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グロビンタンパク質の多様性-立体構造と機能

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脊椎動物のヘモグロビンやミオグロビンは、赤血球、筋肉において酸素の運搬・貯蔵を担う重要なタンパク質である。その一方で、単細胞生物においても「グロビンタンパク質」が発見されているが、構造と機能は大きく異なっている。その中でも、短縮型グロビン、フラボヘモグロビン、グロビン結合型センサーの3種類のタンパク質について、以下の機能がわかった。1) 短縮型グロビンは結合酸素の安定性が非常に高く、一酸化窒素を硝酸イオンへと解毒する可能性がある。2) フラボヘモグロビンは、アゾール系抗菌剤の一部と高い親和性で結合する。3) グロビン結合型センサータンパク質はグロビンドメインに酸素などのリガンドが結合することで酵素活性を上昇させる。また、短縮型グロビンとグロビン結合型センサーのX線結晶構造解析を行い、立体構造を解明した。いずれも主に α ヘリックスから構成される2/2グロビンフォールド(短縮型グロビン)と3/3グロビンフォールド(グロビン結合型センサー)をとるものの、構成する α ヘリックスの長短などに違いが見られる。また、ヘムの周辺環境には結合した酸素や一酸化炭素を認識・保持する特徴的な水素結合によるネットワークが見られた。

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1. はじめに

脊椎動物のヘモグロビン(Hb)やミオグロビン(Mb)は酸素の運搬・貯蔵を担うタンパク質である。酸素分子はHb・Mbに含まれるヘムb(プロトポルフィリンIX鉄錯体)の鉄原子に配位結合し、可逆的に酸素を脱着できる。Hbは α 鎖2本、 β 鎖2本の4量体を形成している。一方、Mbは単量体である。いずれもアミノ酸150残基程度からなり、以下では、これらをまとめて「グロビンタンパク質」と呼び、タンパク質の一部に含まれる場合は、グロビンドメインとする。

ヒトのHbの場合、 α 鎖等(アミノ酸142残基)をコードする遺伝子群(ζ , $\alpha 2$, $\alpha 1$)が第16番染色体に、 β 鎖等(アミノ酸147残基)をコードする遺伝子群(ϵ , $G\gamma$, $A\gamma$, δ , β)が第11番染色体にクラスターを形成しており、成人型HbA($\alpha_2\beta_2$)や胎児型HbF($\alpha_2\gamma_2$)などを合成している。Mb(アミノ酸154残基、第22番染色体)に加えて、ニューログロビン(Ngb, アミノ酸151残基、

第14番染色体)とサイトグロビン(Cgb, アミノ酸190残基、第17番染色体)が新たに発見されている。なお、Ngbは単量体で存在するが、Cgbは2量体を形成する。

ところで、ヒト以外の生物に目を向けると、大腸菌のような原核生物から、単細胞の真核生物まで広くグロビンタンパク質が存在することがわかってきた[1-4]。しかし、そのグロビンタンパク質の構造、機能はヒトの場合と大きく異なっている。これらの生物では、グロビンタンパク質は酸素濃度の感知や、酸素分子の除去、ヘム鉄に結合した酸素分子を使って、一酸化窒素を硝酸イオンへの分解など、様々な機能が示唆されている。これらの機能の指標として、Table 1に酸素分子のヘム鉄への結合しやすさ(酸素親和性)および結合した酸素がヘム鉄から電子を奪う、自動酸化速度定数についてまとめた[5]。酸素親和性と自動酸化速度定数について、HbやMbと単細胞生物で見られるグロビンタンパク質を比較すると、結合した酸素を安定

化するもの（短縮型グロビン）もあれば、酸素が結合してもすぐに酸化されてしまうもの（グロビン結合型センサー）もある。

本稿では、単細胞生物にみられるユニークなグロビタンパク質について、その立体構造と機能について、私たちの研究成果をもとに述べる。Figure 1 に、これから述べるグロビタンパク質の模式図を示す。

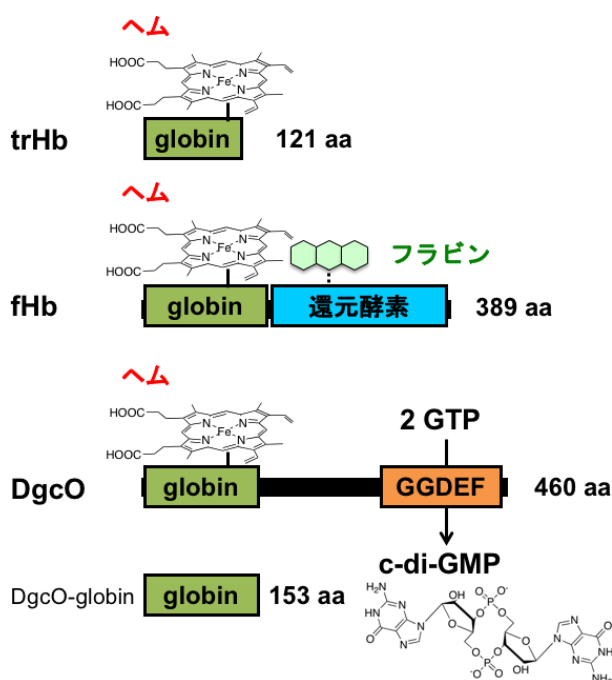


Figure 1: 本論文で取り上げるグロビタンパク質の模式図。globin はグロビンドメインを示す。

次の 2 節では原生生物繊毛虫の *Tetrahymena pyriformis* の短縮型グロビン (trHb), 3 節では酵母の一種 *Candida norvegensis* で発見されたフラボヘモグロビン (fHb), 4 節では大腸菌

Escherichia coli の酸素センサータンパク質 DgcO についてそれぞれ述べる。なお、いずれのグロビタンパク質、グロビンドメインについても、遺伝子組換え技術を用い、大腸菌内で大量に発現したものを精製して用いた。結晶化には、ナノリッター分注システム Mosquito (TTP Labtech) を使用し、結晶化条件のスクリーニングを行った。また、構造解析に使用した結晶は Figure 2 に示した。最後に 5 節では、今後の展望について述べる。

2. *T. pyriformis* の短縮型グロビン

テトラヒメナ *T. pyriformis* や *T. thermophila*, ズウリムシ *Paramecium caudatum* などの原生生物繊毛虫にグロビタンパク質が存在することは古くより知られていた。これらの生物はレジオネラの宿主としても知られている。しかし、タンパク質を単離精製し、アミノ酸配列の決定や吸収スペクトルの測定が行われたのは 1990 年であった。その結果、*T. pyriformis* のグロビタンパク質はアミノ酸 121 残基から成る単量体であり、酸素の親和性が高く P_{50} 値が 0.2 Torr 以下であることがわかった[6]。

他のグロビタンパク質が 150 アミノ酸残基程度から成るのに比べて、*T. pyriformis* のグロビタンパク質は 30 アミノ酸残基も短い構造を持つので、短縮型グロビン (trHb) と呼ばれる。

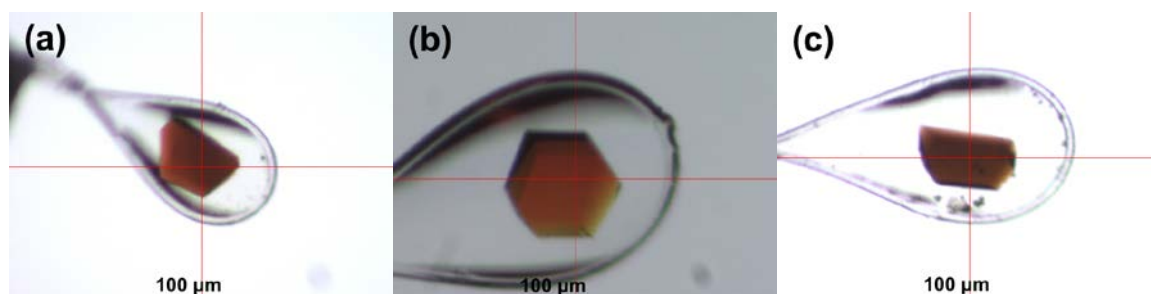


Figure 2: 構造解析に用いた結晶の様子。ナイロンループ内に結晶をすくい取り、X 線（波長は $1.0 \text{ \AA} = 0.1 \text{ nm}$ ）を照射して、回折データを取得する。位相と回折データより得られた構造因子から逆フーリエ変換を行うことで、電子密度マップが求められる。

(a) *Tetrahymena pyriformis* の短縮型グロビン、酸素結合型 (b) *Candida norvegensis* のフラボヘモグロビン、酸化型 (c) 大腸菌 *Escherichia coli* の DgcO-globin、酸化型

Table 1：酸素親和性と自動酸化速度の比較

種名	タンパク質名	酸素親和性 (Torr)	自動酸化速度定数 (h^{-1})	References
<i>Homo sapiens</i>	HbA ($\alpha_2\beta_2$)	9.2	0.0023	[7,8]
	Mb	0.72	0.0083	[9]
	Ngb	8.4	5.4	[10,11]
	Cgb	1.8	— ^a	[10]
短縮型グロビン				
<i>Tetrahymena pyriformis</i>	trHb	0.018*	0.0038	[12]
<i>Paramecium caudatum</i>	trHb	0.46*	0.031	[13,14]
<i>Mycobacterium tuberculosis</i>	HbN	0.013	0.0013	[15]
フラボヘモグロビン				
<i>Candida norvegensis</i>	fHb	0.01	0.024	[16,17]
<i>Saccharomyces cerevisiae</i>	YHB1	0.020*	— ^b	[18]
<i>Cupriavidus necator</i>	FHP	0.0022*	— ^b	[18]
<i>Escherichia coli</i>	Hmp	0.0064*	— ^b	[18]
<i>Bacillus subtilis</i>	HmpBs	0.088*	— ^b	[19]
<i>Salmonella enterica</i>	HmpSe	0.14*	— ^b	[19]
グロビン結合型センサー				
<i>Escherichia coli</i>	DgcO	0.77*	0.55	[20]
<i>Azotobacter vinelandii</i>	AvGReg	0.015	—	[21]
<i>Bordetella pertussis</i>	BpeGReg	0.35*	—	[22]
<i>Desulfotalea psychrophila</i>	HemDGC	—	1.5	[23]

—：報告されていない。^a, 1 時間以上安定；^b, 数分以内に酸化される

*：酸素親和性について、酸素の結合定数 K （結合速度定数÷解離速度定数）を元に、 $P_{50} = 760 \text{ Torr} \div 1.38 \times 10^{-3} \text{ M}$ （酸素の溶解度）÷ K で計算した。

