Anti-dsDNA-NcX ELISA (IgG)
Test instruction

ORDER NO.	ANTIBODIES AGAINST	IG CLASS	SUBSTRATE	FORMAT
EA 1572-9601 G	dsDNA (double-stranded, genomic DNA)	IgG	Ag-coated microplate wells	96 x 01 (96)

Indication: Systemic lupus erythematosus.

Principles of the test: The ELISA test kit provides a semiquantitative or quantitative in vitro assay for human autoantibodies of the IgG class against double-stranded, genomic DNA (dsDNA) in serum or plasma. The test kit contains microtiter strips each with 8 break-off reagent wells coated with dsDNA. In the first reaction step, diluted patient samples are incubated in the wells. In the case of positive samples, specific IgG antibodies (also IgA and IgM) will bind to the antigens. To detect the bound antibodies, a second incubation is carried out using an enzyme-labelled anti-human IgG (enzyme conjugate) catalysing a colour reaction.

Contents of the test kit:

Component	Colour	Format	Symbol
1. Microplate wells, coated with antigens: 12 microplate strips each containing 8 individual break-off wells in a frame, ready for use	---	12 x 8	STRIPS
2. Calibrator 1 800 IU/ml (IgG, human), ready for use	dark red	1 x 2.0 ml	CAL 1
3. Calibrator 2 100 IU/ml (IgG, human), ready for use	red	1 x 2.0 ml	CAL 2
4. Calibrator 3 10 IU/ml (IgG, human), ready for use	light red	1 x 2.0 ml	CAL 3
5. Positive control (IgG, human), ready for use	blue	1 x 2.0 ml	POS CONTROL
6. Negative control (IgG, human), ready for use	green	1 x 2.0 ml	NEG CONTROL
7. Enzyme conjugate peroxidase-labelled anti-human IgG (rabbit), ready for use	green	1 x 12 ml	CONJUGATE
8. Sample buffer ready for use	light blue	1 x 100 ml	SAMPLE BUFFER
9. Wash buffer 10x concentrate	colourless	1 x 100 ml	WASH BUFFER 10x
10. Chromogen/substrate solution TMB/H_2O_2, ready for use	colourless	1 x 12 ml	SUBSTRATE
11. Stop solution 0.5 M sulphuric acid, ready for use	colourless	1 x 12 ml	STOP SOLUTION
12. Test instruction	---	1 booklet	
13. Quality control certificate	---	1 protocol	

LOT	Lot		Storage temperature
IVD	In vitro determination	CE	Unopened usable until

Storage and stability: The test kit has to be stored at a temperature between +2°C to +8°C. Do not freeze. Unopened, all test kit components are stable until the indicated expiry date.

Waste disposal: Patient samples, calibrators, controls and incubated microplate strips should be handled as infectious waste. All reagents must be disposed of in accordance with local disposal regulations.

Preparation and stability of the reagents

Note: All reagents must be brought to room temperature (+18°C to +25°C) approx. 30 minutes before use. After first use, the reagents are stable until the indicated expiry date if stored at +2°C to +8°C and protected from contamination, unless stated otherwise below.

- **Coated wells:** Ready for use. Tear open the resealable protective wrapping of the microplate at the recesses above the grip seam. Do not open until the microplate has reached room temperature to prevent the individual strips from moistening. Immediately replace the remaining wells of a partly used microplate in the protective wrapping and tightly seal with the integrated grip seam (Do not remove the desiccant bag).
  Once the protective wrapping has been opened for the first time, the wells coated with antigens can be stored in a dry place and at a temperature between +2°C and +8°C for of 4 months.

- **Calibrators and controls:** Ready for use. The reagents must be mixed thoroughly before use.

- **Enzyme conjugate:** Ready for use. The enzyme conjugate must be mixed thoroughly before use.

- **Sample buffer:** Ready for use.

