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# Datasheet for the decision of 31 January 2018

**Case Number:** T 2227/14 - 3.3.08

**Application Number:** 07008271.4

**Publication Number:** 1808496

**IPC:** C12Q1/68, B01J19/00

**Language of the proceedings:** EN

**Title of invention:**
Methods of sequencing polynucleotide arrays, and preparation methods therefor

**Patent Proprietor:**
Illumina Cambridge Limited

**Opponent:**
Kilger, Christian

**Headword:**
Polynucleotide arrays/ILLUMINA

**Relevant legal provisions:**
EPC Art. 54, 56, 76(1), 83, 84, 111(1), 113(1), 114(2), 123(2), 123(3)
EPC R. 80, 103(1)(a)
RPBA Art. 12(2), 13(1), 13(3)

**Keyword:**
Admission main request (yes)
Admission objections under Articles 76(1), 100(b), 123(2) EPC, Rule 80 EPC (no)
Main request - extension of protection (no); clarity (yes); novelty (yes); inventive step (yes)
Apportionment of costs and refund of appeal fee (no)
Remittal for adaptation of the description (yes)

**Decisions cited:**
G 0010/91, G 0003/14, T 0818/03, T 1020/03, T 0297/05

**Catchword:**

Europäisches Patentamt
European Patent Office
Office européen des brevets

**Beschwerdekammern**

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**Case Number: T 2227/14 - 3.3.08**

# D E C I S I O N
# of Technical Board of Appeal 3.3.08
# of 31 January 2018

| | |
|---|---|
| **Appellant:** (Opponent) | Kilger, Christian<br>Wachtelstr. 4<br>14195 Berlin (DE) |
| **Representative:** | Kilger, Christian<br>CH Kilger Anwaltspartnerschaft mbB<br>Fasanenstrasse 29<br>10719 Berlin (DE) |
| **Respondent:** (Patent Proprietor) | Illumina Cambridge Limited<br>Chesterford Research Park<br>Little Chesterford<br>Saffron Walden<br>Essex CB10 1XL (GB) |
| **Representative:** | Barnes, Colin<br>Stratagem IPM Limited<br>Meridian Court<br>Comberton Road<br>Toft, Cambridge CB23 2RY (GB) |
| **Decision under appeal:** | **Interlocutory decision of the Opposition Division of the European Patent Office posted on 24 October 2014 concerning maintenance of the European Patent No. 1808496 in amended form.** |

**Composition of the Board:**

| | |
|---|---|
| **Chairman** | B. Stolz |
| **Members:** | P. Julià |
| | D. Rogers |

## Summary of Facts and Submissions

I. European patent no. 1 808 496 was granted on the basis of European patent application no. 07 008 271.4, a divisional of the earlier European patent application no. 02 712 025.2, published as International patent application WO 02/061126. Claims 1 and 11 as granted read as follows (emphasis by the board):

"1. A method of sequencing an array of single polynucleotides wherein the array has a density of from $10^6$ to $10^9$ single polynucleotides per $cm^2$ and a higher density of relatively short molecules, whereby those parts of the single polynucleotides that extend beyond the relatively short molecules can be individually resolved by optical means, wherein the sequencing is carried out by the stepwise identification of fluorescently labelled nucleo**t**ides incorporated onto a strand complementary **to** the single polynucleotides and wherein the identification is achieved by scanning the array using a sequential scanning apparatus which shifts between images."

"11. A method for the production of an array of polynucleotides which are at a density of $10^6$ to $10^9$ individually resolvable polynucleotides per $cm^2$, comprising arraying on the surface of a solid support a mixture of relatively short molecules and relatively long polynucleotides, wherein the relatively short molecules are in excess and wherein the relatively short molecules and the relatively long polynucleotides are arrayed separately, with the relatively short molecules being brought into contact with the solid support first."

II. An opposition was filed under Articles 100(a), (b) and (c) EPC. The opposition division considered that the main request (claims as granted and amended page 6 of the description of the patent) and auxiliary request 1 contravened Article 54 EPC and Article 123(2) EPC, respectively, and the patent was maintained on the basis of an auxiliary request 2.

III. Claims 1 and 11 of the request upheld by the opposition division read as follows (emphasis by the board):

"1. A method of sequencing an array of single polynucleotides wherein the array has a density of from $10^6$ to $10^9$ single polynucleotides per $cm^2$ and a higher density of greater than $10^{12}$ molecules/$cm^2$ of relatively short molecules, whereby those parts of the single polynucleotides that extend beyond the relatively short molecules can be individually resolved by optical means, wherein the sequencing is carried out by the stepwise identification of fluorescently labelled nucleo**s**ides incorporated onto a strand complementary the single polynucleotides and wherein the identification is achieved by scanning the array using a sequential scanning apparatus which shifts between images."

"11. A method for the production of an array of polynucleotides which are at a density of $10^6$ to $10^9$ individually resolvable polynucleotides per $cm^2$, comprising arraying on the surface of a solid support a mixture of relatively short molecules and relatively long polynucleotides, wherein the relatively short molecules are at a density of greater than $10^{12}$ molecules/$cm^2$ and wherein the relatively short molecules and the relatively long polynucleotides are arrayed separately, with the relatively short molecules

being brought into contact with the solid support first."

IV. An appeal was lodged by the opponent (appellant). With the statement setting out its grounds of appeal, the appellant filed new documentary evidence.

V. The patent proprietor (respondent) replied to the grounds of appeal and filed auxiliary requests 1 and 2.

VI. The appellant replied to the respondent's submissions and the respondent anew to those of the appellant. As a subsidiary measure, both parties requested oral proceedings.

VII. In a communication pursuant to Article 15(1) of the Rules of Procedure of the Boards of Appeal (RPBA) annexed to the summons to oral proceedings, the board informed the parties of its provisional, non-binding opinion on the issues of the case.

VIII. Both parties, without submitting substantive arguments, informed the board of their intention to attend the oral proceedings. The respondent withdrew auxiliary requests 1 and 2 and filed an auxiliary request 3.