T. pyriformis trHb の酸素結合・解離速度定数は、それぞれ $5.5 \mu\text{M}^{-1}\text{s}^{-1}$, 0.18 s^{-1} であり、酸素親和性を示す P_{50} 値は 0.018 Torr と計算された。一方、自動酸化速度定数は $3.8 \times 10^{-3} \text{ h}^{-1}$ となった[12]。これらの値は、結核菌の trHb と同程度であり、酸素を可逆的に脱着するよりも、他の機能を果たしている可能性がある[15]。そこで、trHb の立体構造を解析することにした。

精製した 15 mg/mL *T. pyriformis* trHb と 2.0 M クエン酸アンモニウムを等量混合し、蒸気拡散法 (sitting drop) で結晶が得られた (Figure 2)。得られた結晶は、空間群 $P6_522$ (単位格子 $a = b = 69.4 \text{ \AA}$, $c = 354 \text{ \AA}$) に属し、非対称単位に 2 分子の trHb が存在した。酸素結合型の構造は分解能 1.75 \AA で分子置換法によって解いた。

その結果、*T. pyriformis* trHb は 2/2 グロビンフォールドを取ることが明らかになった。trHb の構造は N 末端から主に 4 つのヘリックス (B, E,

G, H) から形成されていた (Figure 3)。6 本のヘリックスから構成される 3/3 グロビンフォールドをとる Hb や Mb とは大きく異なっていた。また、 380 \AA^3 もの空洞がタンパク質内部に存在した。

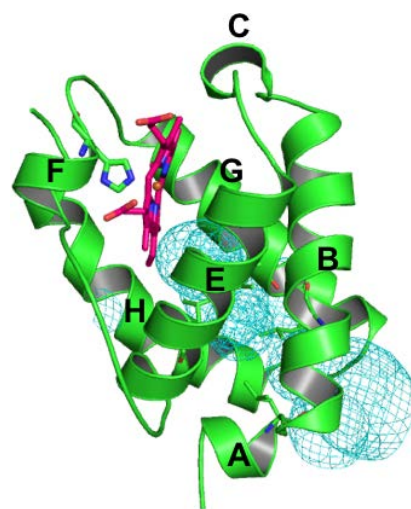


Figure 3: *T. pyriformis* trHb の全体構造と分子内の空洞。1.3-3.0 \AA のプローブを使って小分子の進入可能な部分をメッシュで示した。

Figure 4 に示すように、酸素結合型 *T. pyriformis* trHb のヘム周辺構造では、酸素分子が Tyr25 と Gln46 からの水素結合によって安定化されていた。

酸素親和性が高いことから、trHb は酸素結合型の状態で、空洞を通して進入した一酸化窒素と反応する可能性が示唆された。酸素結合型の結晶を亜硝酸ナトリウムを含む溶液に浸漬すると、結晶化溶液に含まれるクエン酸と反応して一酸化窒素を生成する。この状態の結晶を用いて構造解析を行うと、結合していた酸素が水へと変わる様子が明らかになった (Figure 4)。

3. *Candida norvegensis* のフラボヘモグロビン

Candida norvegensis は病原性 *Candida albicans* と同属の酵母であり、カンジダ症を引き起こす。近年、抗菌薬 fluconazole 耐性の *C. norvegensis* が出現し、医療分野において問題となっている。*C. norvegensis* のフラボヘモグロビン (fHb) は含量が多く、古くから研究が行われてきた [16,17,24]。一方、*C. albicans* では3種類のfHb遺伝子が発見され (yhb1, yhb4, yhb5), yhb1 が宿主マクロファージから産生される一酸化窒素を硝酸イオンへと無毒化すると考えられている

[25]。また、yhb5 が抗菌薬耐性に関係していることがわかっている [26]。

fHb はヘムを補欠分子族とするグロビンドメインと FAD を補酵素とする還元酵素ドメインが融合したタンパク質 (アミノ酸 389 残基) であり、単量体として存在する。NADH から供給される電子は FAD を経由してヘムへと伝達され、ヘム鉄の酸化を防いでいる (Figure 1)。

精製した 25 mg/mL の *C. norvegensis* の fHb と 14% PEG3350, 150 mM 塩化ナトリウム, 0.1 M クエン酸バッファー pH 4.0 を 2:1 の容量比で混合し、蒸気拡散法 (sitting drop) で結晶化を行った (Figure 2)。結晶成長には約 2 週間を要し、得られた結晶は、空間群 *I*432 (単位格子 $a = b = c = 242 \text{ \AA}$) に属した。回折データの分解能は 4.0 \AA に留まり、構造解析には至っていない。

次に、抗菌薬耐性が fHb と関係があるのかを調べる目的で、fHb とアゾール系抗菌薬との相互作用を検討した。6 種類の抗菌薬 (econazole, miconazole, ketoconazole, clotrimazole と fluconazole, itraconazole はそれぞれイミダゾール基とトリアゾール基を持つ) を試したところ、clotrimazole の親和性は高く、fluconazole の親和性は低かった (Figure 5)。

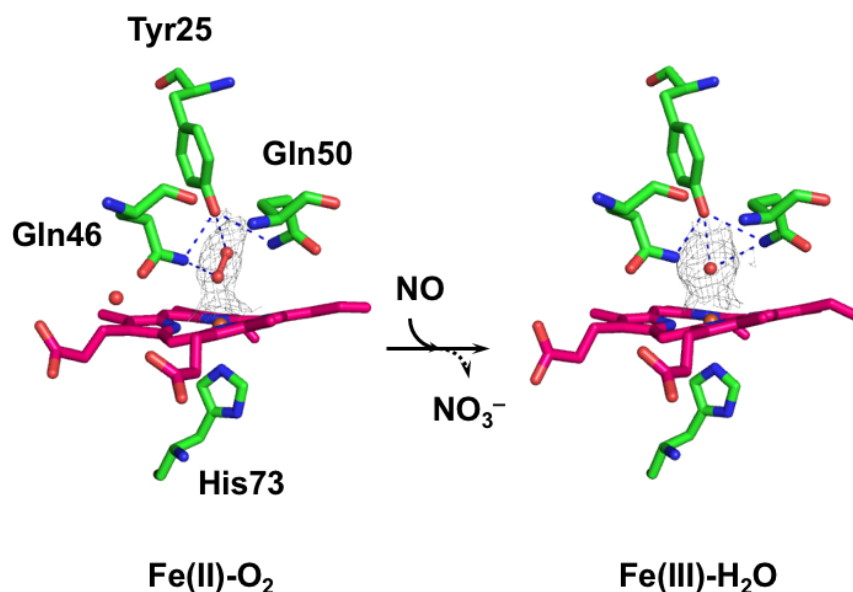


Figure 4: (左) 酸素結合型 *T. pyriformis* trHb のヘム周辺構造 (右) 一酸化窒素と trHb を反応させた後のヘム周辺構造。電子密度マップ (3σ) はモデルを除いて計算した。酸素は赤、窒素は青、炭素は緑で示している。なお、ヘムの炭素はピンクである。

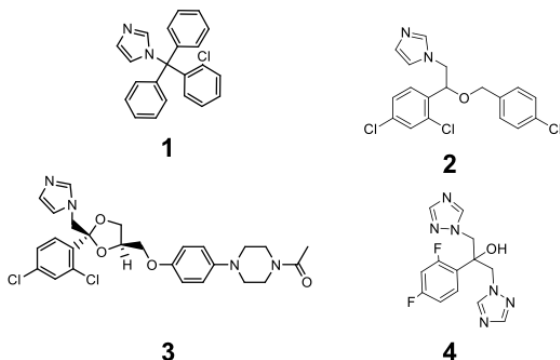
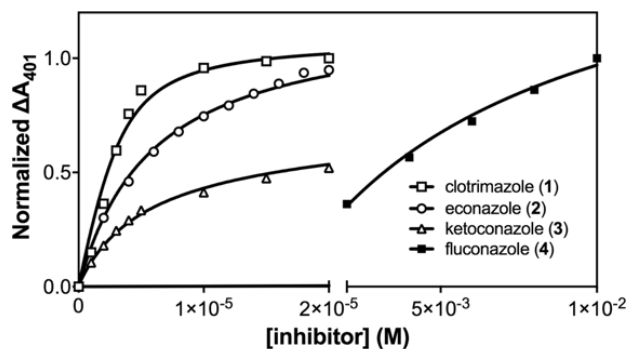


Figure 5: 4 種類の抗菌薬の fHb への結合。5 μ M の fHb に抗菌薬を加え、吸収スペクトルの吸光度変化を測定した。clotrimazole, econazole, ketoconazole, fluconazole の順に親和性が高い。clotrimazole, econazole, ketoconazole はイミダゾール基, fluconazole はトリアゾール基を持つ。

アゾール系抗菌薬の標的は、真菌の細胞膜や細胞膜に必須のエルゴステロール合成に関わるシトクロム P450 (CYP51) である[27]。fHb がアゾール系抗菌薬に結合することで、CYP51 への結合を妨害する可能性がある。したがって薬剤耐性のメカニズムとして、fHb の抗菌薬との親和性が高くなっている可能性がある。

4. 大腸菌 *Escherichia coli* のグロビン結合型センサー, DgcO

DgcO は大腸菌に由来するグロビン結合型センサーの 1 つであり、N 末端のグロビンドメインと C 末端のジグアニル酸シクラーゼ (GGDEF ドメイン) が融合したアミノ酸 460 残基からなるタンパク質である。DgcO は YddV や DosC と呼ばれている [28]。百日咳菌 *Bordetella pertussis* などからも見つかっている。DgcO はヘム鉄が還元された状態において、酸素や一酸化

炭素が結合すると、2 分子の GTP から c-di-GMP の合成を触媒する[20]。c-di-GMP は、細菌における走化性やバイオフィーム合成など調節する重要なセカンドメッセンジャーである。また、真核細胞においては、細菌感染に応答した自然免疫において注目を集めている[29]。なお、腸管出血大腸菌 O103:H2 では、DgcO を含む遺伝子を欠損している[30]。

そこで、DgcO のグロビンドメインに結合した酸素や一酸化炭素によって活性調節が行われるメカニズムを解明するため構造解析を行った。DgcO 全長での構造解析は困難なため、DgcO のグロビンドメインのみ (DgcO-globin) について結晶構造解析を試みた。精製した 20 mg/mL の DgcO-globin と 20% PEG3350, 250 mM 酢酸アンモニウム, 0.1 M Bis-Tris バッファー pH 5.5 を等量混合し、蒸気拡散法 (hanging drop) によって得られた結晶は、空間群 $P2_12_12_1$ (単位格子 $a = 51.6 \text{ \AA}$, $b = 66.1 \text{ \AA}$, $c = 83.2 \text{ \AA}$) に属し、非対称単位に 2 分子の DgcO-globin が存在した (Figure 2)。酸化型 DgcO-globin の構造は分解能 1.37 \AA でヘム鉄を利用した多波長異常分散法 (MAD) によって解いた。

ヘム鉄が酸化された状態での DgcO-globin の構造は N 末端の Z ヘリックスに加えて 7 つのヘリックス (A~H, D ヘリックスは欠損) から形成されていた (Figure 6)。