- **Wash buffer:** The wash buffer is a 10x concentrate. If crystallisation occurs in the concentrated buffer, warm it to 37°C and mix well before diluting. The quantity required should be removed from the bottle using a clean pipette and diluted with deionised or distilled water (1 part reagent plus 9 parts distilled water).
  For example: For 1 microplate strip, 5 ml concentrate plus 45 ml water.
  The working strength wash buffer is stable for 4 weeks when stored at +2°C to +8°C and handled properly.

- **Chromogen/substrate solution:** Ready for use. Close the bottle immediately after use, as the contents are sensitive to light. The chromogen/substrate solution must be clear on use. Do not use the solution if it is blue coloured.

- **Stop solution:** Ready for use.

Warning: Calibration and controls used have been tested negative for HBsAg, anti-HCV, anti-HIV-1 and anti-HIV-2 using enzyme immunoassays and indirect immunofluorescence methods. Nonetheless, all materials should be treated as being a potential infection hazard and should be handled with care. Some of the reagents contain the toxic agent sodium azide. Avoid skin contact.

Preparation and stability of the patient samples

Sample material: Human serum, EDTA, heparin or citrate plasma.

Stability: Patient samples to be investigated can generally be stored at +2°C to +8°C for up to 14 days. Diluted samples should be incubated within one working day.

Sample dilution: Patient samples are diluted **1:201** in sample buffer. For example: dilute 5 µl serum in 1.0 ml sample buffer and mix well by vortexing (sample pipettes are not suitable for mixing).

NOTE: Calibrators and controls are prediluted and ready for use, do not dilute them.

Incubation

For **semiquantitative analysis** incubate **calibrator 2** along with the positive and negative controls and patient samples. For **quantitative analysis** incubate **calibrators 1, 2 and 3** along with the positive and negative controls and patient samples.

(Partly) manual test performance

Sample incubation: (1st step)
Transfer 100 µl of the calibrators, positive and negative controls or diluted patient samples into the individual microplate wells according to the pipetting protocol. Incubate for **30 minutes** at room temperature (+18°C to +25°C).

Washing:
Manual: Empty the wells and subsequently wash 3 times using 300 µl of working strength wash buffer for each wash.
Automatic: Wash reagent wells 3 times with 450 µl of working strength wash buffer (programme setting: e.g. TECAN Columbus Washer "Overflow Modus").

Leave the wash buffer in each well for 30 to 60 seconds per washing cycle, then empty the wells. After washing (manual and automated tests), thoroughly dispose of all liquid from the microplate by tapping it on absorbent paper with the openings facing downwards to remove all residual wash buffer.

Note: Residual liquid (> 10 µl) in the reagent wells after washing can interfere with the substrate and lead to false low extinction values. Insufficient washing (e.g., less than 3 wash cycles, too small wash buffer volumes, or too short reaction times) can lead to false high extinction values.
Free positions on the microplate strip should be filled with blank wells of the same plate format as that of the parameter to be investigated.

Conjugate incubation: (2nd step)
Pipette 100 µl of enzyme conjugate (peroxidase-labelled anti-human IgG) into each of the microplate wells. Incubate for **30 minutes** at room temperature (+18°C to +25°C).

Washing:
Empty the wells. Wash as described above.

Substrate incubation: (3rd step)
Pipette 100 µl of chromogen/substrate solution into each of the microplate wells. Incubate for **15 minutes** at room temperature (+18°C to +25°C) protect from direct sunlight.

Stopping the reaction:
Pipette 100 µl of stop solution into each of the microplate wells in the same order and at the same speed as the chromogen/substrate solution was introduced.

Measurement:
Photometric measurement of the colour intensity should be made at a wavelength of 450 nm and a reference wavelength between 620 nm and 650 nm **within 30 minutes of adding the stop solution.** Prior to measuring, slightly shake the microplate to ensure a homogeneous distribution of the solution.