IX. Oral proceedings took place on 31 January 2018. At these proceedings, the respondent withdrew the main request and made auxiliary request 3 its new main request.

X. The main request is identical to the request upheld by the opposition division, except for amended claim 1 and deletion of claim 14. The amendment introduced into claim 1 reverts the term "*nucleosides*" of the request upheld by the opposition division to "*nucleotides*" as

in granted claim 1 and reads (emphasis by the board): "*... the sequencing is carried out by the stepwise identification of fluorescently labelled nucleo**t**ides incorporated onto a strand complementary **to** the single polynucleotides ...*".

XI. The following documents are cited in this decision:

(1): WO-A1-00/06770 (publication date: 10 February 2000);

(2): US 6,159,695 (publication date: 12 December 2000);

(3): US 6,130,044 (publication date: 10 October 2000).

XII. The submissions of the appellant, insofar as relevant to the present decision, may be summarised as follows:

*Admission of the main request*

According to Article 12(2) RPBA, the statement of grounds of appeal and the reply thereto had to contain a party's complete case. The main request was not filed with the reply to the grounds of appeal but shortly before the oral proceedings as auxiliary request 3. Thus, it was late filed. Although it was based on an auxiliary request 2 filed in reply to the grounds of appeal, this auxiliary request 2 was already late filed because it could have been filed at the first instance proceedings (Article 12(4) RPBA). The patent proprietor/respondent had filed six auxiliary requests shortly before the oral proceedings at first instance. Several new requests were filed at these oral proceedings to replace previously filed requests and these new requests were considered by the opposition division. The patent proprietor/respondent had ample

opportunity to file the main request earlier in the proceedings. The amendments introduced into the main request could have been made before the opposition division, particularly the amendment which according to the respondent was a mere correction of an innocuous error. The filing of the main request at the very latest stage of the appeal proceedings was a tactical abuse of the procedure.

*Admission of the objection raised under Rule 80 EPC*

The respondent had filed numerous claim requests before the first instance and in appeal proceedings but failed to indicate the multiple amendments made in each of these requests. The appellant was thereby hindered from identifying all amendments and it should be thus given the opportunity to raise objections against them later on in the proceedings. The more so if late filed requests were admitted into the proceedings, such as the main request. Since the main request had been admitted at the latest possible stage of the appeal proceedings, it was only fair to admit the objection under Rule 80 EPC raised against the deletion of the feature "wherein the relatively short molecules are in excess" in claim 11.

*Admission of the objections raised under Articles 123(2) and 76(1) EPC*

In reply to the board's communication, the appellant made no submissions on the admission of the objections raised under Articles 123(2) and 76(1) EPC into the appeal proceedings. Nor were any submissions made on this issue at the oral proceedings before the board.

*Admission of the objection raised under Article 100(b) EPC*

In the Notice of opposition, Article 100(b) EPC was given as a ground of opposition and reasons were provided before the opposition division issued the Summons to attend oral proceedings. The opposition division did not consider these reasons in the Summons and, in the decision under appeal, merely copied and pasted from its preliminary opinion. Since a reasoned case on lack of sufficiency had been made by the opponent, the onus was on the patent proprietor and the decision under appeal was thus flawed. The more so because the amendments introduced into the auxiliary requests filed before and during the oral proceedings at first instance, changed the subject-matter of all these requests to a single molecule sequencing method using nucleosides instead of nucleotides as in the granted methods. The opposition division failed to address this point. The decision of the opposition division not to allow Article 100(b) EPC into the proceedings was wrong.

*Article 84 EPC*

The feature characterizing the high density of the relatively short molecules in claims 1 and 11 defined only the result to be achieved; it was not a technical feature. Whilst the numerical feature itself was clear, it was not an easily controllable parameter, the less so because neither the material nor the type of short molecules were defined in the claims. No guidance was provided on how to achieve said high density; there was no example in the patent showing that it had been achieved and how to verify it. Claims defining the invention by the result to be achieved were not

allowable, particularly if they only recited the underlying technical problem (T 818/03 of 6 July 2005).

*Article 54 EPC*

Document (1) disclosed a high density array for large and small molecules with a surface density of one molecule per at least 10 nm x 10 nm; preferred distances for separating individual molecules on the array resulted in a density of $10^7$ long polynucleotides/$cm^2$. Claim 14 of document (1) referred to polynucleotides immobilised to a solid support *via* the 5' terminus, and in claim 15 at least one arrayed polynucleotide had a second polynucleotide hybridised thereto. Thus, the combination of the surface density of one molecule per 10 nm x 10 nm with the preferred distance of the resolvable polynucleotides anticipated the subject matter of the main request. Moreover, document (1) and the examples of the patent described the same procedure for silanizing glass slides. In Example 2 of document (1), slides were rinsed in a 1.5% silane derivative solution for 4 hours, while the examples of the patent described the rinsing of a glass surface with a solution comprising 1% of the same silane derivative for 1 hour. It had therefore to be assumed that the slides prepared as described in document (1) had at least the same density, if not higher, of short (silane) molecules as the glass slides described in the examples of the patent. Thus, the density ranges indicated in claims 1 and 11 of the main request were implicitly disclosed in document (1).

*Article 56 EPC*

The closest state of the art, document (1), originated from the inventors of the patent and corresponded in

large parts to the disclosure of the patent. Document (1) had the same purpose as the patent, namely single molecule sequencing; the sole technical difference was that the term "relatively short molecules" was not used in this document. Document (1) disclosed a high density polynucleotide array with sufficient separation between the molecules to provide distinct optical resolution (each molecule could be individually resolved). The density of this array corresponded to that of the arrays of the patent. A monolayer of short molecules (streptavidin or avidin, epoxide or silane, primer polynucleotides) prevented non-specific interactions and interactions between neighbouring molecules which could hinder interrogation of the array. Starting from document (1), the objective technical problem was the provision of an alternative way to control the density of the (target) polynucleotides. In view of documents (2) or (3), the solution proposed by the main request was obvious.

