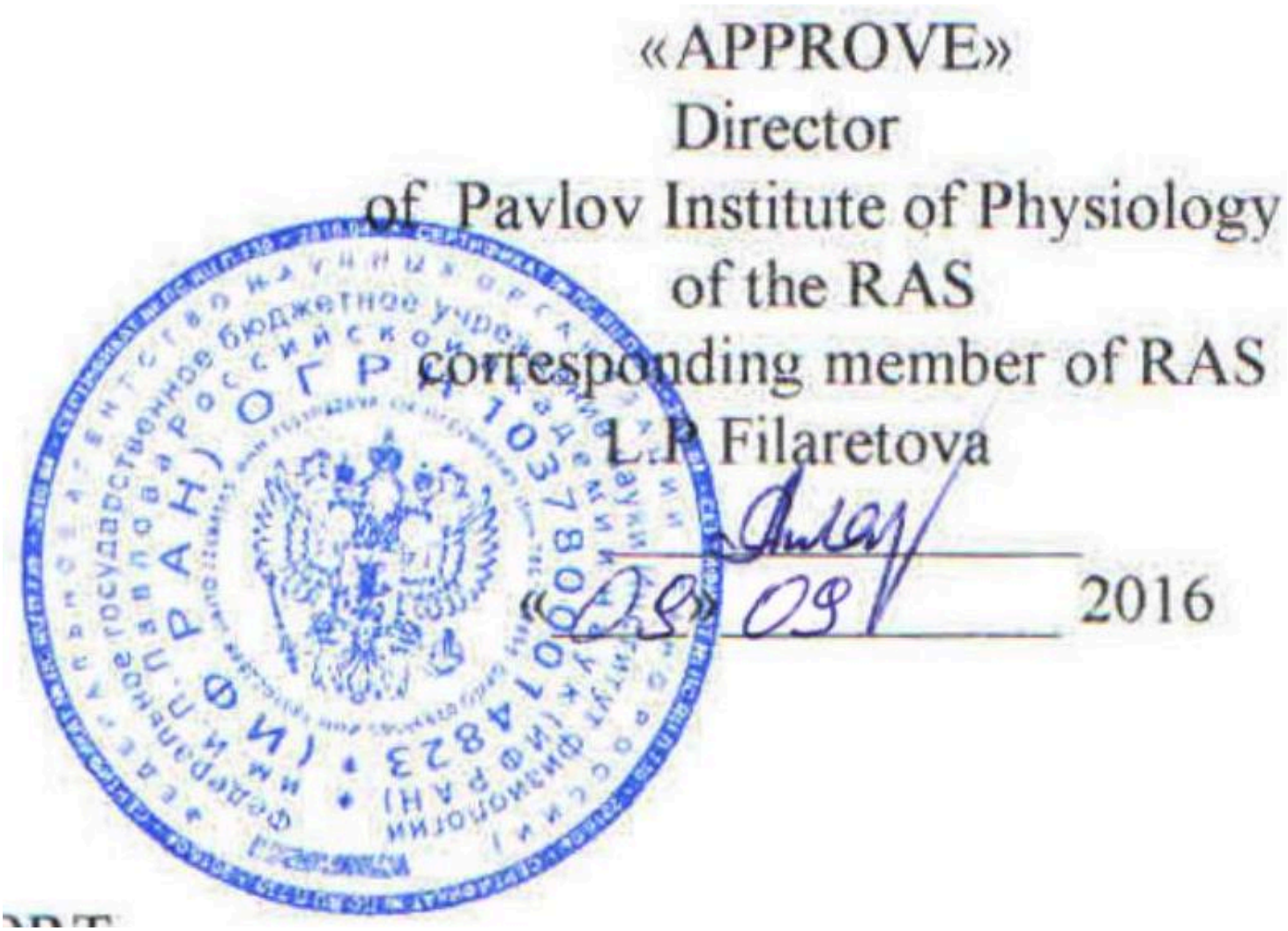


\captionsetup{labelformat=empty}
Figure 1: REPORT **圖 1：報告**
UNDER THE AGREEMENT ON SCIENTIFIC COOPERATION WITH AIRES HUMAN GENOME RESEARCH FOUNDATION

根據與 AIRES 人類基因組研究基金會之科學合作協議

Subject: Study of high-frequency electromagnetic radiation impact and Aires resonators influence on behavior, genetic and epigenetic processes in cells of central and peripheral organs (models organisms rat (Rattus norvegicus) and honey bee (Apis mellifera L.)

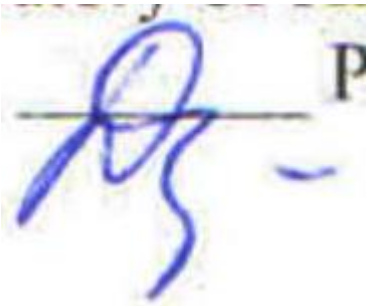
主題：研究高頻電磁輻射的影響及 Aires 共振器對行為、中央與周邊器官細胞之基因與表觀遺傳過程的影響（模式生物：大鼠（Rattus norvegicus）與西方蜜蜂（Apis mellifera L.））

FIRST STAGE: Study of electromagnetic radiation, emitted by the router, and influence of Aires resonators - converters on stability of genetic processes in bone marrow cells of Wistar male rats.