Test performance using fully automated analysis devices

Sample dilution and test performance are carried out fully automatically using the analysis device. The incubation conditions programmed in the respective software authorised by EUROIMMUN may deviate slightly from the specifications given in the ELISA test instruction. However, these conditions were validated in respect of the combination of the Analyzer I and this EUROIMMUN ELISA. Validation documents are available on inquiry.
Automated test performance using other fully automated, open system analysis devices is possible, however, the combination should be validated by the user.

Pipetting protocol

	1	2	3	4	5	6	7	8	9	10	11	12
A	**C 2**	**P 6**	**P 14**	**P 22**			**C 1**	**P 4**	**P 12**	**P 20**		
B	**pos.**	**P 7**	**P 15**	**P 23**			**C 2**	**P 5**	**P 13**	**P 21**		
C	**neg.**	**P 8**	**P 16**	**P 24**			**C 3**	**P 6**	**P 14**	**P 22**		
D	**P 1**	**P 9**	**P 17**				**pos.**	**P 7**	**P 15**	**P 23**		
E	**P 2**	**P 10**	**P 18**				**neg.**	**P 8**	**P 16**	**P 24**		
F	**P 3**	**P 11**	**P 19**				**P 1**	**P 9**	**P 17**			
G	**P 4**	**P 12**	**P 20**				**P 2**	**P 10**	**P 18**			
H	**P 5**	**P 13**	**P 21**				**P 3**	**P 11**	**P 19**			

The pipetting protocol for microtiter strips 1-4 is an example for the **semiquantitative analysis** of 24 patient samples (P 1 to P 24).
The pipetting protocol for microtiter strips 7-10 is an example for the **quantitative analysis** of 24 patient samples (P 1 to P 24).

The calibrators (C 1 to C 3), the positive (pos.) and negative (neg.) controls, and the patient samples have each been incubated in one well. The reliability of the ELISA test can be improved by duplicate determinations for each sample.
The wells can be broken off individually from the strips. This makes it possible to adjust the number of test substrates used to the number of samples to be examined and minimises reagent wastage.
Both positive and negative controls serve as internal controls for the reliability of the test procedure. They should be assayed with each test run.

Calculation of results

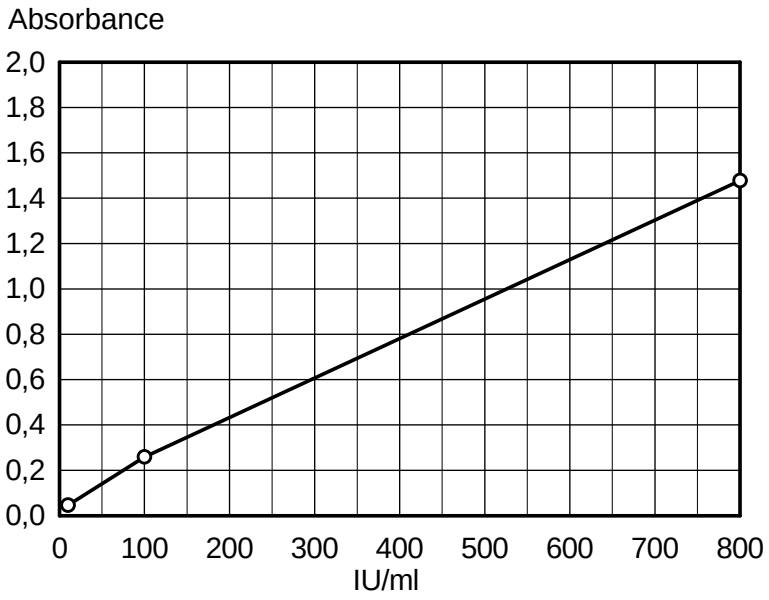
Semiquantitative: Results can be evaluated semiquantitatively by calculating a ratio of the extinction value of the control or patient sample over the extinction value of calibrator 2. Calculate the ratio according to the following formula:

$$\frac{\text{Extinction of the control or patient sample}}{\text{Extinction of calibrator 2}} = \text{Ratio}$$

EUROIMMUN recommends interpreting results as follows:

Ratio <1.0:	**negative**
Ratio ≥1.0:	**positive**

Quantitative: The standard curve from which the concentration of antibodies in the serum samples can be taken is obtained by point-to-point plotting of the extinction values measured for the 3 calibration sera against the corresponding units (linear/linear). Use “point-to-point” plotting for calculation of the standard curve by computer. The following plot is an example of a typical calibration curve. Please do not use this curve for the determination of antibody concentrations in patient samples.