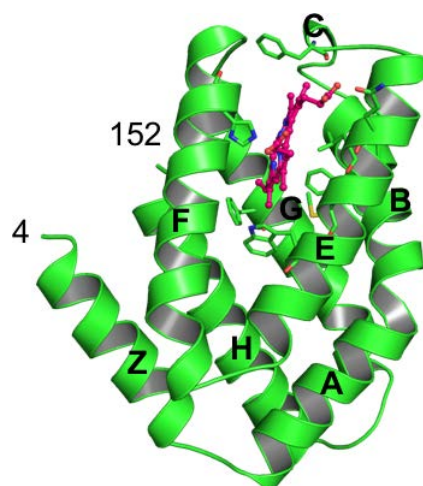


Figure 6: DgcO-globin の全体構造。ヘムは疎水性アミノ酸残基に取り囲まれている。

また、ヘム鉄が還元された状態について、嫌気条件下（酸素濃度 20 ppm 以下）で結晶化を行うことで、還元型および一酸化炭素結合型の結晶が得られた。一方、酸素結合型の結晶は自動酸化速度が速いため、結晶化の最中にヘム鉄が酸化してしまった。一酸化炭素結合型の DgcO-globin の構造は分解能 1.60 Å で決定した。

Figure 7 は還元型と一酸化炭素結合型のヘム周辺構造を示している。還元型ではヘム鉄を Leu65 が覆っている。一酸化炭素結合型では、Leu65 が移動することによって一酸化炭素が結合できる。また、一酸化炭素が結合すると、Tyr43 と Leu56 の間に形成されていた水素結合が弱まるか、切断される構造変化が観察された。しかし、ヘム鉄に結合した一酸化炭素分子はアミノ酸との間に水素結合を形成していなかった。

この構造変化をもとに、酸素結合型による酵素活性の調節を考えてみる。ヘム鉄に結合した酸素分子は Tyr43 との間に水素結合を形成できるので、Tyr43 と Leu56 の間に水素結合がなくなる。この構造変化を引き金にして、C 末端側のジグアニル酸シクラーゼドメインへ情報が伝達されることで、活性が上昇する酸素センサーとして働くと考えられる。

5. おわりに

X 線結晶構造解析によって、タンパク質の立体構造が明らかになったのは、1958 年の Mb がはじめてである[31]。最近では、タンパク質の立体構造解析に結晶を必要としないクライオ電子顕微鏡も加わり、Hb の構造が解かれている[32]。現在までに数多くのグロビントタンパク質の立体構造が解明されているが、その機能、調節メカニズムには、解明すべき問題点が残っている。

また、ゲノム配列の決定が容易になったことにより、数多くの微生物から機能未知のグロビンドメインを含む遺伝子が発見され続けている。これらグロビンドメインを持つタンパク質の機能解明と構造決定は続いていくであろう。

私たちは、fHb と抗菌薬の複合体の構造解析から、薬剤耐性メカニズムの解明を目指して研究を進めていきたい。

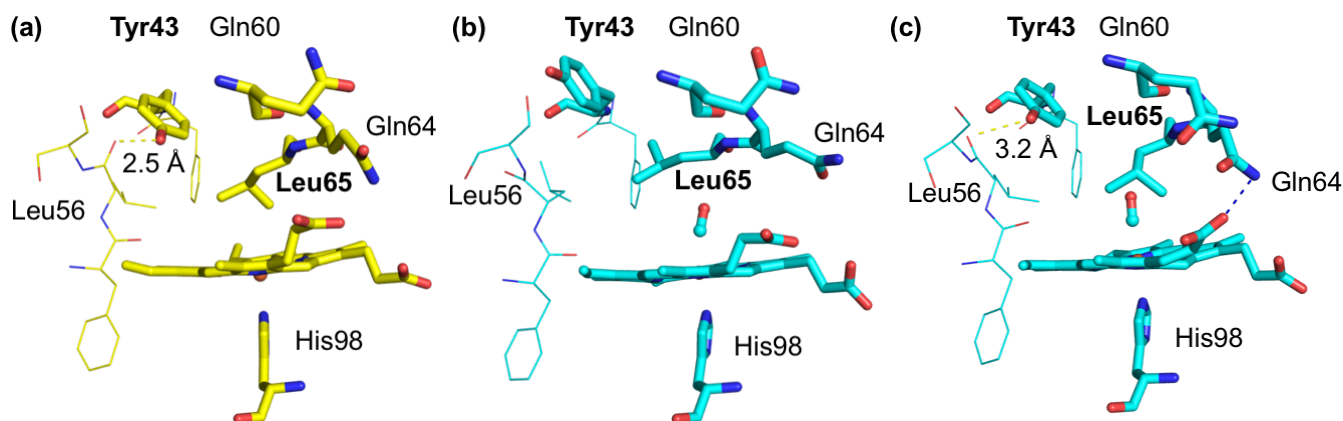


Figure 7: (a) 還元型 DgcO-globin のヘム周辺構造。Tyr53 のヒドロキシ基は Leu56 のカルボニル酸素との間に水素結合 (2.5 Å) を形成している。(b, c) 一酸化炭素結合型の DgcO-globin のヘム周辺構造。単量体の構造が異なるので、2 つ示している。一酸化炭素が結合すると、Leu65 はヘム鉄の近くから離れる。また、Tyr43 と Leu56 の間の水素結合は切断 (b) もしくは弱くなる (c, 3.2 Å)。酸素は赤、窒素は青、炭素は黄もしくはシアンで示している。

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原著論文

Love, Being and Time: An Essay on Julian of Norwich

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1.0 The aim of this essay

This essay aims at exploring the semantic interrelationship among *love*, *being* and *time* in *A Book of Showings to the anchoress Julian of Norwich*¹ (1342—c.1430²). Through this exploration, we may see in what semantic universe Julian was standing and how she found her own existential possibility in a spiritual dimension.

2.0 In the end is the beginning³

All of Julian's theological statements concerning the divine love are logically deducible from the 16th revelation: *Love was our Lord's meaning*, which is also the very summary of all revelations given to her in 1373 and the *terminus ad quem* (the destination point) of her life-long spiritual journey, which is characterized as *anagogical contemplation*, a theological exploration finally attained in 1388 A.D. At the very end of *Showings*, she says:

And frothe tyme pat it was shewde, I desyerde oftyn tymes to wytt [know, cf. wyste] in what was oure lords menyng. And xv yere after and mor, I was answeyrd in gostly/ vnderstondyng, seyng thus: What, woldest thou wytt they lords menyng in this thing? Wytt it wele, loue was his menyng. Who shewyth it the? Loue. [What shewid he the? Love.] Wherefore shewyth he it the? For loue. Hold the therin, thou shalt wytt more in the same. But thou schlt nevyr witt therin other withoutyn ende (And from the time that it was revealed, I desired many times to know in what was our Lord's meaning. And fifteen years after and more, I was answered in spiritual understanding, and it was said: What, do you wish to know your Lord's meaning in this thing? Know it well [be well

¹ *A Book of Showings to the anchoress Julian of Norwich*. ed. by Edmund Colledge O.S.A. and James Walsh S.J., Toronto: Pontifical Institute of Medieval Studies, 1978, part I and II. *Showings* have *Short Text* and *Long Text* based on 16 revelations given to Julian. The former is considered to be written after having received the revelations on 13 May, 1373, and the latter the spiritual reflections about them twenty years after (later than 1393). In this essay, the Short Text is abbreviated as *BSA* (1978), *ST* and *Long Text* as *BSA* (1978), *LT*.

² On Julian's historicity and her personal background, see *BSA* (1978), I, pp. 41-42. Pope Benedict XVI, in his *General Audience* at Paul VI Hall (Wednesday, 1st December 2010), refers to Julian and says: 'It is known that she lived from 1342 until about 1430, turbulent years both for the Church, torn by the schism that followed the Pope's return to Rome from Avignon, and for the life of the people who were suffering the consequences of a long drawn-out war between the Kingdoms of England and of France. God, however, even in periods of tribulation, does not cease to inspire figures such as Julian of Norwich, to recall people to peace, love and joy'. On medieval England 1215-1435, see Saul N. (1997). *The Oxford Illustrated History of Medieval England*. Oxford: Oxford Univ. Press, pp. 102-136.

³ Cf. Eliot T. S. *East Coker*, part II, line 1, *Four Quartets, The Complete Poems and Plays of T. S. Eliot*, London: Faber & Faber, 1982, p. 177.

aware⁴], love was his meaning. Who reveals it to you? [Who showed you this?] Love. What did he reveal to you? [What did he show you?] Love. Why does he reveal it to you? [Why did he show it?] For love. Remain in this, and you will know more of the same. But you will never know different, without end [Hold fast to this, and you will know and understand more of the same; but you will never understand nor know anything else from this for all eternity].⁵

In stating *Loue was his menyng* (Love was Lord God's meaning), what Julian actually refers to is that the *distinctive attribute* of God is *love*. Stating *Love is God* therefore does not make sense. *Loue was his menyng*, though it is stated in the past time because what she here refers to is her past spiritual experience, can be paraphrased as *God is love* ($\exists x (x \text{ is god} \wedge x \text{ is love})$), which should be more precisely read as *There is one and only one God and he is love* ($\exists x ((Gx \wedge Lx) \wedge \neg \exists y (Gy \wedge x \neq y))$).

God is love, for Julian, is not the conclusion of philosophical argumentation she finally attained but the revealed truth to be stated *a priori*, which is ⁶accepted in faith (a Deo revelata, suscipienda per fidem⁷), and which connotes the very essence of all of what she *saw* in spiritual sight and *understood*⁸ throughout her contemplative life, namely that which essentially consists in her anagogical contemplation⁹ of *mysterium fidei*.

2.1 Julian's spiritual journey via *anagogical contemplation*

Julian's life-long spiritual journey is characterized as *anagogical contemplation*;¹⁰ so here we, beginning with its lexical meaning, need to reconfirm what anagogical contemplation is and why it plays a key role in exploring the semantic interrelationship among *love*, *being* and *time* in *Showings*.

Lexical meaning of anagogy: The English word *anagogy* is etymologically derived from the Greek word ἀναγωγή (v-inf. ἀνα-ἄγειν: *to lead up* and *elevate*), which generally means: (1) *elevation*, religious or *ecstatic elevation* in a mystical sense, (2) *spiritual elevation* or *enlightenment*, esp. to understand mysteries and (3) *mystical interpretation*,

⁴ Windeatt (2015): *Julian of Norwich, Revelations of Divine Love*, tr. by B. Windeatt, Oxford: Oxford Univ. Press, 2015, p. 164, pp. 732:13-733:19; CWS, (1978): *The Classics of Western Spirituality. Julian of Norwich, Showings*, London: SPCK, 1978, p. 342.