第一階段：研究由路由器發出之電磁輻射，以及 Aires 共振器—轉換器對 Wistar 雄性大鼠骨髓細胞基因過程穩定性的影響。

Principal investigator **主要研究者**
Senior Research Scientist Laboratory of Higher Nervous Activity Genetics

高等神經活動遺傳學實驗室 高級研究科學家



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Saint Petersburg, 2016 **聖彼得堡，2016**

REPORT **報告**

ON AGREEMENT FOR SCIENTIFIC COOPERATION BETWEEN FEDERAL STATE BUDGETARY SCIENTIFIC ESTABLISHMENT PAVLOV INSTITUTE OF PHYSIOLOGY OF THE RUSSIAN ACADEMY OF SCIENCE AND AIRES HUMAN GENOME RESEARCH FOUNDATION "research of high frequency electromagnetic radiation effect and Aires resonators influence on behavior, genetic and epigenetic processes in cells of central and peripheral organs (model organisms: rat (Rattus norvegicus) and honey bee (Apis mellifera L.)"

关于俄羅斯科學院巴甫洛夫生理研究所（國家預算科學機構）與 AIRES 人類基因組研究基金會之間科學合作協議：「高頻電磁輻射影響及 Aires 共振器對中央與周邊器官細胞行為、基因與表觀遺傳過程之影響研究（模式生物：大鼠（Rattus norvegicus）與蜜蜂（Apis mellifera L.））」

THE FIRST STAGE (April - September 2016): research of router's electromagnetic radiation effect and Aires resonators' influence on stability of genetic apparatus in marrow cells of Wistar male rats

第一階段（2016 年 4 月–9 月）：研究路由器電磁輻射對 Wistar 雄性大鼠骨髓細胞遺傳機制穩定性的影響及 Aires 共振器的調控作用

In the context of technological advancement, growth of power generation, development of communications systems there is an increasing negative influence of non-ionizing electromagnetic radiation (EMR) on human organism. Disturbance of environmental electromagnetic background is recorded everywhere, causing steady increase of different diseases, including microwave sickness, electromagnetic hypersensitivity (EHS). The literature on EMR influence on human and animal organism is quite extensive: http://www.bioinitiative.org/report/wp-content/uploads/pdfs/RFR-11_28-research-summary.pdf, http://www.bioinitiative.org/report/wp-content/uploads/pdfs/RFR-free-radical-abstracts.pdf . It has been established that EMR enhancement influences genetic apparatus of cells in different human and animal organs. For the first time mutagenic effect of certain electromagnetic frequencies was demonstrated in 1959 in the paper by Heller, Teixeria-Pinto, published in the journal Nature (Heller, Teixeira-Pinto, 1959). At present, evidence has been collected that electromagnetic fields of different ranges including mobile phones and Wi-Fi can induce a broad spectrum of genetic damage, modify gene expression, affect structural and functional characteristics of cell nuclei (Kryukov, 2000; Deinekina, 2002; Boyko et al., 2010, et al.). For example, it was proven that the effect of microwave radiation (frequency of 7.7 GHz , power of $0, 5, 10, 30\ \mathrm{mW/cm2}$) with an exposure interval from 10 to 60 minutes increases chromosome aberrations in human lymphocytes (Garaj-Vrhovac et al., 1992). With long periods of exposure, signals with a specific absorption rate (SAR) of $5\ \mathrm{W/kg}$ also damage chromosomes in blood cells (Tice et al., 2002). However, the mechanisms of those processes

are still insufficiently understood.

在科技進步、發電量成長與通訊系統發展的背景下，非游離電磁輻射（EMR）對人體的負面影響日益增加。環境電磁背景的干擾處處可見，導致各類疾病穩定上升，包括微波病、電磁超敏感症（EHS）。關於電磁輻射對人類與動物有機體影響的文獻相當豐富：http://www.bioinitiative.org/report/wp-content/uploads/pdfs/RFR-11_28-research-summary.pdf, http://www.bioinitiative.org/report/wp-content/uploads/pdfs/RFR-free-radical-abstracts.pdf。研究已證實，電磁輻射的增強會影響人體與動物不同器官細胞的遺傳機制。1959 年，Heller 與 Teixeira-Pinto 在期刊 Nature 發表的論文首次證明某些電磁頻率具有致突變效應（Heller, Teixeira-Pinto, 1959）。目前已有證據顯示，不同範圍的電磁場，包括行動電話與 Wi-Fi，能引發廣泛的基因損傷、改變基因表現，並影響細胞核的結構與功能特性（Kryukov, 2000；Deinekina, 2002；Boyko et al., 2010 等）。例如，已證明微波輻射（頻率 7.7 GHz、功率 $0, 5, 10, 30\ \mathrm{mW/cm2}$）在暴露時間介於 10 到 60 分鐘時，會增加人類淋巴球的染色體異常（Garaj-Vrhovac et al., 1992）。在長期暴露情況下，具特定吸收率（SAR）為 $5\ \mathrm{W/kg}$ 的訊號亦會損害血液細胞的染色體（Tice et al., 2002）。然而，這些過程的機制仍未被充分理解。