If the extinction of a serum sample lies above the value of calibrator 1 (800 IU/ml). The result should be given as “>800 IU/ml“. It is recommended that the sample be re-tested at a dilution of 1:800. The result in IU/ml read from the calibration curve for this sample must then be multiplied by a factor of 4.

The upper limit of the normal range **(cut-off)** recommended by EUROIMMUN is 100 international units (IU) /ml. EUROIMMUN recommends interpreting results as follows:

<100 IU/ml:	**negative**
≥100 IU/ml:	**positive**

For duplicate determinations the mean of the two values should be taken. If the two values deviate substantially from one another, the sample should be retested.

For diagnosis, the clinical symptoms of the patient should always be taken into account along with the serological results.

Test characteristics

Calibration: The calibration is performed in international units (IU) using the international reference serum Wo/80 of the World Health Organization (WHO). The Wo/80 serum contains 200 IU/ml by definition.

For every group of tests performed, the extinction values of the calibrators and the international units or ratios determined for the positive and negative controls must lie within the limits stated for the relevant test kit lot. A quality control certificate containing these reference values is included. If the values specified for the controls are not achieved, the test results may be inaccurate and the test should be repeated.

The activity of the enzyme used is temperature-dependent and the extinction values may vary if a thermostat is not used. The higher the room temperature during substrate incubation, the greater will be the extinction values. Corresponding variations apply also to the incubation times. However, the calibrators are subject to the same influences, with the result that such variations will be largely compensated in the calculation of the result.

Antigen: The antigen substrate consists of dsDNA which is complexed with nucleosomes (NcX) and coupled to the solid phase.

Linearity: The linearity of the Anti-dsDNA-NcX ELISA (IgG) was determined by assaying 8 serial dilutions of different patient samples. The coefficient of determination R^2 for all sera was > 0.95. The Anti-dsDNA-NcX ELISA (IgG) is linear at least in the tested concentration range (40 IU/ml to 757 IU/ml).

Detection limit: The lower detection limit is defined as the value of an analyte-free sample plus three times the standard deviation and is the smallest detectable antibody titer. The lower detection limit of the Anti-dsDNA-NcX ELISA (IgG) is 2.6 IU/ml.

Cross reactivity: This ELISA showed no serological cross reactivity with sera positive for antibodies against the following: Scleroderma (n = 19) and rheumatoid arthritis (n = 20).

Interference: Haemolytic, lipaemic and icteric samples showed no influence on the result up to a concentration of 10 mg/ml for haemoglobin, 20 mg/ml for triglycerides and 0.4 mg/ml for bilirubin in this ELISA.

Reproducibility: The reproducibility of the test was investigated by determining the intra- and inter-assay coefficients of variation using 4 sera. The intra-assay CVs are based on 20 determinations and the inter-assay CVs on 4 determinations performed in 6 different test runs.

Intra-assay variation, n = 20		
Serum	**Mean value (IU/ml)**	**CV (%)**
1	157	4.7
2	318	2.8
3	543	2.9
4	713	3.6

Inter-assay variation, n = 4 x 6		
Serum	**Mean value (IU/ml)**	**CV (%)**
1	173	4.9
2	338	2.9
3	544	6.5
4	700	9.0

Sensitivity and specificity: The sensitivity in clinically characterised patients with SLE (n = 213) was 60%. The specificity in a control panel (n = 760) of patients with other autoimmune diseases and healthy blood donors amounted to 99%.

