blood cells using hematology analyser**
- **Observe influence of metal compounds on blood cell count**

$[Cu_3(pmdien)_3(\mu\text{-ttc})](ClO_4)_3$ $[Zn_3(pmdien)_3(\mu\text{-ttc})](ClO_4)_3$ $[Co_3(pmdien)_3(\mu\text{-ttc})](ClO_4)_3$





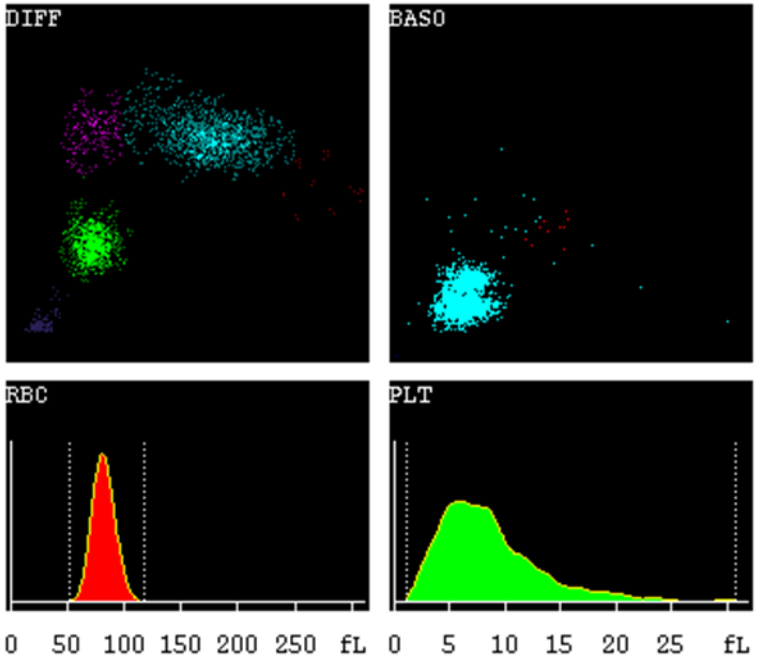
These metal complexes were cytotoxic to some tumor cell lines

PdNPs ($PdCl_2$)

RuNPs ($RuCl_3.2.5\ H_2O$)

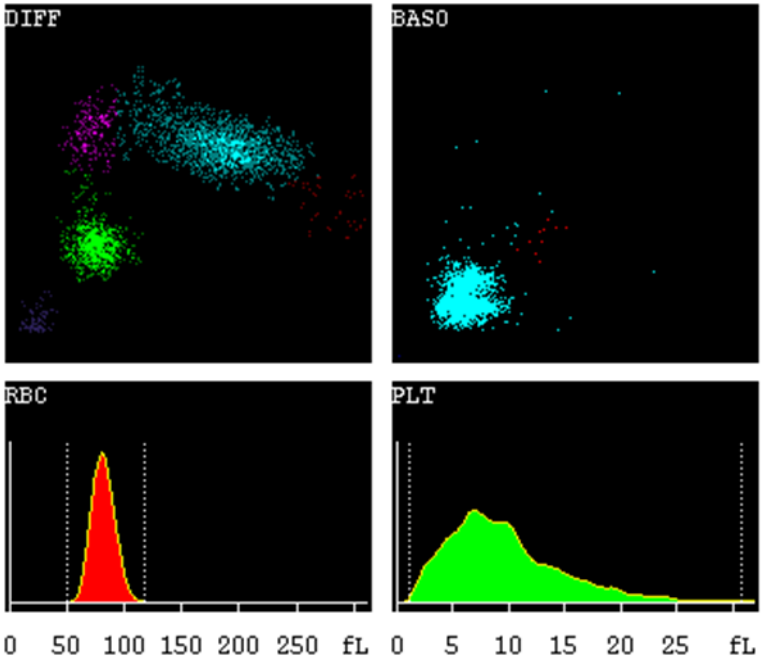
Control

Blood cells count diluted in phosphate buffer (1:2)



WBC 3.02 x 10^9 cells/mL
MON 0.23 x 10^9 cells/mL
EOS 0.11 x 10^9 cells/mL
RBC 1.84 x 10^{12} cells/mL
PLT 61 x 10^9 cells/mL