There is a pressing need to create a system for protection from harmful effect of EMR and study the mechanisms of its influence on genetic processes in the cells of central and peripheral organs of model organisms. At present, Aires has created devices on the basis of the fractal-

迫切需要建立一套保護系統，以防範電磁輻射的有害影響，並研究其對模式生物中樞及周邊器官細胞遺傳過程的作用機制。目前，Aires 已基於分形矩陣電磁輻射轉換奈米技術製造出能有效重新分配電磁輻射並具療效性的裝置。

matrix EMR conversion nanotechnology that efficiently redistribute EMR and have curative properties

矩陣電磁輻射轉換奈米技術的分形-

(http://www.aires.spb.ru/nano.html, http://airestech.ru). However, the mechanisms of protective effect of those devices on the cell chromosome apparatus have not been studied.

（http://www.aires.spb.ru/nano.html，http://airestech.ru）。然而，這些裝置對細胞染色體機制產生保護作用的機制尚未被研究。

Purpose and objectives of the first stage:

第一階段的目的與目標：

research of standard Wi-Fi router's EMR effect in different modes of operation on destabilization of the genetic apparatus in dividing marrow cells in order to identify the conditions of induction of mitotic disturbances by high-frequency EMR;

研究標準 Wi-Fi 路由器在不同運作模式下之電磁輻射（EMR）對分裂中的骨髓細胞遺傳裝置穩定性的影響，以釐清高頻電磁輻射誘發有絲分裂異常的條件；

evaluation of the protective effect of Aires Defender fractal-matrix resonators on the stability of the genetic apparatus in dividing marrow cells of Wistar male rats under router's damaging EMR effect.

評估 Aires Defender 分形矩陣共振器在路由器有害電磁輻射作用下，對 Wistar 雄性大鼠分裂中骨髓細胞遺傳裝置穩定性的保護效果。

MATERIALS AND METHODS. **材料與方法。**

The research was performed on Wistar male rats weighing $250 - 300\ \mathrm{g}$ received from the animal quarters of the Federal State-Funded Establishment of Science Pavlov Institute of Physiology of the Russian Academy of Sciences. Rats of an outbread Wistar population are a generally recognized model used in medical and biological research. Upon arrival, the animals were maintained in a laboratory animal quarters for at least two weeks for adjustment. The males were kept in groups of 6 in standard cages on a standard food ration.

研究以來自俄羅斯科學院巴甫洛夫生理學研究所附屬動物房提供之 Wistar 雄性大鼠為對象，體重 $250 - 300\ \mathrm{g}$。散養 Wistar 族群大鼠為醫學與生物研究中公認的實驗模型。抵達後，動物在實驗動物房至少適應飼養兩週。雄性大鼠以 6 隻一群飼養於標準籠具中，採標準飼料配給。

The research employed a standard Wi-Fi router (LinkSys E1200-EE/RU wireless router) with the following characteristics: wireless frequency: 2.4 GHz , number and type of antennas: 2 internal antennas, standard antenna gain factor, dBi : 4dBi.

本研究使用一般家用 Wi-Fi 路由器（LinkSys E1200-EE/RU 無線路由器），其特性如下：無線頻率：2.4 GHz，天線數量與類型：2 根內建天線，標準天線增益係數， dBi : 4dBi 。

To study router's EMR effect, the «home» cage with animals was placed in a Faraday cage (Fig. 1), a router was placed under the top lid of the cage in the center of a removable shelf. The experimental groups were exposed to the router's effect in the following modes:

為研究路由器電磁輻射之效應，「家用」籠內放置動物後將其置於法拉第籠中（圖 1），路由器放在可拆式層板中央的籠頂蓋下方。實驗組以以下模式暴露於路由器之作用：

once for 2 hours (8:00-10:00);

一次 2 小時（08:00–10:00）；

4 days, 6 hours a day (8:00-14:00);

4 天，每天 6 小時（08:00–14:00）；

3 weeks, 6 hours a day (8:00-14:00).

3 週，每天 6 小時（08:00–14:00）。

The reference was groups of rats placed in a Faraday cage at the same time, but with no router, as well as intact animals.

參照組為同時置於法拉第籠中的大鼠，但未放置路由器，以及未受處理的完整動物。

The experiments also employed Aires Defender fractal-matrix resonators (special circular diffraction grating), which are a universal space-wave Fourier filter (Zhabrev et al., 2005). Due to interaction of the electromagnetic field with the Aires Defender, its structural transformation occurs. To evaluate resonators' influence on the router's damaging EMR effect, 6 resonators were

實驗也使用了 Aires Defender 分形矩陣共振器（特殊的圓形繞射光柵），這是一種普遍的空間波傅立葉濾波器（Zhabrev et al., 2005）。由於電磁場與 Aires Defender 的相互作用，其結構會發生轉變。為了評估共振器對路由器有害電磁輻射影響的抑制效果，使用了 6 個共振器

used. They were placed in the center of each side of the Faraday cage (Fig. 1). One of the experimental groups was exposed to router's effect in the Faraday cage as per the schedule, 6 hours a day for 4 days.