Patient group	**n**	**Anti-dsDNA-NcX positive (IgG)**	
SLE	213	127	(60%)
Sjögren's syndrome	88	1	(99%)
Progressive systemic sclerosis	81	2	
Rheumatoid arthritis	165	7	
Polymyositis/dermatomyositis	26	0	
Healthy blood donors	400	0	

Reference range: The levels of the anti-dsDNA-NcX antibodies (IgG) were analysed with this EUROIMMUN ELISA in a panel of 400 healthy blood donors. With a cut-off of 100 IU/ml, all of the blood donors were anti-dsDNA-NcX negative.

Clinical significance

The detection of autoantibodies against deoxyribonucleic acid (DNA) is essential in the diagnosis of systemic lupus erythematosus [1, 2, 3, 4, 5, 6]. Autoantibodies against DNA are divided into two different types: antibodies against native, double-stranded DNA (dsDNA, nDNA) and antibodies against denatured, single-stranded DNA (ssDNA) [4, 7, 8]. Antibodies defined as reactive with dsDNA (anti-dsDNA) recognise mainly epitopes in the outer deoxyribose phosphate backbone of the double helix [1, 2, 3]. On the other hand, antibodies defined as reactive with ssDNA recognise polymers of purine and pyrimidine bases [8]. However, they are also able to recognise epitopes of the deoxyribose phosphate backbone [7, 9].
Anti-dsDNA antibodies are found almost exclusively in systemic lupus erythematosus (SLE), also known as lupus erythematosus disseminatus [1, 2, 3, 5]. The prevalence of antibodies against dsDNA amounts to 20% to 90% depending on the detection method and disease activity [3, 5, 7, 8]. Antibodies against dsDNA are also occasionally detected in patients with other autoimmune diseases and infections and, in rare cases, in clinically healthy people [4, 10]. 85% of people in the latter group develop SLE within 5 years of initial detection of anti-dsDNA [1, 8]. However, SLE cannot be entirely excluded if anti-dsDNA antibodies are not detected [1, 2, 8].
Systemic lupus erythematosus is a systemic autoimmune disease belonging to the collagenosis group. The term "lupus" (wolf) is derived from possible skin changes caused by SLE lesions [11]. Diagnosis of SLE is based on the 11 so-called ARA criteria (ARA = American Rheumatology Association), which were renamed ACR criteria in 1988 (ACR = American College of Rheumatology) and revised in 1997. If 4 of 11 criteria are present, the probability of SLE presence is between 80 and 90% [6]. They are:

1. butterfly erythema
   (red skin rash on the face, which spreads over both cheeks),
2. red, scaly, defined, elevated skin rash on other body parts,
3. photosensitivity,
4. sores or ulcers on the mucous membrane of the mouth,
5. joint pain and joint effusion,
6. serositis (inflammation of the so-called serous tissues such as pleura or pericardium),
7. renal disorders,
8. neurological disorders,
9. haemological symptoms such as haemolytic anaemia with reticulocytosis, leukopenia, lymphopenia, thrombocytopenia,
10. immunological finds such as dsDNA antibodies, Sm antibodies, anti-cardiolipin antibodies (ACA),
11. ANA in IIFT [8].

The disease was first described by P. L. A. Cazenave in 1851. According to estimations, approximately 40,000 people, particularly young women of child-bearing age, suffer from SLE in Germany [6]. The incidence of SLE in Europe amounts to 25 to 27 new cases per 100,000 persons a year; the number is higher in the US. The probability for SLE patients to survive for more than 5 years is 95% and 85% for 10 years [11].