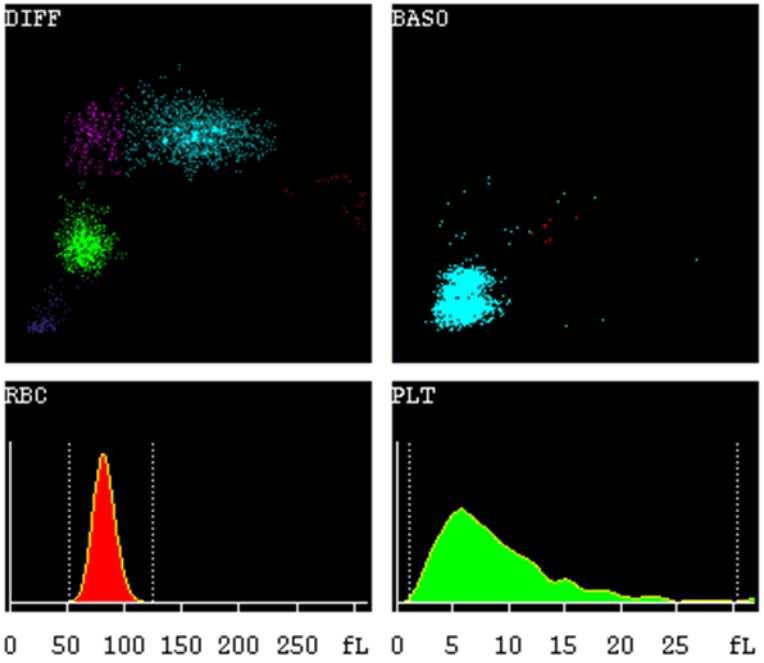
Blood cells count diluted in phosphate buffer (1:2) after 1 hour



WBC 3.32 x 10^9 cells/mL
MON 0.21 x 10^9 cells/mL
EOS 0.13 x 10^9 cells/mL
RBC 1.85 x 10^{12} cells/mL
PLT 62 x 10^9 cells/mL

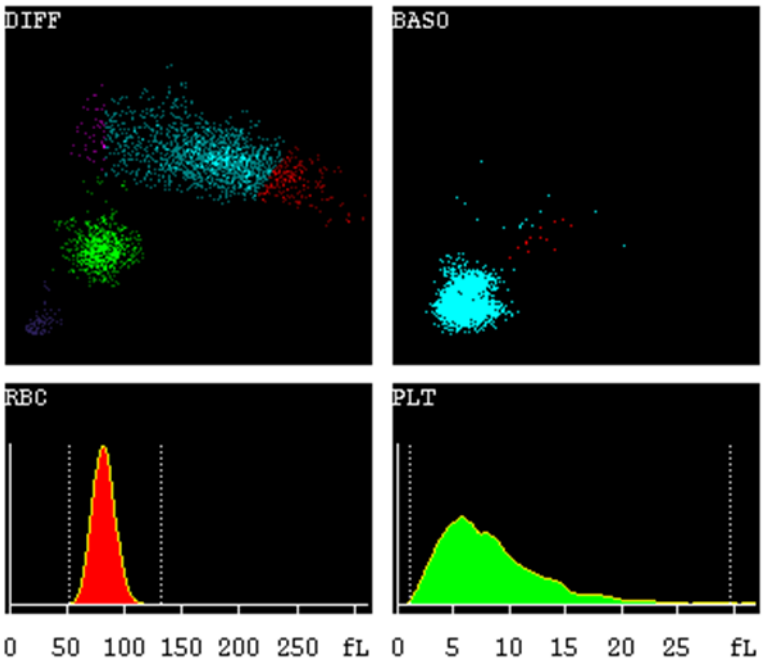
$[Cu_3(pmdien)_3(\mu\text{-ttc})](ClO_4)_3$

Blood cells count diluted in phosphate buffer (1:2), Cu 345 µg/mL



WBC 2.98 x 10^9 cells/mL
MON 0.24 x 10^9 cells/mL
EOS 0.12 x 10^9 cells/mL
RBC 1.84 x 10^{12} cells/mL
PLT 56 x 10^9 cells/mL