⁵ BSA (1978), *LT*, lxxxvi: 13-19; CWS (1978), pp. 342-3.

⁶ Kameda M. (2016). 'Remarks on the Language of Love: A Semantic Exploration', *The Bulletin of Centre for Integrated Humanities and Sciences*, Fukushima Medical School, vol., 5, n. 2.131, 2.223-2.226. The article related to this essay, see Kameda M. (2000). 'Semantics of Love: A Study in Julian of Norwich'. *Journal of the Japan Society of Catholic Theology*, Tokyo: The Japan Society of Catholic Theology, vol. 11, p. 65-97.

⁷ Aquinas S. T. (1980), *Summa Theologiae, S.Thomae Aquinatis Opera Omnia* 2, Stuttgart-Bad Cannstatt: Friedrich Formmann Verlag, I, q. 1, a. 1, ad 1m.

⁸ In Julian's *Showings*, *I sawe (this corporeal sight)* is a typical formula of her anagogical contemplation as well as *oure lorde schewyd me (a gastelye sight...)* and *I was answered in myne vnderstandynge (reason)*.

⁹ OED's definition of *contemplation* as 'a form of Christian prayer or meditation in which [a person] seeks to pass beyond mental images and concepts to a direct experience of the divine' is quite agreeable (*Oxford Dictionary of English*, Oxford University Press, 2005^{2nd}).

¹⁰ CWS (1978), p. 117, pp. 74-75: Julian is very much at home with the fourth, *anagogical sense of Scripture*.

hidden ‘spiritual’ sense of words’.¹¹ The Latin word *anagogia* is, according to De Lubac, equivalent to *sursumductio*; it comes from the prefix *ἀνα*, which is *sursum* (upward), and the word root *γωγή*, which is *ductio* (leading).¹²

Anagogy in Church Fathers: De Lubac’s scholarly work *Exégèse Médiévale (Medieval Exegesis)* ascertains that Origen (c. 185 - c. 254), Gregory of Nyssa (c.330 - c.395) and Jerome ‘had already made anagogy one of the names of the spiritual sense in general. Anagogy, *a sense of the things above* (sensus de superioribus)¹³ or *caelestia mysteria ventura* (the heavenly mystery to come)’¹⁴ leads ‘the mind’s consideration *from things visible to those invisible, or from things below to things above, i.e., to the divine things*’.¹⁵ Later, Robert of Melun (c. 1100-1167), an English scholastic philosopher and theologian, following the same idea, wrote that it is anagogy ‘which lifts the understanding of the mind through the visible things to the invisible (quae per visibilia ad invisibilia animi levat intelligentiam)’.¹⁶ Jerome (c. 342 - 420) as a biblical scholar harmonizes opinions about *sensus anagogicus* in his time and says: ‘We ought to climb from the letter to the spirit, from earthly to heavenly things (De littera debemus ascendere ad spiritum, de terrenis ad caelestia)’.¹⁷

Sensus anagogicus, an exegesis in faith,¹⁸ thus guides us to a *spiritually elevated way* of understanding things or events in Scripture. We therefore ‘can view realities and events in terms of their eternal significance, leading us toward our true homeland: thus the Church on earth is a sign of the heavenly Jerusalem’.¹⁹ Semantically, *sensus anagogicus* (anagogical sense) – one of three *spiritual senses* of Scripture together with *sensus allegoricus* (allegorical sense) and *sensus tropologicus* (tropological sense) – is based on the *sensus litteralis vel historicus* (literal sense or historical sense). This means that ‘the meaning conveyed by the words of Scripture and discovered by exegesis [follows] the rules of sound interpretation’.²⁰

Sensus allegoricus (allegorical sense): A figurative understanding of a thing/ person in the story of the Old Testament which has its/ his or her own counterpart in the New Testament,²¹ such as ‘*the crossing of the Red Sea* is a sign or

¹¹ OED (2009, 2nd edition on CD-ROM, v. 4.0): Oxford English Dictionary (2009^{2nd} edition on CD-ROM), v. 4.0, Oxford University Press.

¹² De Lubac H. (2000), *Medieval Exegesis*. tr. by E. M. Macierowski, Grand Rapids, Michigan: William B. Eerdmans/ Edinburgh: T & T Clark, vol. II., p. 180, modified.

¹³ De Lubac H. (2000), vol. II, p. 180, p. 401, Note 13.

¹⁴ De Lubac H. (2000), vol. II, p. 185.

¹⁵ De Lubac H. (2000), vol. II, p. 180, p. 401, Note 14.

¹⁶ De Lubac H. (2000), vol. II, p. 180, p. 402, Note 17, cf. vol. I, p. 236, p. 432, Note 49.

¹⁷ De Lubac H. (2000), vol. II, p. 185.

¹⁸ De Lubac H. (2000), vol. I, p. 260.

¹⁹ CCC (1994): *Catechism of the Catholic Church*, London: Geoffrey Chapman, 1994, p. 31, n. 117-3: 1-3. Cf. Aquinas S. T. (1952), I, q, 1, a. 10,

²⁰ CCC (1994), p. 31, n. 116. Cf. Aquinas S. T. (1980), I, q, 1, a. 10, ad 1, sol: omnes sensus fundentur super unum, scilicet litteralem (all the senses are built upon one sense, viz., the literal sense). The English translation of *Summa Theologiae* I have quoted in this essay owes much to Fathers of the English Dominican Province (Westminster, Maryland, 1948).

²¹ Hunter A.M. (1984^{9th}) *Interpreting the Parables*. London: SCM Press, p. 10f; Swinburn R. (1992) *Revelation: From Metaphor to*

type of *Christ's victory* and also of *Christian Baptism*,²² The same goes for *The First Letter to the Corinthians* 10:3-4, where *the rock* Moses hit in *Exodus* (17: 6) corresponds to *Christ*, who is *the spiritual rock* from which all of the Israelites drank the spiritual drink.

Sensus tropologicus (tropological sense): Scriptural exegesis relating to morals. That is, the events reported in Scripture show us how to *act justly* or *how we should live and act under the grace of God*.²³ Aquinas refers to *sensus tropologicus* in *Summa Theologiae* and says: 'so far as the things done in Christ, or so far as the things which signify Christ, are types of what we ought to do, there is *the moral sense* (secundum vero quod ea quae in Christo sunt facta, vel in his quae Christum significant, sunt signa eorum quae nos agere debemus, est sensus moralis)'.²⁴

2.2 Anagogical contemplation: Its eschatological characteristics²⁵

Anagogical contemplation is essentially eschatological. De Lubac clearly explains the reason why:

It is in traditional eschatology that the doctrine of the four senses is achieved and finds its unity. For Christianity is a fulfillment, but in this very fulfillment it is a promised hope. Mystical or doctrinal, taught or lived, true anagogy is therefore always eschatological. It stirs up the desire for eternity in us. This is also why the fourth sense [anagogical sense] is forced to be the last'.²⁶ Therefore, we can see in anagogical contemplation that 'the resurrection of Jesus Christ was the pledge and example of our own future resurrection: then, only death being at last vanquished, shall we enjoy the whole *truth* whose *figure* the Son of God had brought upon the earth'.²⁷

Viewed in this light, the following passages in the Scriptures, in which Jesus Christ is described as the fulfillment of all promised hope, are also considered to be the fruits of anagogical contemplation:

Matthew 1:22 Now all this happened in order to make come true what the Lord had said through the prophets.²⁸ (Hoc autem totum factum est, ut adimpleretur quod dictum est a Domino per prophetam dicentem.²⁹

Analogy. Oxford: Clarendon Press, pp. 58-9 Both Hunter and Swinburn refer to John Bunyan's *Pilgrim's Progress*, in which *Christian*, a pilgrim makes a journey to the Heavenly City and 'this journey clearly corresponds to the gradual formation of a *Christian's* character by doing actions so as to make him fitted for Heaven' (Swinburn R. (1992), p. 58).

²² CCC (1994), p. 31, n. 117-1.

²³ CCC (1994), p. 31, n. 117-2. Aquinas S. T. (1963), *Summa Theologiae*. London: Eyre & Spottiswoods/ New York: McGraw-Hill, I, q. 1, art. 10, resp. And on the senses of Scripture, see Appendix 12.

²⁴ Aquinas S. T. (1980), I, q. 1, a. 10, resp. Blackfriars' edition of *Summa Theologiae* (1963) reads: 'the moral sense when the things done in Christ and in those who prefigured him are signs of what we should carry out' (p. 39).

²⁵ CWC (1978), p. 81. Cf. De Lubac H. (1998), II, p.188, 197. Cf. I *Thesssa* 5:2 (The day of the Lord will come like a thief in the night) and *Lk* 17:20f. The coming of Christ will be sudden and discernible for all (NRSV (2010⁴): *The New Oxford Annotated Bible* (New Revised Standard Version), New York: Oxford Univ. Press, 2010).

²⁶ De Lubac H. (2000), vol. II, p. 197.

²⁷ De Lubac H. (2000), vol. II, pp. 182-3.

²⁸ All of the English quotations here are from GNT (1992): *Good News Bible: Good News Translation*, New York: American Bible Society, 1992.

2:17 In this way what the prophet Jeremiah had said came true. (Tunc adimpletum est quod dictum est per Jeremiam prophetam dicentem.)

4:14 This was done to make come true what the prophet Isiah had said (ut adimpleretur quod dictum est per Isaïam prophetam)

5:17 Do not think that I have come to do away with the Law [of Moses] and the teachings of the prophets. I have not come to do away with them, but to make their teachings come true (Nolite putare quoniam veni solvere legem aut prophetas: non veni solvere, sed adimplere.)

26:56 But all this happened in order to make come true what the prophets wrote in the Scriptures (Hoc autem totum factum est, ut adimplerentur Scripturæ prophetarum.)

Mark 14:49 ...But the Scriptures must come true. (...Sed ut impleantur Scripturæ.)

Luke 4:21 This passage of scripture has come true today, as you heard it being read. (Quia hodie impleta est hæc scriptura in auribus vestris.)

22:37 For I tell you that the scripture which says, 'He shared the fate of criminals', must come true about me, because what was written about me is coming true. (Dico enim vobis, quoniam adhuc hoc quod scriptum est, oportet impleri in me: Et cum iniquis deputatus est. Etenim ea quæ sunt de me finem habent.)

24: 44 These are the very things I told you about while I was still with you: everything written about me in the Law of Moses, the writings of the prophets, and the Psalms had to come true. (Hæc sunt verba quæ locutus sum ad vos cum adhuc essem vobiscum, quoniam necesse est impleri omnia quæ scripta sunt in lege Moysi, et prophetis, et Psalmis de me.)

John 13:18 But the scripture must come true that... (...sed ut adimpleatur Scriptura)

15:25 This, however, was bound to happen so that what is written in their Law may come true: 'They hated me for no reason at all' (Sed ut adimpleatur sermo, qui in lege eorum scriptus est: Quia odio habuerunt me gratis.)