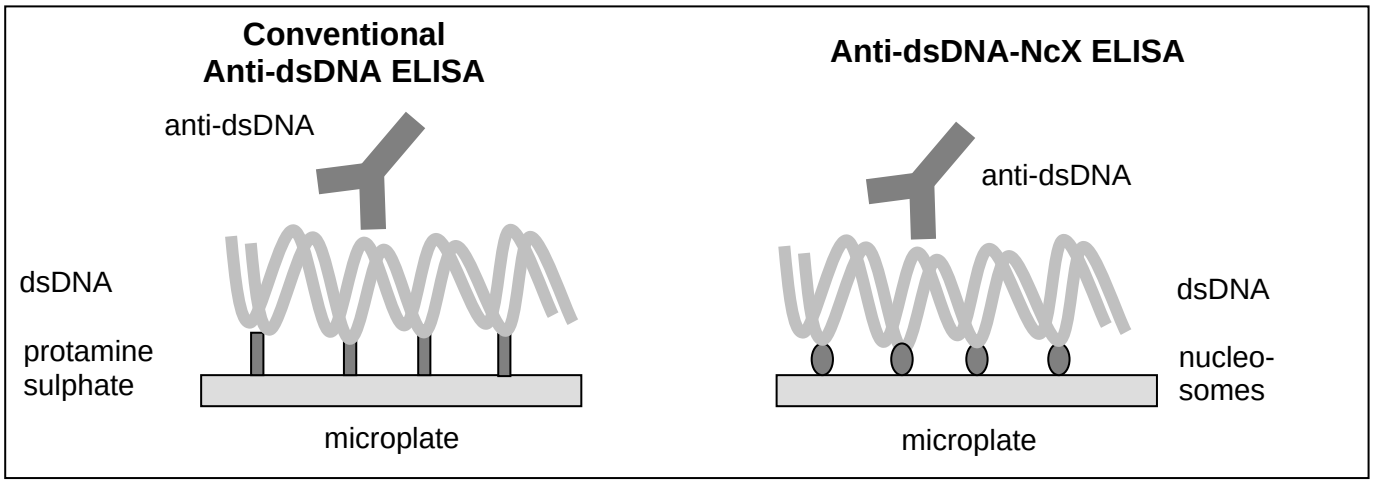
It is known to a large extent that anti-DNA antibodies play a role in the pathogenesis of SLE. During the course of disease, immunocomplexes of double-stranded DNA and the corresponding autoantibodies are deposited in the capillaries of the subcutis, the kidneys and other organs [5, 6, 8, 9, 12, 13]. Here they cause organ damage via activation of the complement system. There is increasing evidence that the primary target antigen of the pathogenically relevant autoantibodies is not “naked” DNA, but DNA complexed with nucleosomes [14].

Serological testing is of particular significance within the frame of the ACR criteria [15]. Antibodies against dsDNA are among the most important criteria for diagnosis of SLE due to their high specificity: 70% to 98% depending on the method of detection [3, 5, 7, 8].

For routine detection of autoantibodies against dsDNA, three test methods are currently available: enzyme immunoassays (ELISA, EUROASSAY, EUROLINE), Farr RIA and Crithidia luciliae immunofluorescence test [3, 4, 5, 8, 12, 15**,** 16, 17, 18, 19, 20, 21].

Since these diagnostic methods, which detect different autoantibody fractions, vary in sensitivity and specificity, many laboratories prefer a combination of two or three tests for supplementation or confirmation of diagnostic results [1, 2, 3, 18].

A new anti-dsDNA ELISA that exceeds the diagnostic quality criteria of the Farr assay (anti-dsDNA RIA) has now been developed using an innovative biochemical preparation [19, 20, 21]. The antigen substrate consists of dsDNA coupled with nucleosomes (NcX) to the solid phase [22, 23, 24]. Highest SLE specificity is ensured through use of a highly purified nucleosome fraction, which is free of H1, Scl-70 and other non-histone proteins [14, 22, 23, 24, 25]. In contrast to conventional anti-dsDNA ELISA the use of linker substances such as poly-L-lysine or protamine sulphate, which represent a potential source of unspecific reactions, is not necessary [3, 15].