In order to control the density of arrayed polynucleotides and avoid excessive steric hindrance, document (2) provided coated (glass) supports having a high surface density of monolayer groups attached thereto. The monolayer groups carried at their distal ends functional reactive groups that could be utilized to bond to a (oligonucleotide) biomolecule. First, as shown in Figure 3 of document (2), a monolayer was formed with a mixture of two silanes, a (long) silane (TTU) exposing an activated (thiol) group and a (short) diluent silane used to control the density of the former silane and to avoid steric hindrance. The monolayer was then coated with oligonucleotides binding only to the activated (TTU) silane. The short silane was present at a higher density than the silane bound polynucleotides. Document (2) provided thereby an

incentive for the skilled person to use an array having a higher density of short molecules than polynucleotides in order to control the density of these polynucleotides on said array.

Document (3) related to DNA/RNA sequencing and provided a high density array for optically scanning. The array contained a surface coated with a compact layer of an organic compound having an exposed group for binding a molecule with biological activity (nucleic acid) which resulted in a compact, monomolecular layer of elongated structure. The monolayer of (relatively short) nucleic acids could anchor (relatively long) polynucleotides. It was well-known to a person skilled in the art of surface chemistry and/or thermodynamics that the short molecules had to be at a significantly higher density in comparison to the polynucleotides in order to provide a monolayer of primers onto which polynucleotides could be hybridized in the desired density. Figures 4 and 5 showed that the monolayer of short nucleic acids had a significantly higher density than the target polynucleotides. Since document (3) taught that the disclosed arrays provided limited background noise and eliminated unwanted attachments, it would have been obvious to a skilled person to combine this teaching with the method disclosed in document (1) and thereby arrive at the subject-matter of the main request.

*Apportionment of costs and refund of the appeal fee*

The apportionment of costs and the refund of the appeal fee were justified because: i) the patent proprietor did not indicate all the amendments introduced into the auxiliary requests filed in preparation of the oral proceedings before the opposition division, in

particular it did not indicate the replacement of "nucleo**t**ides" (granted claims) by "nucleo**s**ides" (auxiliary requests); ii) the opposition division did not properly conduct the oral proceedings, since it admitted oral requests (with no corresponding written document) and did not clarify the requests that were withdrawn and those that were still on file, nor their hierarchical/numerical order; and iii) the minutes of the oral proceedings before the opposition division did not correctly depict the events of these proceedings.

XIII. The submissions of the respondent, insofar as relevant to the present decision, may be summarised as follows:

*Admission of the main request*

The main request was based on auxiliary request 2 filed in reply to the statement of grounds of appeal. In this statement, the appellant raised, for the first time in the whole proceedings, several objections based on the term "nucleoside". The erroneous replacement of the term "nucleotide" by the term "nucleoside" was not noticed by the opponent/appellant and the opposition division at first instance proceedings. The first opportunity for the respondent to correct this innocuous error was in reply to the grounds of appeal. The filing of auxiliary request 2 provided such a correction and this request was thus not late filed. The deletion of claim 14 of auxiliary request 2 in the main request was made in reply to the objection raised under Rule 80 EPC by the board in its communication. This deletion could not have surprised the appellant, did not increase the complexity of the case and was made in the interest of procedural economy (Article 13(1) RPBA).

*Admission of the objection raised under Rule 80 EPC*

The replacement of the feature "wherein the relatively short molecules are in excess" by "wherein the relatively short molecules are at a density of greater than $10^{12}$ molecules/$cm^2$" in claim 11 was first introduced in some of the auxiliary requests filed in preparation of, and during, the oral proceedings before the opposition division. The feature was present in claim 11 of the request upheld by the opposition division which was maintained as the main request in the respondent's reply to the statement of grounds of appeal, and in claim 11 of auxiliary requests 1 and 2 filed with said reply. In the statement of grounds of appeal, the appellant did not raise any objection against this feature, nor was such an objection raised in appellant's reply to the respondent's filing of auxiliary requests 1 and 2. Although the objection could have been raised at an earlier stage of the proceedings, the appellant raised it only at the latest stage of the appeal proceedings and therefore, it should not be admitted.

*Admission of the objections raised under Articles 123(2) and 76(1) EPC*

In reply to the board's communication, the respondent made no submissions on the admission of the objections raised under Articles 123(2) and 76(1) EPC into the appeal proceedings. Nor were any submissions made on this issue at the oral proceedings before the board.

*Admission of the objection raised under Article 100(b) EPC*

The introduction of an objection under Article 100(b) EPC outside the period of opposition had to be rejected. No mention was made of this article in the Notice of opposition. If this objection and the new documentary evidence filed with the statement of grounds of appeal was admitted at this late stage of the proceedings, an apportionment of costs was justified.

*Article 84 EPC*

A numerical range characterizing a technical parameter was not a result to be achieved. The range introduced into claims 1 and 11 for characterizing the high density of the short molecules, was a technical parameter disclosed in the patent application and had a meaningful technical effect, namely to improve the sequencing method. The patent disclosed various ways of preparing arrays with short molecules, described what these molecules could be, what was their function, how they were attached to the array, how the devices could be prepared, and an example was given showing the device in use. The patent disclosed thus the nature and purpose of the short molecules.

*Article 54 EPC*

Document (1) disclosed neither a high density array of short molecules nor an array with a combination of $10^6$ to $10^9$ long polynucleotides/$cm^2$ with $10^{12}$ short molecules. This document disclosed a number of ways for carrying out single fluorophore detection. In one of them, a high density array of long polynucleotides was combined with near-field imaging. In this case, the density of long polynucleotides was much higher than $10^6$ to $10^9$ long polynucleotides/$cm^2$ and, since the long

polynucleotides were closely packed on the array, there was no need for a high density of short molecules. In another way, shown in the examples of document (1), a low density array of long polynucleotides was combined with wide-field imaging. In this case, however, the density of the short molecules was not in the range indicated in the claims of the main request.