17:12 ...so that the scripture might come true (...ut Scriptura impleatur.)

Acts 1:16 ...the scripture had to come true in which the Holy Spirit, speaking through David, made a prediction about Judas, who was the guide for those who arrested Jesus. (oportet impleri Scripturam quam prædixit Spiritus Sanctus per os David de Juda, qui fuit dux eorum qui comprehenderunt Jesum.)

3: 18 God announced long ago through all the prophets that his Messiah had to suffer, and he [Jesus] made it come true in this way. (Deus autem, quæ prænuntiavit per os omnium prophetarum, pati Christum suum, sic implevit.)

²⁹ *Vulgata* (1975^{2nd}): *Biblia Sacra Vulgata*. Editio quinta, German Bible Society, Stuttgart, 1975

3.0 Analogy: What anagogical contemplation makes possible and meaningful

What anagogical contemplation, a kind of mystical exploration,³⁰ makes possible and meaningful totally depends on the *substantial relationship* between human and God, who is *the substance* (cf. *god is þe substance*³¹). Julian herself also substantiates this, referring to what she saw in her anagogical contemplation:

I sawe no difference between god and oure substance, but as it were all god; ... oure substance is in god, that is to sey that god is god and oure substance is a creature in god (I saw no difference between God and our substance, but as it were, all God: ...our substance is in God, that is to say that God is God, and our substance is a creature in God³²). ... Our substance is in oure fader god almighty, and oure substance is in oure moder god all wisdom, and oure substance is in oure lorde god the holy gost all goodness, for oure substannce is hole in each person of the trynyte, which is one god (Our substance is in our Father, God almighty, and our substance is in our Mother, God all wisdom, and our substance is our Lord God, the Holy Spirit, all goodness, for our substance is whole in each of the [Person of the³³] Trinity, who is one God.³⁴)

This passage of *Showings* further provides us with the ground for talking about God not metaphorically but ‘literally though only analogically’³⁵. In the case of Julian, *God is all that is good* (cf. *he es to vs alle thynges þat is good*³⁶), *God is the maker of all things* (cf. *he has made alle thynges*³⁷) and *God sustains everything* (cf. *god keps it*³⁸/ *it is kepydde*³⁹) are all stated analogically.

It is therefore *analogy* that gives a factual and logico-linguistic basis – as *sensus literalis* gives the very basis for *sensus spiritualis* in biblical exegesis – for Julian’s anagogical contemplation of *mysterium fidei*. If not, her use of language will become totally groundless and eventually degenerate into the arbitrary and subjective issue⁴⁰ or simply the matter of *trope*, a figure of speech. It is therefore only through analogy that we can access the invisible or the insensible (the transcendental being) via the visible and the sensible (beings-in-time).

³⁰ ‘[A] mystical exploration is’, as McCabe pointed out, ‘not at all the same thing as a mystical experience’ (McCabe H, *The Logic of Mysticism in Religion and Philosophy* ed. by Martin Warner, Cambridge: Cambridge Univ. Press, 1992, pp. 45), De Lubac H. (1998), vol. I – III.

³¹ *BSA* (1978), *LT*, lxii: 14.

³² *BSA* (1978), *LT*, liv: 17-20, *CWS* (1978), p. 285.

³³ The words inside brackets are all mine.

³⁴ *BSA* (1978), *LT*, lviii: 59-62, *CWS* (1978), p. 295.

³⁵ McCabe H, ‘The Logic of Mysticism’, *Religion and Philosophy* ed. by Martin Warner, Cambridge: Cambridge Univ. Press, 1992, pp. 58. McCabe, referring to St Thomas, says: metaphor is the heart of religious language but it cannot be sufficient of itself. It needs to be underpinned by such non metaphorical but analogical assertions as that God exists, that God is good, that God is the creative cause and sustainer of our world, that he is loving (ibid., p. 58).

³⁶ *BSA* (1978), *ST*, iv: 2-3, *LT*, vi: 2, 29, ix: 12 etc. On Christ’s goodness, *LT*, lxxix: 17, lxxxii: 14. etc.

³⁷ *BSA* (1978), *ST*, v: 14.

³⁸ *BSA* (1978), *ST*, iv: 17.

³⁹ *BSA* (1978), *ST*, v: 15.

⁴⁰ Lewis C. S. (1992^{Rep}) *The Allegory of Love: A Study in Medieval Tradition*. Oxford and New York: Oxford Univ. Press, p.113. Though what Lewis mentions is ‘how allegory supplied the subjective element in literature’, this is also the matter in common to scriptural exegesis that is the very basis for understanding mystical experience.

3.1 Anagogical contemplation based on analogy: Its logico-linguistic structure

The following passage of *The Letter of Paul to the Romans* 5: 17-19 will give us a good example that firstly needs to be interpreted analogically and then anagogically:

If, because of one man's trespass, death reigned through that one man, how much more will those who receive the abundance of grace and the free gift of righteousness reign in life through the one man Jesus Christ. Then as *one man's trespass led to condemnation for all men*, so *one man's act of righteousness leads to acquittal and life for all men*. For as *by one man's disobedience many were made sinners*, so *by one man's obedience many will be made righteous*.⁴¹ (Si enim unius delicto mors regnavit per unum: multo magis abundantiam gratiae, et donationis, et justitiae accipientes, in vita regnabunt per unum Jesum Christum. Igitur sicut per unius delictum in omnes homines in condemnationem: sic et per unius justitiam in omnes homines in justificationem vitae. Sicut enim per inobedientiam unius hominis, peccatores constituti sunt multi: ita et per unius obeditionem, justii constituentur multi.⁴²)

According to Aquinas, analogy is *when the truth of one Scriptural passage is shown not to conflict with the truth of another passage* (analogia vero est, cum veritas unius Scripturae ostenditur veritati alterius non repugnare).⁴³ The passage quoted from Paul's letter here is precisely considered to be one example:

Suppose (A) stands for *One man's trespass led to condemnation for all men*; (A') for *One man's act of righteousness leads to acquittal and life for all men*. And (B) for *By one man's disobedience many were made sinners*, and (B') for *By one man's obedience many will be made righteous*. Then, we can see that there are analogical relationships between (A) and (A') and between (B) and (B'). In the relationship between (A) and (A') *Adam* is analogous to *Jesus Christ* on one side and *Adam's trespass* to the *righteous act of Jesus Christ* on the other side; and in the relationship between (B) and (B') *Adam* to *Jesus Christ* on one side and *Adams's disobedience* to *Christ Jesus' obedience* on the other side.⁴⁴

And if there are analogical relationships between (A) and (A') and between (B) and (B'), on that basis we can have the following anagogical vision that is not a hypothesis but the factual truth in faith: (A') is a *spiritually elevated way* of understanding what (A) describes, and (B') of (B). That is, both (A') and (B') show how humans will be justified in faith or by the life to come. What De Lubac says in *Exégèse Médiévale* is therefore very much to the point: 'in

⁴¹ RSV (1997): *The New Oxford Annotated Bible* (Revised Standard Version), New York: Oxford Univ. Press, 1977

⁴² *Vulgata* (1975^{2nd}).

⁴³ Aquinas S. T. (1980), I, q. 1, a. 10, Ad 2, Sol.

⁴⁴ Analogy is, for Augustine, 'when harmonious agreement between the Old and New Testaments is shown (Analogia, cum veteris et novi Testamentum congruentia demonstratur)[*De Genesi ad Litteram Imperfectus*, Liber, C.2, n.5 (PL 34:222. See De Lubac (1998), vol. 1., p. 126, 358, Note 20).

Christian exegesis there is no longer myth on the one hand; there is no longer naturalistic thought or philosophical abstraction, on the other'.⁴⁵ [When Paul refers to one man's trespass and one man's disobedience, he means Adam's trespass and disobedience. Julian refers to *Adam* in *Revelation XIV*⁴⁶ and says: *Adam, that is to sey oone man was shewed that tyme and his fallyng to make there by to be vnderstonde how god befhodyth alle mann and his fallyng. For in the syghte of god alle man is oone man, and oone man is alle man* (Adam, that is to say, one man was shown at that time and his fall, so as to make it understood how God regards all men and their falling. For in the sight of God all men are one man, and one man is all men). It is quite obvious that Julian sees Adam as the universal set of human beings: $U(\text{Adam}) = \{\text{human}^1, \text{human}^2, \text{human}^3 \dots \text{human}^n\}$ or $\{\text{man}^1, \text{man}^2, \text{man}^3, \dots \text{man}^n\} \in \text{Adam}$.]

This is also the case in *Paul's First Letter to the Corinthians* 15: 42-53:

It is sown a physical body, it is raised a spiritual body. If there is a physical body, there is also a spiritual body. ... Just as we have borne the image of the man of dust, we shall also bear the image of the man of heaven. ...the dead will be raised imperishable, and we shall be changed. For this perishable nature must put on the imperishable, and this mortal nature must put on immortality⁴⁷ (Seminatur corpus animale, surget corpus spiritale. Si est corpus animale, est et spiritale, sicut scriptum est: ... Igitur, sicut portavimus imaginem terreni, portemus et imaginem cælestis. ...canet enim tuba, et mortui resurgent incorrupti: et nos immutabimur. Oportet enim corruptibile hoc induere incorruptionem: et mortale hoc induere immortalitatem).

Suppose *the perishable* (Gr. φθορά, L. corruptio: mortality/ death) stands for (A) in fraction, *the physical body*⁴⁸ (Gr. σῶμα ψυχικός, L. corpus animale) for (B), *the imperishable* (Gr. ἀφθαρσία, L. incorruptio) for (C) and *the spiritual body* (Gr. σῶμα πνευματικός, L. corpus spirituale) for (D) respectively. Then we can see that the very core of Paul's message quoted here is formed by the following proportional analogy: (A) : (B) = (C) : (D). That is, in her anagogical vision, (C) : (D) is a spiritually elevated way of understanding (A) : (B), the world to come seen *sub specie aeternitatis*.

3.2 How *analogy* makes Julian's *anagogical contemplation* possible and meaningful

We have examined how *analogy* gives a factual and logico-linguistic basis for Julian's anagogical contemplation and then reconfirmed this through biblical exegesis taking Paul's letters as examples (cf. 3.0-3.1). Following this, let us analyze the structure of what she saw in her anagogical contemplation described in

⁴⁵ De Lubac H. (2000), vol., II, p. 101.

⁴⁶ *BSA, LT*, li: 101-4.