The Anti-dsDNA-NcX ELISA provides a semiquantitative or quantitative in vitro assay for human autoantibodies of the IgG class against double-stranded genomic DNA (dsDNA) in serum or plasma. The great advantage of the Anti-dsDNA-NcX ELISA is that antibodies against pathogenetically relevant target structures of SLE can be determined with unsurpassed sensitivity and specificity without having to take into account the disadvantages of working with radioactive substances (Farr RIA) [19, 21]. A high concentration of autoantibodies against dsDNA is a very reliable marker for the diagnosis of SLE [12]. The changes in the concentration of antibodies against dsDNA correlate with the activity of SLE nephritis [1, 2, 3, 12]. Therefore the Anti-dsDNA-NcX ELISA is not just significant for the prognosis of SLE, but also for monitoring the disease activity [4, 12, 19, 20, 21].

As can be seen from the variety of ACR criteria, the collagenosis SLE manifests itself in many different ways. It must be taken into consideration that other serologically detectable autoantibodies may be responsible for the individual picture of the disease in addition to anti-dsDNA. Therefore, antibodies against nucleosomes, Sm, nRNP/Sm (U1-nRNP), SS-A (Ro), SS-B (La), ribosomal P-proteins and against other antigens of the cell nucleus should also be investigated [1, 4, 7, 8, 22, 23, 24, 25].

Literature references

1. Isenberg D, Smenk R. **Clinical laboratory assays for measuring anti-dsDNA antibodies. Where are we now?** Lupus 11 (2002) 797-800.
2. Rouquette AM, Desgruelles C. **Detection of antibodies to dsDNA: an overview of laboratory assays.** Lupus 15 (2006) 403-407.
3. Radice A, Sinico RA. **A new oligonucleotide-based ELISA for the detection of anti-double-stranded DNA antibodies.** Autoimmunity 39 (2006) 113-119.
4. Egner W. **The use of laboratory tests in the diagnosis of SLE.** J Clin Pathol 53 (2000) 424-432.
5. Isenberg D. **Anti-dsDNA antibodies: still a useful criterion for patients with systemic lupus erythematosus?** Lupus 13 (2004) 881-885.
6. Herrmann M, Voll R, Kalden VR. **Etiopathogenesis of systemic lupus erythematosus.** Immunol Today 21 (2000) 424-426.
7. Makowski GS, Ramsby ML. **Selective detection of autoimmune antibodies to single- and double-stranded DNA by enzyme immunoassay.** Ann Clin Lab Sci 33 (2003) 142-148.
8. EUROIMMUN AG. Stöcker W, Schlumberger W. **Alle Beiträge zum Thema Autoimmundiagnostik.** In: Gressner A, Arndt T (Hrsg.) Springer Lexikon Klinische Chemie. Medizinische Labordiagnostik von A-Z. Springer Medizin Verlag Heidelberg 1 (2007).
9. Parodi A, Drosera M, Barbieri LB, Babbini G, Rebora A. **Antidouble-stranded DNA isotypes in lupus erythematosus patients with prevalent cutaneous presentation.** Br J Dermatol 147 (2002) 754-656.
10. van den Berg L, Nossent H, Rekvig O. **Prior anti-dsDNA antibody status does not predict later disease manifestations in systemic lupus erythematosus.** Clin Rheumatol 147 (2006) 347-352.
11. Fritsch P. **Dermatologie und Venerologie.** Springer Verlag 2. Auflage (2004).
12. Linnik MD, Hu JZ, Heilbrunn KR, Strand V, Hurley FL, Joh T. **Relationship between anti-double-stranded DNA antibodies and exacerbation of renal disease in patients with systemic lupus erythematosus.** Arthritis Rheum 52 (2005) 1129-1137.
13. Stinton LM, Barr SG, Tibbles LA, Yilmaz S, Sar A, Benedikttson H, Fritzler MJ. **Autoantibodies in lupus nephritis patients requiring renal transplantation.** Lupus 15 (2007) 394-400.
14. Bruns A, Blass S, Hausdorf G, Burmester GR, Hiepe F. Bruns A, Blass S, Hausdorf G, Burmester GR, Hiepe F. **Nucleosomes are major T and B cell autoantigens in systemic lupus erythematosus.** Arthritis Rheum 43 (2000) 2307-2315.
15. EUROIMMUN AG. Suer W, Dähnrich C, Schlumberger W, Stöcker W. **In vitro-Diagnosekit zum Nachweis von Lupus erythematodes disseminatus (LED).** Eingetragenes deutsches Gebrauchsmuster DE 202 12524.6 (2003).
16. EUROIMMUN AG. Schlumberger W, Meyer W, Proost S, Dähnrich C, Müller-Kunert E, Sonnenberg K, Olbrich S and Stöcker W. **The New EUROBLOT Technology: Differentiation of Autoantibodies Against Cell Nuclei.** Eur J Clin Chem Clin Biochem 33 (1995) 116.
17. Neogi T, Gladman DD, Ibanez D, Urowitz M. **Anti-dsDNA antibody testing by Farr and ELISA techniques is not equivalent.** J Rheumatol 33 (2006) 1785-1788.
18. Haugbro K, Nossent JC, Winkler T, Figenschau Y, Rekvig OP. **Anti-dsDNA antibodies and disease classification in antinuclear antibody positive patients: the role of analytical diversity.** Ann Rheum Dis 63 (2004) 386-394.