*Article 56 EPC*

The problem of reagent sticking was not solved using the techniques disclosed in the closest state of the art, document (1). This document did not disclose the engineering of array surfaces with short molecules in order to prevent or block the sticking of reagents to these surfaces. Whilst documents (2) and (3) disclosed some features relating to the properties of polynucleotides on an array, there was no teaching that the use of a high density of surface coating by short molecules was advantageous, and none of these documents disclosed surfaces exposed to multiple cycles of fluorescent reagents (for sequencing purposes).

The purpose of document (2) was to increase the density of biomolecules attached to a surface. There was no teaching relating to a low density of polynucleotides and a high density of shorter molecules, let alone a disclosure of their ratio being at least 1000 fold. The ratio of (thiol) activated (TTU) silane (which once de-protected reacted with an oligonucleotide) to a short (diluent) silane varied between 3/7 to 1/1, hence there was no significant excess of short molecules on the support surface. The upper surface was essentially an oligonucleotide monolayer and the lower hydrophobic silane base layer had limited, if any, interaction with the reagents in solution. The short silane was used in

order to increase the density of the oligonucleotide coupling, not as a way of preventing reagent sticking, a problem which was not addressed in document (2).

Document (3) related to the imaging of long, single DNA strands which were stretched out on a surface. It related thus to a single type of surface. Document (3) disclosed surfaces coated with vinyl silane groups that were then treated with a dilute solution of labelled fluorescent (nucleic acid) biomolecules. Since these surfaces were not treated after attachment of the biomolecules, the remaining vinyl groups were able to react with further biomolecules in subsequent treatment steps. There was no disclosure of a monolayer of nucleic acids containing exposed groups for anchoring other (target) DNA molecules thereto. In Figure 4, a long piece of phage lambda DNA was stretched out on a surface. However, it was not attached thereto but dried onto the surface by evaporation. In Figure 5, the surface was coated with a layer of anti-DIG antibodies that bound to DIG-labelled polynucleotides; none of them was a short molecule. Moreover, document (3) did not disclose a higher density of short molecules than long polynucleotides, let alone a ratio of 1000 fold in excess. Nor did document (3) disclose a method of sequencing; the surfaces were not exposed to multiple cycles of fluorescent reagents.

*Apportionment of costs and refund of appeal fee*

The oral proceedings before the opposition division were conducted in a proper manner. The minutes correctly reflected the events of these proceedings. The patent proprietor filed several auxiliary requests over a month before the oral proceedings. The outcome of these proceedings was that the patent was maintained

on the basis of the first auxiliary request previously submitted for consideration. The opponent presented its case to the opposition division and the patent proprietor's conduct during the oral proceedings could not have caused additional costs to the opponent. The "nucleoside" amendment made no difference to the subject-matter of the claims and it could not have caused additional costs.

XIV. The appellant requested that the decision under appeal be set aside and the patent be revoked. The appellant further requested an apportionment of costs and the refund of the appeal fee.

XV. The respondent requested that the decision under appeal be set aside and the patent be maintained upon the basis of the main request filed at the oral proceedings before the board on 31 January 2018.

## Reasons for the Decision

*Article 113(1) EPC*

1. At the oral proceedings before the board, the parties discussed the admissibility of the main request (filed as auxiliary request 3 in reply to the board's communication) and of a new objection raised by the appellant under Rule 80 EPC against the main request. For all other issues, the parties referred to, and relied on, their written submissions, without making any further comments.

2. None of the parties provided any substantive comments or arguments in reply to the board's communication pursuant to Article 15(1) RPBA (cf. point VIII *supra*). Thus, the parties have not availed themselves of the

opportunity to address or comment, and there are no arguments on file, on some of the issues raised by the board in its communication, in particular concerning the admission into the appeal proceedings of the objections raised by the appellant under Articles 123(2), 76(1) and 100(b) EPC. For those issues, the present decision is therefore based on the same grounds, arguments and evidence on which the provisional opinion of the board was based.

*Main request*

*Admission into the appeal proceedings*

3. The main request was filed as auxiliary request 3 in reply to the board's communication (cf. point VIII *supra*). It is identical to auxiliary request 2 filed by the respondent in reply to the statement of grounds of appeal (cf. point V *supra*), except for the deletion of claim 14. This claim was objected under Rule 80 EPC in the board's communication. Thus, the deletion of claim 14 is a direct reply to said communication, it does not raise any new issue and only simplifies the appeal proceedings.

4. The main request is also identical to the request upheld by the opposition division, except for the introduction of an amendment in claim 1 and the above mentioned deletion of claim 14. The amendment introduced in claim 1 reverts the term "fluorescently labelled nucleo**s**ides", as in the request upheld by the opposition division, to "fluorescently labelled nucleo**t**ides" as in granted claim 1 (cf. point X *supra*), and directly addresses the objections raised by the appellant under Articles 123(2),(3) and 76(1) EPC in its statement of grounds of appeal. It is a direct,

straightforward amendment that could not surprise the appellant.

5. None of these objections had been raised in the proceedings at first instance and none of them had thus been considered by the opposition division. In fact, even though the replacement of the term "nucleo**t**ides" by the term "nucleo**s**ides" was already introduced into the auxiliary requests 1 to 6 filed by the patent proprietor before the oral proceedings at first instance and further maintained in the auxiliary requests filed during these oral proceedings, there is no reference to any objection being raised against this replacement either in the minutes of these oral proceedings or in the decision under appeal. These objections were raised in the statement of grounds of appeal for the first time in the whole procedure. In view thereof, the board agrees with the respondent that the first opportunity to address these objections was in the reply to the statement of grounds of appeal and that this was done by filing auxiliary request 2.

6. The board, in the exercise of its discretion according to Article 114(2) EPC, governed by the principles laid down in Articles 13(1) and (3) RPBA, decides to admit the main request into the appeal proceedings.

*Admission of the objection raised under Rule 80 EPC*

7. The objection under Rule 80 EPC against claim 11 was raised at oral proceedings before the board and thus, at the latest possible stage of the appeal proceedings. Claim 11 had not been objected to under Rule 80 EPC in the statement of grounds of appeal nor in the reply to the board's communication. The objection is late filed, represents an amendment of appellant's case in the

sense of Article 13(1) RPBA, and may be admitted and considered at the board's discretion.