它們被放置在法拉第籠每一側的中央（圖 1）。其中一個實驗組依照計畫在法拉第籠內暴露於路由器的作用，條件為每天 6 小時，連續 4 天。

Making human marrow cell preparations. 24 hours after exposure, human marrow cells were fixated in freshly made fixative (1 part of glacial acetic acid : 3 parts of ethanol) for at least an hour. The material was kept at a temperature of +4□C until specimens were prepared following the routine method (Makarov, Safronov, 1978; Dayev et al., 2009).

製備人體骨髓細胞。暴露後 24 小時，將人體骨髓細胞用新配製的固定液（1 份冰醋酸：3 份乙醇）固定至少一小時。試材在製備標本前按照常規方法（Makarov, Safronov, 1978；Dayev et al., 2009）於 +4□C **溫度下保存。**

Analysis of marrow preparations. Squash marrow preparations were analyzed using a Micromed-3 microscope with x640-1600 . Chromosome aberrations at the anaphase-telophase stage were factored in (the standard ana-telophase method) with consideration of additional recommendations (Dayev et al., 2009). At least 200 cells from each animal were analyzed. The study considered the number of normal and aberrant anaphase-telophases with the following types of disturbances: single reorganizations (a fragment, a bridge, a lagging chromosome), multiple reorganizations (two or more disturbances of any type per cell) (Fig. 2).

骨髓塗片分析。利用 Micromed-3 顯微鏡（放大倍率 x640-1600）觀察壓片骨髓塗片。計入處於後期-末期（anaphase-telophase）階段的染色體畸變（採用標準的後期-末期法），並參照額外建議進行判定（Dayev et al., 2009）。每隻動物至少分析 200 個細胞。研究記錄正常與異常的後期-末期數目，異常類型包括：單一重排（片段、橋狀、滯後染色體）及多重重排（每個細胞出現兩種或以上之任何類型之干擾）（見圖 2）。

Statistical processing. The data was checked for homogeneity using the nonparametric method of multi-field χ^2. Based on the check, individual data was united within groups. To present the findings in tables, frequencies of detected disturbances in mitosis were calculated and expressed as per cent with and error percentage. Among cells with chromosome reorganization, shares of cells with different types of disturbances were determined, which characterized the spectrum of chromosome aberrations (Dayev et al., 2009). Significance of differences between the versions was determined and the spectra of mitotic disturbances were compared by means of the χ^2 method (Glotov et al., 1982), as well as a ranking test and ANOVA using Statgraphics Centurion XV11 Statistica 6.0 software.

統計處理。資料以多域非參數方法 χ^2 檢驗同質性。根據檢驗結果，將個別資料在各組內合併。為在表格中呈現結果，計算並以百分比及誤差百分比表示檢出之有絲分裂異常的頻率。對於有染色體重組的細胞，確定不同類型異常細胞的比例，以描述染色體畸變的譜系（Dayev et al., 2009）。各處理組間差異的顯著性以 χ^2 方法（Glotov et al., 1982）判定，並以排序檢定及變異數分析（ANOVA）比較有絲分裂異常的譜系，分析軟體為 Statgraphics Centurion XV11 及 Statistica 6.0。