19. Biesen R, Dähnrich* C, Rosemann* A, Hiepe F, Egerer K, Stöcker* W, Schlumberger* W. (*EUROIMMUN AG). **Anti-dsDNA-NcX ELISA is superior to Farr-RIA and IFA using Crithidia luciliae for SLE diagnosis.** Wissenschaftliche Präsentation auf dem 10th International Workshop on Autoantibodies and Autoimmunity (IWAA), Mexiko (2008) und dem 7th European Lupus Meeting, Amsterdam, Niederlande. Lupus 17 (2008) 506-507.

20. Iking-Konert C, Ostendorf B, Barthuber C, Hermsen D, Schneider M. **A novel anti-dsDNA-NcX ELISA: a non-radioactive alternative in the diagnosis of SLE.** Abstractband zum 36. Kongress der Deutschen Gesellschaft für Rheumatologie, Berlin 2008; VK 1.02.

21. EUROIMMUN AG. Lehmann C, Dähnrich C, Schlumberger W, Wandinger K-P, Stöcker W. **Nicht-radioaktive SLE-Diagnostik mit dem Anti-dsDNS(NcX)-ELISA: Sensitiver als der Farr-Test, bei gleicher Spezifität.** INFODIENST Med Report 32/31 Jahrgang Berlin (2007).

22. EUROIMMUN AG. Schlumberger W, Dähnrich C, Frahm S, Siegemund M, Meyer W, Suer W, Stöcker W. **Diagnostic relevance of autoantibodies against nucleosomes.** Autoimmunity Reviews 1 (2002) 32.

23. EUROIMMUN AG. Schlumberger W, Dähnrich C, Suer W, Frahm S, Stöcker W. **Autoantibodies against nucleosomes are pathognomonic for SLE – a 2nd generation ELISA shows no reactivity with sera from scleroderma patients.** In: Conrad K. et al. (Hrsg). From Proteomics to Molecular Epidemiology: Relevance of Autoantibodies. Pabst Science Publishers 3 (2002) 639-640.

24. EUROIMMUN AG. Suer W, Dähnrich C, Schlumberger W, Stöcker W. **Verfahren zur Herstellung einer Nukleosomen-Präparation und deren Verwendung zur In-vitro-Diagnose von systemischem Lupus erythematodes (SLE).** Europäisches Patent EP 1 476 750 (2009)

25. EUROIMMUN AG. Suer W, Dahnrich C, Schlumberger W, Stocker W. **Autoantibodies in SLE but not in scleroderma react with protein-stripped nucleosomes.** J Autoimmun 22 (2004) 325-334.