8. The objection relates to the deletion of the feature "wherein the relatively short molecules are in excess" in claim 11 (cf. points I and III *supra*). This feature was replaced by a specific density range ("wherein the relatively short molecules are at a density of greater than $10^{12}$ molecules/$cm^2$") in auxiliary requests 1 to 6 filed before the oral proceedings at first instance and in all requests filed during those proceedings. The objection does thus not arise from an amendment to any of the claim requests filed in appeal. The objection could, and should, therefore have been raised at the first instance proceedings.

9. Thus, the board, in the exercise of its discretion according to Article 114(2) EPC, governed by the principles laid down in Articles 13(1) RPBA, decides not to admit the objection raised under Rule 80 EPC into the appeal proceedings.

*Article 123(3) EPC*

10. No objection has been raised under this article nor does the board raise any on its own motion.

*Admission of objections under Articles 123(2) and 76(1) EPC*

11. In the communication pursuant to Article 15(1) RPBA, the board noted that appellant's arguments relating to these articles in the statement of grounds of appeal repeated *verbatim* those given in the Notice of opposition and that, in the statement of grounds of appeal, there was no reference to the reasons given by the opposition division in the decision under appeal

nor any argument why these reasons were wrong. In view thereof, the parties' attention was drawn to the case law concerning the substantiation of grounds of appeal, namely "Case Law of the Boards of Appeal of the EPO", 8th edition 2016, IV.E.3.2.1.h) and IV.E.3.2.1.i), 1122; and related IV.E.2.6.3.b), 1098; IV.E.2.6.4.a), 1102; and IV.E.2.6.6, 1107, on admissibility of the appeal. The parties were informed of the board's provisional, non-binding opinion that the grounds of appeal on Articles 123(2) and 76(1) EPC were not substantiated and that the board was minded not to admit them.

12. In its communication, the board further indicated that, if a discussion of these objections arose at the oral proceedings, the first issue to be discussed would be their admissibility into the appeal. At the oral proceedings before the board, all parties referred to their written submissions and did not provide any argument or reason that could have led the board to deviate from its provisional, non-binding opinion on this issue. Thus, the grounds of appeal under Articles 123(2) and 76(1) EPC are considered not to be substantiated and therefore, not admitted into the appeal proceedings.

*Admission of objections raised under Article 100(b) EPC*

13. It is not contested that the ground of opposition based on Article 100(b) EPC was not substantiated in the original Notice of opposition and that it was substantiated only in reply to the patent proprietor's response to the Notice of opposition (cf. page 3, point 2 of the decision under appeal).

14. In the "Summons to attend oral proceedings", the opposition division did not address the opponent's arguments on Article 83 EPC but stated only that the opponent had failed to provide "facts which would *prima facie* cause the methods of the invention not to be reproducible without undue burden for the skilled person" and that document (1), considered by the opponent to anticipate the claimed subject-matter, had "a similar level of disclosure with respect to the sequencing techniques" (cf. page 3, point 2.3 of the "Summons to attend oral proceedings"). Therefore, the opposition division considered the late substantiation of the objections raised under Article 100(b) EPC to represent a fresh ground of opposition. With reference to decision G 10/91 (OJ EPO 1993, 420), it stated that this ground of opposition could only be introduced into the opposition proceedings with the consent of the patent proprietor (cf. page 3, point 2.3.2 of the "Summons to attend oral proceedings").

15. The board observes that the opponent did not address the opposition division's comments in its letter filed in preparation of the oral proceedings at first instance. Moreover, according to the "Minutes of the oral proceedings before the opposition division", the opponent "did not provide any further arguments" as regards the admissibility of the fresh ground of opposition but "relied on his opposition writ with respect to lack of basis" (cf. page 1, points 2.1 and 2.2 of the Minutes).

16. The opposition division decided not to admit Article 100(b) EPC as a ground of opposition (cf. page 3, point 2 of the decision under appeal), and took no decision as to the substance of the objections raised under this article, in particular not on the

issue concerning the "single molecule sequencing" (cf. point XII *supra*).

17. In view of this course of action and the fact that there is no decision of the opposition division on the objections raised under Article 100(b) EPC, the board informed the parties in its communication that, in its provisional opinion, the admission of this ground of opposition into the appeal proceedings would not be in line with the function of an appeal as defined in the case law, namely to give a judicial decision upon the correctness of a separate earlier decision taken by a department of first instance (cf. "Case Law", *supra*, IV.E.1, 1065, and IV.E.4, 1127), and that Article 100(b) EPC was thus not part of the appeal proceedings (cf. point 31 of the board's communication).

18. At the oral proceedings before the board, all parties referred to their written submissions and did not put forward any further arguments or reasons that could have led the board to deviate from its provisional, non-binding opinion as expressed in its communication. Therefore, objections on the ground of Article 100(b) EPC are not admitted into the appeal proceedings.

*Article 84 EPC*

19. Claims 1 and 11 of the main request differ from granted claims 1 and 11 by the introduction of the feature "greater than $10^{12}$ molecules/$cm^2$" defining the (higher) density of the "relatively short molecules", and the deletion of the feature "wherein the relatively short molecules are in excess" of granted claim 11. The feature introduced into claims 1 and 11 is not found in

any of the granted claims and thus, the objection raised under Article 84 EPC is in line with the criteria set out in decision G 3/14 (OJ EPO 2015, A102) for allowing the examination of Article 84 EPC in appeal proceedings, namely "when, and then only to the extent that, the amendment introduces non-compliance with Article 84 EPC" (cf. Order of this decision).