⁴⁷ *RSV* (1997)

⁴⁸ *RSV* (1997) reads σῶμα ψυχικός in the Greek text as *a physical body* and ἀφθαρσία as *the imperishable* literally (Aland B. et al. (2008^{4th}). *The Greek New Testament*. Stuttgart: United Bible Societies, 2008).

the Fourteenth Revelation, which concerns the loving-care provided by *earthly mother* and *the second person of the Trinity, the true mother*⁴⁹ *for all of humans*:

The moder may geue he child sucke hyr mylke, but oure precyous moder Jhesu, he may fede vs wyth hym selfe,...*with the blessyd sacrament, this is precious fode of very lyfe...* ([Earthly] mother ‘can give her child to suck of her milk, but our precious Mother Jesus can feed us with himself..., with the blessed sacrament, which is the precious food of true life)⁵⁰ ...*though oure erthly moder may suffer hyr chylde to perussch, oure hevynly moder Jhesu may nevyr suffer vs pat be his children to peryssch, for he is almighty, all wisdom and all loue...* (...*though our earthly mother may suffer her child to perish, our heavenly Mother Jesus may never suffer us who are his children to perish, for he is almighty, all wisdom and all love*).⁵¹

It is evident that a human [earthly] mother and her loving activities, such as feeding her baby with milk from her breast, are analogous to the Second Person of the Holy Trinity⁵² (*The seconde person, which is oure moder*⁵³/*oure moder Cryst*.⁵⁴), who is the true mother for all humans and his [Christ’s] activities in love, such as giving his life – in the word of Julian, *precious fode of very lyfe* (the precious food of true life) – to humans to be saved. Or it is possible to say that the relationship between a human [earthly] mother and her loving activities is proportionate to the Second Person of the Holy Trinity (Jesus Christ) who is the true mother for all humans and his [Christ’s] activities in love. Either way, in Julian’s anagogical contemplation, what humans’ true Mother, the Second Person of the Holy Trinity does in love is seen as a spiritually elevated way of understanding the human [earthly] mother’s activities in love. This is the same in understanding the analogous relationship between *oure erthly moder may suffer hyr chylde to peryssch* and *oure hevynly moder Jhesu may nevyr suffer vs pat be his children to peryssch*. Thus we can conclude that analogy makes Julian’s anagogical contemplation possible and meaningful. That is to say, Julian’s anagogical contemplation can make sense on the basis of analogy.

4.0 The interrelationship among *love, being* and *time*: A logical analysis of in Julian’s spiritual sight

Julian’s detailed descriptions of what she saw in gastelye sight (spiritually elevated vision) and understood through

⁴⁹ BSA (1978), *LT*, liv: 17-20, 20-27, lvii: 47-91, lviii: 12-63, lix: 9-48, lxiii: 28-34. On the motherhood of Jesus, the Second Person of the Holy Trinity, see Kameda M. (1997). ‘*God-talk* Language in Mother Julian of Norwich’s *Showings*: An Exploration of God’s Motherhood’. *Journal of the Japan Society of Catholic Theology*, Tokyo: The Japan Society of Catholic Theology, vol. 8, pp. 57ff. On metaphorical understanding of the motherhood of God among Church Fathers, such as Clement of Alexandria (c. 150-c.215), Ambrose (c.339-97) and Augustine (354-430), see Beer F. (1992) *Women and Mystical Experience in the Middle Ages*. Woodbridge, Suffolk: Boydell Press, p. 152f.

⁵⁰ BSA (1978), *LT*, lx: 29-32, *CWS* (1978), pp. 298-299.

⁵¹ BSA (1978), *LT*, lxi: 37-40, *CWS* (1978), pp. 300-301.

⁵² BSA (1978), *LT*, lviii: 19-68.

⁵³ BSA (1978), *LT*, lviii: 37-38.

⁵⁴ BSA (1978), *LT*, lviii: 46.

Revelation I show how love, being and time are interrelated to each other and why love is the very foundation of every being/ life:

① *And this same tyme that I sawe this bodily sight, oure lorde schewyd me a gastelye sight of his hamly lovyng. I saw that he es to vs alle clethyng, for love wappes vs and wyndes vs, halses vs and alle be teches vs, hynges a boutte vs for tendyr love, that he maye nevere leve vs. And so in this sight ye saw sothelye that he ys alle thynge that ys goode, as to myne vndyrstandyng* (At the same time as I saw this corporeal sight [bodily vision⁵⁵], our Lord showed me a spiritual sight of his familiar love. I saw...He is to us everything which is good. ...He is our clothing, for he is that love which wraps and enfolds us, embraces us and guides us, surrounding us for his love, which is so tender that he never deserts us. And so in this sight [vision⁵⁶] I saw truly that he is everything which is good).⁵⁷

② *And in this he schewyd me a lytille thyng, the qwantyte of a haselle nutte, lyggande in the palme of my hande, and to my vndyrstandyng that, it was as rownde as any balle* (And in this he showed me something small, no bigger than a hazelnut [a little thing, the size of a hazelnut⁵⁸], lying in the palm of my hand, and I perceived that it was as round as any ball). *And I was answerde generally thus: It is all that ys made. I merveylede howe pat it might laste, for me thought it might falle sodaynlte to nought for litille [nawght for littleness]. And I was answerde in myne vndyrstandyng: It lasts an euer schalle, for god loves it; and so hath alle thyng the beyng throwe the love of god [hath all thing being by the loue og god⁵⁹]* (And I was given this general answer: It is everything which is made. I was amazed that it could last, for I thought that it was so little that it could suddenly fall into nothing. And I was answered in my understanding: It lasts and always will, because God loves it; and thus everything has being through the love of God).

③ *In this lytille thyng I sawe thre partyes. The fyrste is that god made it, the seconnde ys that he loves it, the thyrde ys that god kepes it. Botte whate is that to me? Sothelye, the makere, the lovere, the kepere. For to I am substancyallye and aned to him, I may nevere have love, reste ne varray blysse; that is to saye that / I be so frestenede to hym that thare be right nought that is made betwyx my god and me* (In this little thing I saw three properties. The first is that God made it, the second is that he loves it, the third is that God preserves it. But what is that to me? It is that God is the Creator and the lover and the protector. For until I am

⁵⁵ Windeatt (2015), p. 6.

⁵⁶ Windeatt (2015), p. 7.

⁵⁷ BSA (1978), ST, iv: 1-2, CWS (1978), p. 130.

⁵⁸ Windeatt (2015), p. 7. Windeatt reads this passage more literally and precisely than Walsh and Colledge.

⁵⁹ BSA (1978), ST, iv: 8-12, This passage, as Colledge and Walsh point out (BSA (1978), ST, Footnote, 11), strongly echoes *The Wisdom of Solomon* 11: 25-26: For thou lovest all things that are, and hatest none of the things which thou hast made: for thou didst not appoint, or make any thing hating it. And how could any thing endure, if thou wouldst not or be preserved, if not called by thee?) (Diligis enim omnia quæ sunt, et nihil odisti eorum quæ fecisti; nec enim odiens aliquid constituisti aut ecisti. Quomodo autem posset aliquid permanere, nisi tu voluisses? aut quod a te vocatum non esset conservaretur?). Cf. *The Revelation to John*, 4:11: Thou didst create all things, and by thy will they existed and were created (σὺ ἐκτίσας τὰ πάντα, καὶ διὰ τὸ θέλημά σου ἦσαν καὶ ἐκτίσθησαν).

substantially united to him, I can never have love or rest or true happiness; until, that is, I am so attached to him that there can be no created thing between my God and me).⁶⁰

4.1 Love: The very foundation of every being/ life

- (1) In the context of ② and ③, it is obvious that *a little thing, the size of a hazelnut (lytille thyng, the qwantyte of a haselle nutte)* Julian – as stated in ① – she saw in her spiritual sight symbolically depicts that every created thing exists by the love of God, the Uncreated (the love of *god that es vn made*⁶¹).
- (2) The expanse of the semantic universe ② creates will be clarified after analyzing what is described in ③.
- (3) The crux of ③ will be logically summed up as $\exists x((x \text{ is god} \wedge \forall y(y \text{ is a thing}) \rightarrow ((x \text{ creates } y) \wedge (x \text{ loves } y)) \wedge (x \text{ keeps } y))$, which is premised on *There is one and only one God and he is love* ($\exists x((Gx \wedge Lx) \wedge \neg \exists y(Gy \wedge x \neq y))$).
- (4) Then we can proceed to ② whose crux can be logically summed up as *Every created thing has being if and only if God loves it* which can be rendered by the following *biconditional statement*: $\phi \leftrightarrow \psi$ (In this case, ϕ stands for *x has being*, and ψ for *God loves x*. Here, ' \leftrightarrow ' reads as *if and only if*.) This implies: every human, for example, has his/ her own being if and only if God loves him/ her, or no human will exist if God does not love him/her. [Suppose p stands for: *God loves human* and q for: *A human has being/ existence*. Then the logical formula of *Human has his/ her being/ exists if and only if Gold loves him/ her* (*Human will not have his/ her being if and only if God does not love him/ her*) will be: $(p \rightarrow q) \wedge (\neg p \rightarrow \neg q)$ that is semantically equivalent to $(p \leftrightarrow q)$. That is, $(p \rightarrow q) \wedge (\neg p \rightarrow \neg q) \equiv (p \leftrightarrow q)$.] This is also Julian's response to the question, *Why is there something rather than nothing?*
- (5) Therefore, for Julian, the following was a logically necessary consequence: *oure lyfe is alle grounded and rotyd in loue, and without loue we may nott lyve* (our life is all founded [grounded⁶²] and rooted in love, and without love we cannot live).⁶³ [Here, *oure lyfe is alle grounded and rotyd in loue and without loue we may nott lyve* can be semantically translatable to: *If our life is all founded and rooted in love, it is not the case that we can live without love (of God).*]

In ② and ③, *love* is, as clearly stated in *Revelation* 14 et al., identified as the specific property of Jesus Christ, the Second Person of the blessed Trinity, who is our true Mother (cf. *the depe wisdom of the trynnyte is oure moder*⁶⁴).

⁶⁰ BSA (1978), ST, iv: 8-23, CWS (1978), pp. 130-1 and LT, 5: 9-22, CWS (1978), p. 183.

⁶¹ BSA (1978), ST, iv: 43-44. Corresponding Passage in LT is 5: 1-9, CWS (1978), p. 183.

⁶² Windeatt (2015), p. 103, 195.

⁶³ BSA (1978), LT, xix: 5-6, CWS (1978), p. 263, cf. LT, lxxxvi: 24-26, p. 342 and BSA (1978), LT, 86: 25: the loue wher in he made vs (the love in which he created us). The human soul is also the creation by God and naturally rooted in His endless love (oure soule is kyndely rotyd in god in endlesse loue (BSA (1978), LT, lvi: 15-6; CWS (1978), p. 289). God is the very fround/ foundation all of humans are beseeching and from which humans' prayers spring (BSA (1978), LT, lxi: 9-11, 26-27, xlii: 5, 18-21, 65-66).

⁶⁴ BSA (1978), LT, liv: 20-27 and CWS (1978), p. 285, BSA (1978), LT, lviii: 19-27, 34f and CWS (1978), pp. 293-5.