Faraday cage for research

實驗用法拉第籠

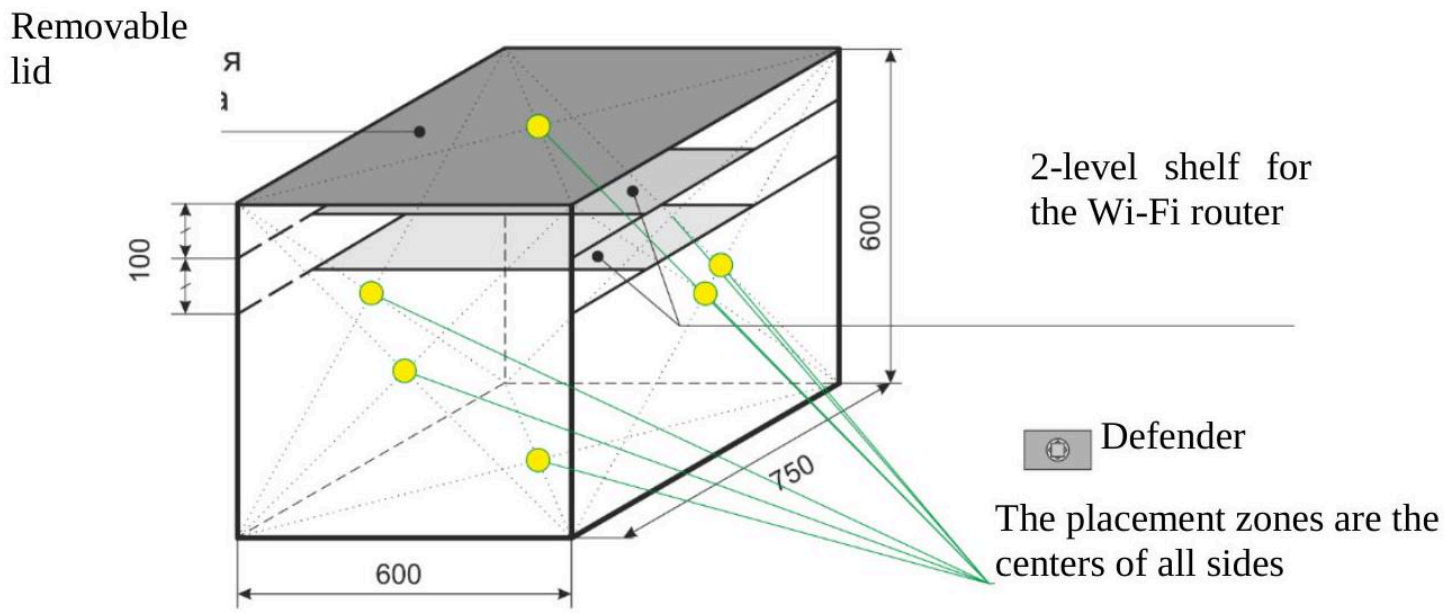

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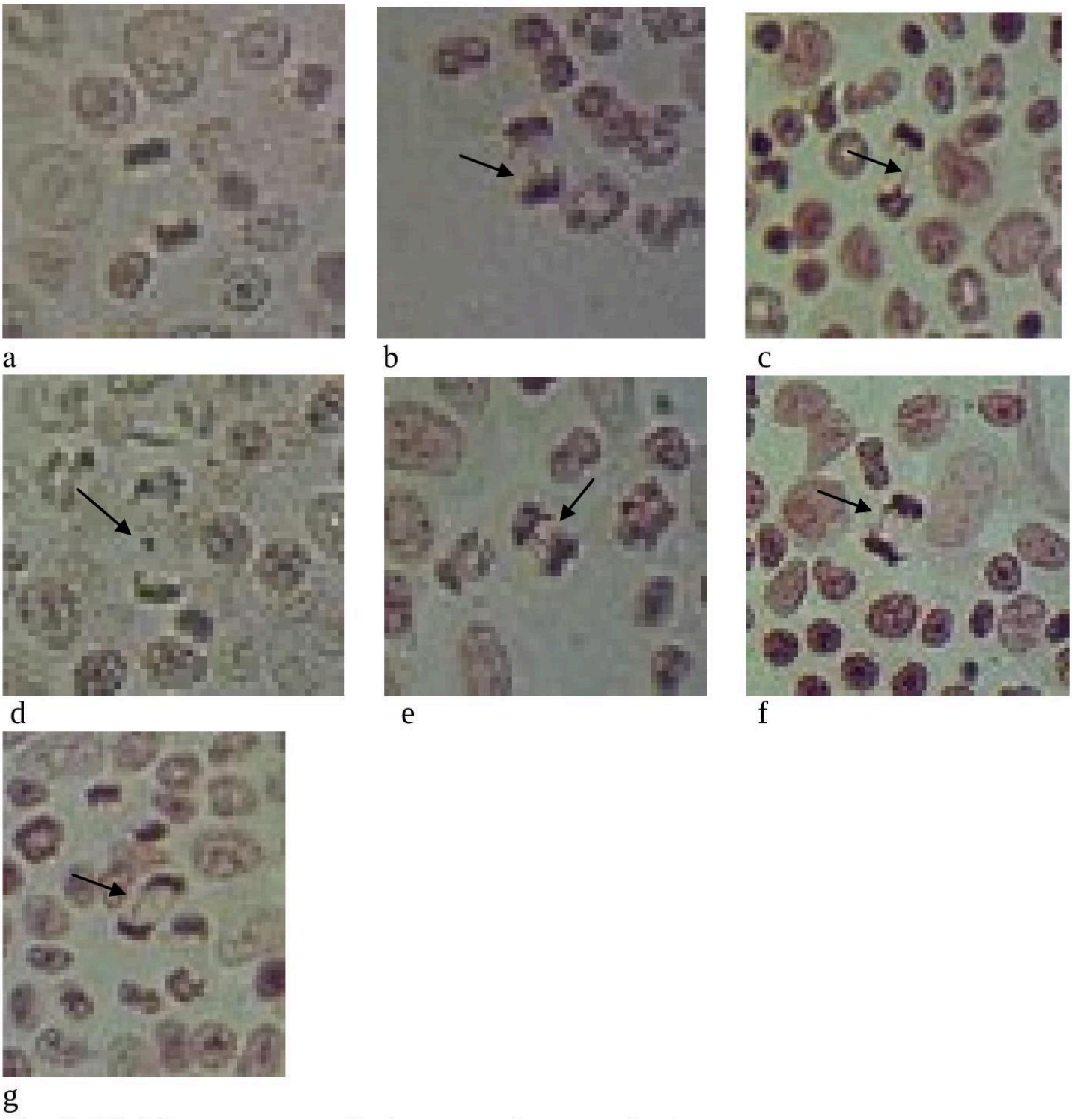
Figure 2: Fig. 1. The diagram of the Faraday cage used in the research showing the location of resonators.