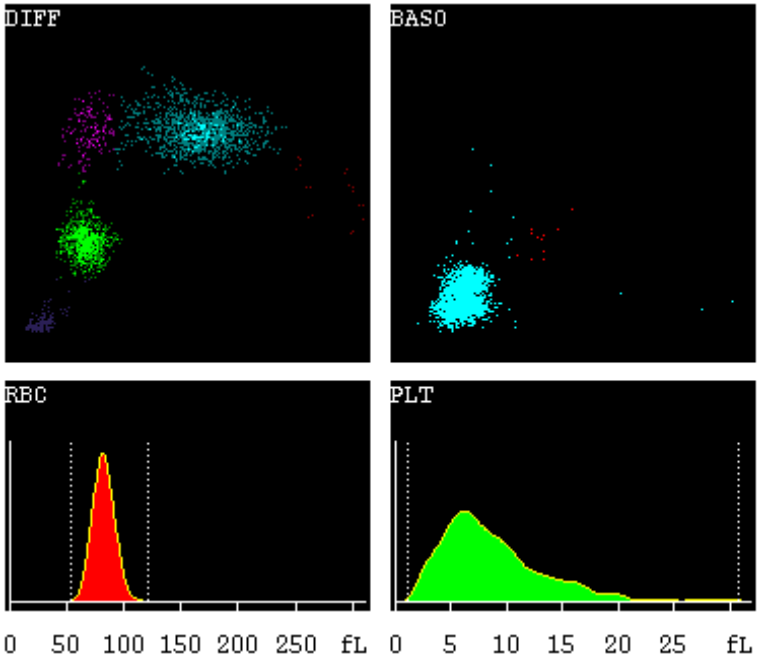
Blood cells count diluted in phosphate buffer (1:2), Cu 345 µg/mL after 1 hour



WBC 3.64 x 10^9 cells/mL
MON 0.06 x 10^9 cells/mL
EOS 0.37 x 10^9 cells/mL
RBC 2.08 x 10^{12} cells/mL
PLT 51 x 10^9 cells/mL

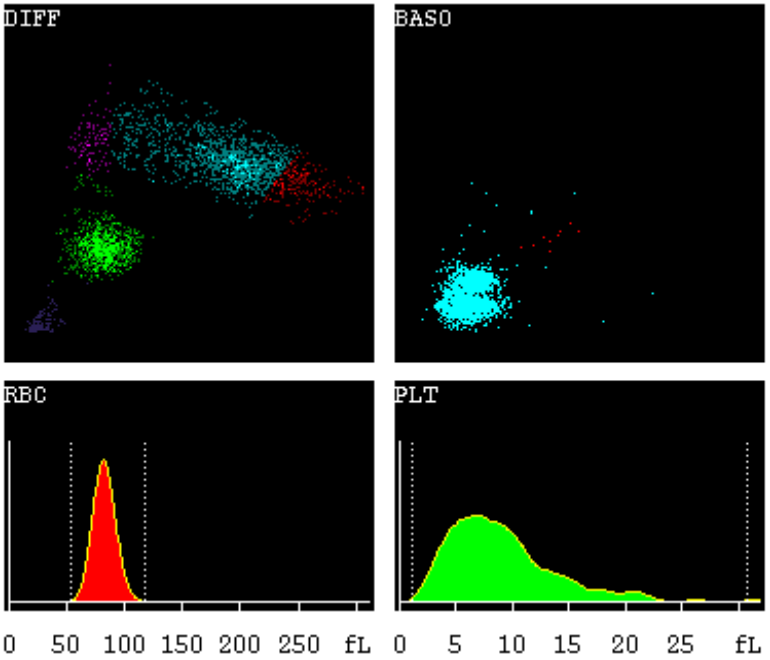
$[Zn_3(pmdien)_3(\mu\text{-ttc})](ClO_4)_3$

Blood cells count diluted in phosphate buffer (1:2), Zn 345 µg/mL



WBC 3.00 x 10^9 cells/mL
MON 0.17 x 10^9 cells/mL
EOS 0.13 x 10^9 cells/mL
RBC 1.85 x 10^{12} cells/mL
PLT 57 x 10^9 cells/mL

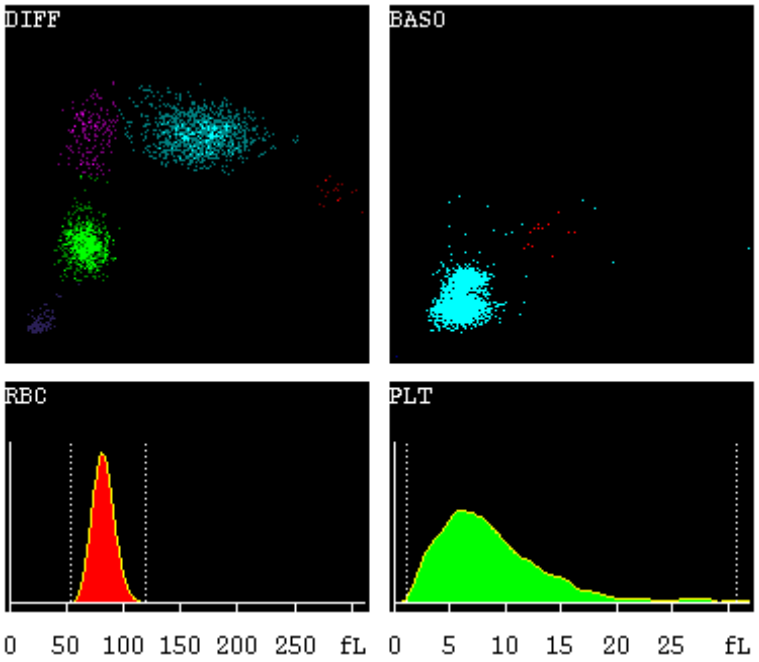
Blood cells count diluted in phosphate buffer (1:2), Zn 345 µg/mL after 1 hour