4.2 Sin as nothing

Julian sees that *God created everything in love* ($\exists x (x \text{ is god} \wedge \forall y (y \text{ is a thing} \rightarrow x \text{ creates } y \text{ in love}))$), and the love of God is the very foundation of every being/ life. This means: through the His love, God is present in all things (*I sawe that he es in all tinge*⁶⁵) and sustains them. Thus everything which is made for love and exists through the love of God is *good* in nature:

I may make alle thyng wele, and I can make alle thing welle, and I shalle⁶⁶ make alle thing wele, and I wylle make alle thyng welle; and thou shalt se thy selfe pat alle maner of thing shall be welle (I may make all things well, and I can make all things well, and I shall make all things well, and I will make all things well; and you will see yourself that every kind of thing will be well⁶⁷).

What is stated here is, in the words of Aquinas, *omne ens, inquantum est ens, est bonum* (Every being, as being, is good).⁶⁸ God, who does *good* in opposition to *evil*,⁶⁹ is therefore analogically considered to be *everything which is good* (cf. 4.0 - ①).

Julian sees that (a) sin ‘has no kind of *substance*, no share of *being*, nor can it be recognized except by the *pain* caused by it’ (*it had no manner of substance, ne no part of beyng but the by the payne that is caused therof*⁷⁰). (b) Sin, that is not *good* (nought goode⁷¹), is *nothing* (synne is nouȝt.⁷²). (3) Sin is, however, *necessary*⁷³ (Synne is behouely/e.⁷⁴) because ‘we cannot in this life keep ourselves completely from sin, in the perfect purity that we shall have in heaven (we may nott in this lyfe kepe vs fro synne alle holy, in full clenesse as we shall be in gevyn⁷⁵). Following (a), (b) and (c), which reflect how heavily the theological language Julian uses is owed to St Augustine,⁷⁶ let us examine what will happen to us when we commit a sin, an evil act in the eyes of God, such as murder.

⁶⁵ BSA (1978), ST, viii: 2.

⁶⁶ Shall in both OE and ME is ‘used to express *necessity*, indicate ‘what is appointed or settled to take place’ and ‘a *determination insisted on in spite of opposition*’ (OED (2009, 2nd edition on CD-ROM, v. 4.0).

⁶⁷ BSA (1978), LT, xxxi: 1-6, CWS (1978), p. 229.

⁶⁸ Aquinas S. T. (1980), I, q. 5, a. 3, resp. Cf. I, q. 5, a. 1, sed contra, where Augustine’s *De Doctrina Christiana*. i, 42 is referred to: *inquantum sumus, boni sumus* (inasmuch as we exist we are good).

⁶⁹ BSA (1978), LT, lix: 9: Jhesu Crist, that doth good against evyll, is oure moder;... (CWS (1978), p. 295).

⁷⁰ CWS (1978), p. 225, BSA (1978), LT, 27:26-28.

⁷¹ BSA (1978), ST, xiv: 54.

⁷² BSA (1978), ST, viii: 9, cf. xxiii: 26, etc.

⁷³ In the context of Julian’s theological argument, what the *necessary* (adj) means is: *inevitable, inevitably resulting from the nature of things* (OED (2009 2nd edition on CD-ROM, v. 4.0)).

⁷⁴ BSA (1978), ST, xiii: 52.

⁷⁵ BSA (1978), LT, lii: 57-58, CWS, p. 281.

⁷⁶ Cf. Saint Augustine (1998). *Confessions*, tr. by Chadwick H., Oxford: Oxford Univ. Press, III, vii (12): *malum non esse nisi privationem boni usuque ad quod omnino non est* (evil has no existence except as a privation of good [evil was nothing else but a privation of good], down to that level which is altogether without being). The quoted passage in brackets is the translation by Watts. W (Saint Augustine. (1999). *Confessions*, Massachusetts: Harvard University, vol. 1, p. 121).

Suppose *x* (a human person) had killed *y* (an another human person) deliberately. In this case, what would happen to both *x* and *y*? In killing *y* deliberately, because *being* is convertible with *good/ goodness* (*ens et bonum convertuntur*⁷⁷) and killing *y* deliberately is an evil that is the absence of *being* and *good*, it is clear that *x* starts losing his/ her share of *being*, his/ her *goodness* and the *genuineness* as the quality of being human. Or, it may be possible to state that in killing *y*, *x* *steps over the barrier of being human*.⁷⁸ This means: in killing *y*, *x* not simply kills *y* but kills *x*'s humanity.

4.21 Evil or sin experienced as *pain*

Next, we need to examine why Julian says that sin can be recognized through *pain*.⁷⁹ It seems to be very clear that what she refers to here is *a spiritual pain/ grief* that is the opposite of *spiritual happiness/ joy*. In the above-mentioned case (4.20), it is necessary that *x*, in *x*'s killing *y* deliberately, experiences his/ her evil act as pain, which steadily and certainly damages his/ her goodness and genuineness as the qualities of being human. This is because *x*'s evil act is not under the love of God, that is, God is not present in *x*'s evil act. This illumines evil, which constantly annihilates the quality of being human; that is nothingness or meaninglessness in which the love uncreated (God) is not present.⁸⁰

4.22 Sin and the loving activity of God

Then, if sin, which gradually ruins our humanity is necessary in this life (cf. 4.2), how can we come to an agreement with Julian's grand thesis, *Hath alle thyng the beyng throwe the love of god* (everything has being through the love of God (cf. 4.0f))? It is because, as Aquinas appropriately states: 'God loves sinners insofar as they are existing natures.' (*Deus peccatores, in quantum sunt naturae quaedam, amat*). There is no absurdity between the reality of humans who sin one after another and the loving activity of God.⁸¹

5.0 *Being-in-time: The very nature of human being*

The ontological condition of every created thing as symbolized by '*a lytille thyng* (a little thing), that was so little that it could suddenly fall into nothing'⁸² in her spiritually elevated vision, reveals the very nature of human beings

⁷⁷ Cf. Aquinas S. T. (1980), I, q. 5, a.1, resp: bonum et ens sunt idem secundum rem, sed bonum dicit rationem appetibilis, quam non dicit ens. Cf. I, q. 16, art., 3, resp: Sicut bonum habet rationem appetibilis, ita verum habet ordinem ad cognitionem, autem in quantum habet de esse, intantum est cognoscibile. ...sicut bonum convertitur cum ente, ita et verum. ...sicut bonum addit rationem appetibilis supra ens, ita et verum comparationem ad intellectum.

⁷⁸ Dostoevsky F. (2008^{Revised}). *Crime and Punishment*. tr. by Peace p. Oxford: Oxford Univ. Press, p. 248-9, 255, 264, 316, 402,

⁷⁹ Cf. *Oure synne is cause of Christes paynes* (BSA (1978), LT, lii: 51-52). Cf. lii: 57-58, CWS (1978), p. 281, p. 304, p. 328, 338.

⁸⁰ Cf. BSA (1978), ST, viii: 1-2.

⁸¹ Aquinas S. T. (1980), q. 20, art 2, ad 4 sol, Kameda M. (2016), 2.3214.

⁸² BSA (1978), ST, iv: 13-14; BSA (1978), LT, v: 1-19, CWS, p. 183.

created by God, the uncreated (cf. 4.0 –②, footnote 56). Julian’s later contemplative reflection will help understand that. She says:

in oure making’, we had begynnyng, but the loue wher in he made vs was in hym fro with out begynnyng (In our creation we had beginning but the love in which he created us was in him from without beginning. In this love we have our beginning,...)⁸³

As mentioned in 4.1 (4), *Every created thing has being if and only if God loves it* ($\phi \leftrightarrow \psi / (p \rightarrow q) \wedge (\neg p \rightarrow \neg q) \equiv (p \leftrightarrow q)$). This means that if every created thing has being if and only if God loves it, it is necessary that it has its beginning and end. That is, every created thing – not excepting every human being – is *perishable*⁸⁴ and could suddenly fall into nothing, being essentially a *being – in – time*. In the words of Kierkegaard (1813-55), ‘as soon as a human [person] is born, he [she] begins to die’.⁸⁵ The following biblical passages give very good pictures of the temporal characteristics of a human being:

Psalms, 30: 16 *My times are in your [God’s] hand* (in manu tua tempora mea/ ἐν ταῖς χερσίν σου οἱ καιροί μου).

78: 33 He (God) ended their [the people who kept sinning] days like a breath and their lives with sudden disaster.⁸⁶

144: 4 We are like a puff of wind; our days are like a passing shadow.⁸⁷

Isaiah, 40: 6-7 All people [*Vulgata*: omnis caro; *LXX*: πᾶσα σὰρξ; *KJV*: all flesh⁸⁸] are grass, their constancy is like the flower of the field. The grass withers, the flower fades, when the breath of the Lord blows upon it; surely the people are grass.⁸⁹

The Letter of James, 4: 14-15 You don’t even know what your life tomorrow will be. [What is your life?⁹⁰] You are like a puff of smoke [a mist], which appears for a moment [for a little while] and then disappears. What you should say is this: ‘If the Lord is willing [wills] we will [shall] live and do this and that (ἐὰν ὁ κύριος θελήσῃ, καὶ ζήσομεν καὶ ποιήσομεν τοῦτο ἢ ἐκεῖνο).’⁹¹

Each human individual therefore has his/ her own ‘allotted span of time’.⁹² That is, *every hour* given to each human individual so that he or she lives is a *donation*, a donation of *being* in the form of *time* that comes from *the life itself*⁹³ – in Julian’s theological context, God, *who is our life* (god that is oure lyfe⁹⁴).

⁸³ BSA (1978), LT, lxxxvi: 24-26, CWS (1978), p. 342.

⁸⁴ Cf. BSA (1978), LT, lxi: 37-40, CWS (1978), pp. 300-301. Cf. BSA (1978), LT, liii: 42-45, CWS (1978), p. 284.

⁸⁵ Kierkegaard S. (1992) *Eighteen Upbuilding Discourses*. tr. by E.V. Hong and E.H. Hong, Princeton, New Jersey: Princeton Univ. Press, p. 280. Cf. BSA (1978), LT, xxxvi: 68-69, CWS (1978), p. 241: *in thys passing lyfe* (in this passing life).

⁸⁶ GNT (1992)

⁸⁷ GNT (1992)

⁸⁸ *Vulgata* (1975^{2nd}), *Septuagint* (2007), edited by Alfred Rahlfs, Second Revised Edition, edited by Robert Hanhart, Deutsche Bibelgesellschaft, Stuttgart. *KJV* (2007): *The Holy Bible* (Authorized King James Version), London: Oxford Univ. Press, 2007.

⁸⁹ NRSV (2010^{4th}): *The New Oxford Annotated Bible*, New York: Oxford Univ. Press, 2010. Cf. Psalm, 39:5, 89: 47,

⁹⁰ NRSV (2010^{4th}): ἡ ζωὴ ὑμῶν.