圖 2：圖 1. 研究中使用之法拉第籠示意圖，顯示諧振器的位置。



There are examples of analyzed reorganizations (labeled with arrows): a- normal ana-telophase, b- lagging chromosome, c- bridge, d- fragment, d,e-multiple reorganizations with the bridge and lagging chromosomes, f- double bridge.

下列為所分析之重組範例（以箭頭標示）：a- 正常的後期-末期，b- 滯後染色體，c- 橋，d- 斷片，d,e- 同時具橋與滯後染色體的多重重組，f- 雙橋。

RESULTS **結果**

It is demonstrated that high frequency electromagnetic radiation of a router in the exposure mode of 4 days, 6 hours a day cause *d* the highest destabilization of genetic apparatus of the dividing marrow cells in Wistar male rats: the overall frequency of mitotic disturbances rises by 4.5 times as compared to Reference2 (Faraday cage, 4 days x 6 hours) and by 3.9 times as compared to Reference1 (Table 1), which has a high degree of significance in all statistical criteria applied. One-time 2 -hour long exposure to router's effect raises the number of chromosome aberrations by 1.9 times as compared to the

intact Reference 1 (Table 1), significance of differences is confirmed by the multiple range test (Multiple Range Test ,

研究顯示，路由器在暴露模式下（連續 4 天、每天 6 小時）的高頻電磁輻射，造成 Wistar 雄性大鼠分裂骨髓細胞遺傳裝置的最大不穩定性：整體有絲分裂異常頻率較參照組 2（法拉第籠，4 天×6 小時）增加 4.5 倍，較參照組 1 增加 3.9 倍（表 1），在所採用的所有統計檢定中皆具有高度顯著性。單次 2 小時的路由器暴露則使染色體異常數較完整參照組 1 增加 1.9 倍（表 1），差異顯著性已由多重範圍檢定（Multiple Range Test）確認，

Diff. $= 6,03$, +/-Limits $= 3,33$) and ANOVA ($\mathrm{F} = 19,65, \mathrm{p} < 0,004$), but not χ^2. At the same time, as compared to the group of animals exposed to router's effect for 4 days, 6 hours a day, the frequency of disturbances reduced by 2.1 times (Table 1). After the animals were exposed for 3 weeks, 6 hours a day in the conditions of router's electromagnetic radiation, the frequency of mitotic disturbances rises by 1.8 times as compared to Reference 3 (Faraday cage, 3 weeks, 6 hours a day) (Multiple Range Test , Diff. $= 5.02$, +/-Limits=3.63; ANOVA , F=3,13, p<0,01) and by 1.5 times as compared to the intact Reference 1 (Multiple Range Test, Diff. $= 4,1, +/-$ Limits $= 3,9$; ANOVA , $(\mathrm{F} = 2,49, \mathrm{p} < 0,04)$, but it decreases by 2.6 times as compared to the group of animals exposed to the router's effect for 4 days, 6 hours a day (Table 1).

差異 $= 6,03$ ，正負界限 $= 3,33$ ）及 ANOVA（ $\mathrm{F} = 19,65, \mathrm{p} < 0,004$ ），但非 χ^2 。同時，與暴露於路由器效應 4 天、每天 6 小時之動物組相比，紊亂發生頻率減少了 2.1 倍（表 1）。當動物在路由器電磁輻射條件下暴露 3 週、每天 6 小時後，分裂期紊亂頻率較參考組 3（法拉第籠，3 週、每天 6 小時）增加 1.8 倍（多重差異檢定，差異 $= 5.02$ ，正負界限=3.63；ANOVA，F=3.13，p<0.01），較完整的參考組 1 增加 1.5 倍（多重差異檢定，差異 $= 4,1, +/-$ 界限 $= 3,9$ ；ANOVA，$(\mathrm{F} = 2,49, \mathrm{p} < 0,04)$ ），但較暴露於路由器效應 4 天、每天 6 小時之動物組減少 2.6 倍（表 1）。

The effect of Aires Defender fractal-matrix resonators was evaluated using the pattern of 4 days, 6 hours a day, which caused the most damage to the marrow cell chromosome apparatus. Using resonators in combination with router's effect reduces fourfold the frequency of damage to mitosis in dividing marrow cells as compared to router's effect without protection, and that level is comparable to Reference 2 (Faraday cage, 4 days, 6 hours a day) and intact Reference 1 (Table 1).