20. The Boards of Appeal have developed a large body of case law on the requirement set out in Article 84 EPC that the claims must be supported by the description (cf. "Case Law", *supra*, II.A.5, 284). In this case law, the boards have considered whether a purely formal support by the description, i.e. a *verbatim* repetition of a claimed feature, suffices to meet this requirement or whether the claims must reflect the actual contribution to the art in such a way that the skilled person is able to perform the invention across the entire range claimed (cf. *inter alia*, T 1020/03, OJ EPO 2007, 204, point 10 of the Reasons). These two approaches correspond to the so-called formal aspect and substantial aspect of Article 84 EPC, the latter requiring that the objection must be substantiated and not based on mere suppositions (cf. *inter alia*, T 297/05 of 2 February 2006, points 8 and 10 of the Reasons). The Boards of Appeal have also acknowledged that the requirements of the substantial aspect of Article 84 EPC are related to those of Article 83 EPC (cf. "Case Law", *supra*, II.C.7, 356).

21. It is not disputed that the formal aspect of Article 84 EPC is fulfilled. Indeed, the feature introduced into claims 1 and 11 is found *verbatim* in paragraph [0021] of the patent application. Appellant's objection under Article 84 EPC is directed only and exclusively to the substantive aspect of this article

which, as stated above, is closely related to Article 83 EPC. In this context, the board considers the following points to be highly relevant:

21.1 Claim 1 as granted required the "relatively short molecules" to have a "higher density" than the single polynucleotides in the array which had to be present at a density of "from $10^6$ to $10^9$ single polynucleotides per $cm^2$". Likewise, granted claim 11 required the "relatively short molecules" to be "in excess" of the "relatively long polynucleotides" which were "at a density of $10^6$ to $10^9$ individually resolvable polynucleotides per $cm^2$".

21.2 The array's support, the short molecules and the functional groups used for binding these short molecules to the solid support, were defined neither in granted claim 1 nor in granted claim 11.

All this information is provided by the patent application which explicitly refers to suitable solid supports (cf. paragraph [0031]), small or short molecules (cf. paragraphs [0038] to [0047]), functional groups (cf. paragraph [0041]), etc. Moreover, it is important to note that the terms "higher" and "in excess" in granted claim 1 and claim 11, respectively, require densities of the "relatively short molecules" higher than "$10^9$ molecules per $cm^2$". Indeed, according to the description of the patent application, this density is defined as being "from $10^8$ to $10^{14}$ molecules/$cm^2$" and "more preferably greater than $10^{12}$ molecules/$cm^2$" (cf. paragraph [0021] of the patent application). This latter density is in fact the feature introduced into claims 1 and 11 of the auxiliary request 2 filed in reply to the statement of grounds of appeal. Examples 1, 2 and 3 of the patent

application exemplify the claimed subject-matter with glass slides as solid support, mixed silanes as short molecules and several DNA sequences as single or long polynucleotides.

21.3 In view of these considerations, the feature introduced into claims 1 and 11 of the main request is considered to merely limit or narrow the scope of the granted claims. In the board's view, it is clearly defined and "the steps that need to be taken to achieve that result" (i.e. this feature) do not differ from those that had to be already taken for the methods of the claims as granted (cf. T 818/03 of 6 July 2005, point 2.5 of the Reasons). In the board's view, this objection under Article 84 EPC is an attempt to introduce a new argument for a ground of opposition that had not been admitted into the opposition procedure, namely Article 83 EPC.

22. In view of these considerations, the board sees no reason to deviate from the findings of the opposition division and considers the main request to fulfil the requirements of Article 84 EPC.

*Article 54 EPC*

23. Document (1), originating from the inventors of the patent, discloses the advantages of "spatially addressable arrays of single polynucleotide molecules" over the high density arrays of the prior art (cf. *inter alia*, paragraph bridging pages 2 and 3; page 2, second paragraph; pages 4 and 6). The extent of separation between the individual molecules is stated to be determined "in part, by the particular technique used to resolve the individual molecule" (cf. page 6, lines 16 and 17). Preferred distances when using a

(wide-field) sensitive 2-D image detector are explicitly disclosed (cf. page 6, lines 25 to 28) and the more preferred distance (1 molecule per 350 nm x 350 nm) falls, according to appellant's calculation ($10^7$ molecules/$cm^2$), within the density range indicated in claims 1 and 11. For other techniques which are capable of smaller optical resolution, such as scanning near-field optical microscopy, more dense arrays are permitted and the distance may be "less than [one molecule per] 10 nm x 10 nm" (cf. page 6, last paragraph) which, according to appellant's calculation, equates to less than $10^{12}$ molecules/$cm^2$.

24. In the board's view, these bits of technical information cannot be directly combined because they are based on different techniques used to resolve or interrogate the single individual molecules (relatively long polynucleotides). Whilst the density of single molecules in the more dense arrays used with near-field techniques may be outside the range indicated in the claims of the main request, this is not the case for the arrays used with wide-field techniques. However, there is no explicit reference in the description of document (1) to the specific relationship between the density of the relatively long polynucleotides and the relatively short molecules in the disclosed "spatially addressable array", nor to the possible advantages associated with such a relationship.

25. Example 2 of document (1) refers to the treatment of a support material (glass slides) with the same silane product (relatively short molecule) as used in Example 3 of the patent before immobilization of the (relatively long) polynucleotides (cf. page 16, line 1 to 13). According to the appellant, the same or a higher density of small molecules is achieved and the

product is thus identical to the claimed product; this is however contested by the respondent (cf. points XII and XIII *supra*). In the communication pursuant to Article 15(1) RPBA, the board noted that although the same silane product was used in the Examples of the patent and in Example 2 of document (1), the solvent used for applying it to the support was different (water in document (1) and acidified 95% EtOH in the patent), and that no information was on file to show whether this affected the immobilisation of the compound. None of the parties replied in substance to the board's comment, neither in writing nor at the oral proceedings before the board, but relied on their written submissions (*supra*).

26. In view of the actual information provided in Example 2 of document (1), it cannot be unambiguously asserted that the array obtained in that example is an array of polynucleotides having a density of relatively short molecules falling within the range given in claims 1 and 11 of the main request. In the board's view, there is no unambiguous disclosure in document (1) of a density of relatively small molecules that falls within the range given in claims 1 and 11 of the main request, nor is the attention of a skilled person clearly drawn to the relationship between the densities of both the "relatively small molecules" and the "single or relatively long polynucleotides", let alone to its relevance.