WBC 2.99 x 10^9 cells/mL
MON 0.16 x 10^9 cells/mL
EOS 0.43 x 10^9 cells/mL
RBC 1.72 x 10^{12} cells/mL
PLT 64 x 10^9 cells/mL

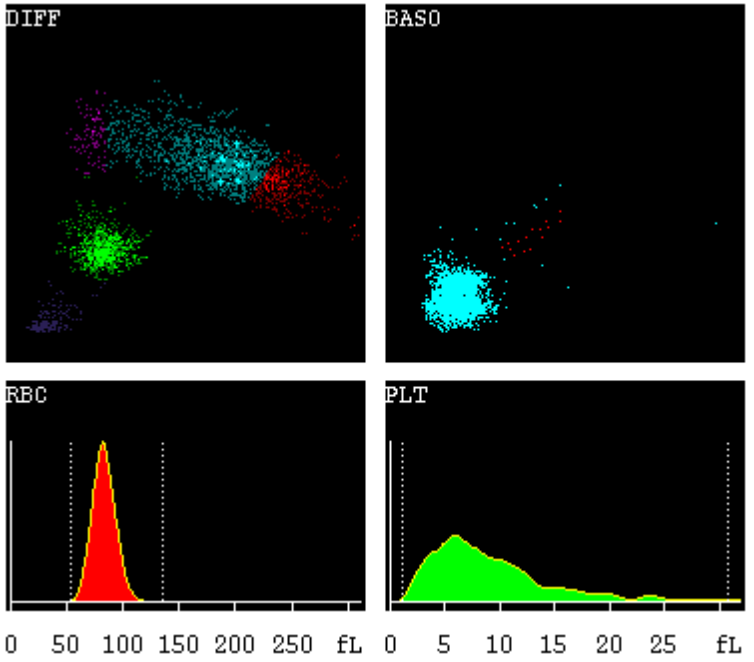
$[Co_3(pmdien)_3(\mu\text{-ttc})](ClO_4)_3$

Blood cells count diluted in phosphate buffer (1:2), Co 345 µg/mL



WBC 2.97 x 10^9 cells/mL
MON 0.18 x 10^9 cells/mL
EOS 0.11 x 10^9 cells/mL
RBC 1.86 x 10^{12} cells/mL
PLT 59 x 10^9 cells/mL

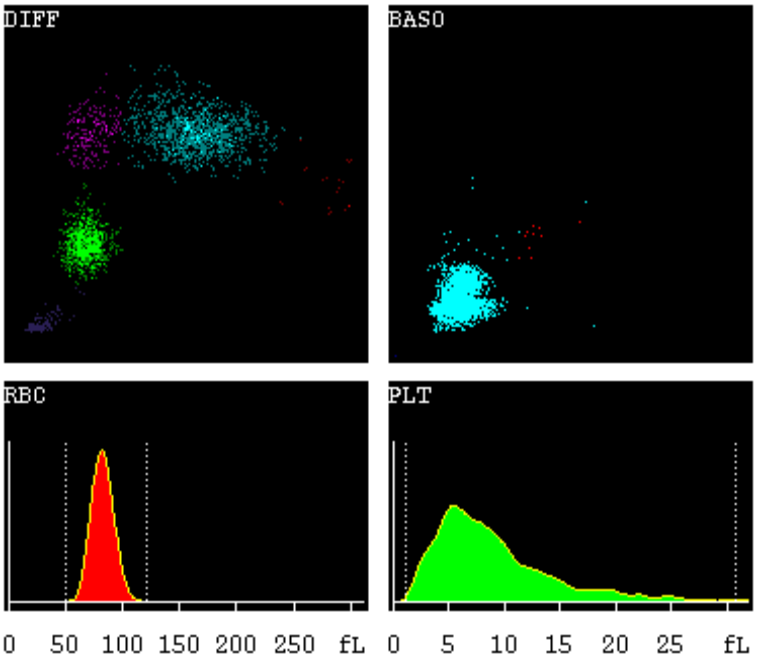
Blood cells count diluted in phosphate buffer (1:2), Co 345 µg/mL after 1 hour