⁹¹ GNT (1992)

6.0 Love one another or you perish: Towards a tropological understanding of *Showings*

The very heart of Julian's message in *Showings* is excellently condensed into the following, Pope Benedict XVI's address to his audience at Paul VI Hall, Rome in 2010:

Julian of Norwich understood the central message of spiritual life: God is love and it is only if one opens oneself to this love, totally and with total trust, and lets it become one's sole guide in life, that all things are transfigured, true peace and true joy found, and one is able to radiate it.⁹⁵

Those who see through to the importance of her message and accept this address in a genuine way will also find the truthfulness of what St. Paul stated in his *First Letter to the Corinthians* 13:2: *If I have no love, I am nothing/none/nobody*, i.e. *I don't exist* (ἐὰν ἀγάπην μὴ ἔχω, οὐθέν εἰμι/ si caritatem autem non habuero, nihil sum).⁹⁶ This is because 'only by loving does the Christian exist authentically'.⁹⁷

Though Julian knew nothing about Greek, the syntactic structure of ἐὰν ἀγάπην μὴ ἔχω, οὐθέν εἰμι, in which εἰ (the Ionic dialect later turned into ἐὰν) with the indicative of reality (*If...really*) verifies that there is a causal relationship between the precondition, ἐὰν ἀγάπην μὴ ἔχω and its conclusion, οὐθέν εἰμι such as *If p, then q in actuality* [or] *If not p, then not q in actuality*.⁹⁸ Loving, that transfigures the meaning of life dramatically, is therefore itself 'a new mode of existence,⁹⁹ [and] a new way of looking at reality'.¹⁰⁰

St. Paul's self-awareness of how to be an authentic Christian seems to be deeply echoed in Julian's description in the *Revelation I* of *Showings*:

⁹² Ende M. (1985) *Momo*. tr. by J. Maxwell Brownjohn, New York: Doubleday & Company, p. 134, cf. p.132. Cf. 'The days allotted [apportioned] to me had all been recorded in your book (Psalm 139: 16, *GNT* (1992)); Ecclesiastes, 8:11.

⁹³ Ende M. (1985) *Momo*, p. 47. Cf. *Matthew* 10: 29: Are not two sparrows sold for a penny? Yet not one of them will fall to the ground apart from your Father (*NRSV*) without your Father's consent (*GNT*, p. 1079) the will of your Father.

⁹⁴ *BSA* (1978), *LT*, 48: 22, *CWS* (1978), p. 262. Cf. Psalm, 36: 9; Acts, 17: 25. *The life itself* can be, using the language of the New Testament, replaced with *He who is and who was and who is to come* (ὁ ὢν καὶ ὁ ἦν καὶ ὁ ἐρχόμενος) or *I am the Alpha and the Omega*, ..., *who is and who was and who is to come* (ἐγὼ εἰμι τὸ Ἄλφα καὶ τὸ Ὠ, ..., ὁ ὢν καὶ ὁ ἦν καὶ ὁ ἐρχόμενος) *The Revelation to John*, 1:4 and 8 (*The Greek New Testament*, Stuttgart: Deutsche Bibelgesellschaft, 2007, 4th edition). Cf. Exodus 3: 14: ἐγὼ εἰμι ὁ ὢν.

⁹⁵ Benedict XVI, *General Audience* at Paul VI Hall, Wednesday, 1st December 2010. (Liberia Editrice Vaticana, 2010)

⁹⁶ *Vulgata* (1975^{2nd})

⁹⁷ Murphy-O'Connor J. (1990). *The First Letter to the Corinthians* commented by Jerome Murphy-O'Connor, O.P. in *The New Jerome Biblical Commentary* ed. by Brown RE, S.S., Fitzmyer JA, S.J. and Murphy RE, O.Carm., New Jersey: Prentice Hall, 1990, p. 811f. Cf. Murphy-O'Connor J. (2009) *Becoming Human Together: The Pastoral Anthropology of St. Paul*. Atlanta: Society of Biblical Literature, pp. 48: 'The distinctive characteristic of authentic humanity is a creativity which effectively opens new horizons of being to others'.

⁹⁸ Moulton J. H. (1998) *A Greek of New Testament*, vol III, *Syntax* by Nigel Turner, T & T Clark: Edinburgh, n. 372.

⁹⁹ Murphy-O'Connor J. (2009), p. 149, 177.

¹⁰⁰ Murphy-O'Connor J. (1990), p. 801.

*For ȝyf I loke syngulerlye to my selfe I am right nought; botte in generalle I am in anehede of charyte with alle myne evynn cristene.*¹⁰¹ *For in this anehede of chryte standes the lyfe of alle mankynde that schalle be save* (If I pay special attention to myself, I am nothing at all; but in general I am in the unity of love with all my fellow Christians. For it is in this unity of love that the life consists of all men who will be saved¹⁰²/ For if I look at myself in particular, I am nothing at all; but in general I am in oneness of love with my fellow Christians. For in this oneness of love depends the life of all humanity who will be saved¹⁰³).

(Φ) In saying *alle myne evynn cristene* (all my fellow Christians), Julian sees who Christians are: every Christian, living together in *the community-in-sinfulness*¹⁰⁴ or *the community of forgiveness and reconciliation*,¹⁰⁵ namely those who are deeply aware of his/ her sins and his/ her existential condition to be saved.

(X) In saying *ȝyf I loke syngulerlye to my selfe I am right nought; botte in generalle I am in anehede of charyte with alle myne evynn cristene* (If I pay special attention to myself, I am nothing at all; but in general I am in the unity [in oneness] of love with all my fellow Christians). Julian obviously based the major premise in her whole theological argument on the statement: *Every created thing has being if and only if God loves it* (cf. **4.0ff**). This manifests how she can hold her authenticity as being a Christian. That is, what she manifests is: if every created thing has being if and only if God loves it, and if she is not in the unity [in oneness] of love with all her fellow Christians, then she is nothing in actuality.

Through (Φ) and (X), it becomes clear what *tropological understanding* the whole message *Showings* calls on every Christian for is: loving one another. Loving one another is – not like ‘Aristotle [who] in considering the nature of friendship had concluded that a good man could not be the friend of a bad man; and since the bond of authentic friendship is a shared allegiance to the good’—¹⁰⁶an eschatological way of life or a way of anticipating the life to come,¹⁰⁷ that is, *God, who is Life Itself* (cf. (cf. **2.1ff**, **4.3**).

The very core of Loving one another is therefore thought possible to be filled with the eschatological tension expressed in the following exclusive disjunction: *Love one another, or you perish*.¹⁰⁸ Suppose *r* stands for *Love one another*, and *s* for *You perish*, then the logical formula *Love one another or you perish* will be: $r \nabla s \equiv (r \vee s) \wedge \neg(r$

¹⁰¹ Cf. I John, 4:16.

¹⁰² BSA (1978), ST, vi: 22-33, cf. LT, ix, 5-11, CWS (1978), p. 134.

¹⁰³ Windeatt (2015), p. 9. Cf. Matthew 5: 43-48, Luke 6: 27-28; 32-36.

¹⁰⁴ Arendt H. (1996) *Love and Saint Augustine*. Chicago and London: The Univ. of Chicago Press, p. 102.

¹⁰⁵ MacIntyre A. (1985) *After Virtue: A Study in Moral Theory*. London: Duckworth, p. 174.

¹⁰⁶ Ibid., MacIntyre A. (1985), p. 174.

¹⁰⁷ Cf. CWS (1978), p. 81), De Lubac H. (2000), vol. II, p. 181, p. 4012, Note 22.

¹⁰⁸ Teilhard de Chardin P. (1967) *Sur L'Amour*, Editions du Seuil, Paris (ET: *On Love & Happiness*. San Francisco: Harper & Row, 1984, p. 36. Cf. BSA (1978), LT, xlix: 23-24, CWS (1978), p. 264

\wedge s), which further elucidates that it is a Christian who, acknowledging that there is no case that both love (r) and perish (s) are true, stakes his/ her total existential possibility on love (loue/ charyte), *the revealed truth*.

総合科学研究会報告

2017 年 1 月以降に開催した総合科学研究会プログラム

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これまでに開催した総合科学研究会プログラム

(1) 「触媒的ヘテロ環構築反応の新展開」

中村 達 先生（東北大学大学院 理学研究科）

「炭素－フッ素結合活性化を伴う含フッ素アリルエステル類の Pd 触媒反応」

川面 基 先生（日本大学大学院 総合基礎科学研究科）

第 44 回総合科学研究会 & 研究連携セミナー [日本化学会福島地区講演会]

平成 29 年 10 月 13 日 16:00～

福島県立医科大学 11 号館第一臨床講義室

(2) 映画 「日本と再生一光と風のギガワット作戦」

監督：河合弘之 制作年：2017 年

「福島の再生可能エネルギー」

千葉 訓道 氏（飯館電力（株）専務取締役）

第 4 5 回総合科学研究会 復興に関する映画上映と講演会

平成 30 年 3 月 1 日 16:30～

福島県立医科大学 5 号館第 7 講義室

(3) 「偏光観測における重力レンズ効果」

吉田 宏 （本学医学部自然科学講座 数理物質科学分野）

第 46 回総合科学研究会

平成 30 年 3 月 29 日 16:00～

福島県立医科大学 4 号館第 3 ゼミナール室

2012.2.29 提示
2012.10.31 承認
2014.10.16 一部改訂

1. 方針・趣旨

本紀要では、センターメンバーの研究活動、および、センターの活動を紹介することを主な目的とする。また、その内容は、本学の理念およびポリシーに則ったものを掲載する。

2. 名称及び発行

福島県立医科大学総合科学教育研究センター紀要
英文名称：The Bulletin of the Center for Integrated Sciences and Humanities
年1回、11月に発行する。

3. 投稿資格

- [1] 本紀要へ投稿できる者は、本学教職員および非常勤教職員であることを原則とする。
- [2] 本学教職員以外の者との共同研究については、本学教職員が共同執筆者である場合に限り、投稿を認める。
- [3] 本学の大学院学生及び大学院研究生で、編集委員会において適当と認めた者については、投稿を認める。
- [4] 依頼論文の場合は、この限りではない。

4. 投稿記事とその種類

記事の種類は次のとおりとする。なお、他誌との完全な二重投稿は認めない。
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- 総説（総合論文を含む）
- 資料
- 総合科学研究会報告
- センター活動報告詳細記事
- 書評
- 企画
- その他（編集委員会が適当と認めたもの）

5. 倫理規定

人、および動物が対象である研究は、倫理的に配慮され、その旨が本文中に記載されていること。

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- [4] 原稿の提出：各年度の原稿提出の区切りは、8月31日とする。

7. 論文等の査読及び採否の決定

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11. 投稿規定の施行

本投稿規定は、2012年4月1日に遡る。

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