27. Thus, the main request fulfils the requirements of Article 54 EPC.

*Article 56 EPC*

28. Document (1), the closest state of the art, discloses arrays of single (polynucleotide) molecules having a surface density that allows each (polynucleotide) molecule to be individually resolved and interrogated, such as by optical means (cf. page 2, line 22 to page 3, line 5; page 5, lines 8 to 31). Polynucleotide arrays may include the attachment of other molecules to a solid surface, these molecules having an attached polynucleotide that can be interrogated (cf. page 6, lines 9 to 13). As examples of other molecules, document (1) refers to protein molecules (streptavidin, avidin), a primer polynucleotide and a (silane) epoxide (cf. page 6, lines 13 to 15; page 8, lines 1 to 28; page 16, lines 1 to 6 of Example 2). The extent of separation between individual (polynucleotide) molecules on the array is determined by the technique used to resolve the individual molecule, and examples are given for wide and near-field optical techniques (*supra*). Document (1) refers to known techniques for ensuring adequate separation of the individual molecules, such as "dispensing small volumes of a sample containing a mixture of molecules onto a suitably prepared solid surface" or "applying a dilute solution to the solid surface to generate a random array", so as to obtain "a mixture of different molecules [that] may be arrayed by simple means" (cf. page 7, lines 9 to 16). The immobilisation must result "in well separated single molecules" so as to advantageously prevent "interaction between neighbouring molecules on the array, which may hinder the interrogation of the array" (cf. page 7, lines 29 to 31). Example 2 of document (1) describes the production of an epoxide coated (glass slide) surface and the immobilisation of a relatively long

polynucleotide (21 nucleotides) (cf. page 16, lines 1 to 9; see also point 25 *supra*). The disclosed polynucleotide arrays may be used for sequencing purposes (cf. page 3, lines 19 to 21 *et seq.*; claims 22 to 24).

29. Starting from document (1), the decision under appeal refers to the objective technical problem as formulated in the patent (cf. page 17, point 20.3.1.2), namely the provision of "flexible means to control the density of the single polynucleotides and optionally to prevent non-specific binding of reagents to the solid support" (cf. paragraph [0014] of the patent). Whilst appellant's formulation bears a close relationship with the first part of this problem but for providing only an "alternative" method (cf. point XII *supra*), respondent's formulation corresponds to the second part of said problem, namely "*the prevention of reagent sticking*" (cf. point XIII *supra*). In view of the disclosure of document (1), the board agrees with appellant's formulation of the technical problem as the provision of an alternative way to control the density of (single) polynucleotides. In the decision under appeal, the opposition division considered this problem to be solved (cf. page 16, points 20.3.1 and 20.3.1.1), and there is no evidence on file that could lead the board to a different conclusion. It is however disputed whether, in the light of document (1), in combination with document (2) or document (3), the solution proposed by the methods of claims 1 and 11 is obvious.

30. Document (2) discloses biochemical sensors based on coated supports having a very high surface density of monolayer groups covalently attached to a substrate and carrying at their distal ends functional reactive (thiol) groups that can be utilized to link (either

permanently or reversibly) a biomolecule such as an oligonucleotide (cf. column 7, line 65 to column 8, line 41). The disclosed sensors may be used, *inter alia*, for amplification purposes (cf. column 11, lines 60 to 62). A preferred embodiment disclosed in document (2) comprises the use of two different alkylsilane groups bound to the surface, a first (long) alkylsilane group with a functional reactive (thiol) group (TTU alkylsilane; cf. column 9, lines 22 to 35) and a second "diluent" silane of alkyl group chain length shorter than the first alkylsilane and being inert at its distal end (cf. paragraph bridging columns 9 and 10). The purpose of the diluent silane is defined as "to further control the packing density of the thiol functionality on the surface, and to guard against excessive steric hindrance in the subsequent reactions with bio-molecules" (cf. column 9, lines 49 to 53). Example 5 and Figure 3 of document (2) describe this preferred embodiment and the TTU/diluent silane mixtures described therein are 30%/70% and 50%/50%, respectively (cf. column 17, line 57 to column 18, line 14). The ratios of these mixtures are far away from the ratio defined by the claims of the main request.

31. The teachings of document (2) concern "a process for preparing biochemical sensor element structures with very high surface density of bio-molecules chemically attached thereto" (cf. *inter alia*, column 8, lines 23 to 26). In the board's view, these structures are more related to the high density arrays of the prior art referred to in document (1) (cf. page 1, lines 11 to 19 *et seq.;* see paragraph [0003] of the patent) than to the "spatially addressable array single polynucleotide molecules" which allow "to resolve the individual polynucleotide" described in document (1) (see also

page 17, point 20.4 of the decision under appeal). In any case, the combination of documents (1) and (2) would not lead a skilled person in an obvious manner to a method for the production of an array of polynucleotides having all the technical features required by claim 11 of the main request, even less so to the method of sequencing defined by claim 1.

32. Document (3) discloses supports having at the surface one compact layer of an organic compound having, outside the layer, an exposed group containing an ethylenic double bond (a vinyl group) having affinity for (i.e. being capable of anchoring) one type of molecule with biological activity, such as nucleic acids (cf. column 3, line 64 to column 4, line 34; column 7, lines 1 to 6). Silane derivatives are mentioned as preferred attachment groups for glass and silica supports (cf. column 5, lines 35 to 67 *et seq.*), and surfaces with multiple layers are also mentioned (cf. column 4, lines 46 to 49). The anchoring of DNA molecules at the surface, the production of elongated monolayer structures and their relevance for the signal/noise (S/N) ratio and for (reduced field) microscopic observation is also addressed (cf. column 10, lines 21 to 67; column 6, lines 57 to 67), as well as a reference to the attachment of a PCR product (cf. column 7, lines 65 to 67) and the "identification of one or more elements for sequencing of DNA or RNA" (cf. column 11, lines 33 to 40). Both a multilayer (silane derivatives-protein A that can react then with an antibody, such as an anti-DIG antibody) (cf. Figure 5, column 3, lines 50 to 55; column 13, line 62 to column 14, line 14) and a monolayer (silane derivatives-DNA) (cf. Figure 4, column 3, lines 43 to 49; column 14, lines 15 to 29) are exemplified. It is in this context that the sole reference to the density of the anchored

DNA molecules is found in document (3). However, as stated by the opposition division (cf. page 18, point 20.5 of the decision under appeal), this density lies outside the range required by the claims of the main request and, as in document (2), there is no information at all in document (3) on the actual ratio between the long polynucleotides and the short molecules.