WBC 3.66 x 10^9 cells/mL
MON 0.12 x 10^9 cells/mL
EOS 0.54 x 10^9 cells/mL
RBC 1.41 x 10^{12} cells/mL
PLT 42 x 10^9 cells/mL

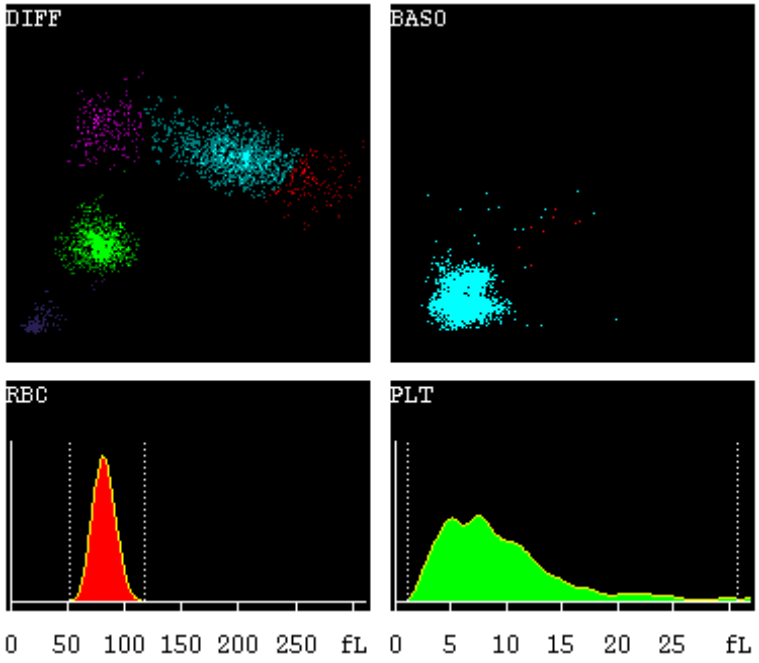
PdNPs ($PdCl_2$)

Blood cells count diluted in phosphate buffer (1:2), Pd 345 µg/mL



WBC 2.95 x 10^9 cells/mL
MON 0.21 x 10^9 cells/mL
EOS 0.11 x 10^9 cells/mL
RBC 1.87 x 10^{12} cells/mL
PLT 58 x 10^9 cells/mL

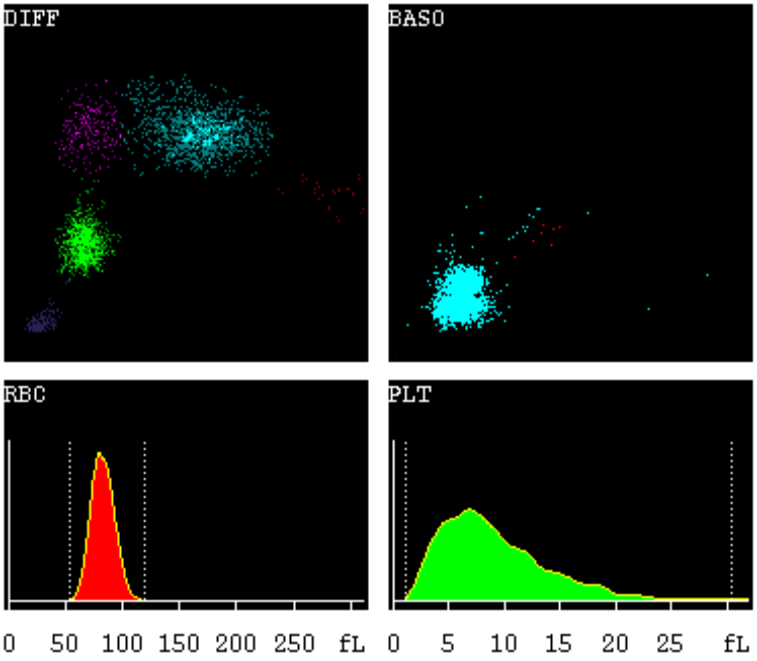
Blood cells count diluted in phosphate buffer (1:2), Pd 345 µg/mL after 1 hour