評估 Aires Defender 分形矩陣共振器的效果時採用的是造成骨髓細胞染色體結構最大損害的模式：4 天、每天 6 小時。與未受保護的路由器效應相比，將共振器與路由器共同使用可使分裂中骨髓細胞的有絲分裂損傷頻率降低四倍，且該水準可與參考組 2（法拉第籠，4 天、每天 6 小時）及完好無損的參考組 1 相當（表 1）。

Comparison of the spectra of spontaneous mitotic disturbances and those induced by router's EMRs revealed that router's effect of 4 days, 6 hours a day changes the spectrum of chromosome disturbances due to increase in the share of lagging chromosomes and decrease in the share of bridges among all types of disturbances, as compared to Reference 2 and Reference 1 (Table 2). Here it is important to note that the Reference 1 and Reference 2 groups differ by the share of lagging chromosomes and multiple reorganizations among all types of disturbances (Table 2). Using resonators changes the spectrum of disturbances owing to all types of aberrations in question as compared to router's effect alone (Table 2).

自發性有絲分裂干擾的頻譜與路由器電磁輻射誘發的頻譜比較顯示，路由器作用（4 天、每天 6 小時）改變了染色體異常的頻譜，表現為所有類型干擾中滯後染色體比例增加、橋狀染色體比例下降，與參考組 2 和參考組 1 相比明顯（表 2）。此處需注意參考組 1 與參考組 2 在所有類型干擾中滯後染色體與多重重組的比例存在差異（表 2）。與僅受路由器效應相比，使用共振器會改變因所討論所有類型畸變而導致的干擾頻譜（表 2）。

Table 1: Table 1. The frequency of mitotic disturbances in marrow cells of Wistar male rats after exposure to router's electromagnetic radiation in different modes.

表 1：表 1. 不同模式下路由器電磁輻射暴露後 Wistar 雄性大鼠骨髓細胞有絲分裂異常的發生頻率。

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Versions of exposure **暴露版本**	Number of analyzed cells (those with disturbances among them) **分析的細胞數（其中存在異常的細胞數）**	Overall frequency of disturbances in mitosis **有絲分裂異常的總體頻率**	Significance of differences χ^2 ($v = 1, p < 0,01$) **差異顯著性 χ^2 （ $v = 1, p < 0,01$ ）**
Reference1 (intact) **參考 1（完整）**	1378 (92)	6.7 ± 0.7	
Reference2 (Faraday cage, 4 d × 6hrs) **參考 2（法拉第籠，4 d × 6hrs ）**	1986 (114)	5.7 ± 0.5	
Router (4 d × 6hrs) **路由器（ 4 d × 6hrs ）**	1360 (354)	26.0 ± 1.2	
Router+resonator (4 d × 6hrs)	1961 (127)	6.5 ± 0.6	
Reference3 (Faraday cage, 3 weeks x 6 hrs;	1714 (96)	5.6 ± 0.5	
Router (3 weeks x 6 hrs)	1789 (180)	$10.1 \pm 0.7^{*\#}$	
Router (2 hours)	1175 (149)	$12.7 \pm 0.9^{*}$	Missing \left or extra \right

Legend: vertical lines mean significantly different values (χ^2 criterion), # - differences from Reference3 are significant (Multiple Range Test, ANOVA ($p < 0,01$), *- differences from Reference1 are significant (Multiple Range Test, ANOVA ($p < 0,01$) .

說明：直線表示數值顯著不同（ χ^2 準則），# - 與 Reference3 相比差異顯著（多重區間檢定，ANOVA（ $p < 0,01$ ））， * - 與 Reference1 相比差異顯著（多重區間檢定，ANOVA （ $p < 0,01$ ））。

Table 2: Table 2 The spectrum of mitotic disturbances detected in the marrow cells of Wistar male rats after exposure to router's electromagnetic radiation in different modes (%).

表 2：表 2 在不同模式下暴露於路由器電磁輻射後，Wistar 雄性大鼠骨髓細胞中檢測到的有絲分裂異常譜（%）。

\captionsetup{labelformat=empty}

Versions of exposure **暴露版本**	Number cells mitotic disturbances **有絲分裂異常細胞數**	Fragments **碎片**	Bridges **橋樑**	Lagging chromosomes **滯後染色體**	Multiple reconstructions **多重重建**	Significance of differences χ^2 ($v = 3, \quad p <$ 0,01) **差異顯著性 χ^2 ($v = 3, \quad p <$ 0,01)**
Reference1 (intact)	92	5	37	46	12	
Reference2 (Faraday cage, 4 d × 6hrs)	114	8	32.5	32.5	27	
Router (4 d × 6hrs)	352	9	18	59	14	
Router+ resonators (4 d × 6hrs) **Router+ 共振器 (4 d × 6hrs)**	127	5	33	30	32	10.3
Reference3 (Faraday cage, 3 weeks x 6 hrs; **Reference3（法拉第籠，3 週 x 每天 6 小時；）**	96	9	26	40	25	9.6 / 16.5
Router (3 weeks x 6 hrs) **Router（3 週 x 每天 6 小時）**	180	8	28	44	20	22.1
Router (2 hours) **Router（2 小時）**	149	7	29	33	31	

Legend: vertical lines mean significantly different values.