33. In view of these considerations, the board concludes that the skilled person trying to solve the above mentioned problem would not, unless with the benefit of hindsight, arrive at the claimed solution in an obvious way. Thus, the main request fulfils the requirements of Article 56 EPC.

*Appellant's requests for apportionment of costs and refund of the appeal fee*

34. A large body of case law has been developed by the Boards of Appeal on the apportionment of costs (cf. "Case Law", *supra*, IV.C.6, 981). In the board's view, however, this case law does not support the appellant's request, which is mainly based on the respondent's failure to indicate the replacement of the term "*nucleo**t**ides*" by the term "*nucleo**s**ides*" in all auxiliary requests filed in preparation of the oral proceedings before the opposition division (cf. point XII *supra*).

35. These requests were filed one month before the opposition division oral proceedings and thus, in the board's view, the opponent/appellant should have been aware of their contents when oral proceedings were held. It is not to be expected that an opponent/ appellant considers and examines only those amendments

indicated and/or highlighted by the patent proprietor/ respondent. Rather, common practice is to expect him/ her to carry out a complete examination of the full contents of all requests on file. The failure of a party to indicate or highlight an amendment does not relieve the other party from its responsibility to examine the full contents of these requests so as to present its case in a complete and clear manner.

36. As regards the reimbursement of the appeal fee, Rule 103(1)(a) states that the reimbursement of the appeal fee is allowable if it is "*equitable by reason of a substantial procedural violation*". The case law established by the Boards of Appeal defines several situations in which a substantial procedural violation occurs (cf. "Case Law", *supra*, IV.E.8.4, 1191), *inter alia*, in the drafting of the minutes of oral proceedings (cf. "Case Law", *supra*, IV.E.8.4.2.e), 1194), in an error of judgement of the opposition division (cf. "Case Law", *supra*, IV.E.8.4.5, 1196), and in the auxiliary requests and the order of these requests (cf. "Case Law", *supra*, IV.E.8.4.6.e).(ii), 1201).

37. In the light of the evidence on file, the board considers that the oral proceedings before the opposition division could have been conducted in a more satisfactory and efficient manner, in particular, as regards a clear and unambiguous indication of the status and order of the requests on file; a conduct which is always highly recommendable. However, none of the specific situations and particular arguments put forward by the appellant in the present case qualifies as a substantial procedural violation as defined by the case law. In particular, appellant's request is mainly based on the fact that the patent proprietor/respondent

did not highlight the amendment referred to in point 34 *supra*. Hence, the opposition division and the opponent/ appellant overlooked it and, from this point on, the opposition division was allegedly no longer in control of the proceedings. In the appellant's view, a fair and orderly conduct of the proceedings was no longer possible, amounting to a clear procedural violation. The board, for the reasons given in point 35 *supra*, cannot follow the appellant's argument. Nor does the board share the appellant's view that the minutes of the oral proceedings before the opposition division are incomplete or wrong. In the board's view, the essential submissions are summarised and reflected in the minutes and, suffice to say here, there is no request on file for their correction.

38. Thus, the board considers that appellant's requests for the apportionment of costs and reimbursement of the appeal fee, is not justified.

*Appellant's request for remittal to the first instance and respondent's request for apportionment of cost*

39. At the oral proceedings before the board, the appellant initially requested that if one of the claim requests was considered to satisfy Article 123(3) EPC, then the case be remitted to the department of first instance for further prosecution (cf. page 2, second paragraph of the Minutes of the oral proceedings before the board).

40. According to Article 111(1) EPC, remittal to the department responsible for the decision under appeal is at the discretion of the board. The board may exercise any power within the competence of said department.

41. At the oral proceedings, after hearing the parties, the board decided to admit the main request. Next, the appellant confirmed that it had no objections against this request under Article 123(3) EPC. The board then, exercising its discretion under Article 111(1) EPC, asked the parties for their comments concerning all other objections raised. When asked whether it wished to add anything to the arguments submitted in writing in relation to objections under Articles 100(b), 84, 54 and 56 EPC, the appellant did not insist on a remittal of the case to the department of first instance but replied that it relied on its written submissions. The appellant did not repeat the request for a remittal of the case to the department of first instance, neither when asked for its final requests, nor when asked whether it had any further comments or remarks at the end of the proceedings (cf. page 4, fifth and seventh paragraphs of the Minutes of the oral proceedings before the board).

42. In view of the course of action at the oral proceedings, and since appellant's objections against the main request are based on the same arguments, grounds and Articles of the EPC that were dealt with in the decision under appeal, remittal to the division of first instance is not justified.

43. At the oral proceedings before the board, the respondent has requested an apportionment of costs in reply to the appellant's request for a remittal of the case to the department of first instance (cf. page 2, third paragraph of the Minutes of the oral proceedings before the board). The board understands this request as a precautionary measure in case that the board would have decided to remit the main request without carrying out an examination of the articles of the EPC other

than Article 123(3) EPC. Since this is not case, and the remittal is only for adapting the description to the main request, the respondent's request for apportionment of costs is not justified.

## Order

## For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the department of first instance with the order to maintain the patent with the following claims and a description to be adapted:

Claims:

Nos. 1 to 13 of the main request received during the oral proceedings before the board on 31 January 2018.

The Registrar: The Chairman:

L. Malécot-Grob B. Stolz

Decision electronically authenticated