WBC 3.10 x 10^9 cells/mL
MON 0.24 x 10^9 cells/mL
EOS 0.26 x 10^9 cells/mL
RBC 1.81 x 10^{12} cells/mL
PLT 58 x 10^9 cells/mL

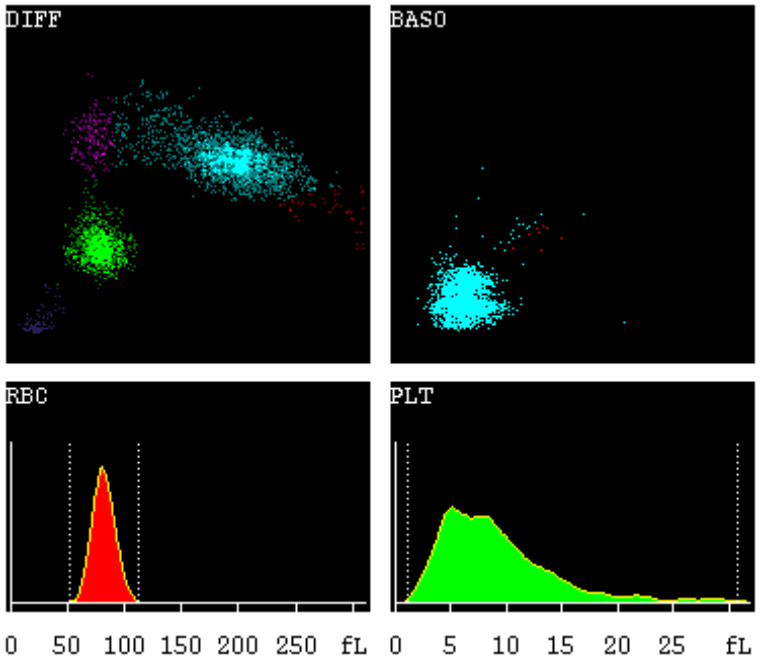
RuNPs ($RuCl_3.2.5\ H_2O$)

Blood cells count diluted in phosphate buffer (1:2), Ru 345 µg/mL



WBC 3.08 x 10^9 cells/mL
MON 0.23 x 10^9 cells/mL
EOS 0.12 x 10^9 cells/mL
RBC 1.85 x 10^{12} cells/mL
PLT 60 x 10^9 cells/mL

Blood cells count diluted in phosphate buffer (1:2), Ru 345 µg/mL after 1 hour



WBC 3.35 x 10^9 cells/mL
MON 0.16 x 10^9 cells/mL
EOS 0.15 x 10^9 cells/mL
RBC 1.71 x 10^{12} cells/mL
PLT 60 x 10^9 cells/mL

Conclusions

- 3 metal complexes (Cu, Zn and Co) and 2 nanoparticles (Pd, Rd) were analysed for their effect on the blood cell count
- The biggest effect had metal complexes and nanoparticles on the number of eosinophils and monocytes
- The number of monocytes by metal complexes increased 3 times in comparison to control, the highest effect had Co complex

Acknowledgment

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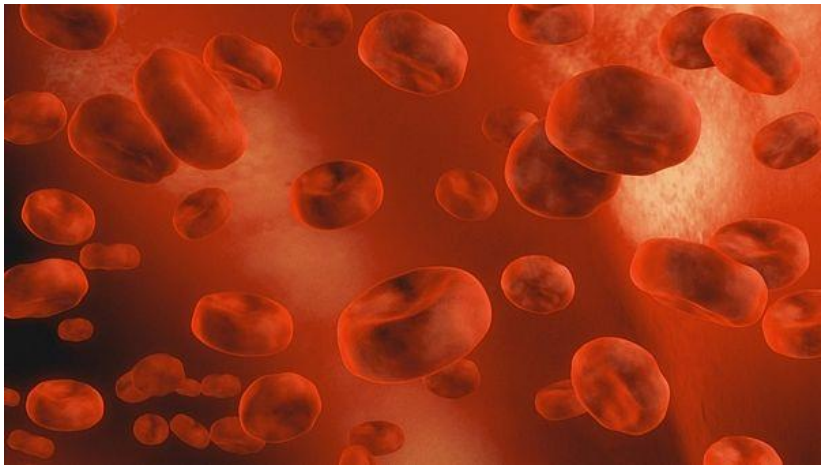
Martina Stankova



Thank you for your attention

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