圖例：豎線表示數值具有顯著差異。

DISCUSSION 討論

The findings of the evaluation of chromosome aberrations in marrow cells of Wistar male rats revealed that router's electromagnetic radiation using different exposure modes (2 hours, 4 days x 6 hours a day, 3 weeks x 6 hours a day) has cytogenetic activity, can induce mitotic disturbances. They can affect the functioning of immune system links related to the marrow's operation.

对 Wistar 雄性大鼠骨髓细胞染色體畸變評估的結果顯示，以不同曝露模式（2 小時、4 天×每日 6 小時、3 週×每日 6 小時）遭受無線路由器電磁輻射具有細胞遺傳活性，能引起有絲分裂紊亂。這些變化可能影響與骨髓運作相關的免疫系統環節的功能。

The most significant changes in the chromosome apparatus were detected after exposure of the animals in a Faraday cage with a plugged in router for 4 days, 6 hours a day - from 8 am till 2 pm . That is the very mode to use for pronounced induction of mitotic disturbances in

在法拉第籠中以插電的路由器曝露動物 4 天、每日 6 小時（上午 8 點至下午 2 點）後，檢測到染色體構造的變化最為顯著。這正是通過高頻電磁輻射在 Wistar 大鼠中顯著誘發有絲分裂紊亂以便後續研究防護裝置效能及其防護機制的理想曝露模式。

Wistar rats by means of high-frequency EMR for the purpose of subsequent research of the efficiency of protective devices, as well as mechanisms underlying their protective properties.

藉此方式可為後續評估防護裝置之效率，以及探究其所依據的保護性質的機制，提供明確的誘發模型。

Differences between the spectra of spontaneous EMR caused by exposure of animals in the Faraday cage, as well induced EMR of a router in combination with the effect of matrix resonators of chromosome disturbances can indicate a specific response of the animals' organisms to the applied effects.

在法拉第籠中曝露動物所引起的自發電磁輻射光譜與路由器誘發電磁輻射光譜之間的差異，連同矩陣共振器對染色體紊亂的影響，可能顯示動物機體對所施加效應的特異性反應。

Change in stability of the genetic apparatus of dividing marrow cells under the influence of a router's EMR can be viewed as the result of cell oxidation stress, whose mutagenic activity is based on the genotoxic effect of internal causes of humoral nature and free-radical products of peroxidation (Achudume et al., 2010). Those mechanisms can cause immunosuppression, inhibition of immunopoesis and haematopoesis, which will affect the state of the organism. However, information that long-term, 3 -week-long exposure of animals to EMR conditions decreases the level of mitotic disturbances relative to a 4-day-long session indicates that there may be adaptive mechanisms causing elimination of cells with disturbances and/or activation of reparative processes.

路由器電磁輻射（EMR）對分裂中的骨髓細胞遺傳機制穩定性的改變，可視為細胞氧化壓力的結果，其致突變活性基於體液性內因以及過氧化作用產生的自由基產物所引起的基因毒性效應（Achudume et al., 2010）。這些機制可能導致免疫抑制、造血與免疫生成的抑制，進而影響機體狀態。然而，有資料顯示相較於 4 天的暴露，動物長期（3 週）暴露於 EMR 條件下會降低有絲分裂異常的水準，這表明可能存在適應性機制，能夠清除帶有異常的細胞和 / 或啟動修復過程。

It should be noted that we were the first to demonstrate that Aires Defender fractal-matrix resonators have a protecting effect on the genetic apparatus of dividing marrow cells in Wistar male rats under router's EMR effect. Its interaction with an Aires Defender causes structural transformation of electromagnetic field (Zhabrev et al., 2005). In a counting number of directions, electromagnetic field strengths concentrate, and in the other directions the electromagnetic field reduces significantly, which in general weakens the sum-total electromagnetic effect exceeding the organism's sensibility threshold to electromagnetic radiation. Thus, resonators' protective properties are evidently based on restructuring (conversion) of incident EMR, which reduces its damaging effect on dividing cells.

值得注意的是，我們首次證明了 Aires Defender 分形矩陣諧振器在路由器電磁輻射（EMR）作用下，對 Wistar 雄性大鼠分裂中的骨髓細胞遺傳機制具有保護作用。其與 Aires Defender 的相互作用會導致電磁場的結構性轉變（Zhabrev et al., 2005）。在某些方向上，電磁場強度被聚集，而在其他方向上電磁場顯著減弱，整體上降低了超出有機體對電磁輻射敏感閾值的總體電磁效應。因此，諧振器的保護特性顯然基於對入射電磁輻射的重構（轉換），從而減少其對分裂細胞的損害作用。

Significantly, among rats from the group using Aires Defender resonators there were several subjects whose chromosome aberration level reduced even in comparison with the intact reference. It is a very interesting fact that calls for further research and special experiments to evaluate the effect of resonators proper on stability of the genetic apparatus in marrow cells of rats.

值得注意的是，在使用 Aires Defender 諧振器的那組大鼠中，有數隻個體的染色體畸變水準甚至比未受處理的參考組還低。這是一個非常有趣的現象，值得進一步研究與專門實驗來評估諧振器本身對大鼠骨髓細胞遺傳機制穩定性的影響。

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